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The first patient I have the pleasure of presenting this afternoon is a male, aged sixty-five years, whose chief complaint is gradual loss of about 15 pounds in weight during the past three years, but for the last six weeks, with rest and careful diet, he has gained 8 pounds. This gradual loss of weight was at first not associated with any symptoms except an occasional heavy feeling in the stomach and some belching of gas. About eight months ago the patient began to have attacks of epigastric pain, usually coming on three or four hours after the noonday meal, recurring on an average of two or three times a week; these attacks are not accompanied by nausea or vomiting. Bowels always regular; appetite good. No other symptoms.

Physical examination negative except heart: rate irregular and force of contraction faint; percussion shows the presence of lung tissue between the heart and the chest wall. Abdomen negative except for some fulness in the epigastrium and slight tenderness to deep pressure over the middle of upper portion of the right rectus muscle. Blood-pressure: systolic 156, diastolic 82. Urine examination negative. Blood examination: hemoglobin, 80 per cent.; red cells, 4,020,000; white cells, 7000;
polymorphonuclears, 69 per cent. Blood urea practically normal. Urine negative; phenolphthalein elimination 68 per cent. in three hours. Hourly test meal: acid reaction; free hydrochloric, 24; total acidity 39. Negative for occult blood. Full meal: no retention, nothing obtained by stomach-tube passed in eight hours.

\(x\)-Ray examination, made in home town, negative except for pylorospasm. These plates were submitted to Dr. Pancoast, who reported no evidence of pathology, although there were not enough plates for him to form a definite conclusion. \(x\)-Ray work in doubtful cases calls for a large number of plates, in some instances it may be necessary to make 40 or 50 of one patient, in fact, I have known of one instance in which 150 plates were made before a definite diagnosis of a very small ulcer on the posterior wall of the stomach was made. The \(x\)-ray diagnosis in this case will consequently have to be ignored. The diagnosis is not by any means certain, but to me it appears that if there is anything organically wrong with the gastro-intestinal tract it is most likely in the duodenum. We are not at all definite as to that, particularly in the absence of careful \(x\)-ray examination, and in the absence of a very high total and a very high free acidity. Evidently there is little or no interference with the motility of the stomach, since there was very little recovered after the test-meal and nothing after the full meal. In cases of this kind, where the diagnosis is not clear, that is, where there is nothing palpable, to establish a reasonably positive opinion it is first, last, and always to be remembered that the appendix may be responsible for a certain train of symptoms like those in this case, including the loss of weight. It has been well said that in the majority of cases diagnosed as ulcer the pathology is in the appendix. The loss of weight may be the result of diet or of anxiety concerning himself, such as the fear of malignancy or of some other serious ailment. In examining this abdomen I should suspect either gastropptosis or gastric dilatation, but from the capacity of the stomach it is hard to tell definitely which. This operation, therefore, is primarily to determine whether or not there
is an organic lesion, and if so, whether or not it is operable. The question may arise whether operation is at all indicated; that, I trust, will be answered positively in a very little while. As to the tentative diagnosis: Other common conditions of the abdomen which sometimes bear a similar train of symptoms are appendicitis, cholecystic and pancreatic disease. In the last two, however, there is frequently some history of jaundice, although jaundice is also present at times in cases of duodenal ulcer; and the pain is apt to be more paroxysmal in character and referred to the right costal margin, the back, and the right shoulder blade. The sex of the patient also plays a rôle, since ulcer is more common among males, while disease of the gall-bladder seems to prefer the female sex. The indications in this case, therefore, are strongly in favor of duodenal ulcer.

We will open the abdomen high up, through the right rectus muscle. It is best to incise the peritoneum during inspiration when the viscera are furthest away from the peritoneum, rather than during expiration when they are in contact with the peritoneum and more likely to be injured. I have opened the abdomen, but as the patient is not yet fully relaxed I will utilize the time by seeing whether or not I can deliver the cecum. There are extensive adhesions in the mid-abdomen, of the great omentum to the peritoneum on a level with the umbilicus. On account of these adhesions I am enlarging the incision in the hope of being able to release them so as to add efficiency and safety to the operation. It is bad practice to tear adhesions without seeing what you are doing. By prolonging this incision I am able to see their point of attachment and note that they do not involve the intestines. I am therefore able to separate them safely. These may possibly have been responsible for a great deal of the symptomatology, and if so, they are what would be termed symptom-producing adhesions.

I am very careful to protect the viscera as much as possible from the iodinized skin surface, as well as from contact with the air. I am unable to bring up the cecum, but by making traction on it I can expose the appendix and deliver it. Now, the presence of such adhesions in the neighborhood of the cecum,
together with a chronically diseased appendix, and the absence of other pathology in the lower right abdominal quadrant, would be suggestive of an old appendical inflammation. We also have some adhesions around the base of the appendix. The appendix being held by a piece of moist gauze and stretched out, I will tie off and sever the meso-appendix. I now tie the appendix itself rather close to its base and introduce a purse-string suture through the serous and muscular coats of the cecum about \( \frac{1}{2} \) inch from the base; I then place a piece of gauze around the base of the appendix to absorb any excretion that may escape coagulation by the cautery knife with which I amputate the appendix. I also apply forceps to the appendix \( \frac{1}{2} \) inch away from the site of the ligature, thus minimizing the chance of material escaping from the distal end. I use the cautery knife quite hot, so that the heat will char the tissues cut through, as well as coagulate any fluid contents in the appendix. I am not content with simply searing. I may here remark that charred tissue within the peritoneal cavity, such as the charred stump after the removal of the uterine appendage, rarely if ever invites adhesions to neighboring viscera. The charred surface may be likened to a scab beneath which the healing process goes on. A charred stump leaves a normal endothelial surface, therefore is better than a stump which has been simply cut away and dropped into the peritoneal cavity. The appendical ligature is then cut away, the stump inverted, and the purse-string suture tied and cut. I will look the ground over to see whether there is any oozing. It is all right, therefore I return the cecum to its normal position. Before going farther and examining the upper abdomen I will protect the incision by placing a piece of gauze over it and will take count of the small pieces of gauze. I now bring up the small end of the stomach, making traction on the same, and pull up with it the duodenum; through the pylorus, which is perfectly patulous, I can invaginate the adjoining duodenal walls. The anterolateral surface of the first portion of the duodenum looks as though it had been the site of an ulcer that had partly healed; here the wall is injected and much redder than the
typical duodenal blush, as well as less pliable than elsewhere. I note that the serosa of the gall-bladder is adherent to the duodenum; by separating these adhesions I will get a clearer view and will be better able to show you the first portion of the duodenum. You note here that in addition to the adhesions of the gall-bladder there are a number of small adhesions between the duodenum and the free border of the gastrohepatic (lesser) omentum. These are protecting adhesions. How wonderfully nature helps the doctor and how very often she does more for her patients than medicines can do, but she does not always get the credit. I do not tell you this to discourage you, but only to make you a little more conservative in your views. I cut away the adhesions and ligate all the bleeding points.

With the duodenum well in view I am able to inspect and palpate it thoroughly. I note the presence of hardness and induration corresponding to the point of induration, already referred to. I am therefore able to say that this is unquestionably ulcer. From the duration of the symptoms and the failure to get permanent relief through medical treatment, operation is certainly indicated.

The next important question is the type of operation. I could merely invaginate the ulcer and infold the adjoining walls over. This method, I am glad to say, is rapidly becoming obsolete, as it should. I could do a Balfour cauterization of the ulcer, perforating the duodenum and closing the perforation, or I could cut out the ulcer with the indurated area; or where the ulcer is small and favorably located a Finney pyloroplasty would be the best procedure; and, finally, I could do that which I usually prefer when feasible—a pylorectomy, by amputating the duodenum below the ulcer-bearing area and amputating the stomach to the proximal side of the pylorus, invaginating both stumps, and finishing with a posterior gastro-enterostomy. When this is not feasible, owing to the presence of exudate extending some distance down to the second portion of the duodenum, which would make it impossible to invaginate the duodenal stump, I do only a posterior gastro-enterostomy.
We will now open the lesser peritoneal cavity, locate, expose, and tie the coronary vessels to each side of the ulcer. Having secured these vessels, I pass my left index-finger into the lesser peritoneal cavity behind the pylorus and along the inner wall of the duodenum, when by directing the point of the finger forward I expose and clamp the vessels supplying this portion of the gut, and sever them along the duodenal side of the forceps. I next clamp the gastrocolic omentum close to its attachment along the greater curvature of the stomach to the point where I will cut through the stomach itself. All of these vessels and also the omentum in the grasp of the forceps are now tied. In this way I have freed the portion of the stomach and duodenum to be removed; I then apply two rubber-covered clamps, one on the duodenum below the site of the ulcer and the other on the stomach close to the pylorus, and cut through the duodenum and the stomach with a cautery knife. The duodenal stump is first closed by carrying a chromic catgut suture in a straight needle through the mucous membrane, then through the serous and muscular coats; the clamps on the duodenum are now removed and a purse-string suture of linen carried through the serous and muscular coats of the bowel a sufficient distance below the end of the stump to permit invagination, after which the suture is tied. The stumps of the omentum including the ligated pyloric and duodenal vessels are sewn to the invaginated stump of the duodenum for the purpose of reinforcement, in order to guard against possible leakage. I next close the opening in the stomach by sewing the two layers of mucous membrane together with a continuous chromic catgut suture threaded in a straight needle, then the clamp is removed. The serous and muscular coats are then apposed. Any spurting vessels should be secured by ligature. The final suture is a continuous Lembert or (properly speaking) Dupuytren suture of linen, which at each end picks up the stumps of omentum containing the ligated right gastro-epiploic and coronary arteries.

The next step in the operation is to make the gastro-enterostomy. In making the anastomosis it is important to look the field over and see whether the posterior wall of the stomach
is accessible through the transverse mesocolon. If it is (as it usually is), the transverse colon with the great omentum is drawn out of the wound, and by pulling these structures upward to the right the transverse mesocolon is put on the stretch and the origin of the jejunum brought into view. The transverse mesocolon is then carefully divided to the left of the middle colic artery and nearer to the vertebral than to the colonic border, so that in the event of the subsequent development of a marginal ulcer there will be less likelihood of the colon becoming involved in the exudate, which may cause a fistulous opening in the colon. The opening in the transverse mesocolon is now enlarged sufficiently to allow the stomach to be brought out in order to make the anastomosis. I next engage the stomach wall at two places, picking up a fold of the stomach which runs in the long axis of its body, and engage it between the left and middle blades of a three-bladed Roosevelt forceps. I then lay a small piece of gauze beneath the parts to be approximated. I now gently grasp the jejunum at its origin and apply the right blade of the anastomosis forceps so as to include 3 or 4 inches of the jejunum in its grasp, turning the jejunum over from right to left. I might say here that sometimes there is a peritoneal fold binding the jejunum to the mesocolon; when this occurs it should be divided up to its origin, so as to place the anastomosis as close as possible to the origin of the jejunum, and thus avoid making a loop. I replace the transverse mesocolon and the other viscera as quickly as possible, and thus have a free field, isolated by sterile gauze. The stomach and the jejunum are maintained in apposition by the clamps and are united by a seroserous continuous suture of linen started at the left end and carried over to the right, leaving the thread long, with the needle attached, for future use. An incision is then carried through the serous and muscular coats about \( \frac{3}{4} \) inch to either side of the line of suture, making the mucous membrane protrude in hernia fashion. With chromic catgut, commencing at the right, a continuous suture is carried over the middle blade of the forceps through all of the coats of the jejunum and the stomach except the mucous membranes.
The protruding mucous membranes of the stomach and the jejunum are then cut through and the suture again passed from left to right through all the coats of the two viscera until the end of the wound is reached. This makes the posterior margin of the new opening. The same needle is then carried through the wall of the jejunum from within out, about ¹⁄₄ inch from the cut margin. Crossing to the stomach, it is carried through that organ from without in, at the same distance from the cut margin; then from within out, and over to the outer wall of the jejunum, where it is carried from without in, and continued in this way until the openings in the stomach and the jejunum are closed. This constitutes a continuous mattress, or Mayo, or in-out-and-over suture. The thread is, of course, then tied and cut away. Now we take up the very first linen thread and carry it from right to left as a continuous Lembert-Dupuytren suture. This suture is the first and the last one used, the alpha and the omega of the method. I now grasp the anastomosis, holding the stomach and duodenum well up, and at ¹⁄₄ inch distant from the end of the opening attach the jejunum to the stomach. This is done to prevent spur formation at the inner end of the opening and to allow the uninterrupted passage of the jejunal contents from the proximal to the distant limb of the jejunum.

We are now ready for the final step in the operation—closing the upper margin of the opening in the transverse mesocolon by attaching it to the stomach distant to the anastomosis. This is better done by tying than by sewing, because it obviates the risk of wounding any small vessels that may be present. This closure of the opening in the transverse mesocolon prevents the possibility of internal strangulation of the bowel into the lesser peritoneal cavity. Some surgeons sew the upper margin of the opening in the transverse mesocolon to the suture line of the stomach and the jejunum. But I believe there is less likelihood of interference with the function of the gastroenterostomy opening by attaching the upper margin of the opening in the transverse mesocolon to the stomach wall.

We now remove the gauze surrounding the field of opera-
tion, inspect the posterior line of sutures, see that everything is all right, replace the viscera in the abdomen, draw the great omentum down over the small intestines, take account of the gauze sponges, pads, etc., and close the wound.

Now I will examine the specimen. It is, as you know, an ulcer and is crater-like in appearance. I will have it put on a platter, because medical students now-a-days must have every-

Fig. 1.—Chronic gastric ulcer near the pylorus.

thing handed them on a platter. I will ask you not to handle the specimen, but simply to look at it very carefully. The ulcer is in the smaller end of the opening. It has a little slough covering the surface. The portion that corresponds to the site of the slough is the most dependent part of the ulcer. Let me call your attention to the difference in appearance between the serosa and mucosa. If the ulcer had not been excised the appearance of the serosa of the duodenum would be such as to make
you think the ulcer had been healed, but, as you know, this is not the fact. I want to emphasize this point so that when in the future you hear the internist or the stomach specialist discourse on the healing of chronic ulcers under medical treatment you will know that they are mistaken. Dr. Reimann, the Chief of the Pathological Laboratory, will discuss this aspect of the subject with you.

Now I imagine some of you are wondering why I chose to do a pylorectomy in this case. Well, it is the most radical operation, and, as a rule in surgery, that which is most radical is the most conservative in the end. It was practically as easy as any other operation, and that means it is the safest for the patient, for that which is the easiest for the surgeon is usually safest for the patient. Furthermore, having done a pylorectomy including the ulcer, I have an empty house and not a questionable tenant, and an empty house is certainly preferable to an undesirable tenant. By the removal of the ulcer I have relieved the patient of any possible chance of perforation and hemorrhage, certainly a great advantage. Now if the ulcer had been gastric instead of duodenal I could also say that I did him a great good in protecting him from subsequent carcinomatous transformation. I cannot speak so strongly in the case of duodenal as of

Fig. 2.—Ulcerating form of gastric carcinoma.
gastric ulcer, because carcinoma engrafted on duodenal ulcer is rare. There are three things which stare an ulcer subject in the face: perforation, hemorrhage, malignancy, especially in gastric ulcer.

Let us pause for a moment to consider the conditions and the symptoms which so closely simulate ulcer as to make a correct diagnosis impossible. In the great majority of cases of duodenal ulcer a diagnosis can be made by x-ray, although this statement must be qualified by the remark, "depending upon the roentgenologist." In experienced hands x-ray diagnosis can be relied upon, but in the hands of the inexperienced it is scarcely ever reliable. In cases in which the plates give no definite information as to ulcer, we have often to come back to that old sinner, the appendix, especially when it occupies a high position. Or we may have to consider the gall-bladder or the pancreas responsible for the symptoms, but as pan-

Fig. 3.—Low-power semidiagrammatic drawing of carcinoma cells streaming into the surrounding tissue.
creatitis is not common except when associated with cholecystitis the two may well be considered together.

As to diagnostic methods, I cannot say that I derive much information from the products of gastric or duodenal lavage, or from laboratory tests except gastric analysis of a test-meal or a full meal, or both. I am aware that most doctors prefer to send their patients to have x-ray pictures taken, to use the language of the patient, but I believe that gastric analysis is as reliable as x-ray except in the presence of actual deformity in the shape of an excavation, or of interrupted peristaltic waves, or roughening of the mucosa, or deformity from the outside, pressure being due to a mass of crippling adhesions. The capacity of the stomach can well be determined by inflating it with air, and by percussion the stomach can be outlined and marked on the abdominal walls; then, after allowing the air to escape, the stomach can be filled with water, and again by percussion the area of dulness can be marked; and allowing the water to escape the amount escaping can be measured, and thus give information that is not otherwise obtainable. The degree of retention can be determined by giving a test-meal and passing the tube in one hour, or with a full meal at the end of eight or ten hours. This, I know, may meet with the objection that it can just as well, if not better, be learned by means of the bismuth or barium meal and the fluoroscope, with much less discomfort to the patient. As far as the patient's comfort is concerned, this may be true, but as to the greater precision, that I cannot concede. Very often where the x-ray has shown retention, in the absence of pyloric obstruction, I have been able to satisfy myself with the tube that there was no retention, and have had my observation confirmed at operation. Chemical analysis of the gastric and duodenal contents makes more impression upon the patient than upon the experienced surgeon. This applies also to the recent introduction of the treatment of certain upper abdominal disorders by duodenal washings, injections of serums, etc. Diagnosis in these cases when brought to the operating table, as many of them eventually are, has rarely been sustained by the pathology exposed at operation.
As to chemical analysis, high acidity is generally regarded as characteristic of ulcer, and low acidity or anacidity, of carcinoma; while occult blood and in some instances microscopic blood, of both ulcer and carcinoma. The abdominal surgeon can tell you that this is not proved at operation. Very often low acidity or anacidity are seen in cases merely of appendicitis or of cholecystitis. In the presence of occult or microscopic blood how often have I found neither ulcer nor carcinoma, but a toxic gall-bladder.

Fig. 4.—Gastric carcinoma at the pylorus arising probably in a previous ulcer.

I want to impress upon you particularly the importance of the study and careful interpretation of the history. Careful palpation, to determine areas of tenderness and rigidity, or the presence of a mass, with percussion and auscultation, are also of paramount importance. In indurated duodenal or pyloric ulcer tenderness will be elicited upon deep pressure made with the tips of one or two fingers over the middle of the upper segment of the right rectus. Tenderness elicited upon pressure opposite the point of the ninth costal cartilage and immediately
to the outer side of the right rectus will probably bespeak gall-bladder disease. Keeping the finger in contact with this point while the patient takes a deep breath will make the tenderness more pronounced, especially if the deep breath is held and the pressure of the finger increased. Palpation at this point in the presence of an enlarged gall-bladder, the fundus of which projects below the border of the right lobe of the liver, will reveal a swelling that moves with respiration. In the case of a diseased appendix in a high position pressure over the area will elicit tenderness, particularly if the appendix is long enough to be almost in contact with the gall-bladder. I have many times seen tenderness in this region caused by a diseased appendix mistaken for gall-bladder disease. This problem can usually be solved by palpating the appendix from below upward, when the tenderness will be made out lower down and can be traced upward, a point strongly in favor of appendical disease. But where the inflammation of the appendix is mostly at its distal end and active enough to have caused inflammation of the adjoining peritoneum, and where the gall-bladder is not palpable, the differential diagnosis is more difficult.

Hunger-pain if definite and occurring regularly every day, three to five hours after eating and especially during the night, belongs to the symptomatology of ulcer. Sometimes, however, hunger-pain is present in chronic disease of the gall-bladder, but it is not apt to be so constant or so marked as in the typical ulcer case. The most important points in the history of the ulcer patient are the long duration of symptoms, extending as a rule over several years, with intervals of almost if not entire freedom. This latter fact, as has so often been said, argues against cure by medical treatment. These patients are many times told that they are well. It is only just, however, to say that proper medical and dietary treatment, such as the Sippey treatment, will often bring relief and make the ulcer patient more comfortable. But to promise a cure of a chronic ulcer by medical measures is only a delusion. I have seen this exemplified so often that I do not hesitate to use emphatic language. It is parallel to telling a patient with appendical abscess, where the
pus has been evacuated only and the appendix not removed, that he will have no further attacks of appendicitis. Every surgeon knows that this is not the case.

Justice also impels me to say that not all patients are cured by operation. Sometimes there is a return of symptoms and the patient comes to the hospital for the removal of the anastomosis, as in the following illustrative case of a young man recently operated upon in this hospital. For the past three years he has had intermittent pain about the heart due to pressure of excessive gas in the epigastrium; also frequent headaches. He was operated upon in another hospital in April, 1921 for appendicitis, without relief of symptoms, and again at the same hospital in September, when he had an ulcer excised and a posterior gastro-enterostomy done. He still complains of the same symptoms, consisting mainly of a continual pain around the heart and soreness in the epigastrium, moderate belching of gas, and passing of flatus. Since the second operation he has been able to eat almost any kind of food, but always drinks a great deal of water at meals. This causes a great deal of gastric disturbance, with nausea so marked that the patient often feels obliged to empty the stomach with a stomach-pump. Appetite good. Bowels have been extremely constipated since the last operation. Loss of 20 pounds in weight in the last two months; feels extremely weak and has been in bed since September. Unable to pass more than about 4 ounces of urine at any time, although there is no great frequency. Nocturia, two or three times. No cough, cold, or night-sweats. This is evidently a case of vicious circle which can be relieved only by operation.

At the operation an upper right rectus incision was made. Many adhesions below the liver and the hepatic flexure and transverse colon were released. The pylorus was patulous. There was no lesion either in the duodenum or in the stomach. The transverse colon and the great omentum were delivered and the site of the anastomosis exposed. The afferent loop was long and adherent to the wall of the stomach. This was freed, and the terminal part, together with the proximal promi-
Fluent end of the efferent loop and the stomach wall forming the portion of the anastomosis, were cut away with the cautery. The opening in the stomach was closed and the ends of the jejunum united, in other words, a circular enterorrhaphy was done. Recovery was uninterrupted and the patient left the hospital free from symptoms.

Remarks by Dr. Reimann.—The subject of gastric and duodenal ulcer from the laboratory side can be approached from very many angles. Let us confine ourselves to considering only a few. In the first place, Dr. Deaver has mentioned the question of the healing of these ulcers. Intimately connected with this is the question of their etiology. We all know how difficult it is to produce the typical chronic, progressive (and mark this word progressive) ulcer in animals. While gastric ulcers were known for many years, indeed, there are references to them in the late 1700's, all attempts to reproduce them in animals have failed up until quite recently. We might mention briefly a few of the methods which were used. Ligation of vessels, cauterization of the mucous membrane, either with the actual cautery, or with acids, or nitrate of silver, and other such substances were all tried on dogs and other animals, but, and this is an important point, the wounds all healed very quickly. Indeed, about three-fourths of the vessels supplying the stomach can be tied without producing ulcers. About 1908 a typical progressive chronic ulcer was produced in a dog. The production of embolism and thrombosis had hitherto been a favorite experimental method, and while plugging the vessels with India-ink or paraffin or other inert substances yielded no ulcer, the addition of a toxic factor, such as formalin or lead, produced the desired result. Quite recently progressive chronic ulcers have been produced in dogs which were weakened or rendered toxic by such conditions as distemper, unhygienic surroundings, etc. The sum and substance of all the experiments seem to show that given the digestive action of the gastric juice, and this brings up the whole subject of autodigestion which cannot be discussed here, and a toxemia, an ulcer develops. We often hear the idea expressed
that the toxemia from a diseased appendix may lead to ulcer. We are rather fond of this idea here in this clinic, but, as we all know, toxemia may come from many other foci in the body. With this in mind, is it not wise and practical to think of gastric and duodenal ulcers as “secondary diseases”? There are, of course, other theories concerning the mode of formation of this disease. Suffice it to say that very probably they have a special application in special cases.

To return to the healing, if we consider ulcer a secondary disease and if toxemia and the digestive action of the gastric juice are concerned in its formation, we have a basis for treatment. That healing takes place in certain cases is probably true, but we have seen so many instances in which the history indicates the presence of ulcer for many years, and in which, and this is important, there have been periods of freedom from symptoms for varying lengths of time, that we must conclude there is no very good criterion to be obtained from subjective or objective symptoms that healing has really taken place. Many of the actual specimens are calloused and show connective tissue at various stages, from granulations, the youngest, to fibrous tissue, the oldest. We have seen a number of very remarkable specimens in which no effort at healing has been manifest. The ulcers have presented a punched-out appearance, and the surrounding tissue showed no inflammatory reaction. We do not know just where to place this kind of ulcer. Several times Dr. Deaver has believed from finding a scar on the serous surface that an ulcer had been present, but was now healed. He has excised the scar tissue, and on gross and microscopic examination we have found defects in the mucosa which were in no sense covered, so that ulcer was present. The so-called hunger-pain, so frequent a symptom of ulcer, is said to be very characteristic of ulcers. The question of the origin of the pain is of more than academic interest. Unfortunately, too little is known at the present time either of the afferent nerves from the viscera or of pain nerves. It is good to see a systematic study of this subject such as is coming from Carlson and his associates in Chicago. Hyperacidity is often found
in cases of ulcer. This was known very early in Virchow's time and it was often thought that it gave rise to the pain. Experiments on individuals with fistulae, however, soon showed that this view was not correct. Moreover, hyperacidity is by no means always present in ulcers, nor is it increased if it is present during the pain. We know from Carlson's work that the empty stomach contracts, and that these contractions are associated with the sensation of hunger. With this idea in mind, the same worker studied the contractions of the stomach during pain in ulcer. He found that the two were associated. Very recently Reynolds and McClure also found that often, but not always, pain was associated with movements of the stomach whether of hunger or of digestion. This gives us a clearer light concerning the manifestations of this pain, for whether or not it occurs and whether it be mild or severe will depend on a number of factors, namely, the strength of the contractions, the situation of the ulcer, that is, how close to nerve endings, principally the vagus, the psychology of the patient, and so on. Dr. Deaver has excised the ulcer in this case and made a blind end in the stomach. This necessitates a gastro-enterostomy of course. Offhand one would say that the only indication for a gastro-enterostomy is pyloric obstruction, which is of course the major indication, but gastro-enterostomy alone even in the absence of pyloric obstruction will cause ulcers to heal. Why it does is still a mystery. That it is a fact is attested by many reports, especially of those cases in which two operations are done; the first discovers an ulcer supposed to be carcinoma. A gastro-enterostomy alone is done. In several weeks another operation to resect the supposed carcinoma is undertaken, when total disappearance of the ulcer is shown. At first it was supposed that the stomach emptied itself very quickly through a gastro-enterostomy, and that the irritating acid and digesting pepsin were removed in that way, but subsequent studies have shown that the emptying time of the stomach with a gastro-enterostomy is practically normal. Furthermore, when the pylorus is patulous very little contents actually escape through the artificial open-
ing. Even when the pylorus is completely obstructed the contents of the stomach do not simply drop into the jejunum, but are sent through in irregular squirts, not as regularly or as rhythmically as through the normal pylorus. While, therefore, the movements of the stomach and its rate of emptying are not very markedly influenced by the anastomotic opera-

Fig. 5.—Marginal ulcer.

tion, the chemistry is considerably changed. There is always some regurgitation of alkaline jejunal contents by which the acid in the stomach is neutralized. This does not, of course, explain very clearly why gastro-enterostomy exerts a healing influence on ulcers. It seems at the present time that we must accept it as a fact and await further investigation for its explanation.
ADENOCARCINOMA OF LEFT BREAST: RADICAL AMPUTATION, WITH DISSECTION OF THE AXILLARY CONTENTS

The Lord has given us organs of sight, taste, smell, hearing, and touch, but too often we fail to use them to the best advantage in making a diagnosis. Sometimes a diagnosis can be approached by observation. Looking at the right mamma of the patient upon the table you will see the normal prominence in the center of the breast, the nipple. Now let us look at the left breast. You note there is an extra little prominence which is not present on the opposite side. The skin immediately over this little prominence is dimpled. Have you (speaking to the intern) examined this patient?
A.: Yes, sir.
Dr. Deaver: How did you examine her?
A.: Sight and touch.
Dr. Deaver: What did your touch tell you?
A.: Tumor in the left breast.
Dr. Deaver: What do you mean by the word "tumor"?
A.: An undetermined growth.
Dr. Deaver: Can be only determined by what means?
A.: By the naked eye together with pathologic examination.
Dr. Deaver: Macroscopic and microscopic. Now in your experience would you rely more upon the microscopic or the macroscopic?
A.: Macroscopic.
Dr. Deaver: Now, doctor, how does that feel to you?
A.: Feels hard.
Dr. Deaver: Contour what?
A.: Irregular.
Dr. Deaver: Movable?
A.: Yes.
Dr. Deaver: Did the patient have any symptoms?
A.: No, sir. The tumor was not tender to the touch.
DR. Deaver: In your experience, what would you say this tumor is?
A.: Probably malignant.
DR. Deaver: What type of malignant tumor?
A.: Adenocarcinoma.
DR. Deaver: I think the doctor is as near right as any of us would likely be from a gross inspection.

If this case were a young woman, who like others say to me, "Doctor, I want to wear a low neck, etc., I am still a young woman," then I would make an incision here under the breast in the crease between the breast and the side of the chest, lift up the breast, and dissect it out from beneath, making a scar which does not show, and allowing the patient to wear a low neck. Of course it would not be nice to wear it too low, but we are living in an age when fashionable women, as some one recently remarked, wear their dresses only high enough to cover and their skirts short enough to be attractive, so, of course, we surgeons have to bear these points in mind.

I take the scissors because it answers as well as the knife. I am suspicious here, but I am going to clear up the doubt. Now I will section it. I should say from the appearance and feel that it is adenocarcinoma. There was a little dimpling of the overlying skin, you recall, which with or without retraction of the nipple is usually a sign of carcinoma. I feel reasonably sure that it is not benign. I want the student body to feel this tumor; I will pass it around. How is the dimpling of the skin over a breast tumor as well as retraction of the nipple to be explained, and what do they signify? Dimpling of the skin is due to shortening of the vertical septa of the fascia connecting the superficial and deep layers of the superficial fascia of the upper and anterior chest between which the mammary gland is located; in other words, the mammary glands are sandwiched between these layers of fascia. These septa run between the lobules of the gland and when the lobules are infiltrated they too are infiltrated and become shortened and contracted, and pull in the skin to which they are attached by the superficial layer of the superficial fascia. They have
been named the ligaments of Cooper. The nipple becomes retracted through shortening of the lactiferous ducts, the latter being involved in the infiltrate. These signs are, as a rule, pathognomonic of malignant growth. Doctor, kindly read the history of this patient.

Dr. T.: Female, age fifty-five. Two years ago first noticed lump in the left breast, which has been slowly increasing in size without causing pain or any other symptoms; no loss in weight, no respiratory symptoms. Patient has had occasional indigestion for years, never severe; no cardiac or renal symptoms.

Dr. Deaver: Is this your patient, Dr. C.? Have I her consent to take off the breast?

Dr. C.: Yes, sir.

Dr. Deaver: By both superficial and deep touch I am not able to satisfy myself that I feel any axillary glandular enlargement, but this does not mean that the glands are not enlarged, in other words, that this growth has not metastasized to the armpit. I have the patient’s consent to act as I think best, I will therefore do a radical operation.

The operation I employ for the radical removal of the breast is essentially Halsted’s method except that I rarely resort to skin-grafting. In the great majority of cases I close the wound at once. I believe that much may be accomplished by extensive subcutaneous dissection, both lateral and medial; also in the average case there is more danger in removing too little of the deep fascia than too little of the skin which may be involved. Of course this method is not applicable to all cases, such as cancer en cuirasse or where ulceration is extensive, but with wide dissection of the skin and with the flaps made movable, the necessity for skin-grafts rarely arises; and only exceptionally does necrosis of the flaps occur to prolong convalescence.

I begin the incision on the arm at a point opposite the insertion of the pectoralis major muscle at the level of the anterior edge of the deltoid, and carrying it upward and inward, well on to the shoulder, to a point about 2 inches beyond the line of the anterior axillary margin; curving it gradually with the
concavity outward to within 2 inches of the upper margin of the breast; this places the incision well within the line of the anterior axillary margin, so that the scar will not cross the axilla obliquely, and perhaps bind the arm to the side of the chest wall. Two other incisions are made to diverge from the lower end of the one just made, the two forming an inverted V, the limbs of which encircle the upper segment of the breast. The remaining portion of the incision is marked out by merely cutting through the epidermis, converging at a point about 2 inches below the lower margin of the breast, below which a single incision is carried down to a point midway between the tip of the xiphoid cartilage and the umbilicus. I now deepen the upper incision until the fascia over the pectoralis major muscle is exposed. The skin-flaps are reflected, the median one being dissected well beyond the edge of the sternum upward as high as the upper border of the clavicle, thus exposing the anterior portion of the deltoid muscle. The lateral flap is dissected outward and backward well beyond the anterior edge of the latissimus dorsi muscle. We now expose the axillary space by cutting the tendon of the pectoralis major close to its humeral attachment, removing this muscle in toto. See how the sternal fibers of the muscle recede downward and inward as the muscle is freed from its insertion on the humerus; and the clavicular head continues slightly to obscure the infra- clavicular region. We must now separate this portion of the muscle from its origin on the clavicle, being careful not to injure the cephalic vein. Next we expose the second layer of the anterior axillary wall consisting of the pectoralis minor muscle and the costocoracoid membrane. The index-finger is pushed through the costocoracoid membrane between the pectoralis minor muscle and the acromiothoracic artery, close to the coraco- coid process of the scapula, raising the tendon of insertion of the muscle on the finger, being careful to exclude the long thoracic artery which arises behind it, and the tendon is then severed with a pair of blunt scissors. Strong traction is made to lift the muscle away, and the tendon of the muscle is grasped with a pair of hemostatic forceps to catch the veins which
traverse its substance, and a branch of the long thoracic artery which frequently enters it near its scapular attachment. (To the assistant): Now bring the arm up and bend the elbow. I now proceed to the dissection of the axilla, beginning at the apex, I cut the costocoracoid membrane near the clavicle and expose the subclavius muscle and the deep infraclavicular triangle. With gauze dissection I open the axillary sheath as near as possible to the apex of the axilla and strip it from the subclavius muscle and the axillary vessels from above downward, wiping the areolar tissue and the lymphatics away from the vessels and nerves. It is important to remove every vestige of fibrous and fatty tissue, especially from the upper portion of the axillary space. The branches of the axillary artery are now exposed at their origin, as well as the termination of the tributaries of the axillary vein and the terminal portion of the cephalic vein. You know that the arteries here encountered from within outward are: the superior thoracic, the alar thoracic, acromiothoracic, long thoracic, and subscapular. The vessels except the acromiothoracic and the subscapular are ligated and cut; the subscapular should, if possible, be preserved. The veins accompanying the arteries, except the cephalic vein, are tied near their terminations and cut. I now remove the fascia and fat surrounding the subscapular artery and its branches. Beginning above the teres minor, the dissection with gauze is carried downward, removing the fascia over the muscle, the teres major, subscapularis, latissimus dorsi, and serratus magnus muscle, being careful to preserve the external thoracic nerve (nerve of Bell) which runs over it in the line of the midaxilla, and also preserving the long subscapular nerve which supplies the latissimus dorsi muscle. This finishes the axillary dissection. The lower field of the operation is now exposed. Beginning with dissection of the lateral flap by deepening the incision already outlined, I expose the lower serrations of the serratus magnus muscle, and some of the upper serrations of the external oblique, the outer half of the upper part of the sheath of the rectus abdominis; I now dissect the median flap well beyond the sternum, paying no attention to the bleeding
from the perforating branches of the internal mammary artery, as these branches will again be cut when the pectoralis major muscle is removed. Grasping the breast in the left hand, I put the pectoral muscles on the stretch by downward traction, and release them from their attachments to the chest wall; and now I remove the axillary contents, the pectoral muscles, and the breast in one mass. Next I remove the fascia covering the upper serrations of the external oblique and the upper part of the anterior rectus sheath. The bleeding points are ligated with iodinized gut. I make a counterincision in the posterior flap in this way, so that when the patient lies on her back the opening through which the drainage-tube is passed will be in a dependent position and just in front of the free edge of the latissimus dorsi muscle, sometimes I carry the opening through the muscle. A fenestrated drainage-tube is placed in the axillary space, being careful to avoid contact with the axillary vessels and nerves, and is anchored to the skin edges of the counteropening with a single suture of silkworm-gut.

I am now ready to close the wounds, but before doing so I look for bleeding points and apply hot compresses to control the slight oozing that occurs. Some surgeons believe that drainage here is unnecessary, but I find that providing a free exit for the serum and the slight oozing of blood that may collect in the axilla during the healing process reduces the danger of infection, hastens the healing process, and prevents the formation of very strong adhesions in the axilla.

The arm is now adducted and the flaps approximated with interrupted sutures of silkworm-gut, as many as are required to bring the incision edges together. The margins of the skin are sewn with interrupted sutures of fine silkworm-gut. Sterile pads are placed in the axilla in order to keep the flap of skin and superficial fascia which form the base of the armpit in contact with chest wall, and the arm is placed at an angle of about 70 degrees. The incision is covered with sterile gauze and a figure-of-8 bandage 6 inches wide, and composed of 8 thicknesses of gauze, is applied to include the shoulder of the affected side, the axilla, and the chest.
After the wound is healed and before the patient leaves the hospital the area will be exposed to x-ray treatment, with as many subsequent treatments as in the opinion of the roentgenologist may be necessary to secure the best possible results from the operation. It is generally believed, as you all know, that radiation either by x-ray or radium brings about fibrosis and kills cancer cells (within reach) that may have escaped the knife. These cancer cells are in a state of division, which are more susceptible to destruction by x-ray or radium than mature cells.

A word regarding tumors of the breast may not be out of place here. It is well, of course, to act on the principle that a tumor of the breast is malignant or potentially so, until by frozen or microscopic section it is proved to be benign. Nevertheless there are a few points that may be of service in the clinical differentiation between benign and malignant growths. A benign tumor has a tendency to separate itself from its surrounding tissue by encapsulation, and is usually freely movable within the breast tissue. The most common type of benign growth I believe is the fibro-adenoma. There is, as a rule, no abnormality of the overlying skin, such as ulceration, although this may occur as a result of pressure. Retraction of the nipple is very unusual and occurs only when the tumor is situated directly beneath the nipple. Enlargement of the lymph-glands is also rare in connection with benign growths; when present it is invariably due to a complicating lymphadenitis. A benign tumor is also apt to be associated with pain in its development, and like sarcoma is characterized by rapid growth and by lobulation and cyst formation, and often by a thin glossy overlying skin and prominent veins. If for no other reason than this resemblance to a malignant neoplasm like sarcoma early removal of the tumor would be indicated, for one cannot always be absolutely sure of the diagnosis. Furthermore, simple excision of the tumor is a minor operation, practically devoid of danger, while the growth if allowed to develop carries the serious menace of possible malignant transformation. The question of radical operation for benign fibro-epithelial tumors of the breast also
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deserves consideration, especially in patients in middle life, beyond the child-bearing period. In preparing the statistics for my book on Diseases of the Breast it was found that 24.3 per cent. of the patients traced, who had been operated upon for benign tumors of the breast, reported postoperative complications at more or less remote periods, consisting either of a similar growth in a different part of the same breast or in the other breast. This certainly seems to indicate the susceptibility of certain breasts to tumor formation.

Bleeding from the nipple in the presence of a tumor is generally regarded as a sign of malignancy, although so eminent an authority as Bloodgood, I believe, disagrees with this view. But in my experience a discharge from the nipple, particularly a bloody one, is rarely associated with a benign tumor. It nearly always indicates a somewhat rare tumor, known as intracystic papilloma, which is classed among the benign tumors, but has a pronounced tendency to malignant transformation. I am inclined to think that in most cases the growth is malignant from the onset. At any rate, it is advisable when operating for this condition to determine the presence or absence of malignancy before deciding upon the type of operation.

Remarks by Dr. Reimann.—To jump from this concrete case of carcinoma of the breast to a more general theme, let me make a few remarks in reference to co-operation in tumor study. I shall only say a few words, but give you impressions which we receive here almost daily. It will be admitted by all that pathologic anatomy is a fundamental subject, and there will be no hesitation in agreeing with another general statement, namely, that proficiency cannot be attained in this branch except as a result of years of practice and experience. Pathologic anatomy is an art as well as a science and the judgment of the pathologist is a combination of the art as he has acquired it plus the science behind it. The general subject has been worked over very carefully and thoroughly, but no doubt all surgeons and all pathologists who co-operate with surgeons know that there are wide gaps in one most important phase, and that is correlation of the patient with his tumor. Path-
ologists receive specimens, tissue, and sometimes even bits of tissue, with the request for diagnosis. Often there is no word or very little of the clinical aspects of the patient from whom the specimen was removed, and still less information is given concerning the future course of events in that patient. Therein lies a gap in our knowledge. The pathologist, Ewing, of New York, is helping to supply knowledge in that direction; the surgeon and pathologist, Bloodgood, of Baltimore, is working along the same lines, only to mention two, although if we hunted, we would find it hard to increase the list to any considerable degree. Carcinomata, to return to the specific tumors of the breast, usually fall into certain well-known classifications. When they are hard and fibrous they are called scirrhous; those that are less hard are known as simplex; and the soft ones are called medullary carcinomata. Microscopically the cells may arise from the ducts or the acini; they may form “adeno” structures, or they may grow diffusely, or there may be combinations of both; furthermore, the axillary lymph-nodes, when they are involved, may show varied structures in the respective individual nodes. We have patients with large tumors and very small metastases in the axillary lymph-nodes, while the reverse also occurs. We have followed patients whom we expected to die very quickly for years after the operation; others were expected to live long or to be entirely cured of the disease, and we were disappointed. We would obtain more knowledge of the factors involved through a correlated study of, let us say, the position of tumors, duration, size, degree of axillary involvement, the gross and microscopic picture, and finally the follow-up history to mention only several of the more obvious considerations. This has been done to a certain extent, but how incompletely is only apparent in a study of the general literature.

This talk has become, as you see, a plea for closer co-operation between surgeons and surgical pathologists, but while we are on the subject of the breast it will be useful to call attention to the admirable piece of work done by McFarland, of the University of Pennsylvania. This was presented at the Phila-
delphia meeting of the American College of Surgeons last fall, and will be published very shortly. Among other things he speaks of chronic cystic mastitis, the disease very frequently looked upon as one of the precursors of malignancy. According to his work there is no such thing as chronic cystic mastitis, since there is no inflammation present. It is a cystic disturbance of the breast traceable to modifications of involution. It is not necessary that lactation be absolutely established for changes to take place in the breast. Indeed, he says, they even take place with the onset of pregnancy. When the call upon the breast function ceases it undergoes an involution, but there are areas which fail to reach the final stage. The least objectionable of the terms, according to McFarland, is "abnormal involution," as suggested by Warren many years ago. The objection to this term is to determine when it is abnormal because so many different appearances are presented. This most important work should be studied by all who deal with conditions in the mammary glands.
TRANSPERITONEAL HYSTEROTOMY

The next patient I present is one of pregnancy of seven and a half months’ duration in which the symptoms indicate a hysterotomy. They consist of pyelitis, persistent vomiting, headache, low blood-pressure, very high blood urea, and low phenolphthalein output; urinalysis shows a low specific gravity and the presence of albumin, pus, casts, etc.; in other words, a type of the toxemia of pregnancy. The pregnancy, in fact, is almost far enough advanced to call the operation a cesarean section. When I first saw this patient with the medical chief and the house doctors we hoped it might be possible to tide her over until the eighth month, in order to save the child if possible, but conditions seemed to demand operation now. The case being one of pyelitis, we will do it under nitrous oxid and oxygen anesthesia. From the surgeon’s point of view, ether, chloroform, or intraspinal anesthesia would be preferable because the patient is more relaxed and permits greater ease of manipulation. The condition of the kidneys make chloroform or ether objectionable, while the low blood-pressure makes intraspinal anesthesia, particularly with stovain, too dangerous. The latter even under so-called favorable conditions is dangerous enough. Novocain solution, which I understand is now being given in the Mayo Clinic, is considered safer than stovain for intraspinal anesthesia. I will use the transperitoneal route, discussing the value of the operation and its indications when I have finished.

With the patient in the Trendelenburg position I make the incision, carrying it over and through the right rectus muscle, expose the transversalis fascia, pick it up with the peritoneum and cut it, thus opening the peritoneal cavity; the incision is now enlarged enough to allow delivery of the uterus upon the abdominal wall. Before attempting to deliver the uterus and introducing the retractors we will cover the abdominal wall
adjacent to the wound with warm gauze pads to prevent contact of the uterus with the skin. Two retractors are now placed in the wound, the one in the lower end, the other in the side of the wound, and as the assistant makes traction downward, upward, and outward, I deliver the uterus, packing gauze around it to prevent any fluid getting into the peritoneal cavity. With great care and gentleness I now carry an incision through the wall of the uterus down to the membrane, making it large enough so that by compression upon the sides of the uterus the fetus can be delivered with the membranes intact. This I consider the way ideal, the mother practically is not being exposed to any chance of infection of the peritoneum. I have always considered emptying the uterus within the abdominal cavity poor surgery. I now close the wound in the uterus in layers by a continuous chromic catgut suture up to the serosa, but not carrying the stitches into the cavity of the uterus. The wound in the serosa is closed by interrupted linen or fine silk sutures. Usually it is not necessary to clamp and tie bleeding vessels in the uterine wall because contraction of the uterus and the sutures control the bleeding, but occasionally it may have to be done. The uterus is returned to the abdominal cavity, the appendix taken out if it has not already been removed, and the wound closed.

Transperitoneal hysterotomy is one of the most satisfactory as well as successful operations we perform. I have done it about one hundred and fifteen times without a fatality or any postoperative morbidity. In closing the superficial portion of the uterine wound I use the Lembert stitch and introduce the needle threaded with linen or with silk, at a distance from the center of the wound so that enough of the superficial portion of the uterine wall fills the wound, which when the stitch is tied will act as a compress, and thus control any oozing that might otherwise take place. In other words, the deeper the superficial wound, the more of the uterine wall will be inverted. The idea is the same as in a gastro-enterostomy where the last stitch is carried along the anterior margin of the anastomosis, thus making two rows of suture stitches in this margin which
answers the same purpose in controlling bleeding as three rows placed in the posterior margin.

You may ask why I do not use catgut sutures in closing the uterine wound. Catgut, first of all, does not absorb so easily and is more likely to break than linen or silk; second, we cannot be as absolutely sure of catgut as of linen or silk. In closing the abdominal wound also I would advise you always to use silk, linen, or silkworm in addition to catgut sutures if you wish to avoid such unpleasant sequelæ as postoperative disembowelment.

Some surgeons, particularly obstetricians and gynecologists, prefer to do a vaginal hysterotomy or a so-called extraperitoneal abdominal operation. But in this clinic, especially in the absence of a septic condition of the uterus, we do not use these routes, since we do not consider them ideal surgery.

I consider transperitoneal hysterotomy a very valuable operation. I know that I have been accused of using it when other simpler and, perhaps to the inexperienced surgeon, less dangerous methods might do just as well. We are all human and liable to err, but I can do only what my judgment tells me is best. My results I believe bear me out. I may add, however, that I would not advocate the use of this operation except by the experienced surgeon.

In the non-pregnant uterus transperitoneal hysterotomy is useful in clearing up doubtful cases, especially of bleeding where no definite cause for the same can be made out, and which I believe can be better diagnosed by direct inspection than in any other way. I know that the general rule is to treat such cases with radium. While radium does arrest the bleeding, it does not fathom its cause. Furthermore, there is a certain degree of danger in its use which is not always admitted by its unequivocal advocates. I have seen severe peritonitis not due to any inflammatory condition of the appendages result from the use of radium, while the development of fistulæ is another morbid condition that may follow its application.

In the pregnant woman we do a transperitoneal operation for placenta prævia, accidental separation of the placenta,
prolapse of the cord, eclampsia, toxemia with nephritis, and in certain cases of pulmonary tuberculosis where the pregnancy is beyond the fourth month. Before the fourth month, however, dilatation and curetage and the introduction of a catheter would be indicated, but even in these cases accidents, such as perforation of the uterus and infection, may occur which would not follow a clean and skilful hysterotomy.

(Mother and child left the hospital in good condition three weeks after the operation.)
RECURRENT CHOLECYSTITIS; CHOLECYSTECTOMY

The patient I will now present has already had her gall-bladder drained, but not at this clinic. The question before us now is, Why is she here this afternoon, what is the matter with her, and what are we going to do. Let us read the history. Female, aged twenty-nine; chief complaint, pain in abdomen. Two and a half years ago the patient was operated upon in another hospital, stones were removed from the gall-bladder and the organ drained, not removed. She was free from symptoms until two months ago, when she began to have attacks similar to those prior to the operation. These attacks come on suddenly, three or four times a week, and consist of pain in the epigastrium and beneath the right costal margin, radiating through to the back; nausea, but no vomiting; last attack, two days ago, was relieved by hypodermic of morphin. No definite jaundice; has had a feeling of heaviness in the epigastrium, also bloating and considerable belching of gas after meals; occasional hunger-pain relieved by eating. Bowels constipated. This certainly looks like a case of recurrent cholecystic disease. In our examination of the patient we have not been able to palpate the fundus as frequently can be done in the presence of an enlarged gall-bladder; this, however, does not contraindicate an enlargement with or without stones any more than does the absence of jaundice. We have been able by delicate palpation to detect slight rigidity as well as elicit slight tenderness over the position of the gall-bladder, most pronounced when the patient takes a deep breath and holds it, at which time tenderness of the liver immediately overlying the gall-bladder is also evident to a slight degree. We have not by deep pressure over the lower anterior chest been able to make out any general liver tenderness, as we frequently can in many cases of cholecystic disease. In this connection I may say to you that it is now being generally recognized that
most cases of interstitial cholecystitis are associated with or develop from hepatitis, the infection being carried to the walls of the gall-bladder by the lymphatics of the liver, which communicate with the lymphatics of the gall-bladder. Dr. Stanley P. Reimann, our pathologist since 1917, has been reporting to this clinic the presence of chronic hepatitis in pieces of liver frequently removed with the gall-bladder in cases of chronic cholecystitis. The next most common avenue by which infection reaches the gall-bladder walls is through the blood; in fact, the lymphatics and the blood-streams are practically the only avenues by which organisms are transmitted to the wall of the gall-bladder. Descending infection from the liver by bacteria carried down in the bile and ascending infection from the duodenum up the common duct are now seldom thought to play a rôle in the causation of chronic inflammation of the gall-bladder. The wall of the gall-bladder is occasionally but rarely infected from an inflamed contiguous organ. I have seen such infection take place from an appendix in contact with the gall-bladder. The first instance of this kind occurred in my experience several years ago in the person of the wife of a colleague. I was asked to operate. The husband's diagnosis was suppurative appendicitis in a high-lying appendix, but operation revealed the two conditions appendicitis and cholecystitis. This subject of cholecystic infection has been most intelligently and convincingly discussed by Drs. Graham and Peterman of St. Louis. Their conclusions are supported by clinical study as well as by experimentation. I would urge those of you who are especially interested in this subject to familiarize yourselves with the splendid work of these investigators. Their results justify the statement I have already made this afternoon when I referred to the irrational treatment of cholecystic disease by duodenal flushings with Epsom salts solution. If time permitted I should like to talk to you further along these lines, but there is too much work awaiting us to allow me that pleasure now.

In answer, then, to the question, What is the matter with the patient? we can say definitely interstitial cholecystitis with
adhesions, the characteristic symptoms being the feeling of bloating, distention of the stomach with gas and occasional hunger-pains, the presence of adhesions about the stomach and duodenum. Let me here say that in the absence of very definite history of gall-stone colic with pain referred to the costal margin and to the right shoulder-blade, requiring morphin for relief, and in the presence of the other symptoms, such as described above, such patients are not frequently sent to us with the diagnosis of duodenal ulcer. I am not always surprised at this diagnosis, because the presence of adhesions arranged in the shape of comparatively broad bands (pathologic sheets of fascia) attached to the duodenum oftentimes cause ulcer symptoms, and barring positive x-ray findings, it is difficult to make a differential diagnosis.

We will now proceed with the operation. The patient is placed with a round sand pillow beneath the lower dorsal vertebra. This elevates the lower chest and the upper abdomen, brings the liver in a high position so that when the abdomen is opened the structures to be dealt with are more accessible than when the patient lies flat on the table. The size of the sand pillow depends upon the size of the patient. This patient having been operated upon before, I will cut out the scar and go into the abdomen through the route employed by the previous operator. My usual incision is a vertical one through the rectus muscle. I have never used the transverse incision as practised by many surgeons as I have always been able to get a good exposure and to work with ease and safety by the vertical route. In my experience the simpler the operative method, the better the result. This also applies to our armamentarium, namely, as few instruments as possible. That upon which I lay great stress is the skilful disposition of moist gauze pads, not towels, to keep the structures other than those to be attacked out of the way. The abdomen opened, I pass my finger down to the right iliac fossa, bring up the cecum and deliver the appendix in the manner familiar to those of you who frequent this clinic, and already described this afternoon. We are not always able to do this without either enlarging the incision or making
a separate one over the position of the appendix. When the cecum does not lift up easily, so that the technic of the removal cannot be carried out in the open, which means safety, it is better to make a second wound, as two comparatively small wounds are better than one large one. When I do take out the appendix through a second wound I decidedly prefer the McBurney incision. The most important part of the technic after the removal of the appendix is the handling of the stump. I am sure many patients' lives have been sacrificed by faulty technic at this stage of the operation. I have had this forcibly brought to my mind upon more than one occasion. To illustrate: Recently I was asked by a colleague to see a patient upon whom he had operated three days before for gall-stones, at which time he removed the appendix through the wound over the gall-bladder. I found the patient hopelessly ill from the toxemia of a diffused peritonitis. My colleague said to me he had attributed the peritonitis to faulty technic in the removal of the appendix which made him much dissatisfied with the operation. He furthermore remarked that he would never do this again.

When making two operations upon the same patient perform the larger of the two first. You will then be better able to judge of the capability of the patient to withstand the second. To illustrate the force of this statement I recall an instance of three operations having been made on a patient with a triple crush: the forearm and leg on one side and the thigh upon the other. The surgeon amputated the forearm first, then the leg, and last the thigh. When having finished the thigh amputation the patient died. This shows you the value of experience and judgment. I frequently say to the students, next in importance to the information derived from reading and listening to lectures is the opportunity to apply this information in the hospital wards during their internship. This gives them experience, and with experience together with knowledge properly used they may acquire wisdom.

With the abdomen opened we first determine what can be learned by careful inspection; next locate the site of the lesion,
and place a small piece of moist gauze in the wound to cover the structures seen; we then introduce retractors, making gentle traction preparatory to introducing the moist gauze pads. I have now clearly exposed to your view the lower portion of the right lobe of the liver and the suspensory ligament of the liver, a portion of the gall-bladder, extensive adhesions, and what I make out to be the pylorus, the duodenum, the hepatic flexure of the colon and great omentum, which to you, I dare say, looks like a conglomerated mass. The picture presents some of the pathologic possibilities of an infection of the upper right abdomen. This part of the abdominal cavity is capable of concealing numerous secrets, too often only to be revealed by a master stroke with the aseptic scalpel. There is no other way, that I know of, of making the abdominal walls transparent. Some have tried to do this by injecting air into the peritoneal cavity, but as I view it the latter is a much less certain and much more dangerous procedure than is operation by the experienced surgeon. What is more illuminating, fascinating, and inspiring than opening up to the light of day the true condition and thus dispelling doubt and revealing truth, too often the only way of solving the riddle. The flash-light can never take the place of the search-light. Therefore it has been well said that the medical man walks by faith only; the surgeon walks by light and faith.

The next step in this operation is to separate the adhesions in order to expose the lesion. Adhesions serve both a protective and destructive purpose. Doubtless in this instance the adhesions you here see were first protective, that is, by binding these structures together they protected the surrounding portion of the peritoneum against bacterial invasion. But now you must agree with me they are harmful in the sense that they handicap the movements of the viscera which they embrace. In other words, they cannot perform their normal physiologic functions due to pain in the shape of pylorospasm, regurgitation, distention after eating, constipation, etc., and which medicines have failed to relieve. As I release these adhesions I note the deformity of the particular organs to which they are attached, the pylorus
and the duodenum, which in the latter is so pronounced as to make a prominent duodenal cap. Note the irritability of the pyloric antrum, how its musculature rises up in bundles when I strike it lightly with the handle of the scalpel or with the scissors. Is this condition of affairs not enough to cause melancholia in the individual who is not too strong of mind, and drive him to Christian Science, osteopathic, chiropratic treatment, and a host of other "ics" of a like kind? Let me cut one of the longer and broader of these adhesions, and place it in a basin of water, which is the best way to demonstrate large-sized adhesions. With the hepatic flexure anchored to the liver, the gall-bladder, and the suspensory ligament, and the great omentum adherent to the viscera normally occupying this region, it is easy to understand why this patient was constipated. I could discourse at length upon the destructive effects of adhesions, to say nothing of acute intestinal obstruction which they may cause, the mortality of which is 50 per cent. Adhesions that cripple the duodenum are capable of causing a train of symptoms which often lead to a diagnosis of duodenal ulcer. Only by opening and seeing can the diagnosis be made with certainty. Sometimes it can be made with the x-ray, but this diagnosis is often doubtful; operation removes the doubt.

To proceed with the operation, there is no trouble in recognizing an interstitial cholecystitis. The liver immediately over the gall-bladder is streaked with white lines, indicative of chronic hepatitis at this point which, with cholangitis, will no doubt be shown in the microscopic study of the specimen. You will also note that the portion of the gall-bladder adjacent to the cystic duct is adherent to the free border of the gastrohepatic or lesser omentum, which we must separate in order to examine the common duct, and also to see whether there are any enlarged lymphatic glands other than the gland lying at the junction of the common duct and duodenum which, you see, is of considerable size. I examine the head and body of the pancreas, look for enlarged lymphatic glands about the head of the pancreas, then put my finger into the foramen of Winslow and palpate the common duct. I am unable to find any evidence
of other inflammation except that of the gall-bladder. I will next take out the gall-bladder from below upward, as is my usual practice, although occasionally I remove it from above downward. Through traction on the liver and the gall-bladder in the absence of adhesions between the liver and the diaphragm, and by pulling the liver and the gall-bladder downward, outward, and upward, the free border of the gastrohepatic omentum is made taut, which in turn stretches the cystic duct. I now incise the omentum high up and by careful dissection bring the cystic duct into view. This duct is clamped by two long hemostatic forceps and cut between with the cautery knife, a small piece of moist gauze being placed beneath the free border of the omentum; next the cystic artery is exposed, clamped, and cut when the gall-bladder is dissected from below upward, avoiding as far as possible going into the liver substance. The cystic duct and cystic artery are tied separately by chromic catgut ligatures.

The gall-bladder bed is closed by carrying a continuous iodin catgut suture on a long curved needle around the bed. This not only closes the bed, but arrests oozing and necessitates less drainage than would otherwise be required. A small rubber tube is carried down to the stump of the cystic duct, and in some instances a part of the free portion of the great omentum is interposed between the bed of the gall-bladder, the pylorus, and the duodenum, the object being to prevent contact and consequent adhesions to the liver at the site of the line of the suture which closes the gall-bladder bed. The wound is closed with through-and-through sutures of silkworm-gut and layer sutures of iodin catgut, and the skin is closed with silkworm-gut of small size. In placing the drainage-tube it is important not to carry it beyond the free margin of the gastrohepatic omentum; if carried beyond this point it may come in contact with the diaphragm and cause the patient to have a dry cough, which is at once relieved by slightly withdrawing the tube. It is my practice always to use drainage. Where it has not been used I have seen patients die from extravasation of bile into the peritoneum; a condition, however, if recognized
is nearly always successfully treated by prompt operation. It may sound well not to use drainage and the patient may be more comfortable without it, but in a certain percentage of cases it results in disastrous adhesions, constituting one of the unpleasant sequelæ of cholecystectomy. Cases of this sort often require reoperation of a more or less extensive nature, such as separating the stomach and the duodenum and interposing a portion of the great omentum (as described above) between the liver, the stomach, and the duodenum, with permanent relief of symptoms; or a posterior gastro-enterostomy, as in cases where the viscera are so firmly fastened together that to attempt to free them would expose them to the risk of being torn. I have seen these structures—the stomach, duodenum, and the under surface of the liver—so firmly bound together that they could be no better described than by the German word "eingemauret," masonried in. I could relate a number of such instances that are still fresh in my mind, but just this one case will serve the purpose: A young woman, six months after a cholecystectomy, developed all the symptoms of practically complete obstruction of the pylorus for the relief of which she was obliged habitually to use the stomach-tube; and in seeking relief she came to know all the prominent stomach specialists in the country. Finally, after much deliberation and procrastination, she agreed to my making a posterior gastrojejunostomy, with complete relief, and now, six years after the operation, she is still entirely well. These with other sequelæ of operations come under the heading of the trials, the tribulations, the disappointments, and the joys of the surgeon.

The after-treatment of these cases is usually simple, consisting chiefly of careful nursing, and restricted diet for at least one year after operation.

While the majority of patients are relieved after operation for disease of the gall-bladder, symptoms recur in about 8 per cent. of the cases. Of course this happens more frequently after drainage of the gall-bladder than after its complete removal. In draining the gall-bladder by a cholecystostomy it may happen that stones are left in the cystic duct; or when
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the common duct has been involved in the original operation stones may reform in the papilla of Vater or in the hepatic duct or its radicles. Operation for the removal must include exploration of the main hepatic duct as well as its primary branches. This is best done by passing sounds of graduated sizes or by means of the scoop. No operation for the removal of calculus obstruction of the common duct should be considered complete without thorough exploration of the duct, including passing of a medium-sized probe through the papilla of Vater until the end of the instrument can be felt in the duodenum. This, however, must be carefully and gently done in order to avoid puncturing the wall of the duct. Sometimes a stone in the common duct will cause almost complete occlusion of the opening of the duct into the duodenum, amounting practically to an annular stricture. This, no doubt, results from inflammation of the duct—choledochitis—incited by infection plus the presence of the stone. The opening should be restored preferably by gradual dilatation in order to relieve jaundice.

In attempting to remove stone or stones from the hepatic duct care must be exercised not to push the stones upward where it may be impossible to reach them. Sometimes a stone that has been pushed up in this way, or one that may have escaped detection at the original operation owing to its high location, may later find its way downward and cause the return of symptoms. Other causes for the recurrence of symptoms after operation are: adhesions, which are more likely to cause trouble after cholecystectomy than after cholecystostomy; reinfection of the biliary passages, and lastly, a latent hepatitis and cholangitis may produce a return of symptoms from two to ten or more years after the primary operation of the gallbladder. This requires rather prolonged drainage of the common duct for relief. Very often, too, a subsequent pancreatic lymphangitis or pancreatitis plays a part in the reappearance of symptoms after operation for disease of the gall-bladder.

Remarks by Dr. Reimann.—There is much to be learned of the gall-bladder and the bile passages; not only regarding their
pathologic physiology, but their normal every-day physiology as well. The most obvious function of the gall-bladder is that of a reservoir from which bile can be sent down into the duodenum as occasion demands. Observe that I said "sent down" and not "forced down" or "squirted down" or any other word suggesting force. The gall-bladder has muscle in its wall, but only a very little. It is assumed by some that this muscle contracts and forces the contents of the gall-bladder outward. The contractile property of the gall-bladder has been examined a number of times from the day of Doyon down to the present time. We ourselves have also examined the contractile function of this organ. I will mention just a few of the methods which have been used in this work, but will anticipate by saying that if the gall-bladder does contract, the force which it can exert has never been demonstrated to be greater than the secretory pressure under which bile flows down from the liver. Balloons have been placed in the gall-bladder through incisions or up through the common duct. Threads have been applied and connected to levers. Oncometers have been adjusted; stimuli, electrical, chemical, and mechanical, have been applied directly, indirectly, and through its nervous supply. It has been excised, and strips of the whole organ suspended between levers in suitable oxygenated solutions. The latter method has demonstrated a slow and deliberate change representative of ordinary smooth muscle tonicity. The objection that an anesthetic is used may be of some importance, but all surgeons and experimentalists know and have seen that the intestines do not lie motionless in the abdominal cavity under suitable conditions even in an anesthetized animal or the human subject. Why should the gall-bladder be different? But the strongest argument against any noteworthy contractile power of the gall-bladder which we can deduce is that we have never seen, and as far as we know there has never been reported, a hypertrophied muscular coat in the organ in spite of the fact that we have had numerous cases with stones impacted in the cystic duct; others certainly have had the same experience. Other smooth muscle structures with different contractile power tell a
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We cannot help believing that what contractile power the gall-bladder has is very small.

Coupled with its property as a reservoir is the one so obvious, viz., its concentrating ability. Quite recently, through the work of Rous and McMaster, this function has been studied quantitatively. Briefly, the gall-bladder concentrates the bile while the ducts tend to dilute it. This latter remark is made because there are certain closely related species of animals some of which possess gall-bladders and some of which do not. The question arises, Does any other structure in animals without a gall-bladder concentrate the bile? Which again brings up another question, Is concentrated bile more useful in digestion than unconcentrated bile? The first of these questions has recently been answered by McMaster in the Journal of Experimental Medicine, where the other publications also appeared. Gall-bladderless animals, at least the rat, have no structure which corresponds to that function of the gall-bladder. He points out that it is interesting, but of course at present we cannot evaluate the significance of the fact, that the bile of the rat which is not concentrated by any organ contains eight times as much pigment as does the liver bile of the mouse which has a gall-bladder. The further significance of this must be left to the future. The next question is this, Does the gall-bladder concentrate bile by withdrawing fluid through its lymphatics or directly into its blood supply? I know of no answer to this point, but returning to the question of the gall-bladder, as a reservoir and as a concentrating organ, we find that animals without gall-bladders also have a muscle at the end of the common duct, namely, the sphincter of Oddi. Mann, in the Journal of Laboratory and Clinical Medicine (1920), says that the tonus of this sphincter is very low in the rat in contradistinction to that in animals possessing gall-bladders. When the gall-bladder is removed it is well known that the ducts dilate, and it is said after a time dilatation and high pressure overcome the sphincter of Oddi, and bile flows into the intestine more or less continuously. Further than that we cannot go, that is, we can say little further in regard to any
effects of this on the metabolism in general. It is interesting to remember that if a stump of the cystic duct is left behind after cholecystectomy a sort of pseudogall-bladder develops; at any rate it is a dilatation, and we wonder whether this little dilated sac develops concentrating abilities, and if so, whether the cystic duct did not have it in the first place.

This subject could be enlarged upon at considerable length, but I must hasten to the pathology. Starting with the well-known clinical observation that a gall-bladder which has once given trouble is likely to continue to do so, what pathologic facts have we to explain it? In the first place, a large majority of diseased gall-bladders show pathologic changes not limited to the mucosa, but extending outward into the wall and to the serosa. They consist of the ordinary evidences of acute or chronic inflammation, namely, edema, congestion, pus-cells, fibrin, lymphocytes, and fibrosis, as the case may be. This penetration of the walls is furthermore shown to be related to the presence of bacteria therein. Rosenow has shown it; others have found the same thing. When we remember the well-known ability of streptococci and other organisms to remain latent for a length of time, we can see why exacerbations will occur. We can also see why there should be adhesions in the neighborhood. We can see why pathologic changes are found in bits of liver tissue removed at operation, and this brings up another question. We have found as, of course, many others have, that the longer the delay in removing the focus of infection, that is, the gall-bladder, the less likely is the patient to return to complete health. We wonder just how big a part this infection of the liver plays in the subsequent history of the patient. This means more work, of course, particularly necropsy observations.
RENAL CALCULUS—PYELOTOMY

Dr. T. will please read the history of the next patient.

Male, aged twenty-two years. Three years ago had an attack of pain in the right kidney region which lasted about one week. Since then similar attacks have recurred about every two weeks. The pain, more or less severe, starts in the right lumbar region, radiates downward toward the bladder, and sometimes to the left side; purgation relieves the pain. About four weeks ago the patient passed a stone which resembled two grape-seeds pressed together. Urination is accompanied by a burning sensation. Microscopic examination of the urine shows red blood-cells, pus, mucus, and many epithelial cells. The blood count is normal; urea percentage normal; phenolphthalein elimination 60 per cent. in three hours; amount of urine in twenty-four hours normal. Cystoscopic examination: Bladder normal; both ureteral orifices normal, ureters open throughout; left kidney functional activity good; right activity poor, elimination of indigocarmin being delayed fifteen minutes. Urine from right kidney shows heavy trace of albumin, few leukocytes, many epithelial cells; no organisms present. Urine from left kidney normal.

Cystoscopic examination is important if for no other reason than to determine the presence of both kidneys. The x-ray picture shows a small shadow in the pelvis of the ureter clearly seen in the illuminated plate. The x-ray plate in this case—where the stone is one that casts a shadow—not only clinches the diagnosis, but is of value in giving some idea of the location of the stone. But, as you all know, not all types of stone can be detected by x-ray. In such instances we must rely on our other means of diagnosis in order to differentiate the condition from others which often resemble the symptomatology of calculus. The most common conditions in this respect are: pyelitis, tuberculosis, early tumor formation, movable kidney, causing a sudden twist of the ureter.
We are fortunate in having diagnostic aids at our disposal. But it often occurs to me whether with these mechanical methods we are not losing some of the acumen possessed by our predecessors of about thirty years ago. In a case of this kind, for example, they would have had only the history, the physical examination, and the urinalysis to depend upon for a differential diagnosis. In this connection I would like to call your attention to an address recently delivered by Dr. Alfred Stengel before the Virginia State Medical Society. He draws a comparison between the diagnosticians of today and those of the generation preceding ours, who with nothing but their brains, fingers, and their God-given senses developed to the utmost, probably were better diagnosticians than we are turning out today, in spite of or perhaps because of the mechanical means at our command.

In making the differential diagnosis it is well to remember that pyelitis gives constitutional symptoms, fever, general malaise; with local tenderness and rigidity; frequency of urination and pyuria. Cystoscopy, if permissible, will materially assist in making the diagnosis, and an x-ray study should also be made. Incidentally let me caution you not to mistake pyelitis for appendicitis, an error that may occur, a possibility that should be borne in mind, particularly when the patient is a pregnant woman.

A kidney condition with a history of frequency and of burning urination, in the absence of acute urethritis, is suggestive of tuberculosis. Here, fortunately, the pouting and dimpling of the ureteral orifice as seen in the cystoscopic picture is practically pathognomonic. In early renal tuberculosis local tenderness and muscular rigidity are absent; when present these signs indicate an advanced pathologic process probably with abscess in the kidney and ulceration of the bladder, and possibly also involvement of the opposite kidney. Early tuberculosis, however, is usually unilateral, so that prompt recognition and prompt removal of the affected organ offer good prospects for a cure.

In its early stage tumor formation in the kidney, the most
common type of which is hypernephroma, causes blood to appear in the urine. As the blood-clots in the renal pelvis or the ureter pass downward they cause pain similar to that of renal colic due to stone. As the tumor enlarges the kidney becomes palpable. The absence of pain and of hematuria make cystoscopic examination imperative in order to determine which of the two kidneys is causing the trouble. In advanced cases there is the cachexia and anemia associated with neoplasms elsewhere in the body. In some instances x-ray shows enlargement of the kidney as well as tuberculous foci.

Pain like that produced by renal calculus may also be associated with a very freely movable kidney. I have seen instances of this kind where the lesion was demonstrated by careful physical examination and in which a nephropexy restored the organ to its original position with complete relief of symptoms. This condition should be thought of before arriving at a definite diagnosis.

A perplexing condition in making a differential diagnosis from early tumor formation, and one which has not as yet been clearly explained, is so-called essential hematuria. The chief point is that, as a rule, the condition is symptomless except for the appearance of blood in the urine. Every known means of diagnosis must be used in such cases: microscopic, chemical, and bacteriologic study of the urine, Wassermann tests, cystoscopy, ureteral catheterization, pyelography, x-ray, and, of course, careful history and observation of the patient.

The patient being now ready, we will proceed with the operation. You will note that the patient lies on the side opposite to the one to be operated upon, with the legs flexed against the thighs and the thighs upon the abdomen; a sand pillow is placed under the loin, thus raising the operative field. An assistant standing opposite the operator pushes the flexed leg and thigh toward the operator, thus widening the iliacostal space, making the soft parts more tense and more prominent, and facilitating the operation. The arm and forearm are held and manipulated in the same way as the leg and the thigh, thus making breathing less embarrassed. The surface landmarks are: the crest of the
ilium, the lower chest margin, the spinal furrow with the longitudinal prominence produced on each side by the erector spinae muscle, and to either side of the furrow a slight depression corresponding to the site of the lumbar aponeurosis covered by the latissimus dorsi and the external oblique muscles.

A vertical incision, with its lower end directed forward, is carried through the skin over the lumbar aponeurosis, then through the superficial and the deep fascia, exposing the posterior border of the external oblique muscle, the fibers of which are separated in the line of the incision exposing the lumbar fascia or lumbar aponeurosis. The aponeurosis is incised in the line of the wound, when the perirenal fat above and the retrocolic fat below are seen. I grasp the perirenal fat, consisting of the two superficial fatty layers and the deep membranous layer, with two hemostatic forceps and incise the superficial fatty layer, enlarging the incision enough to expose the kidney enveloped within the true capsule and surrounded by the membranous layer of the fatty capsule. The membranous layer is next incised and the two halves of this capsule are separated from the true renal capsule; the kidney is then delivered; the pelvis of the ureter is now exposed and carefully palpated. I detect a small hard body within the pelvis of the ureter, which I take to be a stone. I now incise the pelvis and deliver the stone at the point shown on the x-ray plate. I close the wound in the pelvis with fine chromic catgut sutures, replace the kidney in its normal position, and introduce a small rubber drainage-tube to the site of the wound in the pelvis. I next bring the reflected halves of the fatty capsule over the kidney and appose them with iodin catgut sutures. Before closing the abdominal wound I will separate the retrocolic fat and expose the peritoneum, deliver the cecum, and remove the appendix. Were this a septic kidney I would not remove the appendix. The wound in the abdominal wall can now be closed with layer sutures of iodin catgut, and dressed in the usual manner.

Incising and removing a foreign body, in this case a stone, from the pelvis is known as a pyelotomy, while incising the
kidney and delivering a stone is a nephrotomy. The former is the preferable operation when it is feasible. The incision into the pelvis can be made large enough to admit the end of the finger and thus permit exploration of the calices; if a stone is present it can be removed with a curved forceps without incising the kidney. Nephrotomy is attended by the loss of considerable blood. This, however, can be prevented by placing two or more small moist gauze sponges into the wound directly over the renal vessels, held in position by the convex end of a retractor, by means of which enough pressure can be made to make the incision into the kidney, when the stone can be delivered without loss of blood. The wound in the kidney is closed by deep and superficial iodin catgut sutures. This method has proved most satisfactory in our clinic.

Remarks by Dr. Reimann.—In general, calculus formation in the body is a problem in colloid chemistry. This applies particularly to urinary calculi. The urine is not simply a salt solution, but it contains, in addition, various colloids. Putting the proposition into the language of colloid chemistry, "a salt solution is suspended in the spaces of a more or less connected scaffolding which consists of a very diluted jelly" (Schade). As a salt solution urine is hypersaturated, that is, it contains more salts than a corresponding amount of water could dissolve. Even larger quantities of crystalloids may be suspended or even dissolved in urine. Thus Haskins has found that urines that are slightly acid and all that are neutral or alkaline can take up extra uric acid when this substance is shaken up in them. Some dissolve so much that they contain more of the substance than is present in a saturated solution of monosodium urate. He remarks that at least part of this uric acid is in colloidal solution. We know that there are diseases in which the secretion of uric acid is markedly increased, e. g., leukemia, without calculous formation. Precipitation does not take place until "the stability of this system is disturbed." Schade succeeded in producing laminated calculi experimentally by using the irreversible colloid, fibrin. In inflammations fibrin is present and it may be that inflamma-
tion is a factor favoring the formation of calculi; although, of course, there are many more cases of inflammation of the urinary tract without calculi than with them. There must apparently be particular circumstances in the inflammation which causes this precipitation of the colloids and crystalloids. The feeding of oxyamid is known to be followed experimentally by calculi. The mechanism of this is unknown. Osborne, Mendel, and Ferry report the impressive statistical fact that in every rat which they had fed in their experiments on diets with food deficient in fat-soluble vitamin, there were discovered phosphatic calculi. The significance of this awaits further investigation. You will see even in these few words that there is nothing very definite known of the mechanisms of the formation of calculi. Only hints here and there are given. In the practical management of such cases it is always the sequelae of calculi and not the calculi themselves that demand treatment. There are many interesting details for discussion and we must necessarily limit ourselves to only a few. The development of so-called reflex anuria and pain referred to the opposite kidney are connected with the so-called renorenal reflex. The kidneys receive their innervation from the major and minor splanchnics and from the vagus. It is said that there are sympathetic ganglia in the kidney itself which may be a reason why the kidney with all afferent nerves severed shows adaptibility to various functional stimuli. The afferent nerves, however, have a certain influence which is not entirely clear at the present time. The sympathetic branches pass to the celiac ganglion, and this is probably the first station where reflex stimuli may be transferred from one side to the other; very probably there is another station in the spinal cord, although the further course of these tracts upward is unknown. It is also not known with certainty whether these nerves are directly secretory or whether they act through vasomotor changes, or both. Certainly there are abundant vaso nerves present and the kidney receives an extraordinarily large amount of blood compared to its size. The kidney capsule, the pelvis, and the renal connective tissue contain nerve filaments, and these probably are concerned in
the pain in certain kidney lesions. Reflex anuria has been produced experimentally by stimulation of a number of different areas, for example, the sciatic nerve, vagus, bladder, and ureter. To sum up, there are certain general anatomic grounds known for the occurrence of pain and of reflex anuria, but the exact details are still lacking.

Not long ago we had a patient in the hospital with complete anuria for a number of days. At autopsy both ureters were found plugged tightly with uric acid calculi. There was slight dilatation of the pelves of the ureters and the kidney tissue was entirely necrotic with the exception of the glomeruli, which showed degenerative changes, but were still preserved. This brings up the subject of obstruction to the outflow of urine. Briefly stated, sudden ligation of the ureters leads to quick necrosis of the kidney, whereas a more gradual or incomplete closure leads to the development of hydronephrosis. The former is important especially in operations on the uterus in which the ureter may be accidently tied. It is certain that complete obstruction for even a matter of a few hours leads to injury. Just how severe will depend on the length of time. Among other things in reference to the second process, it may be mentioned that extensive dissection and loosening of the ureter from its bed, as may be done in removing calculi, leads to such interference with the motility of the ureter that hydronephrosis and perhaps pyonephrosis frequently results.

Finally, a few words may be said regarding the kidney itself. It is often necessary to incise the organ. Many experimental and clinical studies have shown that the kidney heals readily. Scar tissue forms a tight union, and although there is growth of epithelium, it is rather irregular and probably non-functioning. It is not necessary to call attention to the fact that when one kidney is removed, the other hypertrophies, and this increase in size is probably only hypertrophy of the elements that are present and not an actual hyperplasia. The final thought is directed to calling attention once more to the differences between the two kinds of kidney insufficiency. The one is imitated fairly well by the symptoms shown in an
animal which has had both kidneys removed; the other is the toxemia from the failing kidney because of nephritis or nephropathy, to use the term in late use. The difference between the two have led to the assumption more than once that a kidney with Bright's disease produces symptoms not merely because of its lack of functioning ability but also because of the addition of some toxic factor. Differential diagnosis will lead oftentimes to decidedly different methods of treatment.
CYST OF THE LIVER—EXCISION

The next case comes to operation with a diagnosis waver-
ing between duodenal ulcer and cholecystic adhesions. The symptoms are rather obscure and x-ray findings indefinite. The patient is a male, aged thirty-five years. Six years ago he began to suffer from more or less constant epigastric pain, gradually increasing in severity, for which he was treated medically for one year, without relief. He then came to this hospital, where a diagnosis of chronic appendicitis led to the removal of the appendix, which showed evidence of marked chronic disease of that organ. After this the patient felt well for about three years, when the epigastric pain recurred with increasing severity. For the past two months it has been almost constant, aggravated by eating, regardless of the kind of food taken. There is occasional nausea, but no vomiting. Bowels alternately regular and constipated. No urinary symptoms. Appetite poor. Constant headache. Loss of 5 to 8 pounds in the past five months. No venereal history.

Physical examination is negative except for the abdomen. There is slight rigidity and tenderness on deep pressure at the median line at a point corresponding to the site of the gall-bladder. The blood count is negative and so is urinalysis. A test-meal was given, all of which the patient vomited. The stomach-tube was then passed. Quantity obtained 80 c.c., total acidity, 12; full meal: quantity 50 c.c., total acidity, 12. Also negative for lactic acid. Stools positive for blood.

x-Ray taken elsewhere before the patient was admitted gives the safe diagnosis of "upper right abdominal lesion," the referring physician hesitating between a diagnosis of duodenal ulcer and cholecystic adhesions.

We are evidently dealing with an upper right abdominal infection or the results of such an infection. The fact of a previous
chronic appendicitis gives us a focus from which infection may have spread. The history and study of this case would lead me to make a diagnosis of cholecystitis.

Let us proceed with the operation. I make the usual upper right rectus incision, going through the aponeurosis of the internal oblique muscle. Here is the gall-bladder near the median line, but in a very deep location and surrounded by a few cholecystic adhesions. I examine the stomach and the duodenum and find no lesions there. The gall-bladder also is normal. But here is a mass which looks like a gall-bladder, protruding from the under surface of the liver. It does not seem to be a hydatid cyst, for I believe I know a hydatid when I see it. It seems to be liver substance. I shall try to remove it intact. There it is; it has no odor and is perfectly soft; on section it seems to be filled with sebaceous material.

This I believe is the most interesting case we have had this afternoon. It well illustrates some of the pitfalls of diagnosis, and calls attention to the many possibilities to be encountered in the right upper abdominal quadrant.

The operation was completed in the usual manner. The laboratory report on the specimen reads: A fibrous walled cyst, measuring 3 cm. in diameter; received opened, and with some liver tissue adherent to it. The cyst is smooth, shiny, congested on its outer surface, and pale and smooth on the inner surface. Contains chalky material.

Microscopy: The lining of cyst is partially necrotic, but gives evidence of having been a sort of mucosa. The wall consists of dense connective tissue. Origin unknown, but may have been a diverticulum of the gall-bladder. Liver tissue shows moderate cloudy swelling and fatty degeneration.
January 4, 1922: I bring before you a patient about whom I must speak with carefully chosen words, because I think it quite possible that a lawsuit may result from this case, and I wish to do injustice to neither party to the case.

This is a man, thirty years of age, an Italian by birth, a laborer by occupation, who has lived for some time in Bridgeton, N. J. He was brought here to the Jefferson Hospital over three months ago after a head injury. He was complaining of weakness in the right arm and leg, of numerous attacks of spasm in the right arm, and of some other phenomena.

The family history is without bearing on the case. He had the usual diseases of childhood; does not remember having had any other illnesses.

On September 21, 1921, while at work, a large piece of steel dropped from a height and struck him on the parietofrontal region a little to the left of the middle line. The patient was rendered unconscious, was taken to a hospital, where it was found that he had a depressed fracture, and his skull was trephined.

A few weeks after leaving the hospital his sight, which previously had been good, began to fail, and he noticed progressive weakening in the muscles of the right arm and leg. This weakening has been getting slowly but gradually worse until the present time. He now suffers from severe headaches, has occasional attacks of vertigo, is heavy and dull, one might say stupid mentally, and has gained about 30 pounds in weight.
You observe when I ask him any question he answers slowly, but, I believe, on the whole, accurately.

The superficial and deep reflexes are minus in the right upper extremity, and the right lower extremity exhibits ankle-clonus and the Babinski sign. You can observe the site of the old fracture, and the depression readily admits my thumb.

We ordered that an x-ray be taken immediately, and Dr. Manges reported an old depressed fracture over the left side of the cortex back of the coronal suture. The fragments had been removed. The skiagraph shows that the bone edges are smooth and slightly thickened along the anterior margin, especially of the inner table. No fracture line discovered in any other part of the head. The clinoid processes are almost completely destroyed, which must have been brought about by the growth of a tumor in the sella turcica. There is marked depression on the floor of the sella, and the tumor or cyst, together with the pituitary body, make a mass approximately 1 inch in diameter.

The eye examination shows that the failing vision is due to the development of central, star-shaped opacities in the lenses. There is no choked disk. There is no lesion of any sort in the nerve of either eye. No palsy of the eye muscles.

Doctor Gilpin reported that there was very slight palsy of the right side of the face. The tongue is slightly deviated. The right arm is almost completely paralyzed. There is some voluntary motion of the right leg. Doctor Gilpin is of the opinion that the trouble is with the motor cortex because of the loss of power of the right side, the loss of disturbance of motor speech, and the coming on of clonus and the Babinski sign in the right foot during the past two weeks.

Now it seems to me that we are here confronted with one of the common pitfalls in diagnosis. We find a man who has had previous traumatic cause for motor trouble and who now has something pointing to the motor cortex as the seat of trouble. We find, furthermore, strong indications of another pathologic condition which may have antedated the injury. Now I am quite convinced there is cortical trouble. The cortex was
probably damaged by the original injury and at present there
are areas of impaired nutrition. There are adhesions between
the membranes. The frequent attacks of spasm in the right
arm are characteristically jacksonian epilepsy, but the destruc-
tion of the clinoids and enlargement of the sella, as shown by
the x-ray, are particularly significant of pituitary tumor or cyst.
The recent rapid increase in weight is strongly suggestive of a
pituitary tumor causing impairment of function of that important
gland. We, of course, must study this case more thoroughly.
We must take the carbohydrate tolerance. We must follow
all possible retinal changes day by day; we must make a lumbar
puncture and note the tension of the fluid. We must make a
Wassermann test both of the blood and the spinal fluid.

You may well ask me, If this is a pituitary tumor of very
considerable size why is there no hemianopsia? I don’t know,
and to prophesy is a dangerous occupation, but I am strongly
disposed to prophesy that this man will develop hemianopsia
before very long, but before we make up our minds to what
we shall do surgically, if anything, we will watch this case a
short time longer.

January 18, 1922: Further studies of this case show a very
great increase in carbohydrate tolerance. Unfortunately, the
exact figures have not been transferred to this clinical history,
but they are available in the laboratory.

The spinal tap does not indicate excessive pressure. The
spinal fluid contains 2 cells per cubic centimeter. The Wasser-
mann test of both blood and spinal fluid is negative. Here I
may say that an eye examination made three days after the
occasion on which I first presented this case showed bilateral
temporal hemianopsia.

I had an opportunity to see this man in one of his convul-
sive attacks, which started with a series of rapid and wide-
spread tremors passing from the right hand and forearm up
to the shoulder. The shoulder was then raised as though he
were taking hold of the head of the bed. The episode was brief.
I then learned the following interesting fact—that all of these
attacks came on with very marked auras. These were olfactory
and gustatory, a hideous odor and a horrible taste. These warnings or signals are known to accompany pituitary epilepsy, and to indicate pressure upon or irritation of the uncinate lobe.

We know that pituitary tumor may be responsible for epilepsy and that old epileptics may present evidence of pituitary disease, but as far as I know such a condition is a general epilepsy and not a focal one. We know that irritation of the motor cortex may produce focal epilepsy, but there seems to be no reason why it should be ushered in by auras of smell and taste. A possible hypothesis is that the cortex in the motor area, being in a state of impaired nutrition, is the first part to lose control when the epileptic influence comes sweeping through the brain from the uncinate lobe.

The nature of these spasms is the interesting and curious feature of this difficult case. We have in mind to lay down a bone-flap, expose the motor area at the site of trouble, and endeavor to reach the pituitary body by retracting the brain.

February 1, 1922: In a previous lecture I showed an individual who had cortical trouble from a head injury, and also a pituitary tumor. I dwelt on the diagnostic difficulty caused by two conditions. To our surprise, we have learned that our late patient had three conditions.

I must have had my guardian angel in a peculiar state of attentiveness when I was saved from operating on this patient, as in all human probability I would not have found the third condition which we now consider.

On the evening of January 26th the patient became heavily stuporous, soon comatose, and died of respiratory failure. The specimens obtained at the postmortem I now lay before you.

The postmortem shows a large pituitary tumor, cortical adhesions, and a large abscess of the brain. The abscess took origin in the brain substance above the left lateral ventricle. It was beneath the region of the cortex which underlay the depressed fracture, but did not reach the surface at that point. You can see the abscess distinctly where the brain was sectioned. Had I exposed the cortex in the search for the seat of disease I believe I would have missed the abscess.
TUMOR OF PITUITARY BODY AND BRAIN ABSCESS

This patient died from rupture of the abscess into the ventricle. The abscess was the result of the injury. The pituitary tumor may have been the result of the injury, though the complete absorption of the clinoids would suggest a longer duration. Rapidly growing sarcoma would, however, be capable of effecting this rapid destruction. I am unable to decide what part the abscess played in the epilepsy. It is strange that until the last few hours of life we found no definite pressure signs.

I append the postmortem report of Dr. Edward Weiss:

Laboratory No. 13,990. Specimen received 1/29/22.

Death, January 26, 1922, 9.50 P.M.
Autopsy, January 29, 1922, 10 A.M. Limited to head.
Body of Mr. X.
Service of Prof. J. Chalmers DaCosta.

Body is that of an adult white male; 12.5 cm. from the glabella and 16 cm. from point of occiput the skin is thin and fibrous, and upon reflection of the flap a circular opening is seen in the cranium, corresponding to this area and measuring 2.5 by 3 cm. Removal of the skull cap shows that the membranes are densely adherent to the edges of this opening; the membranes otherwise appear normal. When the brain is lifted a tumor is seen occupying the sella turcica, and pus exudes from a region corresponding to the floor of the third ventricle. The tumor measures 3.5 by 3 by 2.5 cm.; weight 18 gm. It is shaped like an olive and is situated with the long axis from side to side. The tumor is fairly soft, has a thin capsule, and fits closely into the sella turcica, pressing upon the optic nerve. On section the tissue is soft, smooth and glistening, yellowish pink, and mottled. Numerous minute blood-vessels are visible. The tumor is attached to the brain proper by an attenuated infundibulum. The pus issuing from the base of the brain is greenish yellow and viscid. Horizontal section of the brain substance shows a large quantity of this purulent material in the left lateral ventricle communicating below with the third. It infiltrates and appears to arise in the cerebral substance
above the left lateral ventricle, approaching but not quite reaching the surface of the brain in the area of the depressed fracture.

Bacteriology: Inoculations prepared from the brain abscess yielded the staphylococcus.

Histology: The tumor is composed of a mass of small round cells, numerous thin walled blood-vessels, and loose fibrous tissue supportive structure. The cells are small, usually round; the nuclei are large and deeply stained; the protoplasm is small in amount and takes the acid stain. The supportive connective tissue is scanty and loosely arranged, but condensed at the periphery to form a capsule which is infiltrated with tumor cells. The blood-vessels are numerous, thin walled, in intimate contact with the tumor cells, and distended with blood. Some of the cells infiltrating the capsule are larger than the predominant tumor cells, and contain one or even two deeply stained round nuclei and a large amount of pink protoplasm (hematoxylin-eosin).

Diagnosis: Round-cell sarcoma of the pituitary gland.

Respectfully submitted,

Edward Weiss.
CASE I. STRicture OF THE RECTum. RESECTION

This patient is a man forty-seven years of age; he came into the hospital on October 15, 1921, his chief complaint being pain in the rectum and constipation. He has a long surgical history. He acquired gonorrhea when twenty-two years of age and developed strictures shortly afterward, and when twenty-seven years of age he was operated on by Dr. Neilson at the University Hospital by external perineal urethrotomy. He has had no trouble with his strictures since. Ten years ago he was in the Philadelphia General Hospital, where Dr. T. Turner Thomas repaired a right inguinal hernia, and at the same time opened an ischiorectal abscess, and in doing the latter found a stricture of the rectum, which he dilated.

After this he remained well for eight years, but over one year ago the hernia recurred and has gradually grown larger, but it is not painful and is always easily reducible. He had lobar pneumonia in February, 1921. He says he never knew that he had a stricture of the rectum until after the operation for ischiorectal abscess, when he was told that one was found during the operation. Up until about eight months ago he had no particular trouble, but since that time it has become more and more difficult to get his bowels open, and I suppose it is certainly the straining incident to the efforts to evacuate his bowels that has brought about a recurrence of his hernia. In a large majority of patients with chronic intestinal obstruction you will find one or more herniae are present.

Examination was negative on admission except for the scar of the hernia operation, the scar of the external perineal ure-
throtomy, and a stricture about 4 or 5 cm. within the anus which just admits the index-finger. His blood Wassermann is negative. Naturally, one wants to find a cause for a stricture such as this, and there seems to be nothing in this patient's history to account for it except the external perineal urethrotomy. It is a well-known fact that a certain number of women who have vaginal or other lesions produced during childbirth may develop strictures of the rectum from the inflammation propagated from the genital tract to the walls of the bowel. I have seen 2 such cases myself: the first patient, a women fifty-three years of age, had acute intestinal obstruction supervening upon a chronic obstruction, and all that could be done was a colostomy, which relieved her discomfort for a few days before death. Autopsy showed a benign stricture of the rectosigmoid, and according to the history the onset of rectal trouble followed an injury in childbirth thirteen years previously. A second patient, a negro woman thirty-five years old, was under my care in August, 1919. Four years previously, following childbirth, she developed a fistula from the bowel into the lower end of the vagina, and before she came under my care she had had five different operations trying to close this fistula. Her chief complaint was that the bowels moved from the vagina as well as from the anus. Only at the fifth operation apparently did the surgeon find that there was a stricture within the anus and recognize this as the cause of the persistence of the fistula, it being easier for the bowels to evacuate themselves through the fistula than through the stricture. As I expected to postpone any formal operation on the fistula until after relieving the stricture, I attacked the stricture first, and by thoroughly dilating the sphincters exposed to view a stricture in the rectum which would not admit a finger and barely admitted a urethral sound. I merely divided the stricture by an incision from its mucous surface all the way through the posterior rectal wall and well past the margins of the induration, and thoroughly dilated the rectum, and passed the largest sized cigarette drain procurable through the stricture. The patient removed this herself on the second day after the operation and, curiously enough, with the moderate use of laxatives, which kept her
bowels moved several times daily, all the feces passed through the rectum and none came into the vagina. Upon her discharge from the hospital three weeks after operation examination showed only a very minute communication between the rectum and vagina; the stricture was considerably less tight than before and she was allowed to go home to return later if there was any more trouble. Two years later she reported that she was "all right" in every way and required no further operations. But I do not think that simple linear proctotomy, as it is called, is a very desirable way of treating strictures of the rectum, and what I propose to do in the patient now before us is a circular resection of the rectum by the coccygeal route, with end-to-end anastomosis of the bowel above and below. I have examined this
patient with the proctoscope since his admission to the hospital, and as the proctoscope can be passed through the stricture I was able to ascertain that the bowel above appeared normal. There is no reason to think that the stricture is carcinomatous. He says that he has felt better since the stricture was stretched by the passage of the proctoscope. You see that I have him lying in the left lateral prone position, like the Sims position for gynecologic work, and by making an incision from just posterior to

![Fig. 7.—Resection of the rectum: After excision of the coccyx the gluteus maximus is cut from the sacrum well up into the sacrosciatic notch.](image)

the anus up along the right margin of the coccyx and the sacrum almost to the right posterior inferior spine of the ilium (Fig. 6) and detaching the right gluteus maximus from the sacrum after excising the coccyx (Fig. 7) I can expose the rectum high enough in the hollow of the sacrum for such a case as this without removal of any of the sacrum itself, which, after all, gives very little better exposure. Passing a finger around the rectum as high up as possible and opening the peritoneal cavity I insert a pack to hold the small intestine away, and I also have the head
of the operating table lowered (Fig. 8). This will decrease the venous bleeding as well as keep the intestines out of the operative field. The superior hemorrhoidal artery running here on the posterior wall of the rectum is tied and cut and two tapes are passed around the rectum mobilizing it and drawing it up into the wound (Fig. 9). Then I divide the rectum transversely above the stricture and turn the lower end down, and here I find it is very densely adherent in the region of the old scar in the perineum. I find no indication of the rectoprostatic space, which normally exists, but which I suppose has been obliterated by the previous inflammatory changes. This rectoprostatic space, called by the French "l'espace décollable rétroprostatique," is, as you know, comparable to the tunica vaginalis of the testis; in fetal life it was a prolongation of the peritoneal cavity, but has become obliterated at its upper end. Thus if in the anatomic room you attempt to separate the parietal peritoneum from the underlying structures in the pelvis by means of blunt dissection,
Fig. 9.—Resection of the rectum: The lower sigmoid is drawn into the wound and supported by tapes. The superior hemorrhoidal artery has been ligated and divided preparatory to section of the bowel.

Fig. 10.—Resection of the rectum: After transverse division of the bowel above the stricture the lower segment is turned downward, and the levator ani muscle is cut away on each side to a point below the stricture.
it is easy enough to do so until you reach the rectovesical pouch; here you will find it necessary to use scissors for the dissection.

Having now mobilized the lower segment of the rectum sufficiently, I will cut the levator ani on each side from the rectum (Fig. 10), and, splitting the sphincters posteriorly, divide the rectum transversely below the stricture and remove the segment containing the stricture. The segment removed is from 6 to 7 cm. in length; and I find now that the proximal end of the rectum reaches to the distal without much tension,

and I will unite one to the other by a number of interrupted chromic mattress sutures, introducing them in such a way that the loops of the sutures will be on the mucous surface of both segments of the bowel and the knots on the outside (Fig. 11). This will invert the mucosa (Fig. 12) and, I hope, secure dry healing, although it is unusual for patients on whom this operation is done to recover without some fecal discharge through the wound before the latter finally heals. The operation, you see, is a tedious one; it has taken over an hour and a half, but
the patient is in very good shape. I will leave a gauze wick passing through the sutured area of the bowel, and protruding at the anus, as well as a rubber-tissue drain to the hollow of the sacrum, and will close the soft structures in layers.

(The pathologic report on the specimen, by Dr. C. Y. White, showed it was a benign fibrous stricture with no evidence of carcinoma. After hardening in formalin the specimen was split longitudinally (Fig. 13), showing, above, the normal rectal wall raised by an abrupt shelf at the upper border of the stricture. The lower margin of the stricture is shown sectioned transversely.)

Note.—There was much serosanguineous discharge from the drainage tract for the first two days after operation. The bowels moved by a laxative on the fourth day, and by the first of November, a week after operation, the wound was practically clean. On November 5th, however, there was quite a profuse discharge of fecal matter through the incompletely healed drainage tract. To control a fecal discharge it is best to stop all fluids by the mouth, to administer deodorized tincture
Fig. 13.—Stricture of the rectum, removed by resection (Case I). The specimen has been split longitudinally, showing the prominent shelf which formed the upper border of the stricture, and, below, the sectioned fibrous wall composing the stricture.

Fig. 14.—Case I. Photograph made two months after resection of rectum, showing healed cicatrix.
of opium in fairly large doses, and to give the patient a daily enema. This plan was adopted in the present case, and less than two weeks later the sinus had entirely ceased draining and he was allowed to have 750 c.c. of water daily by mouth. A month after operation he was out of bed and before being discharged from the hospital my associate, Dr. Crossan, repaired his inguinal hernia. At the time of his discharge, early in January, 1922, he had good control of his bowel movements unless they were too loose. The sphincter of the anus was strictured, barely admitting the index-finger, but the rectum felt absolutely normal from within, no evidence of the anastomosis being palpable. Figure 14 is from a photograph taken at this time to show the scar of operation.

In February, 1922, four months after operation, he reports himself as free from symptoms. His sphincter easily admits the index-finger, and he has never soiled himself since leaving the hospital but once recently when he had a severe diarrhea from some indiscretion in diet.
CASE II. CARCINOMATOUS STRicture OF RECTUM
ABOVE THE ANUS. RESECTION AND END-TO-END
UNION

WILLIAM J., forty-eight years of age, is now in the ward in the next bed to the man with stricture of the rectum upon whom I have just operated. He also has a stricture of the rectum just above the sphincters and a small fistula in ano. His chief complaint is pain in the rectum and inguinal hernia. For about a year he has noticed that he would have continuous sharp pain in the rectum after being on his feet for a while. He would then have to sit down, although this did not relieve him very much. He thought he had piles. Three months after this—that is to say, nine months ago—he noticed that his stools were becoming small in size and ribbon-like. The stools are very small at present and he has continuous pain in the rectum, which is worse when at stool. His pain is sharp and burning and has not been relieved by any of the medicines which have been prescribed for him previous to his admission to the hospital. He has never passed blood by the bowel; his appetite and digestion are good and he thinks he has lost no weight.

Examination on admission was negative, except for bilateral inguinal hernia (the hernia on the left being a little larger than that on the right) and the rectal condition. Examination of the rectum shows a fistula in ano opening into the right posterior quadrant, a few small hemorrhoids; and about 5 cm. above the internal sphincter a stricture admitting the index-finger with difficulty. This stricture is hard, apparently encircles the lumen of the bowel, and is about 1.5 cm. in breadth, except its anterior third, which is less pronounced. The rectum is not adherent to the surrounding structures; the prostate is soft; the inguinal lymph-nodes are slightly enlarged, especially on the left. On admission this man's urine was negative, but his phthalein output was only 5 per cent. for the first hour and
10 per cent. for the second hour, a total of 15 per cent., which is very low. His red blood-cells numbered 4,450,000 and his hemoglobin was 67 per cent. Under treatment his phthalein output rose rapidly and six days after admission the report showed 35 per cent. excreted in the first hour, 30 per cent. in the second hour, or a total of 65 per cent. His blood Wassermann is negative. Though I suspect that the stricture may be carcinomatous, there is nothing except its extreme hardness and the absence of any obvious cause for a benign stricture to make me think it is malignant. It does not appear to be ulcerated, and as it is situated so low in the rectum, yet not involving the sphincters, it seems to be a suitable case for resection of the rectum by the coccygeal route, with end-to-end anastomosis, as in the patient you have just seen; and I propose to do this same operation on this second patient within a few days.

Note.—Operation was done on this patient October 29, 1921, and was precisely similar to that just described, except that it was not necessary to divide the sphincters to amputate the rectum above them, the stricture being a little higher in this patient than in the one on whom the operation was done October 25th. A gauze wick was left in the anus up past the anastomosis, as in the previous case. This man developed a fecal discharge through his wound on the eighth day after operation, but on dry diet, with no fluids by mouth, deodorized tincture of opium three or four times daily, and a daily enema before the dressing of his wound this almost ceased to discharge in the course of three weeks. Then only gas passed through the sinus and finally the wound healed entirely. When he left the hospital, December 24th, just eight weeks after operation, he had been able for some time to control his bowel movements if they were not too loose.

The laboratory report, unfortunately, showed a scirrhous carcinoma. Figure 15 shows a cross-section of the rectum through the stricture.

In February, 1922 he reports in the same condition: his bowels move usually twice daily, and unless they are loose he has sufficient control over them; but for fear of accidents he
still wears a gauze pad and T-bandage; and he keeps to a rather dry diet. Digital examination shows the sphincters relaxed,

![Image](image_url)

Fig. 15.—Carcinoma of rectum, Case II. Cross-section of the specimen removed by resection.

but not paralyzed; and within the rectum no abnormality can be felt except a fine linear cicatrix around the posterior circumference of the bowel at the site of the anastomosis.
CASE III. CICATRICIAL CONTRACTURE OF BUTTOCKS NEARLY OCCLUDING ANUS. PLASTIC OPERATION ON THE BUTTOCKS

These patients with strictures so near the anus recall to my mind a lad eighteen years of age on whom I operated two years ago for a stricture below the anus resulting from burns at the age of two months. At this tender age he had convulsions and was put in a tub of hot water, severely burning both his buttocks. The burned area gradually healed, with marked contraction, and eighteen years later he came to the hospital complaining of constipation and abdominal pain. His constipation had gradually been growing more obstinate, and he had to be very careful what he ate, as any heavy food caused very obstinate constipation. For some years his bowels had opened only once a week and then only as the result of drastic purgatives; and the stricture was so tight that he had to have assistance in removing the fecal matter from his anus.

Examination was negative, except for the region of the buttocks, which was occupied by a dense, broad, indurated cicatrix, with a very small, firm aperture over the anus which would not admit the index-finger and barely admitted the tip of the little finger. It was impossible while in the hospital before operation to get his bowels thoroughly opened, so four days after admission I operated on him, doing a plastic on the cicatrix of the buttocks. This operation is best understood by the accompanying diagram (Fig. 16). I made two semilunar incisions with their convexity toward the stricture, leaving uncut skin at each side between the anterior and posterior incisions (Fig. 16, a). The triangular flaps thus outlined were dissected back and front, exposing the strictured canal (Fig. 16, b). This stricture was then incised in midline anteriorly and posteriorly up to the external sphincter (Fig. 16, c). Fortunately, all the scar tissue was external to the sphincter, the canal of the stricture involving the skin only and being about 2 cm. in length. The anterior and posterior triangular flaps were then sutured into the gaps made by incising the strictured
Fig. 16.—Case III. Plastic operation for cicatrix of buttocks, occluding anus. (See text.)

Fig. 17.—Case III one week after plastic operation on buttocks for cicatrices resulting from burns at the age of two months.
CICATRICIAL CONTRACTURE OF BUTTOCKS

canal. The anterior flap completely filled the gap, but the posterior left secondary gaps over each buttock (Fig. 16, d); and to close these I cut a flap from each buttock and swung it toward the anus, thus securing complete closure without tension, while the patient was in the lithotomy position (Fig. 16, e). I should add that as soon as the anus was exposed at the operation the wound surfaces were swabbed with 2 per cent. picric acid and the rectum was thoroughly irrigated until the fluid returned clear; and that at the end of the operation

![Image](image.png)

**Fig. 18.**—Case III more than two years after plastic operation on buttocks for cicatrices causing stricture of anus.

a drain was left in the spaces between the posterior flap and the coccyx as a matter of precaution. Figure 17 is from a photograph made just one week after operation. Four weeks after operation the wound was all healed but one or two granulating spots, the boy's bowels were opening every day without any laxative; and I have recently seen him (during the month of January, 1922), over two years since the operation, and there has been no further trouble of any kind. Figure 18 is from a photograph made at this time.
CASE IV. ABDOMINAL EXTRIPATION OF THE RECTO-SIGMOID FOR BENIGN STRicture DUE TO LOCALIZED MUSCULAR HYPERTROPHY

I want to tell you, also, about a patient who has lately been discharged from the hospital, and who had an obstruction of the sigmoidorectal juncture from a lesion which I have not seen described as causing symptoms. He was a man sixty-three years of age, a carpenter by occupation, sent in to the hospital by Dr. Bigley on September 8, 1921. He had always been healthy, but for eight years had suffered with indigestion and diarrhea alternating with constipation. His chief complaint was pain in the upper abdomen. This had lasted for more than six weeks; it was dull and throbbing and there was always present a sensation of heaviness. The pain was not influenced by meals. He belched a good deal, but had never had nausea nor vomited. He had never been jaundiced, never passed any blood in his stools, but said that lately his bowel movements had been ribbon shaped. He claimed to have lost 10 pounds in the last six weeks. His daughter said that he had often started out to his work in the mornings all doubled up with pain in the abdomen.

His weight on admission was 130 pounds (59 kg.), he was well developed and well nourished, apparently not very ill, and though somewhat thin, his color was good. Examination was otherwise negative, his abdomen being soft, with no areas of tenderness or rigidity. There was a medium-sized right oblique inguinal hernia and a small left inguinal hernia, both easily reducible.

Rectal examination showed the prostate slightly enlarged, but otherwise negative. If it had not been for the x-ray examinations of his gastro-intestinal tract, made by Dr. Bromer, it would not have been easy to make a diagnosis of any definite lesion from the symptoms and the gross physical examination. This x-ray examination showed that the esophagus was normal;
that there was slight ptosis of the stomach, but normal peristalsis and mobility; that there was no six-hour retention and no filling defects in the stomach. Examination twenty-four hours later showed a marked spastic condition of the large bowel, the cecum and ascending colon being very short. The forty-eight-hour examination showed marked hypermotility, the bowel being completely empty; there was nothing in the stomach to account for the patient's symptoms.

Dr. Bromer suggested another examination after the administration of a barium edema in order to exclude a lesion of the large bowel. This examination was made a few days before the patient's admission and showed a circular serrated filling defect where the sigmoid flexure joins the rectum. Dr. Bromer's conclusion was that this was the cause of the man's symptoms and could be caused by an annular constriction from a carcinoma, though it might also be due to adhesions.

The man's blood Wassermann was negative, as was his urine. In view of the history and the x-ray findings I thought that there was an obstruction, probably an early carcinoma, at the point indicated by the x-ray study. It is well to be guarded in one's conclusions when they are based on x-ray study alone. I had some months since in my care in the hospital here a patient, fifty-nine years of age, who brought with him an x-ray plate made by an outside roentgenologist and which showed very prettily a filling defect in the sigmoid (Fig. 19). As this patient's symptoms pointed to a lesion of the large bowel and the x-ray findings were so very definite I operated upon him, expecting to find an obstructive lesion as indicated by the x-ray; but I must say that our own roentgenologist, Dr. Bromer, when he looked at the plate which the patient brought with him to the hospital, told me that he did not feel sure that the constriction was other than a spasm; and on opening the patient's abdomen I found no lesion at all in the sigmoid or rectum, and the removal of a chronically adherent and inflamed appendix has entirely relieved his symptoms of constipation and indigestion; and he is now, some six months after operation, able to enjoy and digest any food, has gained 40 pounds (18 kg.) in weight, and is in every way in
excellent health. But in the case of the patient I am now discussing the constriction shown by the x-ray was too constant to be the result merely of spasm, and I decided to explore his abdomen with a view to doing a radical extirpation of his rectosigmoid.

In preparing patients for operations on the large bowel I believe it is very desirable not only to have the intestinal tract well purged, but, after the purging has been secured, to administer to them enough opium to dry up the intestinal secretions as much as possible. Of course, many operations must be done in emergencies on the large bowel for acute obstruction, or in chronic obstruction which has become acute; but whenever possible it is my practice to have the patient purged one or two days in advance, and beginning the night before the proposed operation to make him take 15 minims (1 c.c.) of the deodorized tincture of opium every three hours, and I am sure that this has simplified the operation and promoted healing without infection.

On opening the abdomen September 13, 1921, with the pre-
operative diagnosis of carcinoma of the rectum, I proceeded first to examine for metastases, but found the liver, stomach, pylorus, gall-bladder, and pancreas apparently normal. The rectum and the lower sigmoid were abnormally thick walled for a distance of about 10 cm., with definite terminations of this thickening above and below; and though it was not like anything I had seen before, I concluded that as it might be an early carcinoma it would be safer to treat it as if it were, rather than close the abdomen doing nothing. The thickening was so low down that it was entirely out of the question to resect and do an ordinary end-to-end anastomosis. It was necessary to do a combined operation from within the abdomen and from below. So I proceeded to mobilize the sigmoid by dividing the outer layer of the mesosigmoid and turning the bowel toward the midline; and then divided the sigmoid with the cautery about 10 cm. above the stricture, invaginating both ends. The upper end was isolated by one of the packs, and the lower end, including the rectum, was stripped from the hollow of the sacrum down to the perineum after ligation of the superior hemorrhoidal vessels at their origin. This segment of bowel was doubly clamped above the perineum and divided between the clamps with the cautery, the diseased segment, 25 cm. in length, being removed. The proximal end of the sigmoid, it was found, would reach the lower end of the rectum without tension; so this proximal end was opened, and a rubber tube with a lumen of 12.5 mm. was sutured into it, and the end of the sigmoid was inverted around this tube by a purse-string of chromic catgut. Then I asked Dr. Boykin, who was assisting me, to dilate the anus and to divide the sphincter posteriorly and through the lower end of the rectum to pass a long forceps up into the abdominal wound; I then placed the end of the tube (already sutured into the proximal sigmoid) in the bite of Dr. Boykin’s forceps (Fig. 20), and as he withdrew his forceps through the anus the proximal sigmoid was drawn down into the lower segment of the rectum. I had taken the precaution to place a number of mattress sutures of chromic gut in the end of the sigmoid before Dr. Boykin drew it down into the pelvis, so that to complete the anastomosis between upper
ABDOMINAL EXTIRPATION OF RECTOSIGMOID

and lower segments it was only necessary to insert the ends of the sutures (which had been left long for the purpose) into the lower segment just above the perineum and thus secure firm closure around the tube. These sutures were inserted through the abdominal wound. I placed a rubber-tissue drain in the extraperitoneal space around the rectum, closed the peritoneum over it, and then closed the abdominal wound in layers, without drainage. Finally an incision was made in the left ischiorectal fossa and the end of the rubber-tissue drainage previously placed from above was withdrawn through the ischiorectal incision.

Fig. 20.—Abdomino-anal extirpation of the rectum, Case IV. After removal of the diseased segment of bowel a rubber tube is fixed into the proximal sigmoid, and is drawn into the distal rectum by a forceps passed through the anus.

It is certainly true that in cases of carcinoma situated at the lower sigmoid or upper rectum this combined operation completed in one stage is preferable whenever it can be done; and with the use of a rubber tube, as I have described it, a method which I believe was first introduced by Mr. Mummery, surgeon to St Mark's Hospital, London, about the year 1908, it is not difficult to complete the operation within a reasonable time and to secure firm union. It took me a little over two hours to do this operation, but the patient recovered without any unfavorable symptoms, although the tube (which I had expected to remain in the lumen
Fig. 21.—Specimen of rectosigmoid (Case IV) showing stricture from hypertrophy of muscular wall. Note abrupt beginning and ending of the thickened wall.

of the intestine to protect the anastomosis until the latter was firm) was found pulled out of his anus the morning after opera-
tion. I presume he did this during his sleep. There was a profuse sanguineous discharge from the drainage tract in the ischiorectal fossa for a few days, but the patient’s temperature never rose above 100.4°F.; and though feces were discharged on the fourth and fifth days after operation from the drainage tract, this gradually healed up, and on October 5th, three weeks after operation, he was out of bed and went home a week later entirely healed, except for a superficial area in the abdominal wound which had been burnt by the cautery used in dividing the rectum. He returned to the hospital and was shown at a staff meeting some time later, being in excellent health and with no abdominal symptoms of any kind, entirely relieved from his previous troubles. (In February, 1922, five months after operation, he continues to be free from symptoms, his weight is 150 pounds (68 kg.), a gain of 25 pounds (11 kg.) since leaving the hospital.)

Now the interesting part of the patient’s history, to my mind, is not so much the operation as the pathologic findings. Dr. C. Y. White, our pathologist, can find nothing wrong with the rectum except a hypertrophy of its muscular walls over the area which was grossly thickened (Fig. 21). There is no ulceration, and while the lumen of the bowel is very much diminished, there is no inflammatory change to be found and no apparent cause for the condition; yet Dr. White tells me that in perhaps 1 or 2 per cent. of autopsises such a condition of localized muscular hypertrophy of the wall of the sigmoid may be found, but he does not know that it was ever productive of symptoms.
CASE V. CARCINOMA OF THE SIGMOID CAUSING CHRONIC OBSTRUCTION: RESECTION; DEATH

I had a man, fifty-two years of age, under my care a year ago, admitted to the medical ward of the hospital (Dr. Robertson's service) August 7, 1920, and transferred to my care the day of operation, August 13, 1920, whose chief complaint was "stomach trouble, pains in the abdomen, and constipation." He had been in good health up to five years previously, when he had had an attack of abdominal pain, but he took a heavy purge and his symptoms cleared up in a few days. Since then he had been perfectly well up to five days before admission. His stomach had always been very good, he never had any indigestion, he could eat anything. His bowels were pretty regular, but he took a laxative occasionally; yet for five days before admission he had had no bowel movement, although he had taken three doses of salts and two of castor oil. These medicines made him vomit and he had eaten nothing for five days, but had not kept to his bed, except a day or so before admission. He was sent to the medical ward from the receiving ward, with the diagnosis of acute gastritis and chronic constipation, and one would scarcely expect a man with such an excellent previous record and with only five days' illness to have any lesion that must have lasted for many months, if not years. Dr. Bloodgood has stated on many occasions that it is a disgrace to have carcinoma because it is a perfectly preventable disease; but in the present instance, and also frequently in cases of carcinoma of the stomach, at least in my own experience, the growths have not given any indication of their presence until they have been well advanced or entirely inoperable. This patient is an instance of the kind. Examination on the medical ward was practically negative; the abdomen was soft and was moderately tympanitic on percussion; there was a small mass on the right side near the umbilicus which was tender on pressure; there was slight abdominal pain; rectal examination showed the rectum dilated and a
moderately enlarged prostate. The knee-jerks were decreased, but otherwise the extremities were negative. His blood examination and urine examination were negative, and his blood Wassermann was negative. An x-ray examination made by Dr. Bromer showed that "the esophagus was normal, that free fluid was demonstrable by a wave in the abdominal cavity, that the stomach was lying high with apparently a constant filling defect near the pylorus, but no retention. It seemed to be pressed upward by the free fluid. The large intestine was greatly distended and enlarged both by air and the barium meal, especially the ascending, transverse, and descending colon. Examination was unsatisfactory because of the presence of the fluid," but Dr. Bromer thought that the shape of the stomach suggested a carcinoma and that distention and enlargement of the cecum and colon might be due to some lesion beyond the splenic flexure causing obstruction. The notes on the medical ward the next day showed that they could detect a shifting dulness in both flanks, and that when standing the fluid seemed to fill the lower third of the abdomen when the patient was examined fluoroscopically. The liver was not palpable at the costal margin. On August 12th I was asked to see the patient in consultation. I diagnosed chronic intestinal obstruction and advised his transfer to the surgical ward for operation. His stomach was washed and 200 c.c. of 5 per cent. sodium bicarbonate solution was introduced, which he vomited shortly afterward. The next day, under nitrous oxid and oxygen anesthesia, I opened the abdomen through a right paramedian hypogastric incision, believing that the obstruction was in the region of the cecum because it was thought an indistinct mass could be felt here. I found that there was no free fluid, that the cecum was negative, that the small intestines were moderately distended, but that there was an annular constricting tumor in the sigmoid. The sigmoid was delivered with some difficulty into the incision already made, and I think this was a mistake. It would have been better, having found that the lesion was in the sigmoid, for me to have closed the first incision and made another in the left iliac region and to have exposed the sigmoid by the more direct
approach, or even to have made a false anus in the cecum and postponed resection of the tumor until the intestinal obstruction has been relieved. However, by dividing the adhesions of the outer layer of the mesosigmoid the tumor came into the wound sufficiently far for resection, and here again I think I erred perhaps in doing a one-stage resection in the presence of obstruction, even though the latter was incomplete. After ligating the mesosigmoid

![Specimen of annular carcinoma of sigmoid resected from Case V.](image)

and clamping the bowel about 10 cm. apart above and below the tumor the latter was removed (Fig. 22) and an end-to-end anastomosis was done, the mesosigmoid being repaired to prevent an internal hernia; and the bowel was replaced and the wound closed without drainage. The patient did not vomit after the anesthetic and seemed at first to be about to do well. He was restless and noisy during the first night, but the morning after the operation he was doing well and passing flatus, and he
voided 24 ounces of urine on the day after operation. The second
day he vomited a little bile; his hands were cold and clammy, he
was restless, but clear in his head, and though peristalsis was audi-
ble, he looked as if he would die within twenty-four to thirty-six
hours. Toward night he became very restless, but was relieved
by lavage of the stomach, which removed a large amount of
bilious material; but the next day he died, with a temperature of
98° F.; his pulse at 96 and his respirations 28. He did not die
from peritonitis; I think he died partly from the shock of the
operation which involved considerable manipulation of the
distended small intestines and packing them off to expose the
sigmoid, and partly from toxemia from his chronic obstruction
and partly from inefficiency of his kidneys, because on the second
day after operation the amount of urine was much diminished
and some red blood-cells and granular and hyaline casts were
present. Dr White’s pathologic report showed the mass was an
adenocarcinoma of the sigmoid.
CASE VI. PELVIC ABSCESS FROM CARCINOMA OF HEPATIC FLEXURE OF COLON

Now I said a few moments ago that patients may have internal carcinoma without giving any history which would have warned them of its presence. I recall, for instance, the case of Mary C., seventy-six years of age, who was admitted to my care May 25, 1915. She had always been healthy, had no indigestion, and came in with the chief complaint of "pain in the abdomen of four days’ duration." She had vomited bile at the onset of the attack, her bowels had moved freely after a purge, but had not moved since. She had retained nothing on her stomach for four days. Her abdomen was markedly distended and tender on pressure. Peristalsis was present over the upper and left areas of the abdomen; no tumor was palpable and rectal examination was negative. When I saw her an hour after admission her temperature was normal, her pulse 80, full and strong, and her white blood-cells numbered 15,000, of which 82 per cent. were polys. She did not seem extremely ill; she was collected and talked clearly; she had vomited that day, but not since admission to the hospital. Her tongue was moist and fairly clean; her abdomen, which was very fat, was very much distended, but not very tense, except in the right iliac fossa, where also was the greatest tenderness. No mass could be felt and there was no dulness to percussion. Enemata given since admission had been returned clear; no flatus had been passed.

The preoperative diagnosis was appendicular abscess. Under local anesthesia the abdominal wall was opened, and a few whiffs of ether were given now and then, while the intestines were packed off and the retractors used. On opening the peritoneal cavity there was a flow of clear serum, culture of which proved negative. Packs were then introduced, the adhesions toward the pelvis were broken up, and a gush of colon bacillus
pus came from the pelvis. An adherent appendix, one point of which appeared to approach perforation, was removed, a glass tube and an iodoform gauze wick were placed in the pelvis, the isolating packs removed, and the inner part of the transverse incision was closed. This old lady did well at first. The glass tube was removed on the third day after operation, being replaced by a rubber tube; four days after operation there was some fecal discharge in the wound, and following this the distention became less, and within three weeks after operation she was able to be out of bed for a time, though the fecal fistula persisted with moderate discharge. By July 1st, six weeks after operation, she had gradually improved and had been up in the chair most of the time, but from July 1st on she weakened rapidly and died on July 6th. The autopsy showed, in addition to numerous pockets of pus among the coils of small intestines and the layers of the mesentery, and the fistula from the operative wound into the cecum, also an adenocarcinoma at the hepatic flexure of the colon, annular in shape, 3 to 5 cm. in length, the mucous surface being ulcerated and with cauliflower-like projections, causing intestinal obstruction. The pelvic organs and gall-bladder and liver were normal, and the laboratory report on the appendix, which had been removed at operation, showed chronic fibroid appendicitis with purulent peritonitis and infiltration of the muscular coats, with inflammatory exudate; and though clinically I had thought that the acute illness was due to an attack of appendicitis, it may have been a perforation of the cecum microscopic in size with resultant abscess formation in the pelvis due to the chronic obstruction caused by the tumor at the hepatic flexure. I do not see that this old woman of seventy-six, who had been in perfectly good health until four days before admission, presented any premonitory symptoms neglect of attention to which should have made her consider it a disgrace to develop carcinoma. It was certainly not her fault that she was not operated upon sooner.
CASE VII. CARCINOMA OF ASCENDING COLON: RESECTION; ILEOCOLOSTOMY. DEATH

In August, 1915 I had another patient with carcinoma of the ascending colon under my care. She was then fifty-four years of age, and seven years previously she had been operated upon in the University Hospital for left tubo-ovarian abscess; and fifteen months later she had had an incisional hernia repaired at St. Mary's Hospital. On May 1, 1915, three months before admission, she had developed a severe pain in the lower right iliac fossa, which she thought was due to constipation. She took olive oil and was relieved. On May 15th she developed a dull pain in the epigastric region. This had no relation to the taking of food and lasted only two days, but had recurred since about once weekly, and during the last two weeks she had had about four attacks of epigastric pain. Her physician thought she had gall-stones. She had alternating constipation and diarrhea. In some of these attacks she had been jaundiced; she had lost 20 pounds (9 kg.) in weight during the last few months and on admission her weight was only 101½ pounds (45.5 kg.). Her appetite was poor and she looked weak and emaciated. Examination was negative, except for the abdomen. There was a mass felt in the right iliac fossa which was tender on deep pressure and probably was a distended cecum. The scar of the pelvic operation bulged slightly when she was in the erect posture. The liver and spleen were negative, there was no tenderness over the gall-bladder region, and the stomach was not dilated. Vaginal examination showed the cervix present and normal, but the uterus was not palpated. X-Ray examination of her gastro-intestinal tract showed seven-hour retention in the stomach and an obstruction in the colon near the hepatic flexure, with marked distention of the ascending colon and small intestines (Fig. 23). Three days after admission examination showed the same mass in the right iliac fossa as on ad-
mission. This was rather dull on percussion at first, but could be emptied into the ascending colon by pressure, and then disappeared. Above this mass, and probably in the ascending colon, was a small mass about 3 or 4 cm. in diameter, which was tender. There was also tenderness over the region of the pylorus and gall-bladder, but no mass could be felt there. On August 10th, six days after admission, I opened her abdomen through a right rectus incision, freed the omental adhesions to the former operative scar, and resected the diseased omentum. The cecum was dilated and there was a narrow annular constriction in the ascending colon about 10 cm. above the ileocecal valve resembling scirrhous carcinoma. The gall-bladder, liver, and stomach appeared normal. The cecum was then freed from its attachments up to the hepatic flexure and the terminal ileum was cut across and the proximal end closed and a lateral anastomosis made between this and the transverse colon just beyond the hepatic flexure. Then the transverse colon was divided at the

Fig. 23.—Case VII. Carcinoma of ascending colon. The barium meal distends the small intestine and cecum, but is arrested in the ascending colon.
hepatic flexure, the distal end closed, and the cecum and ascending colon were removed. The patient was rather shocked by the operation, which lasted two hours, but reacted well by the next day and passed some flatus, retained her enteroclysis, and during the afternoon took some water by the mouth, but only 15 c.c. (½ ounce) of urine was obtained by catheter in the twelve hours after the operation, and the second day after operation she voided only 45 c.c. (1½ ounces) of urine, and she died on the third day after operation apparently from suppression of urine and exhaustion. The specimen removed at operation showed a typical annular carcinoma of the ascending colon, with a stricture barely admitting a goose quill (Fig. 24). Autopsy showed no peritonitis or hemorrhage, anastomosis in good condition, but some loops of small intestine had slipped from left to right through the unsutured gap beneath the anastomosis; but no obstruction of the intestines had been caused by this internal hernia, though certainly the gap should have been sutured at the time of operation. No secondary deposits of carcinoma were found.

Fig. 24.—Case VII. Adenocarcinoma of the ascending colon.
CASE VIII. CARCINOMA OF HEPATIC FLEXURE OF COLON: INOPERABLE

Many of these cases of carcinoma of the large intestine, however, have had sufficient warning and should have sought surgical relief sooner than they have done so. Anna B., twenty-eight years of age, was admitted to the Episcopal Hospital July 21, 1912, on Dr. Fussell’s medical service. She was married and had 3 children, the youngest being thirteen months of age. She had had no miscarriages. Apart from typhoid fever at thirteen years of age, her general health had always been good until shortly before the birth of her last child, when she felt weak, faint, and giddy; she had suffered from constant diarrhea all through the later months of pregnancy, and this had persisted up to admission. She had passed no blood in her stools at any time and had no vomiting or nausea except during the later months of pregnancy, and even then she had a good appetite after vomiting, and sometimes when she ate again the food would be retained. Her normal weight, she said, was 186 pounds (84.2 kg.). On admission it was 125 pounds (56.5 kg.). Her chief complaint was a weak and dragging feeling. While in bed she had no pain and felt well, but as soon as she exerted herself she felt exhausted. Examination showed she was a very anemic, wasted woman, with skin and mucous membranes pale, but no yellowish tinge to the skin; head, neck, and thorax negative, except for a soft systolic murmur at the apex of the heart which was not transmitted. The liver was not enlarged, but the spleen was palpable on deep inspiration. The abdominal walls were relaxed and flabby, and in the right upper quadrant there was a palpable mass the size of a kidney, movable, tender, and rather firm in consistency. It did not seem to be connected with the gall-bladder. On August 2d Dr. Fussell asked me to see her, and he told me he thought it was a tumor of the right kidney, but chromo-ureteroscopy, done that same day by Dr. B. A. Thomas, showed the indigocarmine solution eliminated
in seven minutes from both ureters, proving the kidneys functionally sufficient; and the ureteral orifices appeared normal. The patient was certainly very anemic, her hemoglobin was only 36 per cent., her white blood-cells numbered 12,000, and her temperature ranged from 100° to 101° F. In the upper right quadrant was an indurated mass about the size of a large fist which moved on respiration, was dull to percussion, and was only slightly tender. There was tympanitic bowel in front of it, there was tympany between it and the liver, and yet the mass did not feel to me as if it were connected with the kidney. It moved more laterally than upward and downward and was fairly freely movable under the abdominal wall.

Under ether anesthesia just before operation (August 5, 1912) the tumor was found to be clearly outlined, nodular, freely movable in the right flank, but not extending back to the region of the kidney. A transverse incision was made over the mass, and while the stomach, pylorus, and gall-bladder were normal, there were very dense adhesions, with a mass of woody hardness below the pylorus, involving the hepatic flexure. The omentum and the transverse colon appeared normal, but the appendix was not found. After packing off with gauze the mass was burrowed into on its anterior aspect, and some partially necrotic omentum was found, as well as some colon bacillus smelling moisture, but no real fluid and no pus. I abandoned the operation, putting in an iodoform-gauze drain.

The report on the excised specimen of omentum showed it was the seat of metastatic adenocarcinoma. A fecal fistula developed in the wound on the third day, but in spite of this the patient felt much better, with more appetite and less soreness in the abdomen. The fecal discharge continued until August 25th, when it ceased for a time under the influence of daily enemas and opium, but the patient gradually failed, and died September 20th. The autopsy showed the lower surface of the right lobe of the liver, the gall-bladder, duodenum, and hepatic flexure of the colon were included in a large carcinomatous mass and that the fistula from the abdominal incision led into the colon through the tumor.
CASE IX. CARCINOMA OF HEPATIC FLEXURE OF COLON: RESECTION; ILEOCOLOSTOMY. RECOVERY

Occasionally, however, a surgeon is gratified to have a patient come to him in an operable condition. Such was the case of the Reverend R. L. S., sixty-nine years of age, who was admitted to the hospital June 22, 1920. He had been a very athletic man ever since his college days, when he was a "champion." He had had an operation for hemorrhoids in 1893 and was under my care in 1908 for dislocation of the hip sustained in a suicidal attempt in jumping from a second-story window. This was during an attack of melancholia, of which he had had a number.

On admission in 1920 his chief complaint was intermittent, knife-like pain in the abdomen. He had been in fairly good health except for his melancholia until the winter of 1919–20, when he had a slight attack of influenza, but he had had chronic indigestion for the last few years and the most obstinate constipation increasing for the last three years. Three months before admission he first had some definite pain in the abdomen and at the same time he noticed a small lump in the right side of his belly. There had been no change in his weight for the last forty years until within the past few months, when he had lost 25 pounds (11 kg.), about 15 pounds (6.7 kg.) of this being lost within the last month. The pain had been very severe, especially during the last three weeks, but always more or less intermittent. His bowels could no longer be moved by cathartics, and for the last two or three weeks he had had to use an enema daily, usually 2 quarts at a time. His appetite remained good, but he could not eat much because the food disagreed and caused pain.

Examination showed a poorly nourished man, so weak that he held on to the wall or the furniture in walking across the room. His weight was 107 pounds, 10 ounces (48.85 kg.). His heart was enlarged down and out, with a systolic thrill and diastolic murmur.
transmitted toward the axilla. His pulse was irregular, there being two regular beats and then two small beats in quick succession. There was marked pulsation in all the superficial arteries. His blood-pressure was 168 systolic, 95 diastolic. Examination of the abdomen showed it was tympanitic, except for a small area on the right side. He was emaciated and peristalsis was seen occasionally. Palpation showed a mass above and to the right of the umbilicus apparently about 10 x 10 cm. in size, movable in all directions, apparently not adherent, dull on percussion. It was movable toward the left as far as the middle, but returned again of itself to the usual site. There was tympany between it and the liver, and it was not tender except on hard pressure. It did not have the characteristics of fecal impaction, but was extremely hard and nodular. There seemed to be enlarged lymph-nodes palpable through the abdominal wall in the epigastric region, probably in the gastrohepatic omentum. There was a reducible left inguinal hernia, for which the patient wore a truss. His urine was normal, his blood Wassermann was negative, and his blood count showed red blood-cells 4,390,000, hemoglobin 80 per cent., white blood-cells 8400, polys. 64 per cent. x-Ray examination by Dr. Bromer showed that the esophagus and the stomach were normal, but that there was a filling defect in the transverse colon just beyond the hepatic flexure, continuing well up toward the sigmoid flexure. This filling defect persisted in examinations both after ingestion of barium by mouth and by enema, and Dr. Bromer thought in connection with the history of chronic constipation it indicated a carcinoma, or other tumor, involving that region.

The operation was done on June 24, 1920, when I found a movable mass at the hepatic flexure, but adherent to the gall-bladder and duodenum. The ileum was divided above the ileo-cecal valve and sutured, end on, into the inferior longitudinal band of the transverse colon. (I am sure that it is a much better plan in doing any operation of this kind to make the anastomosis first and then proceed to the excision of the growth only if the patient's condition is such as to warrant it, because after the anastomosis is made the operation can be abandoned at any
stage if necessary and concluded at a second sitting; but it would not be convenient to have to abandon the operation for excision of the growth before the anastomosis was made.) The colon was then sectioned just distal to the hepatic flexure and the distal end closed with sutures and the cecum and ascending colon removed (Fig. 25). Some trouble was encountered on account of dense adhesions between the tumor and the gall-bladder and the descending and transverse duodenum and pancreas, but these adhesions were ligated and divided; and finally the opening between the mesentery of the ileum and the transverse mesocolon was closed by suture. The abdomen was closed without drainage, the time of the operation being one hour and forty minutes.

This patient's highest pulse-rate was 92 just before the anesthetic was begun, the anesthetic being gas with only 2 ounces of ether. His highest temperature was 99.4° F. on the fifth day after operation.

July 7th he seemed convalescent. All the sutures were
removed from the wound; there was a slight fecal smelling discharge on the gauze, but after this date no further discharge occurred.

July 14th he was sitting up in bed.
July 20th walking a little.

August 2d gastro-intestinal x-ray study showed the esophagus and stomach normal, and in the twenty-four-hour plate the result of excision of the cecum and ascending colon was shown, with anastomosis of the terminal ileum to the transverse colon. There was now no filling defect at the transverse colon and in the twenty-four-hour plate there was no delay in the normal movement of the barium meal through the large bowel.

The patient left the hospital August 14th, his weight 114 pounds (51.3 kg.), over 6 pounds (2.7 kg.) more than on admission.

The laboratory report on his specimen showed that it was a medullary carcinoma of the colon, in areas adenocarcinoma, with no involvement of the adjacent lymph-nodes; Fig. 26 is a drawing
of the specimen. Examination of the specimen confirmed what I had suspected at the time of operation, that I had apparently left a small portion of colon, perhaps 0.5 cm. in diameter, adherent to the transverse duodenum, for after the specimen had lain in the pan for some time a little fecal discharge was found at this point from the interior of the lumen of the excised bowel. Section of the tumor showed a channel about 1 cm. in diameter, the tumor being about 2½ cm. in thickness and about 10 cm. in length, involving the entire circumference of intestine at the hepatic flexure. The lymph-nodes that were removed were in the gastrocolic omentum. No others could be found at operation.

This patient wrote me a year after operation that his weight was above normal, that he was in perfect health, that he had had no constipation or any intestinal trouble since the operation, and I am happy to say that this condition still continues at present (February, 1922), over eighteen months since operation.

It is certainly true, with very few exceptions, that the inoperable cases of carcinoma of the large intestine occur in those patients who have neglected fair warning symptoms, or who have been incompetently treated by ignorant physicians during the operable stage. In Case VI, where symptoms were of four days' duration only, neither the patient nor her physician can be blamed for not recognizing a symptomless malady. But what shall we say of the individual calling himself a “rectal specialist” who, until his admission to the hospital (September 28, 1916) had been treating the old man, a photograph of whose carcinomatous rectum and buttock is represented in Fig. 27. This poor old man, seventy-two years of age, had faithfully and with confidence put himself into the care of the so-called specialist for what he thought was “piles,” and the ignorant if not charlatanical malpractitioner had been treating him for eight months for “piles” and “ischiorectal abscess.” The latter he had incised only to find the carcinoma of the rectum growing out through the ischiorectal fossa on to the buttock.

Note also the aid derived in almost every case from roentgenologic study; but remember also that there are very many
incompetent and ignorant individuals calling themselves roentgenologists who know nothing but the technical details of their trade (and often know too little even of these), and who are utterly unable to interpret what they see even if their x-ray plates or their fluoroscopic expositions are good. They may, on the one hand, lull the unsuspecting patient and the overconfident physician into a sense of false security, because the existing lesions are overlooked; or, on the other, they may make an erroneous interpretation pointing out disease where there is no disease, and so the patient may be subjected to unnecessary operation.

In reaching your diagnosis make use of all the laboratory aids that are available, but keep your sound clinical judgment untrammeled. Get a clear history of the onset and progress of the malady; cross examine your patient time and again as to suggestive occurrences or symptoms he may have forgotten; and then act before it is too late, in the light that all of art and all of science can afford.

If the case is clearly inoperable when first seen, it may yet
be possible to cause an amelioration of the patient's condition even though his disease cannot be cured. Quite apart from local treatment with radium or the x-rays I am a firm believer in colostomy as a palliative measure in inoperable carcinoma of the rectum, because I know that a colostomy properly performed really palliates the patient's discomfort, and even if it does not prolong his life, makes his remaining days infinitely more comfortable. Make a left-sided McBurney incision, draw the sigmoid up into this wound, and draw its proximal end taut; this is to prevent an intussusception of the afferent loop occurring after operation. Then suture your afferent and efferent loops together like a double-barreled shotgun ("en canon de fusille" as the French call it), uniting them for a distance of 10 cm. if possible. This forms a firm spur which will last until the patient's death, and will prevent fecal discharges from continuing past the false anus to irritate the tumor in the rectum. Then reduce your loop of sigmoid until the apex of its mesentery lies level with the peritoneum, and suture the parietal peritoneum around both coils of bowel at this level, placing a rubber tube across the mesentery to prevent the coil from retracting entirely within the abdomen. Dress the wound, and two or three days later, if there is no acute obstruction demanding immediate relief, you may open the bowel without any anesthetic by cutting transversely across the projecting loop of sigmoid, preferably with the actual cautery. Cut all the way through to your rubber tube, and remove the latter. It is a simple and efficient operation; but to promote the patient's comfort the bowel must be well taken care of afterward, and when this is done no colostomy apparatus is required, and the patient is entirely inoffensive to himself and to those about him. I must confess to reading with considerable surprise of the various "modifications" and "improvements" on this simple operation which are from time to time reported in the current journals; and I hear with regret of patients, who have been operated on by some of these latest methods, who are so uncomfortable themselves, in spite of the use of the most approved and most widely advertised colostomy apparatuses, and who are so offensive to their family, that both patient and
family eagerly await the former's transition beyond that bourne from which no traveler returns.

For it is a fact that when the method of colostomy which I have just described, and for the merits of which I think most credit must be given to Tuttle of New York—when this method is employed, I say, and when the bowel is properly cared for, it is satisfactory in every way, and the patient is required only to wear a gauze pad over the opening and to change it once or at

Fig. 28.—Case of colostomy for inoperable carcinoma of rectum. Three weeks after operation. Note also truss for right inguinal hernia, a very frequent complication of chronic obstruction.

the most twice a day (Fig. 28). And how is the bowel to be cared for, do you ask? If each morning the colon is thoroughly filled, through the afferent loop, by 500 to 1000 c.c. of warm water, and if this injection is retained for about twenty minutes, free evacuation of the bowel is secured by turning face downward and making pressure over the cecum; and I can testify from repeated personal observations to the truth of Sir Frederick Wallis' assertion that "the patient is then quite comfortable and clean for the rest of the day."
It is quite impossible to comprehend many of the problems that have to do with the diagnosis of intracranial lesions or with their surgical treatment without an intimate understanding of the physiology—the pathologic physiology—of the cerebrospinal fluid and the cavities within which it is contained. This general statement applies not only to an understanding of the symptomatology and behavior of brain tumors, to their diagnosis, but also to many practical problems as they present themselves on the operating table.

Let me be more explicit. The papilledema, the headache, and vomiting of brain tumor are evidences of increased intracranial tension, and this increased intracranial pressure is not due alone to the presence of the tumor, but in the majority of instances in a large measure to the dilatation of the ventricles. This dilatation of the ventricles—call it internal hydrocephalus if you will—is, I might say, an invariable accompaniment of all tumors of the posterior fossa. One can understand how readily a tumor in this locality, particularly is the cerebello-pontile angle a favorite site, even though of small dimensions, could obstruct the outlet to the ventricles. I say invariable accompaniment; there are, of course, exceptions to all rules. There happens to be in the hospital today a striking exception. Here is a patient whose tumor history extends over a period of at least eight years. Four years ago I removed from the right posterior fossa an endothelioma so large that it had re-

1 Lecture to the Surgical Group of the Post-Graduate School of Medicine of the University of Pennsylvania.
placed an entire cerebellar hemisphere. In spite of the fact that the tumor was so large there was at that time not the slightest evidence of a papilledema. It is of further interest to note that a year ago she returned with evidences of a recurrent growth which, upon exploration, I found inoperable. But even then there was no choking of the disks. This patient has been treated by radium, in the first instance by direct implantation, and later by the indirect method, and there is no doubt in the mind of her family or of her medical attendants that there has been a very decided improvement. When I tell you that the patient had a staggering gait you can see for yourselves, as the patient walks across the clinic floor, how much she has improved. One hears and reads skeptical views as to the effect of radium, but I venture to say that if you inquire into the experience of those who have expressed these views, you will find that, in the first place, they never had any radium themselves, and in the second place, they have had no experience with it. Although this is not germane to our main theme, I wish to say quite emphatically that from an experience now including a large series of cases I have very strong conviction that radium does retard the growth of brain tumors, and that it has proved an invaluable agency in the treatment of certain inoperable cerebral neoplasms.

To return now to our original theme, while, as I have said, internal hydrocephalus is an almost invariable accompaniment of subtentorial tumors, it is also observed in pretentorial growths, especially those at the base so situated as to readily obstruct the ventricular outlets. Here, for example, is a patient, now under observation, who has unquestionably an internal hydrocephalus and who, we believe, has a tumor at the base of the occipital lobe. Observe the cerebral hernia beneath the right temporal muscle. I will not go into this patient's history in great detail save to say that when he came to us a month ago he was bedridden, suffering intensely from headache and vomiting, with a papilledema in each eye of three diopters. Merely to relieve his subjective disturbances and to conserve vision while he was under observation a subtemporal decompression
was performed, with most gratifying results. The operation has controlled the vomiting, relieved the headache, and the choked disks have subsided. The patient has thus been transformed from one bedridden and with many discomforts to one ambulant and practically free from any subjective disturbances. I want you to note while he is here (I will bring him before you later on) that the cerebral hernia at the site of the decompression is under great tension.

Finally, with regard to internal hydrocephalus and tumors, even in the absence of obstruction, such as might be caused by tumors at the base, there is an internal hydrocephalus, perhaps of more moderate degree, in tumors of the cerebral hemispheres which do not obstruct ventricular drainage. Just what disturbs the balance between the secretion of and absorption of cerebrospinal fluid in the presence of a brain tumor I am not prepared to say. That this balance is disturbed I have no doubt, so that practically in all cases of brain tumor wherever situated one has to reckon with an internal hydrocephalus.

Before applying to the practical problems of diagnosis or technic what we know of the cerebrospinal fluid in its perverted state, let me review some of the fundamental facts concerning its origin, circulation, and absorption.

First of all, let me remind you that the cerebrospinal fluid is in large measure (90 per cent., possibly more) the product of the choroid plexus; I call it product, although we know little of the process by which it is formed. How rapidly it is formed under normal circumstances we do not know, but it is quite certain that under abnormal conditions the rate of production is greatly increased and that the process of production, whatever that may be, is readily influenced by deviations from normal.

I show you this patient who had, we presumed, a basal tumor with ventricular obstruction. I had performed an exploratory craniotomy and the flap was raised above the surface by the distended ventricle. By direct ventricular puncture I could readily withdraw 60 c.c. of cerebrospinal fluid, and the osteoplastic flap at once returned to the level of the skull. Within
two or three hours this amount of fluid would be replaced, as evidenced by the elevation of the flaps and the renewed signs of pressure. At this rate 720 c.c. of fluid would be secreted in a day (Fig. 29). There is in this crude demonstration a lesson to be learned. Frequently physicians write me as to the propriety of practising ventricular puncture through a decompression opening, when the hernia is increasing in size and the tension becomes excessive with aggravation of symptoms. The answer at once suggests itself to you. The relief afforded under such circumstances would be only a matter of a few hours.

To illustrate the extreme variability of the rate of production and the response to varying conditions take this case of fracture of the base of the skull with rupture of the tympanic membrane. The fluid was collected from the external ear, the amount recorded and charted. This is a rather crude demonstration,
but it would seem to indicate that the rate of secretion is influenced by a number of factors (Fig. 30).

Much of what we know about the production of cerebrospinal fluid has been derived from experimental research. I directed a few years ago an elaborate investigation as to the factors which influenced the rate of flow of cerebrospinal fluid or the activity of the choroid plexus. We were looking particularly for some agent which would retard the rate. With one exception all the drugs, tissue, and glandular extracts used were followed by a transitory increase. The one notable excep-
Inhalation of 5 min. Amyl nitrite. Marked increase in outflow with fall in blood pressure. Fluid sucked back

Fig. 31.

5cc. brain extract injected C.S.F. stimulated. Then considerably slowed.

Fig. 32.

8cc. Human Thyroid extract. Drop in blood pressure with slight stimulation.

Fig. 33.

40 minutes after above chart. Still flowing extremely slow.

Fig. 34.

Continuation of above. Flow much slower than normal.

Fig. 35.
tion was thyroid extract. In every instance thyroid extract caused a definite retardation of flow, not transitory, continuing over a period of several hours (Fig. 31–35).

Has this phenomenon, you ask, any practical application? Theoretically, yes, in non-obstructive congenital hydrocephalus. Unfortunately, I have been able in but one case of congenital hydrocephalus to supervise the administration of thyroid extract over a sufficiently long period. In this case the treatment was begun when the child was five weeks old and con-
tinued faithfully by the parents for six months. The child is now, to all intents and purposes, normal, quite comparable mentally and physically to her two sisters. A photograph of the patient at various ages is shown in Fig. 36.

You should remember that the normal pressure of the cerebrospinal fluid as measured by the mercurial manometer is 6 to 8 mm.

From the practical point of view we are more concerned with the process of absorption. There is, of course, a regulatory mechanism, under normal conditions, whereby the balance between secretion and absorption is maintained. We have already spoken of conditions which affect the secretion, but what disturbs the rate of absorption? To answer this question you must recall to mind these facts: that the fluid is formed in the lateral ventricles, that the ventricles are mere receptacles, as the urinary or gall-bladder, that the fluid escapes from the

Fig. 37.—Illustrating the technic of cisternal puncture. (Courtesy of Dr. James B. Ayer.)
ventricles by their several outlets to the subarachnoid space, to the cisterna cerebello-medullaris or the cisterna magna, the distributing center of the cerebrospinal fluid system. The accumulation of fluid in this cistern has been availed of for the practice of cisterna puncture, a substitute for lumbar puncture proposed by Ayer (Fig. 37). A small quantity of fluid passes from the basal cistern into the spinal canal, but the bulk makes its way through the incisura tentorii to the subarachnoid space over the cerebral hemispheres, where it is taken up by the arachnoid villi. A relatively small quantity is absorbed in the spinal canal or escapes from the cranial chamber by the lymphatics or beneath the sheaths of the cranial nerves. But the amount through these several channels is insignificant. The great mass is absorbed by the arachnoid villi over the cerebral hemispheres. Hence, when there is any obstruction to the circulation, either at the outlet of the ventricles or at the passage through the tentorium, the fluid will accumulate to such excess as to give rise to serious consequences. The causes of obstruction are either the adhesions of an inflammatory process or new growth.

From this very cursory review of certain fundamental facts regarding the cerebrospinal fluid in normal and abnormal environments I want to draw some practical lessons in relation particularly to brain tumors.

Consider for a moment the operation subtemporal decompression, once heralded with a great deal of enthusiasm as an operation promising much to the patient with an inoperable growth, no matter where located. When a hernia develops at the site of subtemporal decompression, does that represent the increase in bulk within the skull caused by brain mass plus tumor? Only to a limited degree; in most instances the size of the hernia is in proportion to the degree of ventricular distention. In other words, the space presumably provided for tumor growth is largely preempted by the dilating ventricle. This young man (Fig. 38) was sent to me for an opinion. You see he has a large cerebral hernia in the right subtemporal region. Now we know, for we have just completed a ventriculo-
gram in this case, that this hernia is essentially a hernia of the ventricle, and in all probability the tumor is a posterior fossa tumor. I presume in this case a subtemporal decompression was performed because of the obscurity of the lesion, but had the doctor who performed the operation suspected a posterior fossa growth he should have performed a suboccipital rather than a subtemporal decompression for obvious reasons. Here are two lessons to be learned: First, do not perform subtemporal decompressions in posterior fossa lesions; second, do not fall into the habit of resorting to the subtemporal decompression without clear indications. Too often the operation is performed because the attending surgeon does not feel competent to engage in a complicated exploration and shrinks from the more hazardous of the two procedures, or because the conditions essential for an exhaustive study are not at hand and a localization of the growth has not been attempted. There should be no question, then, in your mind as to the impropriety of a subtemporal decompression for obscure lesions.

Fig. 38.—Patient referred to the clinic with a large cerebral hernia at the site of a subtemporal decompression. Our investigation disclosed a subtentorial lesion.
decompression in posterior fossa tumors. But what of pre-
tentorial growths? Horsley many years ago advised decompress-
ion directly over the growth, and when we see on the operating
table a tumor of the cerebral hemisphere that we regard as
inoperable, we should follow Horsley’s directions. Of course
in unlocalizable growths the right subtemporal region is the
site of election.

The excessive accumulation of cerebrospinal fluid, some-
times within and sometimes without the ventricles, has led to
errors in diagnosis. “Pseudotumor” is a term which has crept
into the medical nomenclature and is self-explanatory. Whether
the term is or is not an appropriate one, we see a number of
cases having the earmarks of an intracranial growth, both
general and focal. The subsequent course of events or perhaps
an exploratory operation makes our original diagnosis untenable.
The underlying pathology in those cases is an arachnitis, general
or local, following a systemic infection, exanthemata in children
or influenza in the adult. The presence of adhesions may cause
ventricular obstruction, or if limited to a given area may
eventuate in a localized cyst. This child (Fig. 39), for example,
had signs of increased intracranial pressure; there were no focal
symptoms. A subtemporal decompression relieved the head-
ache and vomiting, but, unfortunately, optic atrophy was so
far advanced that the child was blind. Many years have passed
since this operation was performed, and with the exception
of loss of vision the child is entirely well. This tragedy might
have been averted had the operation been performed sooner—
a very striking example of the urgency of early decompression
in doubtful cases. Contrast this case with that of this young
lady, who had all the signs of intracranial pressure plus evidence
suspicous of a cerebellar lesion. There was a beginning pap-
illedema, but the disks were not atrophic. Three years have
elapsed since the operation; she has completed her course in
college and is now symptom free. I could cite other examples
of these so-called pseudotumors, but these are sufficient for our
purpose.

Another source of error in diagnosis attributable to the ex-
cessive accumulation of the cerebrospinal fluid, in this instance in the ventricles, is the suggestion of a frontal lobe picture. One can readily see how a distended ventricle by pressure upon the frontal lobe might disturb its function. This patient we know from our examination had an internal hydrocephalus; we know, furthermore, that the lesion was subtentorial rather than pretentorial, but there were two symptoms which, had there not been other conflicting signs, might have justified a localization in the frontal lobes, loss of memory, and what the Germans appropriately call "Witzelsucht." Both these symptoms were conspicuous features in the clinical picture, but were readily accounted for in the manner described.
Again, dilatation of the fourth ventricle from an obstructive lesion may lead us astray. The proximity of Deiter’s nucleus to the fourth ventricle is responsible, we believe, for erroneous deductions from disturbance of function as elicited by the Bárány test. This is not an infrequent source of error and should be guarded against.

Fig. 40.—Anteroposterior view of dilated ventricles.

Fig. 41.—Slight obliteration of posterior horn of left lateral ventricle. Markedly dilated ventricle. No air below aqueduct of Sylvius. (Same case as Fig. 40.)
Ventriculography.—This leads me to discuss with you the question as to whether we can derive any information of practical value from the ventriculogram. You are already familiar with

Fig. 42.—Same case as Fig. 40. Ventricle on other side. Dilatation, but no distortion. Third and fourth ventricles not seen. No air below third ventricle, which may be obliterated by tumor.

Fig. 43.—Dilatation and distortion of left lateral ventricle in case of occipital pole tumor. Third ventricle, aqueduct, and fourth ventricle all seen.

this method of demonstrating in the roentgenogram the outlines of the ventricles. Here is the roentgenogram of a case in which there was a rather complex clinical picture; there were clearly
signs of increased intracranial pressure, but the precise localization of the growth was problematic as between a pretentorial or subtentorial growth. You see the ventriculogram (Figs. 40–42) presents in the lateral view enormously distended ventricles and,

![Lateral ventricle diagram](image)

Fig. 44.—Complete occlusion of posterior and inferior horn of left lateral ventricle by large occipital pole tumor pushing upward and inward. (Same case as Fig. 42.)

![Right ventricle diagram](image)

Fig. 45.—Right ventricle. (Same case as Figs. 43, 44.)

what is especially important, in the anteroposterior view a symmetric enlargement of the ventricles. One would deduce from this a tumor of the brain stem so situated as to cause obstruction to the ventricular outlet.
Contrast that with this roentgenogram; the left ventricle distended moderately, the right encroached upon (Figs. 43-45). This might be interpreted not only as suggesting, first, that there was a tumor of the right hemisphere, and second, that the tumor was subcortical rather than cortical. Naturally, the more deeply seated the tumor, the more likely will it encroach upon the ventricle. So that we may derive information which may be helpful in these two particulars, first, as to the hemisphere involved, that is, right or left, and second, as to whether the tumor is subcortical. Of what practical value the ventriculogram will
be considered from the standpoint of surgical accomplishments remains to be seen. The majority of these obscure tumors are deep seated and a much larger majority are infiltrating gliomata. The favorable growth for radical extirpation is a tumor such as this (Fig. 46), removed in the clinic a few days ago; it was cortical in origin and location and encapsulated, so that from the standpoint of accessibility and of the possibility of complete extirpation it was an "operable" growth in every sense of the word. Not so with the subcortical glioma, which in most instances is distinctly "inoperable."

Problems On the Operating Table.—By no means in all but in most cases of cerebral or cerebellar growths the intracranial pressure is greatly increased, and under these circumstances an exploration, satisfactorily and properly safeguarded, can be carried out only when the tension can be reduced to within limits approaching normal. You know, from what has preceded, that increased pressure is due not to the tumor alone, but in large measure to ventricular distention. Hence to relieve pressure cerebrospinal fluid must be withdrawn in sufficient quantities. Lumbar puncture is not appropriate for two reasons: in the first place, if there is ventricular obstruction the ventricle cannot be evacuated by lumbar puncture, and in the second place, lumbar puncture is not unattended with risks. There are occasions when one may have no choice, as in this case (Fig. 47), where the ventriculogram, previously taken, showed that the ventricles were collapsed. Here there was no alternative; not until after the osteoplastic flap had been reflected, but before the dural incision was made, 15 c.c. were withdrawn by lumbar puncture; the tension immediately subsided and a large growth, a tuberculoma, was removed. Obviously the dangers of lumbar puncture are not so great in pretentorial growths, particularly after the flap has been reflected. Under these circumstances the conditions provocative of the much-dreaded foraminal hernia do not maintain.

In posterior fossa tumors, as a matter of routine, preliminary to the dural incision one resorts to a ventricular puncture to relieve pressure. As the ventricles are dilated this is not difficult
of performance. The cannula is introduced through a perforation 4 cm. above the occipital protuberance and 2 cm. to one side of the median line. The cannula is introduced in a direction slightly upward and at a distance of 4 to 5 cm. should enter the ventricle. In pretentorial growths one has the choice of two methods of evacuating the ventricles, either by callosal puncture or by direct puncture of either the anterior or posterior horn.

**Dehydration by Sodium Chlorid.**—Continuously in this discourse we have been confronted with the problems involved in the disturbance of the cerebrospinal fluid as related to the surgery of brain tumors. It has been the theme of this lecture,
and it leads me to bring to your attention one of the more recent contributions to our aids in diagnosis and in the practical problems on the operating table, namely, the employment of sodium chlorid. I will not describe the laboratory experiments of Weede and McKibbon, to whom we are indebted for this extremely interesting phenomenon, suffice it to say that by the administration of the sodium chlorid, either intravenously or by mouth, there is a shrinkage of brain volume and absorption of cerebrospinal fluid. One may give from 80 to 100 c.c. of a 15 per cent.

solution intravenously or 15 grams in capsules by mouth, in from fifteen minutes to an hour and a half.

I bring before you again this patient who, at the beginning of the lecture, you recall, had a large hernia at the site of a subtemporal decompression. Meanwhile he has received 80 c.c. of sodium chlorid intravenously, with the result, as you see, that the hernia has been reduced in size and the tension, before extreme, has been materially reduced. Of what practical value is this demonstration? To answer that question I must tell you that the effects of the administration are much more striking when the fluid is free in the subarachnoid space, in the cisterns

Fig. 48.—Markedly dilated ventricles without distortion or displacement in a case of cerebellar tumor. No air in fourth ventricle.
or ventricles, than when the fluid is in the brain tissue as in an edema. Hence when we see the rapid reduction of a hernia in

![Diagram of brain anatomy](image)

Fig. 49.—Dilated right lateral ventricle in same case as Fig. 48. Irregular enlargement of lateral and posterior horn probably due to subtemporal decompression and hernia. Air is checked at entrance to fourth ventricle.

![Diagram of brain anatomy](image)

Fig. 50.—Left lateral view of same case as Figs. 48 and 49. Posterior part of left lateral ventricle obliterated. No air in fourth ventricle. Greatly enlarged third ventricle.

size and tension, we assume that the hernia is in large measure due to ventricular distention. In this case this deduction has
been confirmed by the ventriculogram (Figs. 48-50), which shows an enormous enlargement of both ventricles.

This, then, is one of the practical applications of sodium chlorid therapy—that is, a differentiation after a subtemporal decompression between intracranial pressure due, on the one hand, to increase in brain bulk, on the other to an internal hydrocephalus. We have used it for other purposes, as a means of relieving excessive headache or to meet the emergency in threatening signs of medullary pressure. And in the latter connection let me again remind you that sodium chlorid encourages absorption of fluid free rather than tissue bound. In the latter respect, as in the edema, so grave in its consequences, either complicating trauma or subcortical glioma, sodium chlorid has not in my hands proved efficacious. To all intents and purposes, so far

Fig. 51.—A subcortical glioma regarded as inoperable.
as I have been able to observe, it has been utterly inert. Here is a brain with a large subcortical glioma (Fig. 51). At the exploratory operation the convolutions were found flattened, the ventricles evidently collapsed; those findings, considered with the clinical picture, were sufficient to establish a diagnosis of a subcortical growth, presumably glioma. A cortical incision 3 cm. deep failed to reach the tumor; 1 cm. further and the tumor would have been seen. But, as you see, the tumor is inoperable, an infiltrating ill-defined growth that could not have been removed in toto. Although the exploration was of itself well borne by the patient, I predicted an unfavorable outcome. I forecast the

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Fig. 52.—The sudden rise of temperature immediately preceding a fatal issue after exploration of a subtemporal decompression in subcortical gliomata.
development of stupor from twenty-four to forty-eight hours after the operation, a sudden rise in temperature, circulatory and respiratory disturbances of central origin, and a fatal issue. This chart (Fig. 52) tells the story and the autopsy confirmed my apprehension. Now it is presumed that disasters such as these are the result of a spreading edema, and did sodium chlorid promote the absorption of the fluid of an edematous brain this patient's life might have been saved.

Of real value and assistance is the employment of sodium chlorid in the course of an exploratory operation where the intracranial tension is so great as to embarrass the operator either in his search for the tumor or in his closure of the wound. Had you been present a few days ago at the operation upon this patient you would have seen a practical demonstration of the usefulness of sodium chlorid under these circumstances. There was a reasonable doubt as to whether this was a tumor of the occipital lobe involving the visual cortex, or a tumor involving the optic tracts at a lower level. An inspection of the occipital lobe excluded the former, but at the conclusion of the exploration, as happens not infrequently in deep-seated lesions, there had been an increase in brain volume and the dural flap could not be replaced and sutured. The introduction intravenously of 50 c.c. of a 15 per cent. sodium chlorid solution accomplished the result anticipated. The brain volume was reduced sufficiently to make it possible to close the dural incision without difficulty. Here there was an example of the conversion of an insuperable obstacle to wound closure into a simple uncomplicated procedure.

There is no need, I take it, for further demonstration to impress upon you the important part played by the excessive accumulation of cerebrospinal fluid in the ventricles, cisterns, and subarachnoid space generally in the symptomatology, diagnosis, and prognosis of brain tumors. Clinical citations have been made illustrative of these several aspects of brain tumor observations. But of no less importance are the lessons to be learned as how best to deal with the cerebrospinal fluid in the problems of intracranial exploration.
LACERATED CERVIX WITH EVERSION; RELAXED PERINEUM; RETROFLEXIO-VERSION OF UTERUS IN YOUNG CHILD-BEARING WOMAN

This patient's "baby" is twelve years old; we asked her whether she wanted any more children, and she said, "any more would be a surprise." Then we told her there were two ways in which she might be treated—one was by operation and the other was by using a pessary. She at first decided in favor of a pessary, but after one visit to the office she changed her mind and preferred an operation. Before coming to the hospital she had eased up in her social and other activities and felt much better. Then she was in doubt whether she wanted anything done. We let her decide the matter, with the warning that when she resumed golf and driving an automobile the old symptoms would come back. It is easy to forget the ills of the past; it is hard to elect an operation when you feel well; yet that is the ideal time.

As a rule, we would not advise operation on the cervix or the perineum or the ligaments of the uterus in a woman twenty-eight years old. When there is every reason to expect two or three subsequent pregnancies such operations are undesirable, provided the patient can be made comfortable with a pessary. Most women may be carried through their reproductive period with entire comfort. At the approach of the menopause operation is indicated to give them permanent relief and to prevent trouble in later years.

Now the pessary, of course, in some women is unsatisfactory. We do not know of anything that requires a more thorough understanding of the mechanics involved than the fitting of a
pessary. But skill in doing it is easy to acquire. We constantly see cases in which the pessary has been tried and the results have been unsatisfactory because, first of all, the uterus was never properly replaced, or the pessary was not exactly right in size and shape, or the patient did not return periodically for observation. When the opposite conditions obtain, the patient is greatly benefited and we have never seen it do the least harm.

No matter how well an operation on the round ligaments may be done, one cannot expect to improve on nature, and it is possible that if the woman has another pregnancy she may have a recurrence of her displacement. So you might go on *ad infinitum* operating after every pregnancy. A different but a most excellent plan which may cure the patient without abdominal section is feasible in the young child-bearing woman. Fit her with a pessary and let her wear it until five months' gone in the next pregnancy; after delivery, say within a week, do a perineorrhaphy if that is required. A week later have the patient begin to take the knee-chest position twice a day for fifteen minutes; at the end of three weeks put in the pessary that she used before, the one that you know fits her. In this way the displacement *may* be cured without any abdominal operation, and possibly with no more than an additional week in bed.

Our attitude should be much the same relative to the lacerated cervix during the child-bearing period, *i.e.*, avoid operation if you can. It is well known that a woman in labor who has had an operation on the cervix gives us something to think about in addition to the ordinary problems of labor. The cervix that has been repaired or amputated, and in which there is more or less scar tissue, often dilates or is dilated with difficulty, and may prove a source of considerable dystocia in the first stage of labor.

During the child-bearing period surgical operations on the reproductive tract should be avoided. Of course there are certain cases in which operation is imperative, as, for example, when there is eversion of the cervical mucosa and hypersecretion, so that the vagina and the vulva are almost constantly bathed with leukorrheal discharge, or when the relaxation of the perineum
is so great that a pessary cannot be worn comfortably, or the uterus is adherent, or there are adnexal complications.

**Plastic Operation.**—In plastic operations on the young child-bearing woman one important point is to remove very little of the mucosa. If one takes away as much mucosa as was done in the old-fashioned Emmet operation the woman is almost sure to have another tear when she has another baby. The mucosa is so much diminished in extent that it cannot stretch to a sufficient degree; but if there is a minimum of denudation while the muscles and the fascia are brought together in the depths of the wound, the predisposition to laceration subsequently is distinctly less.

It would be an excellent plan for every woman at the finish of her child-bearing period to have all disabilities in the reproductive tract corrected. This might spare a certain number of women the horrors of malignant disease, and it would surely save a lot of them the discomforts of prolapse late in life.

**Round Ligament Suspension.**—There are several operations which may be used to correct displacement of the uterus, so that it is important to bear in mind the indications and advantages of each one. These operations are done for the purpose of suspending the uterus by the round ligaments and increasing the efficiency of the uterosacral ligaments. We get the intestines out of the pelvis by gravity, and place between them and the pelvis some folds of gauze, taking care to avoid any undue pressure, as this sometimes causes postoperative ileus, adynamic ileus, so called. We do not keep the patient in the Trendelenburg position any longer than absolutely necessary; the Continental operators years ago found that a very frequent cause of shock after operation was hypertension or dilatation of the right heart due to a prolonged elevation of the pelvis and the use of large quantities of salt solution.

Shortening of the round ligaments extraperitoneally by Simpson’s plan is the operation which we prefer; it makes use of the strongest part of the round ligament, viz., the inner part, that part nearest the uterine cornu; the outer part of the ligament—the tendinous or the fibrous—does not undergo so
much hypertrophy early in pregnancy, and does not, therefore, undergo so much involution during the puerperium (Fig. 53). With linen sutures we anchor the ligament to the under surface of the rectus fascia, drawing it up to that point through an extraperitoneal passage. When this operation is completed there are no bands running across the peritoneal cavity, the uterus has not been touched with sutures, and there are no points of bleeding or exposed surfaces which predispose to post-operative adhesions.

Now there are some cases in which you may prefer the Webster-Baldy operation. That is based on a different principle and consists of drawing the round ligaments through the broad ligaments below the utero-ovarian ligaments, and attaching them.

*Fig. 53.—Semidiagrammatic, showing the co-operation of the round and the uterosacral ligaments in maintaining the uterus in anteversion. The muscular part of the round ligament bears the strain.*
to the posterior surface of the uterus. The uterus is supported by
the weaker part of the round ligament, the outer tendinous part,
which, as we have said, does not hypertrophy so much in the
early part of pregnancy, nor undergo involution so well during
the puerperium. However, if the ovaries are prolapsed the
Webster-Baldy operation is of value, for it supports the ovary
better than any other. Nevertheless, its disadvantages out-
weigh its advantages; if one fixes the ligaments under much
tension the patient is almost sure to complain of backache;
in attaching the ligament to the posterior surface of the uterus
if one impedes the ovarian circulation there may be edema and
swelling of the ovary, and this, with the needle holes on the
posterior surface of the uterus in a certain proportion of cases,
results in postoperative adhesions.

You may have noticed that we put a rectal tube in position
before starting the abdominal section; while the incision is being
closed, the nurse, without disturbing the dressings, etc., runs
into the bowel 2 pints of a 2 to 4 per cent. solution of sodium
bicarbonate. Bicarbonate of soda is preferable to sodium chlorid,
since it is more effectual in the prevention of postoperative acidi-
osis. We use it freely in any case in which this dangerous com-
plication seems imminent.

In addition to the round ligament operation in some cases it
is a very great help to shorten the uterosacral ligaments. These
vary considerably in development; they usually consist of
peritoneal folds enclosing connective tissue and run from the
posterior surface of the uterus at about the position of the
internal os around the pouch of Douglas to the peritoneum cover-
ing the sacrum. The operation is very simple, the only difficulty
being the exposure, which, of course, depends upon the Trend-
delenburg position and a good light. There are two things to
be avoided: first, in picking up the peritoneal folds one must
be careful lest by any chance he catches the ureter; second,
in tacking the ligament to the uterus one must not puncture
any of the broad ligament vessels. The last is readily avoided
by sticking close to the median line; if one goes to either side,
troublesome hemorrhage may occur. Uterosacral shortening is
indicated when the cervix is in descensus. You have all seen cases in which after the fundus is pulled up and forward by shortening the round ligaments the cervix still has a tendency to prolapse through the vagina; that is where the additional operation on the uterosacrals is needed, and you will be very much pleased with its results.
OVARIAN CYST WITH SLOW TORSION, NECROSIS, AND PERFORATION. OPPOSITE OVARY THE SITE OF A MULTILOCULAR CYST ELEVEN YEARS BEFORE

Woman aged fifty-seven. Chief complaints, swelling in left side, indigestion, nausea, headaches, occasional vomiting. Menstruation began at sixteen; periods recurrent from twenty-seven to twenty-nine days; duration, four to five days; moderate flow; slight pain. Married at nineteen; six pregnancies, all normal; no abortions; normal, easy labors; no complications; no trouble in the puerperium; last labor occurred twenty-two years ago. Menopause at forty-six. Eleven years ago was operated on for ovarian cyst. Six weeks ago she was taken with a sudden hemorrhage; passed about a cupful of blood. There has been no bleeding since.

Present Illness.—The “lump” started about the middle of November, 1921, in the left side. She first noticed it herself. It has gradually grown larger. Pain in the left half of the abdomen is only occasional, but there is always tenderness on pressure.

DISCUSSION WITH CLASS

Q. Bleeding that starts ten years after the menopause, in the majority of cases, has what significance?
A. Malignancy.
Q. Of what type and situation?
A. Carcinoma of the endometrium.
Q. What other conditions would come up for consideration?
A. Myoma uteri.
Q. Is it not unusual for a myoma to develop after the age of forty-six? What else sometimes occurs in older women.
A. Ovarian cyst.
Q. Is hemorrhage from the uterus usual in the case of ovarian cyst?
A. No.
Q. What else might explain the sudden hemorrhage? What is the cause sometimes in older women of sudden hemorrhage from the uterus?
A. High blood-pressure and arteriosclerosis.
Q. Yes. As in the brain, so in the uterus—apoplexy. Due to high blood-pressure a small vessel may burst in the endometrium and produce a flow of blood. But as the patient tells you that she noticed a lump in her abdomen a month before she had the hemorrhage, you naturally wonder whether the two have not the relation of cause and effect. An abdominal enlargement at the age of fifty-seven big enough to rise above the brim of the pelvis and attract the notice of the patient herself is more likely to be an ovarian cyst than a carcinoma of the fundus of the uterus. Will you tell me why?
A. Carcinoma is a relatively rare condition and it is not so big.
Q. It is not a relatively rare condition, unfortunately, not at all, but you are correct in saying that it does not produce an abdominal tumor or at least not until the disease is far advanced and the patient is in extremis; in other words, until the cancer grows through the uterine wall and involves the peritoneum. The most common pelvic tumor at this time of life causing abdominal enlargement is a tumor of the ovary—an ovarian cyst. But we do not, as a rule, have hemorrhage as a symptom of ovarian cyst. Take the average ovarian cyst—the multilocular cystadenoma—what are the symptoms or, rather, what is often the first symptom the woman complains of?
A. Sometimes the first thing she notices is that the abdomen is getting larger.
Q. Yes. No pain or distress, but she must let out her skirt bands. Why does a cyst of that kind give no symptoms?
A. Because it is a smooth movable tumor which rises out of the pelvis and floats, so to speak, among the intestines in the abdominal cavity. Up to the present time, therefore, in our study of this case we do not quite understand the bleeding. We, of course, realize that we may have here an association of diseases, that is, we may have an ovarian cyst producing the
abdominal tumor, and we may have a carcinoma of the endometrium, or an apoplexia uteri to account for the hemorrhage.

**Cervix Uteri Exposed with Bivalve Speculum.**—Q. Upon inspection of the cervix with a speculum, what do you see?

A. A small cherry-red tumor with a stem—a polyp.

Q. Would this explain the hemorrhage occurring five weeks ago?

A. Yes.

Q. Do we stop there in our investigation as to the cause of the hemorrhage?

A. I think not. No, certainly not, for this is an age in which we suspect carcinoma on the slightest provocation, and here we may have a cancer of the endometrium complicating an ovarian tumor; we always consider the endometrium guilty until proved otherwise, so we curet the uterus thoroughly. (Curettment.)

Q. Tell me, are we dealing here with a carcinoma of the endometrium?

A. No. If it were carcinoma there would be a larger amount of curettings.

Q. With what might you compare the curettings in a case of cancer of the endometrium?

A. Fragments of dry cheese or cauliflower.

Q. Exactly. Here we are practically sure there is no carcinoma, because the amount of scrapings is so small and there is no friability or whitish color, but the mucosa comes away in long pink strips. But we will send the curettings, nevertheless, to the laboratory for examination. If this patient had a carcinoma of the endometrium, then with whatever else we did, a panhysterectomy would be indicated. Otherwise there might be malignant tissue left in the cervix. As the case now stands, if it is necessary to remove the fundus of the uterus with the abdominal tumor, a supravaginal hysterectomy will suffice. Let me say a word here relative to diagnostic curetage. You must have a pathologist who has had special training and experience in the diagnosis of uterine scrapings. Otherwise mistakes will occur.
On bimanual examination of the patient we find the uterus normal in size, slightly displaced to the right; a mass as large as a child’s head rises up above the pelvic brim and lies in the left iliac fossa; it is distinctly separate from the fundus of the uterus; it has slightly restricted mobility, it is resilient to the touch, not distinctly fluctuating, dull over the most prominent part, with a ring of coronal resonance around it. The general examination of the patient shows a blood-pressure of 130/80; the blood and urine are normal; the phthalein output is satisfactory and a Wassermann is negative. The medical staff reported emphysema and chronic bronchitis, but not in a degree that forbade anesthesia. These facts in the history and the examination being known to you, let us briefly examine them and make a diagnosis. We must agree that a cystic tumor of the ovary seems probable. It is not at all uncommon for a patient who has had cystadenoma of one ovary to get the same thing on the other side later on. They are not infrequently bilateral. This tumor is not entirely free. That may be due to adhesions the result of the first operation, or it may be some complication or accident which has befallen the cyst. This appears more likely, and especially so when we remember that ovarian cysts of this position and size often produce no symptoms except abdominal enlargement. We here suspect some complication, and in a woman of this age carcinomatous degeneration appears most likely.

Abdominal Operation Begun.—On opening the peritoneum we find some free fluid, not bloody, but yellowish serum with flakes of yellowish-gray sloughs.

Q. What sort of fluid would make you think at once that you were dealing with carcinoma?
A. Bloody fluid.

Q. Correct. Did we not find that many of these tumors give rise to no symptoms save distention of the abdomen unless they are complicated? What are some of the complications?
A. Complications are torsion, rupture, inflammation, and carcinomatous degeneration.
NOTES FROM ANESTHESIA CHART

Diagnosis.—Multilocular cyst of left ovary, chronic torsion, necrosis and perforation of the capsule, and discharge of contents into the peritoneal cavity; possibly carcinomatous degeneration (pathologic examination exhibited no malignancy).

Complication of Operation.—Very free oozing from the separated peritoneal surfaces giving rise to fear of carcinomatous involvement of the peritoneum (not confirmed by subsequent histologic examination). The operation was diagnostic D. and C., excision of cervical polyp, supravaginal hysterectomy, and left salpingo-oöphorectomy; the right adnexa were missing.
LARGE CYSTOCELE AND UTERINE PROLAPSE IN A DIABETIC

This patient is a woman fifty-nine years old, who has a prolapse of the uterus and a large cystocele. She was first admitted to the gynecologic ward in April, 1921, and at that time sugar was found in the urine. A diet was prescribed and she was sent home. She was readmitted to the medical floor December 29, 1921 and placed on a carbohydrate-free diet until the sugar was eliminated from the urine entirely, and then the carbohydrates were gradually increased until the point of tolerance was reached.

Diabetes has often been held as a positive contraindication to any sort of operation. One dread of the surgeon has been that the wounds in the diabetic patient would not heal; another was that many diabetic patients after operation died in coma, and in the past this condition baffled the internist as well as the surgeon. Some years ago, in 1902, Charles P. Noble wrote a paper upon this subject, describing how he had operated upon a diabetic, being unaware at the time of the presence of sugar in the urine. This case resulted successfully, and he reported 7 additional ones, all of which had done well, the wounds had healed by first intention and there had been only one death from diabetic coma. He had collected 62 other cases from the literature of all kinds, of which the mortality had been about 24 per cent. At that time there were no well-recognized premonitory clinical laboratory indications of diabetic coma. The surgeon felt quite hopeless in recognizing the cases in which this fatal complication was likely to occur, as well as being at a loss for curative measures. The patient was put on treatment, mainly the opium treatment, until the urine was as near sugar free as possible, and then the risk of operation was hopefully undertaken. Fortunately, in recent years the presence of acetone and diacetic acid in the urine and the other symptoms of acidosis are recognized as precursors of diabetic coma and operation is avoided when these conditions
cannot be corrected. By suitable measures the acetonuria or acidosis may be set aside in favorable cases and the postoperative measures for the prevention of this dreaded complication are well understood. The old dread that wounds in diabetic subjects would not heal was based upon a misinterpretation, and, as Noble pointed out, it occurred chiefly in the amputation stumps of patients who already had diabetic gangrene of the extremeties. So that the modern attitude of the surgeon toward the diabetic is considerably altered from that of years ago, and at the present time, although diabetes is still held to be a contraindication to operations purely elective, in urgent cases, if the patient can be rendered sugar free, or if in spite of a little sugar, which persists in the urine, there are no evidences of acidosis, an operation may safely be undertaken, the usual precautions being observed before and after to prevent the occurrence of acidosis.

With no sugar, acetone, or diacetic acid in the urine we had no hesitation in advising operation. The patient had used a pessary, with unsatisfactory results, and operation was needed badly to enable her to earn her living. No soda was given previous to the operation, but enteroclysis of 2 per cent. soda solution will be started immediately after the operation, the urine will be examined daily, and the diet carefully regulated.

A Watkins interposition operation and a perineorrhaphy were performed. The urine contained sugar the day after operation, also acetone, but with soda and restricted diet this disappeared; the convalescence was uninterrupted.
URETERAL STRICTURE WITH HYDRO-URETER, NEPHROPTOSIS, AND HYDRONEPHROSIS. DILATATION OF STRICTURE AND NEPHROPEXY

This patient is fifty years old. She was admitted to the medical service more than a month ago, complaining of severe pain in the right loin and frequent and painful urination. On examination the right kidney was enlarged and tender; the urine contained pus and blood. Cystoscopic examination showed a trigonitis with much swelling of the mucosa at the right ureteral orifice. Attempts to pass a catheter into the right ureter were unsuccessful. With rest, applications of heat, etc., the swelling of the kidney subsided, and ten days later we were able to pass a No. 5 ureteral catheter to the kidney pelvis. The urine from the bladder and the right kidney contained pus-cells; there were no pus-cells in the urine from the left kidney; all the cultures were sterile. A pyelograph of the right kidney pelvis and ureter (Fig. 54) showed hydronephrosis and hydro-ureter. The ureteral stricture which was located in the vesical portion of the ureter was dilated at weekly sittings up to 8 F. This was done by my assistant, Dr. Ginsberg, who uses the direct method of ureteral catheterization. The patient experienced considerable relief from the treatment, but as soon as she got out of bed her discomfort returned. She is of a neurotic habit, but her suffering seems real, and as the pyelograph exhibits not only ptosis of the kidney and dilatation of the renal pelvis but also torsion of the kidney, nephropexy is deemed necessary to secure entire relief from the troublesome symptoms. He kidneys are deficient in function; the total phthalein output is 25, and the excretion of indigo-carmin is delayed and deficient on both sides, but especially on the right. (Nephropexy was then done, following the Edebohls capsule splitting and reflection technic.) As a result of this operation the kidney will be securely attached to the quadratus lumborum, the range of mobility will be limited, ptosis and
torsion will no longer occur, and with complete dilatation of the stricture below we may reasonably expect the patient to be cured. Furthermore, the new circulation which will become established between the quadratus lumborum and the decapsulated surface of the kidney may decidedly improve the renal function.

Fig. 54.—Right hydro-ureter and hydronephrosis—stricture of lower ureter, ptosis, and torsion of kidney. (The negative has been reversed in printing.)
EMBRYONAL ADENOMYOSARCOMA OF KIDNEY

Synopsis: Female Baby, Age Fifteen Months. Painful Tumor the Only Symptom. Complete Nephrectomy. Pathologic Diagnosis Showed the Tumor to Be of a Teratomatous Nature. Recurrence in Two Months, Rapidly Increasing, with Evidence of Involvement of the Right Lung Throughout its Area.

The child which I am about to show you was operated on last September. The history is as follows:

E. B., age fifteen months; was referred to me by Dr. Jaffe last September. Two and a half months previously the mother had noticed some distention of the abdomen and, later, while bathing the baby, she accidently felt the mass in the left upper quadrant. It has steadily increased in size (Fig. 55). The child became increasingly fretful and her color much paler than several months previously. The physical examination was negative except for a mass about the size of a grapefruit in the left hypochondriac, epigastric, and left lumbar regions. There was a moderate anemia, the red cell count being 3,250,000. There was no hematuria.
It was suspected that we were dealing with a growth from the left kidney, although the mass came so close to the median line that the possibility of a retroperitoneal sarcoma was considered. Painful hematuria with tumor is the characteristic symptom of a kidney tumor in the adult, usually a hypernephroma or a carcinoma. Painful tumor without hematuria is the characteristic feature of these mixed tumors seen in children. It seemed unnecessary to inflate the colon, to practice a "pneumoperitoneum," x-ray, or cystoscopy. Accordingly, I advised an exploratory operation.

Fig. 56.—Gross specimen of kidney and tumor removed at operation. Note the partly solid and partly cystic character. Drawing is about one-third normal size.
At the operation performed on September 6th I made a left rectus incision, the scar of which you see. It was necessary to mobilize the splenic flexure of the colon by dividing the peritoneum on the outer side of the splenic flexure and the descending colon. It was not until the colon was mobilized that I was positive that the mass was the left kidney. The mass, which was even larger than we expected, was about 6 inches long, 5 inches thick, and about the same in breadth (Fig. 56). It was removed in the way a nephrectomy is performed. The peritoneum was closed with a continuous catgut suture and the abdominal wall with interrupted silkworm-gut sutures. Although the bleeding was not excessive the child was greatly shocked, and so I transfused her with 150 c.c. of citrated blood, introducing it into the left saphenous vein. The recovery was uneventful and she was taken home eleven days later. At the lower end of the wound there was a superficial infection.

The pathologic report of the specimen made by Dr. Case is as follows: "The tumor is very interesting and peculiar. It is a cystic affair with soft solid areas, evidently largely necrotic, and firmer portions that cut easily. Microscopically it consists of several types of tissue. The groundwork is loose fibrous tissue that is quite cellular, and in this there are numerous pink fibers some of which are imperfectly striated muscular tissue. The epithelial elements vary from small gland-like structures lined with columnar tissue to large cysts where the epithelium is flattened. Diagnosis: Teratoma of the kidney, probably malignant" (Fig. 57).

In November, 1921 I saw the child again, and I felt a small mass in the region of the original growth which I thought was a recurrence. This has subsequently proved to be the case, since at present (January, 1922) the mass is larger and the x-ray of the chest shows extensive metastasis to the right lung.

Discussion.—These teratomas are peculiar in their make-up and confusing in their etiology. They are complex structures composed of tissues and organs of one or more germinal layers. There is little or no orderly arrangement of the various tissues. The classification is by no means clear, and there is frequently
a difference of opinion between pathologists as to their exact grouping. If you turn to Ewing’s book on Neoplastic Diseases you will find that the interpretation of the origin of renal mixed tumors has passed through several phases and covered all apparent possibilities. He considers the theory of Busse and Muus as the most acceptable, in which the renal blastema is considered to be the point of origin for all the structures observed in the tumor. It attributes a prominent part to metaplasia.

Fig. 57.—Photomicrograph showing spindle-cells and muscle-fibers.

The tumor is usually found at birth or shortly thereafter, although a case of a bilateral tumor in a patient fifty-four years old was reported by Hedron. They are the largest of renal tumors, Heineke’s tumor weighing 3580 grams. Our case is similar to Brandt’s, in that pulmonary metastasis occurred several months after extirpation of the tumor. This is exceptional, since metastasis is not frequent, and usually in the liver. This child will probably live only a very short time. I
have only seen two other cases of this affection and have been unfortunate in both of them. In 1920 an eighteen months old boy was admitted to the University Hospital suffering from one of these tumors in the right kidney, and died from shock after the nephrectomy. The third case was seen in the Poly-clinic Hospital and operated on October 28, 1914. The child was seven years old and had had symptoms for a year previous. In May, 1915 he returned with a recurrence, and I suppose has succumbed, although we lost track of him.
HEMOLYTIC ICTERO-ANEMIA

Synopsis: Woman, Age Thirty-six Years. Duration Very Indefinite. Patient Came Under Observation Because of Severe Pain and Jaundice. The Anemia and the Splenomegalgy were Revealed During the Physical Examination. Frequent Blood Transfusion Was Followed by Splenectomy, Cholecystectomy, and Removal of Ovarian Cyst. Postoperative Transfusion Performed. Perfect Recovery.

The next case is interesting as illustrating a type of anemia associated with splenomegalgy which is cured by surgery. The history of the case is as follows:

E. M., age thirty-six, a nurse, was transferred to our service August 20, 1921. The diagnosis was hemolytic ictero-anemia with cholelithiasis. Her history, in short, was as follows: She had had measles and whooping-cough during childhood. She never had pneumonia, typhoid, or influenza. Since a very young child she has had attacks of dizziness and weakness. Her complexion has always been somewhat yellow, and three times during her life she has had attacks of jaundice lasting two or three days, preceded by and accompanied by pain. About six days ago she developed intense pain over her gall-bladder, which has increased in intensity. She feels distended. The pains shoot across the abdomen toward the left side and up the back. She has become increasingly jaundiced with this attack. Nausea and vomiting have been pronounced. There is no itching of the skin. During this last attack the stools have been clay colored. On examination we found that the skin was not deeply jaundiced, but seemed to be a color between the lemon-yellow color of the hemolytic anemia and that of jaundice proper. There was a large tumor mass in the left hypochondriac region which we diagnosed as the spleen. The red blood count on admission to our service was 2,270,000. Dr. Ravdin transfused the patient four times, and the count just previous to operation, 8/27/21, was 3,920,000 red blood-cells. At the operation on August 27th I made a right-angled left rectus incision (Fig. 58) and exposed the spleen, which was large, as you can see from the picture (Fig. 59), and irregular. Troublesome bleeding was encountered in the stump of the gastro-splenic ligament and in the tail of the pancreas. The spleen weighed about 1000 grams. It was deeply purple in color. I found the gall-bladder distended and full of stones, and so I did a cholecystectomy. While I was waiting for the sponge count I found a large ovarian cyst on the left side and also removed this. Dr. Ravdin then transfused the patient with 500 c.c. of blood and 750 c.c. of saline. The patient's condition was satisfactory. The red blood-cell count 8/29 was 3,410,000.
The pathologic report (8/27/21) is as follows: The organ is much enlarged and firm. Microscopically there is a marked reduction in the size and number of the malpighian bodies. There is a paucity of cells in the pulp and the sinuses are widely distended with blood (Fig. 60). Considerable blood pigment is to be found scattered through the organ. There is little or no increase in the fibrous framework of the organ. From its gross and microscopic appearance I would diagnose it as a spleen of splenic anemia. Diagnosis: Splenomegaly.

Fig. 58.—Incision marked on the scar three months after splenectomy.

At discharge (9/18) the red blood cell count was 3,950,000. There was no wound infection and the patient left the hospital in excellent condition. I saw her again on January 6, 1922. The R. B. C. is 4,780,000 and the hemoglobin is 82 per cent. She is now back doing general duty nursing.

Discussion.—There are several interesting features about this case. In the first place, Dr. Ravdin and I were in no hurry to remove the large spleen, but instead gave her repeated transfusions by the citrate method. In those cases of primary anemia where the patient is extremely ill from profound anemia I feel
that it is a little safer to use whole blood than to use the citrate. With the new citrate which we are using now chills do not occur frequently, but still they do depress a severely ill patient.

The operation was done in the period between crises, for the acute exacerbations (crisis of deglobulization) typical to this disease offer definite contraindications to immediate operation. During these crises there is tenderness over the spleen, malaise, increased anemia and jaundice, and operation at this period may be fatal.

The coincidence of hemolytic ictero-anemia and gall-stones is very frequent and removal of the gall-bladder is usually neces-
sary. Several years ago Giffin, in reporting the cases from the Mayo Clinic, found that in 7 (58 per cent.) gall-stones were present. About 60 per cent. of all reported cases, according to Moynihan, have had stones, and our case shows the typical picture of a gall-bladder full of small stones and gravel. This fact is often confusing in the diagnosis, for the passing of stones may give frequent attacks of transitory jaundice, but the anemia

![Fig. 60.—Photomicrograph of section of spleen: A, Splenic sinus; B, splenic pulp. The granules are from broken-down red cells.](image)

and large spleen and the mild acholuric jaundice between attacks point to the primary condition. Unless stones are present clay-colored stools, choluria, and itching of the skin are not present. It is important to elicit decreased resistance of the red blood-cells to hypotonic salt solution. This fragility of the reds is usually accompanied by great increase in the urobilin output and in the percentage of the reticulated red cells.
This disease was first described by Hayem in 1898, and is generally referred to as the acquired type (Hayem-Widal) of hemolytic icterus with splenomegaly. A somewhat similar type is seen in children and is termed the congenital or familial type of Chauffard-Minkowski. Splenectomy, properly done, will cure the majority of the cases. The mortality of operation is not more than 5 per cent. in good hands.
CHONDRO-OSTEOSARCOMA OF FINGER


The next patient presents a rather rare condition about which you will find the most information from the papers by Bloodgood, particularly that in the Journal of Orthopedic Surgery for November, 1920. The history of this case is as follows:

B. F., aged eighty-six years. Referred from the Out-patient Department. The family history is negative for malignancy. She has suffered from rheumatism for fifteen years. Some accidental trauma in early life resulted in a deformity (crooking) of the left index-finger. About seven years ago the second phalangeal joint began to enlarge very slowly, until two years ago, when it was about the size of a large walnut. At this time it began to increase very rapidly in size, until now it is as large as the average fist and is spindle shaped (Fig. 61). The terminal phalanx is least involved. About one month ago the surface on the lateral surface of the finger broke down and a foul-smelling ulcer resulted. For the last three or four years the patient has been developing progressively senile dementia. Appetite is excellent. Not constipated. Has lost about 30 pounds in weight in the last year.

Physical examination revealed nothing of importance except the evidence of great senility. The systolic blood-pressure is 188, the diastolic 76. The urine was free from albumin or casts and there is no anemia. As seen by the photograph, the growth involved all three phalanges of the finger and extended into the palm. The x-ray report is as follows: "Osteosarcoma of proximal phalanx of left index-finger with involvement and partial destruction of base of the middle phalanx and probably beginning disease of the second metacarpal bone (Fig. 62). x-Ray examination of the chest not entirely satisfactory, because patient could not hold her breath. There is no evidence of pulmonary disease or any definite evidence to suggest pulmonary metastasis. The heart is somewhat enlarged. Shadow of aorta is increased in width and density. Probably atheromatous."

The growth was removed under local anesthesia on December 1, 1921 by a partial amputation of the hand. Pathologic report by Dr. Case: "Sarcoma showing both bone and cartilage formation. There is also some mucoid degeneration" (Fig. 63).
Discussion.—Originally I had advised a high amputation, but the family objected, so we contented ourselves with a removal of the growth together with the middle finger and the second metacarpal. Local anesthesia was used, the solution being 0.5 per cent. novocain. The field had been prepared with a 5 per cent. solution of picric acid in alcohol. An Esmarch bandage was at first applied, but was removed because of oozing from the ulcerated area. In order to understand how perfect the anesthesia can be when combined nerve-blocking and infiltration is used we must first discuss the anatomy of the region (Fig. 64). The sensory supply on the dorsal aspect of the wrist is from the lateral to the median side, the lateral cuta-
Fig. 62.—x-Ray appearance of tumor before operation.

Fig. 63.—Photomicrograph of tumor: A, Myxosarcoma; B, bone; C, cartilage.
neous nerve of the forearm, the ramus superficialis of the radial, the medial cutaneous nerve of the forearm, and the terminal sensory twigs of the ulnar. Anteriorly in the same direction we have the same nerves except that over the middle of the wrist we have sensory innervation from branches of the median. It was only necessary to infiltrate the lateral half of the wrist

Fig. 64.—Anatomic relations of the anterior surface of the forearm (Spalteholz).

anteriorly, while posteriorly the entire area was infiltrated because, as the figure shows, the ulnar has a sensory distribution in the region of the amputation (Fig. 65).

So I made a small horizontal incision anteriorly at the wrist and exposed the median and radial nerves and injected them. The exposure is simple (Fig. 66). The ramus superficialis
radialis is lateral to the tendon of the supinator longus (brachioradialis m.) and is found just above the wrist crossing the tendon of the abductor pollicis longus. The radial artery is medial to the tendon of the supinator longus, while next to it is the tendon of the m. flexor carpi radialis. Between this tendon and the tendon of the palmaris longus and slightly deeper than them is the median nerve. The skin incision was made as shown in the diagram, and it was necessary to infiltrate only a little on the back of the hand. The index- and middle fingers were removed and all of the second metacarpal and half of the third metacarpal bones also. Hemorrhage was stopped and the skin

Fig. 65.—Nerve distribution to the back of the hand (G. G. Davis).
closed without drainage. Patient made an uninterrupted recovery and is ready to be discharged with the result you see here (Fig. 67).

Fig. 66.—Exposure at the wrist showing also the line of incision and excision in the palm: A, Necrotic area; B, line of incision; C, line of excision; D, flexor carpi radialis; E, radial artery; F, radial nerve; G, palmaris longus; H, median nerve.

We believe that this tumor originated as a chondroma with subsequent malignant transformation. Chondromata are common tumors, and last year I reported in this publication several
of the benign varieties. They are usually located in the diaphysis of the long bones, especially adjoining the epiphysis. A very frequent site is the metacarpal bones and phalanges of the hand. In the humerus and femur they most frequently originate from the periosteum, while in the bones of the hand their origin is usually from the medullary canal. Although when seen in the hand chondromata are usually multiple, this one, which has become malignant, is single. They may become malignant as distinct chondrosarcomas, or they may become mixed as in this case. You can see from the x-ray that the tumor projected externally, pushing the periosteum and a small shell of bone ahead of it, finally rupturing through, thus leading us to believe that it probably began as an enchondroma.

Weber thinks that trauma is a predisposing factor in 50 per cent. of the chondromas and chondrosarcomas. Other possible etiologic influences are metaplastic changes of other forms of connective tissue; embryonic rests of cartilage; inflammation; heredity, as several cases may occur in one family; and Mac-
Callum believes that they may arise from periosteal or endosteal cells.

Very frequently when the tumor has originated as a chondroma the cells in the center of the tumor are apparently normal cartilage cells, while those at the periphery are true sarcoma cells. When this is true we find a tumor such as this one, which is very vascular at the periphery and practically avascular in the center. The metastasis from such tumors may be true sarcomas and show no cartilaginous deposit.
THROMBO-ANGEITIS OBLITERANS (BUERGER)

Synopsis: Polish Male, Age Forty-nine Years. Two Years' Duration. Typical Case Involving Toes and Lower Part of Foot. Amputation of Foot and Lower Third of Leg. Amputation Followed by Pain (Causalgia) which was Controlled by Femoral Sympathectomy and Section of Crural Nerve.

The next patient represents a fairly common condition, especially in our larger cities. It is important because the average physician has not learned the true pathology of the disease and classes it with the diabetes or senile gangrenes. The history of the patient is as follows:

G. M., aged forty-nine. Polish Jew. The patient's previous medical history and environment was unobtainable owing to his imperfect understanding of English. Two years age he began to have pain, redness, and swelling in his right small toe which kept increasing in severity, and finally spread to other toes and infected them. In the meanwhile, however, the small toe was amputated, but the redness and swelling spread over to all of the toes and to the middle of the foot. The pain has increased, especially when he has his leg in a dependent position. The sensation is that of a cold and sticking pain.

Physical examination reveals little of importance. He has many carious teeth and some stumps. The tongue is coated and the breath foul. There are no abnormal findings in the lungs, and except for some muffling of the heart sounds nothing else abnormal was detected in the chest. There was no involvement of the upper extremities. There was no involvement of the left foot and leg. On the right lower extremity was seen a dusky redness extending from the tips of the toes to the middle of the foot, and then gradually shading off as the leg was reached. In spots the epiderm was necrotic and black. The toe-nails were greenish in color. The entire foot was painful and tender. When the leg is elevated for a few minutes everything becomes blanched. The urine was negative for sugar and the blood-sugar was 1.88.

He was treated for a few days with large quantities of Ringer's solution introduced through the duodenal tube, and a little later by injections of sodium citrate. He was given potassium iodid in large doses. He suffered continually from pain and, accordingly, the leg was amputated on November 29, 1921. Following the operation the patient complained bitterly of pain referred to the toes. It was typical “stump pain.” The wound had healed without infection and there was no reason apparent for the pain. On December 17, 1921 the Leriche operation of femoral sympathectomy was performed. The crural branch of the genitocrural nerve was cut. The patient
is ready for discharge, entirely free from pain, and prepared to use an artificial leg. The pathologic report of the tissues of the right extremity is as follows: "Sections were removed from the anterior tibial artery, posterior tibial behind the internal malleolus, portions of deep planter, and sections from the anterior and posterior superficial vessels.

"They show beautiful thrombo-arteritis obliterans with canalization of the organized thrombi by totally insufficient blood-channels. Some of the sections show a perivesicular fibrosis gripping the accompanying nerves" (Fig. 68).

![Fig. 68.—Photomicrograph of posterior tibial artery: A, Internal elastic membrane; B, canal.](image)

**Discussion.**—I think that this is one of the most interesting conditions we are called upon to treat. As some of you no doubt may know, a disease called erythromelalgia was described by Weir Mitchell in 1872 as a painful red state of the limb. Naturally, in this, his home city, we recognize from time to time cases of this type in which the patient complains of a burning pain increased by warmth, and with characteristic reddening of the foot when the limb is pendent and never terminating in gangrene. Some have believed that it is only a manifestation of neuralgia or neuritis, of neurasthenia or hysteria, or is a reflex disease, but Weir Mitchell himself believed it to be a neuritis of nerve endings.
Many cases of the disease from which this patient is suffering were no doubt classed as erythromelalgia until Buerger in 1908 cleared up the subject by extracting the large group seen especially in Polish or Russian Jews, and which he termed "thrombo-angeitis obliterans." In the group with Weir Mitchell's disease we generally place Raynaud's disease, scleroderma, sclerodactyly, and acrocyanosis. In these diseases there is no alteration in the patency of the arteries and veins. Another group comprises the true gangrenes, those due to senile arteriosclerosis, diabetes, syphilis, etc. It is hardly necessary to go over the various theories of Buerger's disease, which may be said to constitute a third group. Buerger himself believes that the disease has its inception in an acute inflammatory lesion in the blood-vessels, resulting in the formation of red obliterating thrombi and occlusion of both the arteries and the veins. Buerger, who has observed and studied many cases of this disease among Russian and Polish Jews in New York, has presented strong evidence which tends to point to a toxic or an infectious origin. Associated with the intravasular changes we find a periarteritis which often involves the sensory nerves. There has been some interesting work done recently which shows the relative frequency of thrombo-angeitis obliterans in typhus-infected areas.

We could not do better than to quote the following from one of Buerger's articles in order that you may fully understand the nature of this gangrene: "(1) The disappearance of the pulses, particularly the dorsalis pedis, posterior tibial and popliteal, more rarely the femoral, radial, and ulnar; (2) the development of typical manifestations of impaired circulation, to wit: blanching of the lower extremities when these are elevated above the horizontal, hyperemia (rubor) or reddening of the foot in the pendant position (a chronic condition which I have elsewhere termed "erythromelalgia") during certain stages of the disease, and trophic disturbances, such as impaired growth of the toenails, slightly atrophic condition of the skin, ulcers, and gangrene; (3) true vasomotor phenomena of transitory nature, such as alternating syncope, rubor, coldness, apparently independent of those chronic changes that have been cited above and that
are distinctly traceable to the occluded condition of the arteries and veins; (4) the symptoms of pain, either in the form of intermittent claudication (pain in the calf of the leg or in the foot on walking, with cessation when the limb is at rest) or the severe pain that is associated with the advent of trophic disturbances, especially with ulcers and patches of gangrene; (5) the slow course of the disease, symptoms of intermittent claudication or pain, preceding the development of trophic disturbances for months and years; (6) the fact that more than 99 per cent. of the cases occur in Polish, Galician, or Russian Hebrews, and that almost always young males between the ages of twenty and thirty are taken with this disease; (7) the onset of symptoms in the lower extremities, one of the legs being first affected; (8) the comparative infrequency of involvement of the upper extremities; (9) the association of a peculiar type of migrating phlebitis in the territory of the external or internal saphenous, less frequently in the larger veins of the upper extremities, characteristic in about 20 per cent. of the cases; (10) the slow but steadily progressive course, leading in a large majority of the cases to amputation of at least one limb, not infrequently of both lower extremities, and in rare instances to amputation of one of the upper extremities as well." The real problem, however, in this disease is that of treatment. The patients want relief from the intolerable pain. They cannot get around to do their daily work and they are constantly threatened with gangrene. Much can be done symptomatically, but unfortunately only palliation is obtained. It is a very difficult thing to make the patient consider amputation early, and they do not until the increasing pain despite treatment has driven them into accepting any measure of relief. I believe that with our present methods of treatment we have nothing whatever to offer the patient except amputation which assures any reasonable promise of success. I would suggest to you, however, that it is best to palliate at first and to advise division, or alcoholic injections of the internal saphenous or musculocutaneous nerves, followed by the use of passive hyperemia with a Bier suction cup or by means of the postural treatment (alternately raising and lowering the leg with an interval
of several minutes between movements). The electric-light cradle also gives relief if palliation is desired.

Other more conservative methods than amputation which have been suggested are: (1) Ligation of the femoral vein; (2) the use of nitrites, iodids, and various glandular substances; (3) the use of liquids such as saline or sodium citrate, either subcutaneously, intravenously, or duodenally in order to alter the viscosity of the blood; (4) local measures, such as those already suggested, which tend to improve or modify the circulation.

I do not think that we can look for anything in the form of cures from arteriovenous anastomosis. I cannot see how a reversal of the circulation would offer anything in vessels that are already thrombosed and how, if the etiology is infectious or toxic, a reversal of the circulation could allay the process.

The suggestion made a few years ago by Dr. Willy Meyer, of New York, that we give these cases large amounts of fluid, was followed out in our case. Meyer thought that these cases showed a hyperglycemia and compared them to a flower withering for the want of water. His treatment, therefore, consisted in supplying an abundance of water to the system. He aimed to produce the highest possible degree of hydremia, introducing the fluid both through the duodenum and by hypodermoclysis. He used 8 to 10 quarts of Ringer’s solution or a solution of sodium bicarbonate (from 15 to 30 grams of the salt per day) of body temperature were given by the rapid drop method within twenty-four hours. Koga reported the return of an almost normal pulse in 10 out of 13 Japanese treated with hypodermoclysis. However, recent studies of large groups of cases do not show that these patients always have a high blood-sugar content.

The Schnee four-cell electric bath has been used, and there have been reports of relief from this treatment. Steele has used large doses of sodium citrate in an attempt to alter the viscosity of the blood. A measure of the apparent success of all of these methods must be attributed to the fact that the patient is kept recumbent while the treatment is being carried out, and it is folly to assure the patient of a permanent cure with any of them.
FUSIFORM ANEURYSM OF THE FEMORAL ARTERY.
MATAS' OPERATION

This patient is a negro laborer, thirty-five years of age, who has noted a swelling in the right thigh for six months. At first it was very small, he had a "feeling of chills" in his leg which attracted his attention to it, but it gave him so little pain and discomfort that he treated it by home remedies of the usual weird varieties favored by this class. It remained small and, according to his account, difficult of detection until four weeks ago, when it began to increase rapidly in size, and the region became extremely tender. At the same time he noted a numbness in the leg below the knee and the flexor muscles of the knee became contracted. These symptoms brought him to the hospital.

The man was formerly a sailor, used alcohol to excess, has a venereal history (gonorrhea in 1909, same type of venereal sore in 1910), smokes a good deal, and now does hard manual labor. He uses a shovel and presses against it with his thigh, about where the swelling appears.

His physical condition in general is good. The physical examination shows nothing of moment except the condition for which he seeks treatment. He has a 4+ Wassermann. There is a large pulsating swelling in the line of the femoral artery about the middle of the thigh (Fig. 69). It measures 4½ by 6½ inches in diameter and the pulsation is expansile. There is a systolic thrill and on auscultation a loud bruit is heard, transmitted downward. There seems to be some in-

1 The illustrations are reproductions of drawings made by Mr. Faber at the time of operation.
flammatory reaction around it, and there is also tenderness around the knee-joint. There is no swelling of the leg below. The diagnosis, of course, is plain and easy.

The circulation is controlled by the application of a tourniquet as far away as possible. A long incision through the overlying tissues exposes and then opens the sac, which is filled with soft clot. This is wiped away, and the interior is dry, except for a slight recurrent oozing from the lower (distal) arterial opening. The outer wall represents the site of the
arterial wall, and is white and glistening in appearance, the afferent and efferent openings of the vessel in plain view, and the wall between quite flat, except for a single shallow depres-

![Fig. 70.—Appearance of the interior of the sac after incision and removal of the clot. The round upper and lower openings represent the afferent and efferent openings of the artery.](image)

sion (Fig. 70). The major portion of the sac is to the inner side and much deeper. It represents the direction in which the aneurysm is dissecting rapidly, extending downward between

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the adductors, and its surface is covered with a thin, glistening, lead-colored membrane. There is little of the thick organized clot in most of the sac, and from the history of the case showing the rapid increase in size of the aneurysm, this is not surprising.

The sac is wiped clean with moist sponges, and the afferent and efferent openings of the artery are sutured with interrupted stitches of No. 0 chromicized catgut, three to the upper and four to the lower opening. The flat depressed area between, probably the site of a branch, is then separately sutured (Fig. 71). No additional collaterals bleed on removal of the tourniquet. The sac is now obliterated by successive rows of sutures of chromic gut (Figs. 72, 73), and the skin wound closed.

Fig. 71.—Suture of vessel openings from within the sac.
FUSIFORM ANEURYSM OF THE FEMORAL ARTERY

without drainage, after suture of the overlying muscles and fascia (Fig. 74). A posterior splint is included in the dressing.

[Note.—The above case was discharged from the hospital twenty days after operation, cured of his aneurysm, having made a smooth recovery, and was transferred to the Urological Service for further treatment of his luetic infection.]

Fig. 72.—First obliterating suture being applied.

This case is one well adapted to the obliterative type of the Matas operation. This is, of course, the operation most often found feasible in operations for aneurysm, and the one therefore most frequently performed. The most recent statistics on the operation of endoaneurismoraphy (the spelling is that adopted by Matas) which I have seen are to be found in Matas’ article published in Surgery, Gynecology, and Obstetrics, May, 1920, and Keen’s Surgery, Vol. VII, 1921. They include a total collective list of 317 operations up to September, 1919,
Fig. 73.—Second row of sutures obliterating the sac from below upward.

Fig. 74.—Completing suture of sac edges and muscle and fascia.
including 46 operations by the distinguished originator of the method. There were 14 deaths which could be attributed to postoperative causes, and 12 cases in which gangrene developed. Of the obliteratorive type there were 210 cases, 72 operations were done by the restorative technic, and 35 were reconstructive operations. There were 13 cases of secondary hemorrhage. These statistics amply confirm the favorable judgment long accorded to this method of treatment by American surgeons. In fact, it is a good many years since Dr. W. W. Keen, the Dean of the Surgical Profession of America, hailed it as the greatest contribution to the surgery of aneurysm since the days of John Hunter. It is unnecessary to recount its advantages. The subject has been exhaustively treated many times by Matas and others. If the student will study and ponder over the articles by Matas in Keen’s Surgery he will derive a world of information in regard to all phases of vascular surgery from those mines of literary knowledge. It is interesting to note that in his last article on the subject in Keen’s work (Vol. VII, Supplementary Volume), while laying stress on the importance of testing out the collateral circulation before operation, and delaying the operation until the most favorable time, he stresses the adequacy of the obliteratorive operation in the majority of cases. He has no lack of confidence in the restorative and reconstructive operations, the safety of which seems amply proved by statistics, but finds that the necessity for their employment is met with less frequently than he formerly believed to be the case. This is especially true of the reconstructive operation. The restorative operation, or closure of a single orifice of communication between the vessel and the sac, is always performed when the conditions are favorable to such closure without occlusion of the lumen of the vessel. His careful study of war literature from all sources convinces him that the majority of arteriovenous aneurysms are susceptible to treatment by the intrasaccular suture, and he quotes extensively from the literature to prove this. The methods employed by Bier, Küttner, and other German surgeons in saccular traumatic aneurysms, in 50 per cent. of their cases were practically the Matas re-
storative operation, great respect being paid to the aneurysmal sac. Similarly, there is a growing tendency toward the adoption of the conservative suture methods among French and British surgeons, and the latter have been recently performing in the varicose type following gunshot injuries of artery and vein, what is essentially the transvenous route advocated by Matas and Bickham since 1904.
LARGE STREPTOCOCCIC ABSCESS OF THE THIGH. 
STERILIZATION BY THE CARREL TECHNIC. SECONDARY SUTURE

This boy, nineteen years of age, was admitted to the hospital three weeks ago. He is employed on the railroad, and one month before admission he fell and struck his right thigh on the end of a cross-tie. The next day he was quite sick, had headache, nausea and vomiting, and developed severe pain and swelling in the thigh. He was treated at his home by a physician, and when admitted was in a septic condition. There was a huge swelling on the outer aspect of the thigh extending from the greater trochanter to the external condyle. Fluctuation was present over it, it was very tender, and there was bleb formation on the overlying skin. The abscess was opened the same day by Dr. Pfeiffer. The incision was about 14 inches in length and about 40 ounces of pus were evacuated. The collection was intermuscular and had no connection with the bone, and no focus of infection could be found. The cavity was packed with gauze, and several sutures inserted in the edges of the wound to keep it in and to control oozing. The culture showed the infection to be a hemolytic streptococcus.

Following this operation there was prompt improvement and fall in temperature. The wound was dressed daily, and the packing was not disturbed for four days, when it was removed. Carreling of the wound was begun on the sixth day after operation, twelve Dakin tubes being used for the instillation. Smears taken on this day showed two organisms per field. The treatment was controlled by smear and culture, according to our usual practise. On the eighth day the smears showed no organisms, nor were any seen on the tenth, fifteenth, and eighteenth days. Two cultures made on the fifteenth and eighteenth days respectively were negative. It may be assumed, therefore, that the wound is ready for suture.
The operative field, including the wound, is carefully cleansed and sterilized, the skin being prepared separately. This preparation is done on the table, the tubes being removed shortly before; green soap, alcohol, ether, and iodin follow in the order named. The wound undergoes the same preparation as the skin, following rigidly the technic of Le Maistre. The wound itself is 12 inches in length, is of a typical clean red color, with thin, narrow, blue epithelial borders, and extends deeply into the muscles on the outer aspect of the thigh (Fig. 75\(^1\)). The thin epithelial margin is removed with a little of the entire thickness of the adjoining skin, completely circumscribing the wound with this incision, for which we use a sharp knife. Approximation of the wound edges is seen to be easy. The skin is, therefore, undermined around the wound for a limited distance only, 1\(\frac{1}{2}\) inches in this case. The granulations are not removed, as they are not very thick, and the skin is sutured with silkworm-gut and without drainage. The tension of the skin sutures is relied upon to secure approximation of the deeper planes (Fig. 76).

This procedure is, of course, a familiar one to practitioners

\(^1\) Photographs by Miss Kingston of the Presbyterian Hospital.
of military surgery. Under laboratory control the secondary suture of infected wounds is a safe and almost certain procedure. One can count on about 95 per cent. of successes in a well-trained service. Its advantages in shortening convalescence, preventing excessive cicatrical tissue formation, and in bringing about a favorable end-result, when contrasted with cases allowed to heal by granulation, were forcibly impressed on military surgeons mainly through the work of Le Maistre. It is equally applicable to civilian surgery. It requires a careful training of the house staff in the Carrel technic. The careful and orderly dressing of wounds which this requires is one of the best methods of training interns and nurses in exact scientific habits. The co-operation of laboratory workers is, of course, a prime essential. With these requisites one finds that the routine employment of the Carrel technic gives results in lessened morbidity and early convalescence, which must be seen to be appreciated.
Applied in a haphazard fashion it is valueless. We use it routinely in infected wounds.

The application of secondary suture to extensive cases of abscess and cellulitis of hematogenous or metastatic origin, and not associated with a wound, has yielded equally good results, where a sterile field could be obtained. We have several cases in the hospital at present which have been closed in this manner or are in process of sterilization. The shortening of the healing time and the minimum production of scar tissue are manifest advantages, to say nothing of a convalescence unattended by exhausting sepsis, and frequent complications and set-backs. Where bone involvement in the shape of osteomyelitis is present, the time of healing is greatly reduced by the chemical sterilization of Carrel, but it is seldom that we secure a field sterile for closure before the granulations have risen to the surface and the wound so narrowed that suture is unnecessary. In most soft part infections, however, this secondary suture is feasible. In streptococcic infections we insist on two cultures negative for streptococci before suture, irrespective of the number of organisms per field seen in the smears. This precaution is necessary in dealing with all organisms growing in chains. In other types it is sufficient to get the bacterial count down to one in four fields in the smears to insure a good result.

[The wound was healed and the patient discharged sixteen days after suture.]
TUBERCULOUS CERVICAL ADENITIS

This boy, aged fifteen years, is sent to us for operation from a school for the deaf and dumb. He is not a case of congenital deaf-mutism, but he lost his hearing completely about six years ago. Before that time he had been somewhat deaf and his eyesight was poor. He is now absolutely deaf, and can only faintly distinguish light from darkness. He knows "when the sky turns white." By reason of this combination of blindness and deafness his powers of receptivity are confined to the sense of touch, and he has been so well instructed that his teacher carries on active conversation with him by finger touch. He bears the stigmata of congenital syphilis, flattened nose, Hutchinson's teeth, keratitis, etc. His serologic reaction is Wassermann positive. In addition to these great handicaps he developed some six months ago a swelling in the right side of his neck, which gradually increased in size. Other masses appeared in the same neighborhood, and two months ago abscesses developed in these enlarged glands, pointed, ruptured, and have continued to discharge to the present time.

The right side of the neck shows a hard, diffuse, nodular swelling, extending from the angle of the jaw downward into the anterior triangle, and beneath the sternomastoid muscle. There are three discharging sinuses, and the skin surrounding these openings is thin, purplish, and ill-nourished (Fig. 77¹). The polyglandular enlargement presents softened areas here and there, and the glands are evidently well fixed by periglandular inflammatory tissue. The picture is that of a case of tuberculous adenitis of the more advanced type, corresponding to what Dr. C. N. Dowd has designated as Group II, and which includes

¹The illustrations are reproductions of drawings made by Mr. Faber at the time of operation.
those cases in which the disease has progressed beyond the favorable primary stage, and in which the original glands have suppurated and the abscesses have perforated the gland capsule, deep fascia and skin, while the lower glands of the jugular chain and those along the trapezius have become successively enlarged. This indicates a lower power of resistance to the tuberculous lymphatic invasion than the milder and more limited examples of this disease, and in this case where implanted on a soil already prepared by the luetic taint, the failure of the natural defensive powers is easily explained. In a number of

Fig. 77.—This illustrates an extensive degree of glandular involvement, with invasion of the lower glands of the deep cervical chain, and sinuses resulting from secondary abscess formation above the deep fascia.
Dowd's cases such association of tuberculous adenitis with syphilis was observed. The combination offers no obstacle to radical treatment of the tuberculous glands, of which type of infection these present the typical history and clinical evidences. Incidentally the tonsils present no evidences of chronic infection, and if, as is usually the case, the tuberculous infection has found its entrance there, it has left no gross pathologic change behind it. Operation is urgently indicated, and to be effective it must needs be radical and include the removal of the diseased glands in which the discharging sinuses have their origin.

The incision which we prefer in these cases, and which has become the standardized one for operations on enlarged glands of a chronic type, as well as for drainage of acute abscesses of inflammatory origin, is one which follows the natural creases of the neck. A curved incision of this character has the great advantage over the old type which follows the line of the sternocleidomastoid muscle, in that it does not undergo the stretching and hypertrophy, and leave the disfiguring scar which is so commonly observed as a sequel of the latter. This advantage was pointed out many years ago by Kocher, who always preferred incisions following the direction of the skin-fibers. Cosmetic results are of secondary importance in malignant disease, but in non-malignant infections, and especially in this frequent operation, and in this favorable and conspicuous locality, the combination of a radical procedure with a good cosmetic result is much to be desired. In the great majority of cases it is possible to obtain a thin, white, and very inconspicuous scar. Where the infection has reached the lower glands of the chain, two parallel incisions are usually better than one oblique incision. An additional oblique posterior incision within the hair line may sometimes be used for removal of glands in the upper portion of the posterior triangle.

In this case the diffuse nature of the glandular swellings and the necessity of including the sinuses in the incision compel us to modify somewhat the line of our incision and make it more oblique than we would wish, but it follows the general
direction of the skin-fibers sufficiently to overcome any marked tendency to stretching or hypertrophy.

We include in the primary incision the thin, ulcerated, and poorly nourished skin edges of the sinuses, and expose the underlying abscess above the deep fascia, the contents of which are removed with sponge and curet. If we stop the operation at this stage it would constitute the so-called curetment, which has resulted in disappointment to so many operators and patients, and contributed so largely to the gloomy outlook which is still entertained in some quarters as to the prognosis of tuberculous adenitis. The causative factor remains to be dealt with. If we examine carefully we will find, as in this case, a sinus perforating the deep fascia and communicating with a large gland beneath the upper portion of the sternomastoid muscle, only the lower pole of the gland being broken down. Removal of this and the neighboring infected but still firm members of the chain is the next and most important step. For its proper performance a knowledge of the deep structures of the neck is of prime importance. Such knowledge demands careful study, and a proper dissection in the face of a complicated pathologic condition such as we are here dealing with is a matter of time, care, and patience. A number of important structures are in danger after the deep fascia has been divided, and the sternomastoid muscle freed and retracted. Routine dissection will invariably uncover the internal jugular vein, to which the infiltrated glands are more or less intimately attached, and from which they must be carefully dissected. Wounds of its short branches result in free hemorrhage, which calls for prompt control. Wounds of the vein itself may require lateral ligature, suture, or ligation of the main vein, which has been safely accomplished many times and seems without special danger. In a large series of cases our single fatality has been one of secondary hemorrhage from the jugular which had not been ligated, and Dowd in his much larger experience has had one death from the same cause. Dowd has collected 3 fatal cases following ligature of the jugular, but has never observed it himself. The spinal accessory nerve is in danger and should be looked for and pro-
tected in glandular dissections in its neighborhood, both before and after it perforates the sternomastoid muscle. In high dissections beneath the jaw avoid separating the platysma and the deep fascia, and make the incision through these structures below the line of incision through the skin. By this means we avoid a division of the branches of the facial nerve which drop into the neck below and parallel to the mandible, and then run upward to supply the depressor labii inferioris. We have observed paralysis of this muscle in our early experience. Fortunately, it is usually temporary.

A number of other important structures are in the immediate neighborhood of the glands in extensive operations, but are rarely injured. Blunt dissection and working in a direction away from danger, with a careful inspection of all suspicious structures before division, and a painstaking operative method will save the surgeon from some anxious experiences. Brilliance of technic must be sacrificed to safety and thoroughness. If a double operation is indicated by involvement of both sides of the neck and the worst side be dealt with first, so much time may be consumed that a secondary operation on the opposite side will be the only safe procedure. A combination of adenectomy and tonsillectomy is ill advised. If the tonsils and adenoids are diseased and have not been removed beforehand, as is sometimes the case, this procedure should be deferred to a later date, although not delayed long, as secondary invasion of fresh groups of glands has been observed by us due to failure to remove the tonsils in time. The direct invasion of the glands by the tubercle bacillus traveling through the tonsils has been clearly demonstrated experimentally by Dr. George B. Wood.

We have now cleared the vein of the infected glands, uncovering both triangles of the neck, first the anterior and then the posterior, and the anterior belly of the omohyoid can be seen crossing the anterior triangle (Fig. 78), and some of the superficial branches of the cervical plexus in the posterior triangle (Fig. 79). One of the latter has been accidentally divided in removing the glands surrounding it. This will result in temporary anesthesia only. All hemorrhage having been controlled, the deep
fascia is united with interrupted sutures of fine catgut, and the skin is sutured with fine sutures of "equisetene," a suture material which combines something of the elasticity of horsehair with the strength of silk. Some provision for drainage is necessary here by reason of the capillary oozing from the extensive dissection, and the mixed infection present in the sinuses. For this purpose we use a small piece of rubber-dam or soft rubber tube in the posterior angle (Fig. 80).

We prefer to keep these children quiet for at least a week, and where possible in a recumbent position to avoid disturbing the tissues during healing. Fortunately, the wounds usually heal quickly, even in the face of extensive caseation and cold abscesses (Fig. 81).
A fairly extensive experience with this operation has firmly convinced us of its curative value. It is true that cervical adenitis has offered a favorite field for the trial of many novel therapeutic methods. Every new form of treatment of supposed value in local tuberculosis has been advocated at one time or another as superior to operation, and asserted to be the method of choice. Each has eventually yielded the field to the next method, which is significant. The extravagant claims of the radium expert constitute one of the newer phases of this subject. For him the carefully studied statistics of investigators such as Wolgemuth, von Noorden, Dowd, Judd, and Mitchell, with their ample proofs of the satisfactory results of operations properly performed, do not exist or are contemptuously dismissed. We quote from a recent article by Russell H. Boggs (American Journal of Medical Sciences, clxii, pp. 90-95, July, Vol. 2—13.

Fig. 79.—Dissection of the posterior triangle of the neck.
Fig. 80.—Appearance of wound at completion of operation.

Fig. 81.—Condition of wound, and practically complete healing at time of discharge from the hospital, fourteen days after operation. (Photograph.)

1921) which is an example of such extravagant statements, the harmful effects of which it is difficult to estimate:
“Formerly radiotherapy was used in the treatment of tuberculous adenitis to avoid deformity and unsightly scars; today this treatment is advised because more permanent cures are obtained than by any other method. At present surgeons of experience are not operating primarily for tuberculous adenitis. If they operate it is only to remove fibrous nodes after the tuberculous foci have been destroyed by Roentgen rays or radium. Then a dissection of the cervical glands is always contraindicated. Radiotherapy alone will cure over 90 per cent. of the cases.” This is the mildest of his statements. Arguments of this type simply demonstrate a complete ignorance of the results which can be obtained by proper operation. We cannot always grant these exponents of radium and x-ray therapy the diagnostic ability to distinguish between the common form of hyperplastic adenitis, which seldom calls for operation, and tends toward spontaneous healing under any form of therapy, and tuberculous adenitis, for such important differentiation requires considerable surgical experience. We are inclined to believe that many of their cures are in the first mentioned class. It has long been recognized that the x-ray has yielded disappointing results, as we emphasized years ago, and radium has no magic properties in this field that render it superior. Indeed, the fibrous encapsulation which follows radiation has rendered more difficult the radical operation which is finally necessary. As an effective contradiction to the assertion of Boggs that surgeons of experience no longer operate primarily for tuberculous adenitis; I will quote from a recent personal communication from Dowd, who is the leading authority on this subject, and whose latest paper on it is based on a study of 687 cases operated upon by him or his associates and assistants, and which covers a period of twenty-two years:

“As to the treatment of tuberculous cervical lymph-nodes, I believe very strongly in surgery, and regret that the subject of recent years has been so much befuddled by statements which show only one side of the subject. I know of no place in the human body where tuberculosis offers so good a prospect of permanent cure as in neck infections. Operations are wonder-
fully satisfactory in children. As they used to come to me at St. Mary's Hospital, we could confidently expect a cure by one operation in about 85 per cent. of the cases, and in a large portion of the remainder a cure followed a secondary operation. These cases were followed through many years, some of them as many as twenty.

"If the disease is permitted to run into adult life and involves very extensively not only both sides of the neck but also other parts of the body, the results of operation are less favorable. Even in the adult cases surgery is probably the most efficient method. It may be followed by some form of radiation, if necessary.

"The whole subject has suffered from the types of operation which have been common. The opening of an abscess or a little cureting have often been called operation, whereas they do not represent proper surgical treatment of the disease. A thorough operation in a child with moderate involvement of the cervical lymphatics of one side can be done in one-half or three-quarters of an hour. The mortality rate is almost nil. The scar is hardly to be found, but the dissection should be carried so as to include the groups of glands which are centered about the upper part of the internal jugular vein and they should be cleanly removed.

"In adults the operation has been done even less thoroughly, and a vast number of partial excisions have been resorted to. There is no reason to expect that these partial excisions would be curative. The operation is tedious; requires a very accurate anatomic knowledge, and is generally avoided by the busy surgeons who are in charge of the large hospital services. They are very willing to turn them over to the younger men or refer the patients to any form of treatment which offers a fair prospect of success. It is particularly unfortunate that in doing this they have condemned many children to forms of treatment which offer little prospect of satisfactory cure." We cannot express more tersely the principles underlying the successful operation for tuberculous adenitis in the neck.

Tuberculin has its advocates, and it is true that some strik-
ing cures and improvements are sometimes observed following its administration. It is a tedious, prolonged treatment, and we believe that better results can be much more quickly obtained by operation, and with a much greater degree of certainty. We would reserve its use for the extensive double cases, most often seen in adults, and often combined with some degree of pulmonary or other visceral involvement, in which radical surgery is no longer possible, and in which the natural defenses of the individual have been completely broken down. As an adjuvant to surgery it has its place, but as a substitute for it is lacking in efficiency in the great majority of cases.

It is well to reiterate that one should not undertake an operation on the glands in the neck without ample time, ample assistance, and ample patience. If the surgeon has these, has studied the operation, and has mastered his anatomy, he will, as his experience in this field grows, feel a glow of satisfaction with the completion of a difficult operation not exceeded by that attending some other more brilliant but less difficult operations in, let us say, the field of abdominal surgery.
CONTRIBUTION BY DR. WARREN B. DAVIS

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HARELIP AND CLEFT PALATE CASES

Many types of operations have been devised during the past sixty years for the correction of harelip and cleft palate deformities. There has also been much discussion as to the best time for operation and the proper sequence of step or stage operations.

During the past six years Dr. J. Chalmers DaCosta has very kindly given me the privilege of operating upon all harelip and cleft palate cases admitted to his service—Surgical Division A—at Jefferson Hospital. We have not endeavored to devise any new operations for the correction of the various types and varying degrees of deformities in these congenital defects, but rather to study carefully the methods already described, and to try the relative merits of those impressing us as being the most practical in such selected cases as seemed best adapted to a particular type of operation. Following this course during the earlier years we have assembled, and now use, what might be termed a composite technic, in which we have taken from several sources such parts of methods as we found to be an aid in securing the best results in our cases. Thus considering our present methods as hybrids, one recognizes characteristics chiefly descended from the basic principles and procedures evolved by Langenbeck, J. Ewing Mears, W. J. Roe, G. V. I. Brown, V. P. Blair, W. A. Lane, E. Owens, J. B. Roberts, J. E. Thompson, J. S. Davis, Berry, and Legg, plus which are the variations, modifications, and some minor additions which naturally develop as a personal element in surgical work.
We shall consider here a few cases showing some of the varieties of conditions found, their surgical treatment, and the results obtained.

Case I.—Unilateral harelip, with cleft through alveolar process; but not extending into horizontal portion of the palate. Private patient, J. M., male, age twelve months, referred by Dr. J. B. Lownes.

Cleft extended through left side of lip almost to the floor of the nostril (Fig. 82). Between the upper angle of the cleft and the floor of the nostril there was no muscle tissue between the labial mucous membrane and the skin. There was a narrow cleft through the alveolar process (Fig. 83), but it did not involve the horizontal portion of the palate. There was slight anterior rotation of the left side of the premaxilla. Nasal septum deviated to the right. Moderate flattening of left nostril.

Operation June 30, 1921: The mucous membrane was removed from the margins of the cleft in the alveolar process,
after which pressure was applied on the premaxilla and also against the lower portion of the right side of nasal septum by means of a small Sinexon nasal dilator, thus forcing the raw surfaces of the margins of the alveolar cleft into contact. No suture was used to hold these surfaces in contact because of the narrowness of the cleft, and the effect of the continuous light pressure and traction to be obtained by correction of the lip defect.

![Image](image-url)

**Fig. 83.—Case I.** Showing narrow cleft through alveolar process, but not extending into the horizontal portion of the palate. Note absence of muscle tissue between upper margin of cleft in the lip and the floor of the nostril.

Points for making incisions in the lip were then marked out by the Thompson method, which we have found to be of the greatest assistance in securing accurate measurements of surfaces for approximation. With a pair of dividers (calipers), regulated with a screw, the distance was taken from the midpoint of the lower margin of the nostril to the estimated point in the same sagittal plane where the free margin of the lip should be, to make the lip of normal contour (Fig. 84). Fixing this
distance on the dividers, one point of the dividers was held at the original midpoint of lower margin of nostril, while the other was rotated, until the described arc crossed the vermilion border on each side of cleft, a puncture being made on the skin surface just above the vermilion borders to mark these points. Points were then located on the free margins of the lip as shown in Fig. 84. The lines connecting the point above the vermilion border and that on the free edge of the lip should be at approximately an angle of 70 to 80 degrees with the lateral lines. The angles should be equal on each side, and since the corresponding lines for incisions on each side are definitely known to be of equal length, one is sure of accurate even surfaces for approximation.

Temporary traction sutures of silk (see Fig. 94) passed through the entire thickness of the lip about ¼ inch lateral to the points marked at the vermilion borders, we find to be of much assistance in handling the lip, producing much less trauma than when forceps of any kind are used. The margins of the cleft in the lip were then removed with a small scalpel passed through the entire thickness of the lip and carried along lines connecting the points determined by measurements described above. Carrying the incisions to the floor of the nostril permitted approximation of muscle tissue throughout the entire length
of lip (which is essential to full function) and aided in also correcting the flattening of the ala nasi. The surfaces thus exposed on the two sides of cleft are of the same length, and when approximated will produce a lip the length of which will be the estimated normal length plus the distance from the vermillion border to the free edge of the lip. This is usually just enough to allow for subsequent contraction in the suture line.

The lip and the cheek on each side were then freed from the attachment to the anterior surface of the maxilla by an incision (most conveniently made with curved scissors) above the alveolar process, and the tissues loosened sufficiently to allow the sides of the cleft to be approximated without undue tension, and, equally as important, to allow the ala of the nostril to be brought into approximately the normal contour at the floor of the nostril. We applied our first suture (00 catgut) through the mucous membrane surface of the lip at the floor of the nostril. Next a black silk suture was placed exactly through the vermillion borders and another at the free margins of the lip. Additional sutures of horsehair and fine silk were used as needed to accurately approximate skin margins, and on the lower mucous membrane surface usually two silk or fine catgut sutures complete the operation.

Figure 85 shows the case four hours after operation. No dressings were used in the after-treatment, the lip being simply cleansed with boric acid solution, and aristol powder lightly applied on suture line three times a day. The more superficial sutures were removed on fourth day. All skin sutures were removed by the eighth day, after which time sterile vaselin was applied over the suture line night and morning for two weeks. Figure 86 shows the appearance of the lip and the nostril January 12, 1922, six and one-half months after operation.

Case II.—Unilateral harelip and complete single cleft palate. H. E. F., male, age five months, referred by Dr. John L. Arnold, Harrisburg, Pa. Admitted to Children’s Ward on Dr. Da-Costa’s service.

As shown in Fig. 87, there was complete unilateral harelip with widely separated margins, and, consequently, marked
Fig. 85.—Case I four hours after operation. Note position of sutures, the fulness of the lip at the free margin, and the even approximation of the vermillion border.

Fig. 86.—Case I six and one-half months after operation.
flattening of the ala of left nostril. The cleft in the palate was complete on the left side. The margin of the premaxilla was rotated anterosuperiorly. The nasal septum was markedly deviated to the right.

Operation December 16, 1919: At this operation the margins of the cleft in the alveolar process were approximated and the harelip repaired. With a small drill a hole was made on each side through the upper portion of the alveolar process, about \( \frac{1}{2} \) inch from left side of cleft, and \( \frac{3}{4} \) inch from the right side.

Fig. 87.—Case II. Unilateral harelip and complete single cleft palate. H. E. F., male, aged five months.

A silver wire was passed through these openings, similar to method shown in Fig. 92. With a thin chisel the alveolar process on the right side was partially divided on its buccal surface just posterior to the canine region. The mucous membrane was then removed from the margins of the alveolar cleft so that, when they were approximated, raw surfaces would come in contact. The premaxilla was then brought into proper position by combining firm pressure with thumb on the antero-superior portion of alveolar process, with pressure against the lower portion of the nasal septum and the floor of the nostril.
by means of a Sinexon nasal dilator. This pressure allowed approximation of the alveolar surfaces—a green-stick fracture occurring at the point on the right side marked by the partial division of the alveolar process mentioned above. The parts were held in this position while the silver wire was tightened, twisted, cut, and the ends bent slightly upward to prevent subsequent irritation of the tongue. This approximation of the alveolar margins brought the margins of the cleft in the lip much closer together, after which the deformity of the lip and nostril was corrected in practically the same manner as that described for Case I. Convalescence was uneventful. Began removing sutures from the lip on the fifth day. All sutures were removed by the tenth day. Silver wire was removed from the alveolus on the sixteenth day. Operation on the palate was advised when patient was seventeen months old. He was not returned, however, until twenty-seven months old. Figure 88 shows the type of union of the alveolar process which had been obtained and the very satisfactory position of the

Fig. 88.—Case II twenty-two months after first operation. Note good union of alveolar process and the satisfactory position of teeth.
teeth. Compare position of alveolar process with that shown in Fig. 87.

Second operation October 7, 1921: Repair of cleft palate and correction of a slightly excessive prominence of free margin of lip at the point of union secured by the first operation.

Closure of the cleft in the palate was by a modified Langenbeck method. An incision was made on each side just medial to and parallel with the posterior portion of the alveolar process. The incisions were carried down to the bone. The mucoperiosteal flaps were then separated from the bone by use of slightly dulled curved periosteal separators of different sizes and angles to fit the varying concavity of different portions of the palate surface. After partially separating one side, placing cotton saturated with 1:1000 adrenalin solution beneath the loosened mucoperiosteal flap, materially decreases the bleeding and does not prolong the operation, since work is continued on the opposite side until a similar stage is reached, after which adrenalin applications alternate as needed. On the right side, where the palate was attached to the nasal septum, the separation of the mucoperiosteal flap was carried around the lower portion of the septum, thus allowing about ¼ inch of septal mucosa to be included in the palate flap. (This additional width of flap assisted greatly in making the approximation at the anterior portion of the cleft relatively an easy procedure.) After the separation on the opposite side was carried through the margin of the cleft, the next step which we employed was to separate the flaps from the nasal mucosa, by dividing along the posterior edge of the palate bone. This we find is most easily and accurately done, and with least trauma, by passing a slender separator from the site of the primary incision, carrying it beneath the previously loosened mucoperiosteal flap and through the opening which has been made in the cleft margin. Pressing the separator posteriorly, it serves, first, in locating the posterior edge of the palate bone, and then as a guide beside which a small narrow scalpel, or a tenotome, may be carried and the nasal membrane divided along the posterior edge of the bone, from margin of the cleft to a point as far lateral as is necessary
to secure the relaxation desired. (Moorehead, Jour. Amer. Med. Assoc., December 17, 1921, is opposed to this step of the operation, regarding it as "the most frequent cause of non-union," but certainly it has not proved so in our series. On the contrary, in a few of our early cases, in which there was incomplete union from the first operation, there was an oval opening at a point corresponding to the junction of the hard and soft palate, which opening we are now convinced was due to insufficient division of the nasal mucosa for relaxation of the mucoperiosteal flaps.)

The margins in the soft palate portion of the cleft were denuded by removing the marginal mucous membrane, but including with it as little muscle tissue as possible. We used for approximation of the mucoperiosteal flaps interrupted sutures of 00 wire from the anterior point of the cleft to the beginning of the soft palate. At this point a single on-end mattress suture of silk was used. (On-end mattress sutures give a nice approximation of the margins at the time of operation, but our experience has been that, where several of them have been used, they interfered to a considerable extent with the circulation in the edges of the flaps, sometimes causing incomplete union and sometimes predisposing to the formation of a slough. Thus at the present time we use only one suture of this type.) Posterior to this point interrupted sutures of fine black silk were used. Small iodoform gauze packs were placed in the lateral incisions to relieve tension. These were removed in forty-eight hours. Some of the sutures were removed on the tenth day, the remaining ones on the twelfth and fourteenth days. Union was complete throughout the entire length of the hard and the soft palate.

Postoperative treatment consisted in giving only an abundance of water by mouth for the first twenty hours, then liquid nourishment for eight days, after which semisolids were added to the diet. Ten drops of 15 per cent. argyrol solution were applied in each nostril every four hours. No applications or sprays were used in the mouth. (In older children and in adults we do routinely use normal salt solution as a gentle mouth-
wash, followed by intra-oral applications or argyrol along suture line and in lateral incisions, but in infants and very young children we have found more harm resulting from the fretting and crying incident to making such applications, than we believed was balanced by any benefit obtained from the mildly antiseptic effect of the solution applied.)

Figure 89 shows the appearance of the lip and the nostril January 15, 1922. The child is now learning to talk, and the distinctness of his articulation and the quality of his voice show the advantage of having early and complete repair of the lip and the palate.

Case III.—W. S., male, age three months, referred to Dr. DaCosta's service by Pediatric Department. This case showed double harelip, incomplete on right side, and double cleft palate, also incomplete on right side. There was anterosuperior rotation of the left margin of the premaxilla (Fig. 90). (The formation of the palate on the right side is unusual (Fig. 91) in that the horizontal process of the right maxilla does not extend
Fig. 90.—Case III. Age three months. Double harelip and cleft palate, incomplete on right side.

Fig. 91.—Case III, showing type of cleft in palate.

Fig. 92.—Case III. Sketch showing position of silver wire passed through upper portion of alveolar process. The wire passes between the premaxilla and the philtrum, through an opening made just anterior to the bone, thus disturbing neither the attachment of the frenulum nor the developing teeth.

more than half-way to the lower border of the vomer, yet the interval between the medial edge of the bony horizontal process
and the vomer is filled with very irregularly placed or unevenly folded mucous membrane and a small amount of soft sub-mucous tissue between the oral and nasal mucosa.) Some of the deformities shown in this patient are similar in character to those shown in Case II, but the case is presented here in order to show by illustration some of the detail of operative procedures as sketched by Mr. Faber at the operation on January 10, 1922.

Fig. 93.—Case III. Sketch showing partial division of alveolar process on right side just posterior to canine region. The mucous membrane has been removed from the margins of the cleft in the alveolar process to secure raw surfaces for approximation. Approximation has been made by combined inferolateral pressure on the premaxilla and on the lower portion of the nasal septum by Sinexon's nasal dilator. Silver wire is tightened while parts are held in position. This part of the operation not only closes the cleft in the alveolar arch but also decreases to a great extent the nasal deformity.

The operative procedures are described in the legends accompanying the sketches. The closure of the remaining portion of the cleft in the palate in such a case is preferably done when the child is between fifteen and twenty months old—selecting a time when the child’s general condition is good.

Case IV.—Age three months. From Dr. DaCosta’s service. This case shows complete double harelip and double cleft palate,
with anterosuperior rotation of premaxilla, as shown in Figs. 96–98. The sketches made by Mr. Faber at the operation, January 14, 1922, illustrate the steps of the operation described in the accompanying legends. Operation for closure of the remaining cleft in the palate will be advised when the child is between fifteen and twenty months old. So wide a cleft in the palate will probably require a two-stage operation—the first

![Image]

Fig. 94.—Case III. Measurements have been made on the lip margins by the Thompson method to determine lines of incision. The philtrum has been trimmed to a V shape just within the vermilion borders. Temporary traction sutures have been placed just lateral to the points above the vermilion border outlining incision lines. These traction sutures we find to be of great assistance in handling the lip during operation, producing less trauma to the tissues than is caused by the use of forceps of any type which we have employed.

loosening the mucoperiosteal flaps through Langenbeck incisions and partial approximation made by lateral packs for several days, after which approximation of the margins of the cleft may be completed with much less tension to contend with.

Case V.—E. P., age four years. From Dr. DaCosta’s service. Examination showed bilateral harelip (complete on right side, incomplete on left) and double cleft palate (complete on right
side and extending to but not through alveolar process on left side) as shown in Fig. 104. There was moderate anterosuperior rotation of right side of the premaxilla.

Operation January 26, 1920: The first operation was to close the cleft in the alveolar process and to correct the double harelip. The rather firm ossification of the maxillæ and the articulating bones in a patient of this age or older makes the closure of the alveolar cleft much more difficult than in infants or younger children. In this case closure was effected by submucous resection of a small quadrilateral piece of the lower portion of the vomer and the nasal cartilage (through an incision made in the mucous membrane on the inferior surface of the vomer just posterior to the premaxilla), and the partial
division of the alveolar process on the left side posterior to the canine tooth. This allowed the premaxilla to be forced posterolaterally, bringing the margins of the cleft into apposition. The mucous membrane was removed from the margins of the alveolar cleft to allow raw surface contact. Parts were held in
contact by a single silver wire suture through upper portion of alveolar process.

The incomplete cleft in the left side of lip was made into a complete one to secure apposition of muscle tissue throughout,

Fig. 99.—Case IV. Sketch shows position of incision for removal of lower portion of vomer and anterior portion of nasal cartilage by submucous resection. A triangular section of bone and cartilage was removed to allow inferoposterior rotation of premaxilla to its normal position. The length of the base of the triangular piece of bone and cartilage removed is determined by the amount of rotation which the premaxilla requires, and should be such that when the premaxilla comes into proper position the sides of the triangle will be brought together. There will be a bulging of the mucoperiosteum at this point for several days, but the excess tissue soon resorbs.

and to secure a better floor of the nostril and to bring muscles into contact. The philtrum was trimmed to a V shape, removing the vermillion border. Incisions were carried inferolaterally into the lateral portions of the lip, after the method of E. Owens. The lip was separated from anterolateral surfaces of the maxillae
Fig. 100.—Case IV. Shows silver wire passed through alveolar processes and between the philtrum and premaxilla.

Fig. 101.—Case IV. Lateral margins of premaxilla and the margins of alveolar process have been trimmed to allow accurate approximation of raw surfaces. Silver wire has been tightened to hold premaxilla in proper position.
to allow approximation of lip margins and the correction of the nasal alae deformities without undue tension. The margins of the cleft were approximated by interrupted catgut sutures on the mucous membrane surface, and by interrupted black silk sutures on the skin surface and at the inferior margin of the lip. No widely placed stay sutures were used in this case. Ten-

Fig. 102.—Case IV. Measurements have been taken according to the Thompson method, and margins of the cleft in lip are shown ready for approximation. The use of temporary traction sutures shown inferolateral to incisions aid in decreasing trauma from handling lip during operation; 00 catgut sutures are used to approximate mucous membrane surfaces. Alternating black silk and horsehair sutures are used on the skin surface and at free edge of lip.

sion on suture lines was decreased by adhesive strips carried from anterior portion of each submaxillary area to the supraorbital and frontal region on the opposite side, the strips crossing over the bridge of the nose. (We now find widely placed shotted stay sutures of silkworm-gut more efficacious in such cases than the adhesive strips.) The lip became infected about the fourth day, the infec-
tion beginning on the mucous membrane surface and extending into all suture lines. I believe the chief causative factor in this infection was my failure to have the teeth properly cleaned and some decayed teeth filled or extracted before operation. The lip healed in spite of the infection, but a larger amount of scar tissue resulted (Fig. 105) than would otherwise have occurred. Figure 105 also shows the upper lip is too long. This
result we now avoid by making more accurate measurements for the incisions by the Thompson method described above.

Second operation August, 1921: The remaining cleft in the hard and soft palate was closed by the Langenbeck method. The anterior half of the cleft remained closed, but the margins of the posterior portion separated, necessitating a third operation. A probable factor in causing the posterior separation was the pressure and manipulation which was necessary on the eighth day after operation to control a profuse hemorrhage from the left posterior palatine artery. Pressure and iodoform gauze packs controlled the bleeding, the packs being removed the following day. Another equally profuse hemorrhage occurred on the fourteenth day after operation, which again required firm packing. This is the only case in my series in which a secondary hemorrhage has occurred.

Third operation October 27, 1921: Figure 106 shows the anterior extent of the remaining cleft in the posterior portion of the palate. The contour obtained in closing the cleft in the alveolar process is also shown. The cleft in the posterior por-
tion of the hard palate and through the soft palate was again closed by the Langenbeck method, and good union was obtained. Articulation is improving, but to obtain good speech will necessitate much more training than is required in the cases where closure of lip and palate defects are completed before the end of the second year.

Case VI.—G. H., male, age six weeks. Referred by Dr. Hugh Baker, Vineland, N. J., and Dr. P. Brooke Bland. Admitted to Dr. DaCosta’s service.

This very unusual case had complete bilateral harelip and bilateral clefts through the alveolar process, with marked anterosuperior rotation of the premaxilla, but with a well-formed palate posterior to the region normally occupied by the premaxilla (Figs. 107-109). The vomer was elongated and was not
attached to the horizontal processes of the maxillae in their anterior portion (Fig. 109), thus allowing the nasal septum and the attached premaxilla to be readily moved from side to side.

We first examined this condition when the child was four days old. Postponement of operation was advised until it was determined that a suitable feeding formula had been selected, and the baby was stronger and gaining weight.

Operation December 20, 1921: An incision was made in the midline on the inferior margin of the vomer, just posterior to the premaxilla. The mucoperiosteum and the mucoperichondrium were separated from the anterior portion of the vomer and the nasal cartilage, to allow submucous removal of a triangular section of the bone and cartilage of sufficient size to permit inferoposterior rotation of the premaxilla to its normal position. The mucous membrane was removed from the margins of the alveolar process and also the anterior margin of the palate. The lateral surfaces of the premaxilla were removed in a way to make it keystone shaped, and to fit snugly into its proper position in the alveolar arch. The mucous mem-

Fig. 107.—Case VI. G. H. Male. Age six weeks. Showing bilateral harelip and bilateral clefts through the alveolar process with marked anterosuperior rotation of premaxilla.

Fig. 108.—Case VI. Showing degree of anterosuperior rotation of premaxilla. Note shortness of the columella and philtrum.
brane on its posterior surface was removed along the line coming in contact with the horizontal portion of the palate to obtain raw surfaces for approximation. The premaxilla was held in

Fig. 109.—Case VI. Showing a well-formed palate posterior to the area normally occupied by the premaxilla.

Fig. 110.—Case VI sixteen days after operation, showing the rapidity with which the tip of the nose is coming into normal position as the columella lengthens.

Fig. 111.—Case VI sixteen days after operation, showing contour of lip and nostrils.

this position by a single silver wire suture passed through anterolateral portions of the alveolar process, passing in front of the premaxilla, between the bone and the philtrum. The double
harelip was then repaired, using the Thompson method for outlining positions of incisions in lip.

A single stay suture of silkworm-gut was used to avoid tension on the suture lines, the suture being carried far lateral and held at desired tension by perforated shot over a button and adhesive plaster, as used by G. V. I. Brown.

Figures 110, 111 show condition and form of lip, nostrils, and tip of nose January 5, 1922, sixteen days after operation. At the time of operation the tip of nose was drawn far downward and flattened by the traction on the short columella and philtrum. The columella, however, has increased daily in length, and in a few more days will allow practically normal position of the tip of nose. The silver wire suture was removed from the alveolar process on the sixteenth day, at which time the union of the premaxilla was firm, both laterally and posteriorly, and the outline of the alveolar arch was of good contour.
HEMANGIO-ENDOTHELIOMA OF SPLENIC FLEXURE

The patient, a boy sixteen years of age, was first admitted to the Presbyterian Hospital June 23, 1921 with the following history: On June 20th he had an attack of pain, dull in character, continuous, and located in the lower portion of the abdomen. He has been unable to eat and has vomited all food since the attack began. He has been constipated and the remedies used at home were more or less ineffectual.

Upon admission, June 23d, there was much tenderness over the whole right side of the abdomen; the leukocytic count was 13,500. A diagnosis of appendicitis was made and operation immediately performed. The appendix was found kinked and acutely inflamed, in addition, there was a small amount of straw-colored fluid in the abdomen. Examination of the abdominal cavity elsewhere showed nothing of significance.

The patient made an uneventful recovery and left the hospital July 5th. During the summer he gained considerable weight and felt perfectly well until September, when he began to experience attacks of sharp pain in the left hypochondriac region. The pain, while severe, was of short duration, and at times was followed by vomiting. His bowels have been regular since he left the hospital in July. On October 4th the patient had a severe chill which lasted one-half hour; the chills have persisted, occurring two or three times a day, and the patient has remained in bed since their development. He has not noticed any frequency in urination, although the pain seems to be in the region of the left kidney.

The past medical and family histories are negative in so far
as the present illness is concerned, and the general physical examination shows no abnormalities with the exception of the abdomen. In the splenic region there is great tenderness, and a small mass apparently attached to, or in, the lower border of the spleen can be elicited.

The blood count October 14th, R. B. C. 5,020,000, W. B. C. 10,700, Hb. 70 per cent., Widal reaction and examination of the blood for malaria negative. On October 21st the leukocytes were 15,150, of which 98 per cent. were polymorphonuclear. The urine was negative.

A tentative diagnosis of a suppurative collection in or about the spleen was made, and on October 24th the abdomen opened through a left rectus incision. A mass in the upper quadrant was found, the intestines easily packed off, disclosing the omentum tightly adherent to the spleen. An abscess of the spleen could not be demonstrated, although the omentum was partially freed with this object in view. Coursing over the outer surface of the spleen and continuous with the mass above were large numbers of greatly engorged blood-vessels, some of which were torn in releasing the omentum. At this stage of the operation the tumor was regarded as an angiosarcoma probably arising in the spleen or kidney, and inoperable, owing to the extreme vascularity and dense adhesions. A small drain was inserted, however, as the possibility of a collection of pus was not excluded.

The following day a large amount of pus was discharged through the tube. The bacteriologic examination revealed a pure culture of pseudotetanus bacillus.

The postoperative course for five days was quite favorable, there were no chills, and the temperature seemed to be subsiding gradually. Chills and high temperature (101° to 105° F.) then developed, the wound was explored and a larger drainage-tube inserted, with the hope that better drainage would have a favorable effect on the temperature. This result, however, was not obtained, although the chills became less frequent. One week after operation a blood examination of 3,530,000 R. B. C., 21,500 W. B. C., 55 per cent. Hb. indicated a developing secon-
dary anemia, so that two blood transfusions were given, with temporary benefit. On November 10th the drainage became fecal in character, and later small amounts of fecal matter were discharged from the sinus. There has been no vomiting, no constipation; only a few days before death was there much distention of the abdomen.

Discussion.—The question naturally arises in this case as to whether the intestinal growth was present at the time of the first operation in June. A thorough search was made because it seemed that the appendical inflammation was insufficient to account for the amount of fluid present. It is doubtful if such a thorough examination would otherwise have been made, as the symptoms were entirely explained by the presence of the inflamed appendix. Furthermore, a period of three months elapsing before symptoms referable to the new growth indicate that the tumor developed after the first operation, or was in an extremely early stage at that time.

Sarcoma of the intestine simulating appendicitis has been mentioned by several writers. In Libman's paper he refers to three instances in which sarcoma of the small intestine assumed a clinical picture similar to that of appendicitis. There are numerous instances recorded of tumors of the cecum producing symptoms simulating inflammation of the appendix, but I am unaware of sarcomata in the large intestine causing such a clinical picture.

Attention is directed to the fact that pain and fever were the most significant of the early manifestations of the disease, and that symptoms referable to the gastro-intestinal tract were altogether inconspicuous. The autopsy findings of multiple abscess formation in the liver would seem to be a complication occurring after the operation performed in October, although the septic course immediately before and subsequent to the operation was undoubtedly due to mixed infection arising in the rapidly growing and necrotic tumor tissue. Spread of the infection was probably favored by the vascularity of the tumor.

In briefly reviewing the subject of sarcomatous growths of the intestine I shall quote from the paper by Jopson and White,
whose summary, while not the most recent, gives the salient features of the disease.

Sarcoma may be found in both the large and small intestine, although the disease is much more frequent in the latter. In analyzing the cases found in the large bowel the age incidence varies considerably, 7 were under ten years, certainly 2 or probably 3 between ten and twenty years, in a series of 22 cases, showing that there is a marked predisposition in early life.

Location.—In 14 of the 22 cases the large bowel alone was the seat of the sarcoma, being distributed as follows: cecum 7, cecum and ileum 5, cecum and ascending colon 3, transverse colon 4, descending colon 1, sigmoid flexure 2.

Metastasis.—The abdominal lymphatics are by far the most common sites for the deposit of metastatic growths, with the peritoneum next in point of frequency. Except where the peritoneum is involved by continuity the dissemination takes place through the mesentery, explaining the frequent and early involvement in the cases coming to operation or autopsy.

Origin of Tumors.—The mucosa or submucosa seems to be the starting-point in most cases; the remaining coats of the bowel gradually becoming involved. Although partial occlusion of the bowel is present in about one-half of the cases, complete stenosis rarely develops from the mere presence of the sarcoma. Even in large tumors encroaching on the intestinal lumen a narrow passageway can be demonstrated, thus explaining the chronic intermittent symptoms of intestinal obstruction, or the almost complete absence of such symptoms.

Symptomatology.—The rapid course of the disease is responsible for the symptoms of loss of weight, emaciation, and weakness, early and prominent symptoms in most cases. Fever is frequently noted, and is moderate unless septic infection and peritonitis develop. Ascites has been noted very uncommonly.

Symptoms referable to the gastro-intestinal tract were present in about 65 per cent. of the cases, were mainly pain, anorexia, and vomiting. Pain is probably always present, and has been the first symptom noted in several cases; it is severe, periodic in some, acute in some, and colicky in others. Bloody stools,
diarrhea, and general dyspeptic symptoms are also mentioned as occasional symptoms. Distention, while rarely due to obstruction, is noted in many of the cases.

**Variety.**—When the type of cell was described fully, 10 were found to be round-cell sarcoma, 9 lymphosarcoma, and 1 was of the spindle-cell variety. In 99 cases of sarcoma of the small intestine which I analyzed some years ago, 34 were lymphosarcoma, 43 round-cell, 13 spindle-cell, 3 fibrosarcoma, 1 mixed-cell sarcoma, 2 myxosarcoma, 2 myosarcoma, 1 melanotic sarcoma.

This instance of hemangio-endothelioma arising in the large intestine, so far as I am able to ascertain, is altogether unique. Ewing states that this term has a very limited application and includes only certain rare tumors arising in the corpus cavernosum; the multiple endothelioma of bones, thyroid, probably the ovary, skin, and an intravascular endothelioma arising in hemorrhoidal or other dilated veins.

The recent literature contains but few reports on the subject of hemangio-endothelioma, and those which I have casually looked up have been tumors of the gastro-intestinal tract. Dr. John H. Jopson recently, in this hospital, operated on a growth of this nature arising in the spleen. Foote has collected 10 cases of what he terms hemangio-endothelio-sarcoma of the liver, a disease seen in the early months of life, and having no tendency to metastasize. Carman has reported a benign hemangioma of the duodenum, a growth sessile in character, but filling the lumen of the gut and easily removed by a transverse incision of the duodenum. Boggs and Winternitz also record a case of multiple subcutaneous hemangio-endothelioma, and multiple tumors of the same type occurring throughout the alimentary tract, esophagus, stomach, large and small intestine.

The report of the autopsy and description of the specimen made by Dr. John Eiman, pathologist of the hospital, is appended:

Emaciated white boy about seventeen years old. Slight edema around ankles. Recent left rectus incision well healed everywhere except the upper end, where there is an opening of
a fistulous tract through which exude small amounts of fecal material. Abdomen is slightly rounded, wall very thin. Peritoneal cavity contains 200 c.c. of clear straw-colored fluid.

Most of the omentum is found in the left upper quadrant, where there are fairly dense fibrous adhesions between the omentum and parietal peritoneum just above the splenic flexure of the colon, forming a fairly complete wall and isolating the spleen
from the other abdominal organs. The omentum and rather recent inflammatory adhesions surround the fistulous tract which leads to a small opening in the small intestine. There are no communications between the fistula and the lumen of the large intestine.

In the wall of the splenic flexure of the colon there is an irregular mass measuring roughly 11 x 5 x 5 cm. (Fig. 112). The serous coat of the colon in this region shows numerous dilated varicose veins some of which measure 4 mm. in diameter. The tumor involves all of the coats of the intestine, so that the thickness of the wall at some points measures 20 mm. There is no evidence of encapsulation, although the growth is rather sharply limited above and below. The mucosa shows irregular fairly deep ulcerations with necrotic bases and edges for 9 cm. The

Fig. 113.—Cross-section of tumor.
tumor cuts with increased resistance. The cross-section of the wall is mottled, grayish to reddish-gray in color, firm in consistency, and shows numerous large blood-vessels in the subserous and what appears to be the outer muscular coats. The lumen of

![Image](image1.png)

Fig. 114.—Large vein in subserous coat.

the intestine is markedly narrowed and barely admits a lead pencil (Fig. 113). The wall of the colon and the mucosa above and below the tumor mass shows no lesions. There are no evidences of secondary tumor growth elsewhere.

![Image](image2.png)

Fig. 115.—Blood spaces in subserous coat, high power.

Between the antero-internal aspect of the left kidney and
the lateral aspect and descending colon there is an irregular cavity which begins at the upper pole of the kidney and extends down to a point 4 cm. below the anterior superior spine. This pocket varies in diameter from 1.5 to 4 cm., is situated extra-

peritoneally, and contains foul-smelling purulent material. This is apparently secondary to the ulcerative process in the colon.

The small intestines show no gross lesions. The appendix has been removed.

The liver is 1640 gm., 20 x 23 x 9 cm., capsule not thickened. There are seen bulging from underneath the capsule numerous abscesses. On section, the liver is honeycombed with branching abscesses which vary in diameter from a few millimeters to 4 cm.
Most of these cavities have fairly thick, jagged walls. They contain thin purulent material. The spleen is 180 gm., 13.5 x 9 x 3.3 cm., capsule smooth, tense section purplish. Neither follicles nor trabeculi very distinct. Pulp fairly firm. No noteworthy lesions.

Microscopic: Tumor: Splenic flexure of colon.

Serous coat thickened. In the subserosa are seen numerous large veins with irregularly thickened walls and irregular spaces lined with endothelial cells and filled with blood. Underneath these blood spaces are seen groups of microscopic blood-vessels and irregular spaces lined with fusiform and cuboidal endothelial cells. These spaces are separated by connective-tissue stroma showing diffuse infiltration of cells similar to those lining the blood spaces.

The muscularis, submucosa, and mucosa show infiltration of endothelial cells and diffuse scattered groups of microscopic blood spaces. The mucosa and, in places, the submucosa are ulcerated and gangrenous.

Summary.—Primary hemangiomatous endothelioma of splenic flexure of colon leading to ulceration and secondary retroperitoneal abscess formation and partial obstruction.

Fecal fistula—small intestine.
Thrombopylophlebitic abscesses of liver.
No evidence of metastases.

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HOUR-GLASS STOMACH: GASTROGASTROSTOMY

This patient, a greatly emaciated woman, forty-four years of age, has suffered for years with gastric trouble. She has consulted various physicians, but treatment has been without symptomatic relief. She states that seventeen years ago she was burned severely about the neck and chest, and that the stomach trouble began shortly thereafter. As a result of the chronic gastric disorder she always has been thin, but within the past two months has lost 25 pounds in weight.

In July, 1920 she had an attack of severe pain in the epigastrium, the pain radiating toward the back. Following this attack there was much eructation of gas and frequent vomiting at irregular intervals, not dependent on the taking of food. There has been no blood in the vomitus, but blood was noted in the stools on a few occasions.

Her last physician, after a short course of medical treatment, had the gastro-intestinal tract studied by x-ray, and a diagnosis of hour-glass stomach was made (Fig. 118). The patient was then sent to the hospital for operation, which at the time of admission, September 22, 1920, was imperative on account of the greatly weakened condition.

Operation.—The stomach was exposed by a midline incision, and the condition disclosed by the x-ray was corroborated on examination of the viscus. There was an old healed ulcer along the lesser curvature at the upper end of the constriction which was responsible for the deformity, which resulted in two pouches of equal caliber. At the pylorus a very small, apparently healed ulcer was noted, this did not cause stenosis. A gastrogastrostomy with clamps seemed to be the quickest means of relieving the condition, as any prolongation of operative procedures would have been extremely hazardous, and a large opening between the two pouches was made. The appendix, the seat of chronic inflammation, was removed.
Postoperative Course.—The patient stood the operation well and was in surprisingly good condition the following day. At no time was there any nausea or vomiting; on the fourth day the stools contained some dark blood, and thereafter were normal. For the first twenty-four hours nothing was given by mouth, enteroclysis supplying sufficient fluid. After the first twenty-four hours small amounts of water and other fluids were given, and increased gradually until the fourth day, when the patient complained of hunger, and requested a more liberal diet, which, when given, caused no distress. Her convalescence was unattended by any untoward symptoms, and when discharged from the hospital October 9, 1920 she was much stronger and was able to digest and assimilate a varied and liberal diet. An x-ray (Fig. 119) taken one month after the operation shows a wide opening be-
tween the two pouches, and no tendency toward the constriction as seen in the first picture. At this time and subsequently the patient has remained well and shows a continued and gratifying gain in weight and strength. She suffers distress only when she is indiscrete in her diet. A study of the gastric chemistry was inadvisable before operation and was refused by the patient at a later period.

**Discussion.**—The etiologic significance of the burn followed by gastric disturbance is an interesting feature in this case. That severe burns are followed by ulcer formation in the duodenum is well known. That the same condition may arise in the stomach seems beyond dispute, as such ulcers must be regarded as the result of toxemia following septic infection of the burned areas. It has been stated that the so-called Curling’s ulcer of
the duodenum does not occur unless septic infection of the burn takes place.

The choice of operation is a matter dependent upon the pathology found and, to a certain extent, upon the condition of the patient. Gastrogastrostomy, with pouches of equal size, presented an easier and quicker operation and perhaps attended with less shock, an important consideration in this case on account of the state of marked malnutrition. Fortunately, the pyloric ulcer seemed to be healed and did not cause stenosis, otherwise a posterior gastro-enterostomy to the distal pouch would have been necessary. Even this additional procedure seemed inexpedient in this case, and was reserved for a secondary operation if symptoms of pyloric stenosis developed. The improvement up to fifteen months after operation, however, has been such that further operation has not been deemed necessary, and would seem to corroborate our judgment in meeting the indications only in this case. We are aware, of course, of the danger of pyloric ulcer, particularly as to the development of malignancy, and have advised careful observation of the patient, supervision of diet, etc., by her family physician, in order to ascertain the appearance of any future trouble in its early stages.

In studying the notes of 50 consecutive cases of hour-glass stomach subjected to operation Thomas (British Journal of Surgery, 1921, ix, 37) makes a number of observations which are most interesting and instructive, and to which I think we can allude with profit.

He found that only 4 of his cases occurred in women. The most noted feature was the long duration of symptoms before surgical aid had been resorted to, with the exception of 3 patients, whose symptoms had lasted only one, two, and three years respectively. All the others had complained of gastric trouble for periods varying from five to thirty years, the average being nine years; and most of the sufferers had been under medical treatment intermittently throughout.

The acute hemorrhagic variety of gastric ulcer rarely leads to this deformity, but rather the chronic ulcer on the lesser
curve with many years' history of a continuous or intermittent type. Many ulcers had completely healed, leaving a hard scar, which in the process of years had drawn to itself the adjacent areas of gastric wall so as to produce the contraction. Many had unhealed ulcers, some with extensive adhesions to liver, pancreas, and even the anterior abdominal wall. In view of the current opinion that malignant disease of the stomach is grafted on a chronic ulcer foundation, the series of 50 without a single malignant case does not support it, although the disease had lasted many years in some patients.

Thomas believes no set operation can be advocated for this condition; the operative procedures can only be determined after the abdomen is opened and the stomach carefully examined. In the series he employed gastroplasty combined with posterior gastro-enterostomy to the distal pouch on account of pyloric constriction. Gastrogastrostomy was satisfactory in 15 cases of large pouches with a narrow and fibrous constriction.

Posterior gastro-enterostomy performed on the proximal pouch was done in 14 cases, when the sac was small and high up.

When the pouches were equal in size and the constriction extensive, with pyloric stenosis in addition, double posterior gastro-enterostomy was done in 2 cases.

In complicated cases, which were few in number, anterior gastro-enterostomy, gastroduodenostomy, combined anterior and posterior gastro-enterostomy, and partial gastrectomy were necessary. These various types of operation show the necessity for thorough examination to meet the conditions arising in this very serious deforming condition.

The end-results indicate that no particular type of operation had much to do with the final outcome, provided a free flow had been established from the stomach. The majority of patients were entirely relieved and the recoveries astonishing in a great many almost hopeless cases, in persons reduced to extreme emaciation through long years of suffering.
BLOOD TRANSFUSION IN A CASE OF SECONDARY ANEMIA ASSOCIATED WITH FIBROMA OF THE UTERUS AND SEPSIS

The patient is shown to demonstrate the prompt and beneficial result of transfusion in a case of secondary anemia resulting from menorrhagia due to a fibroid tumor of the uterus, and low-grade pelvic infection following the application of radium.

I shall briefly allude to the gynecologic condition for which the patient entered the hospital December 9, 1920. She is forty-one years of age, married, and the mother of 3 children. Her chief complaint is menorrhagia, which has been almost continuous for the past five weeks.

Examination showed a fibroid uterus, and for this condition radium was applied on December 31st. Following the application the patient had a severe reaction, her temperature was elevated and ranged from 100° to 102° F. for a period of four weeks. In addition to this there was generalized pelvic tenderness on vaginal examination. The tenderness gradually disappeared, but there still persisted until February 20, 1921 a daily elevation of temperature, 99° to 100° F. The patient feels rather weak, slight exertion out of bed causing exacerbations of pain. Blood examination, February 1, 1921, 3,000,000 red blood-cells, hemoglobin 46 per cent.; there has been no response to hypodermic injections of iron, although the menorrhagia has ceased.

Transfusion of 500 c.c. of blood was given on February 26th, the citrate method being used. This was followed by a slight reaction. The blood count the following day was 4,080,000 red blood-cells, 60 per cent. hemoglobin, and 8250 white blood-cells. There was a very marked improvement in the general condition which manifested itself three days after transfusion. The abdominal pain was slight and the patient felt decidedly better. The appetite improved and she was able to be out of bed a week later without the feeling of lassitude which was
present previously. Two weeks after the transfusion, when she was discharged from the hospital, the blood count showed 4,250,000 red blood-cells and 75 per cent. hemoglobin. The patient’s condition was quite satisfactory, in that she could be up and about without discomfort or becoming tired. The fever, which had persisted for a period of six weeks, became normal one week after the transfusion and has so remained.

Discussion.—The case is shown with the idea of demonstrating the beneficial effects of transfusion for a condition of low-grade infection and secondary anemia. The pelvic peritonitis in this instance was undoubtedly lighted up by the application of radium. The anemia was secondary to the fibroid uterus and its resulting menorrhagia.

The indications for transfusion are now well established, the various methods used are perfected from the technical point of view until the operation is attended with little or no danger. It seems to me that in conditions of low-grade sepsis and the secondary anemia following transfusion has not been used as generally as its beneficial results warrant. This has been so in my own practice, and I find that transfusion before and after operation in many cases of this type have produced results which lead me to employ transfusion more and more frequently.

Choice of Method.—You are familiar with the controversy being waged at present between whole blood transfusion and the citrate method. I believe both methods have their use, and that the surgeon must decide in each case whether there is any contraindication to the use of the citrate method. As experience has been gained in transfusion we have found that certain advanced forms of anemia or other blood dyscrasias with an extremely low blood count give marked reaction to the introduction of citrate, and in such cases we prefer direct transfusion. In the acute anemias following hemorrhage and in the secondary anemias of mild degree, with or without sepsis, the citrate method has been perfectly satisfactory and has not resulted in any harmful reactions. It must be admitted, however, in our own practice the tendency is to do fewer transfusions by the citrate method and to utilize direct transfusions by the Unger method, which we prefer.
The patient is a colored man, twenty-nine years of age. Three weeks ago he received a slight laceration on the dorsum of the left ring finger. A scab formed on the wound and the patient forgot about it until one week ago, when he began to feel pain running up his arm and noticed some tenderness and swelling in his left breast. He picked off the scab and found a little pus under it. For a day or so he felt better, then he was seized with severe pains under the left breast and arm. At times he would feel chilly and at night he had drenching sweats.

- On admission to the Presbyterian Hospital in the service of Dr. John H. Jopson any attempt to move the left arm was very painful. The entire upper left pectoral region bulged and was tender; no fluctuation could be detected. The axilla was not affected except for edema of the superficial tissues, which was marked along the entire lateral border of the pectoralis major. The night before operation the temperature reached 103.4° F. and the patient gave the impression of severe toxemia.

Under gas and oxygen anesthesia an incision was made just external to the margin of the pectoralis major, evacuating an abscess situated in the subpectoral space. The pus was creamy in appearance and consistency and about 150 c.c. in amount. Here also was a mass of inflammatory tissue evidently consisting of fused lymph-nodes and infiltrated cellular tissue. A portion of this was excised. Oozing was free. The cavity was packed with plain gauze for hemostasis and drainage. Beginning on the third day the packing was removed piecemeal, being all out on the sixth day. The Carrel-Dakin treatment of the infected
cavity was instituted. The general condition of the patient had responded at once, and on the seventh day after operation the temperature became normal and remained so. The subpectoral cavity rapidly became obliterated by granulation and cohesion, leaving a rather deep superficial wound. Two weeks after operation the bacterial count of the smear from the wound discharge showed only 2 cocci to 50 oil-immersion fields and cultures yielded a few scattered colonies of staphylococci. Under gas and oxygen anesthesia again the skin edges were pared and the wound surfaces apposed by on-end mattress sutures of silk-worm-gut, the deep portion of the suture entirely encircling the wound, the superficial or returning loop merely catching the lips of the wound to insure skin approximation. There was some discharge of wound secretion, but never any local or general evidences of infection, and in ten days the wound was solidly healed.

Fig. 120.—Showing incision employed to evacuate subpectoral abscess. The lower end was prolonged to the border of the latissimus because of the extreme edema and swelling in this region. Note axilla unaffected.
The pus yielded a pure culture of Streptococcus hemolyticus. I recall vividly three other cases of subpectoral abscess seen within the last three years. A farmer, aged fifty-four, cut his middle and little fingers slightly on hot-bed sash. He paid
little attention to the wounds, which were not deep, and three
days later he plowed and spread manure. Two days after this
he felt pain in his left chest. There was no pain in the arm and
the hand seemed to have healed. The next day he called his
physician, Dr. Crowe, who found his temperature 104°F. The
left pectoral region was swollen and tender, and so painful was
motion of the arm that the condition simulated paralysis. The
patient refused to go to a hospital and was kept under observation
for eleven days at his home. Fortunately he did not become septic
and his general condition actually improved. When I saw him
and operated at this time, the subpectoral space was a huge
abscess cavity. The axilla had become involved secondarily.
The skin was thin, red, and fluctuating at several points over the
sternal attachments of the pectoralis major. The abscess was
freely incised at the lateral margin of the pectoralis and through-
and-through tube drainage carried to the mesial and superior
aspects of the muscle. Recovery with full function took place in
four months. Culture showed the streptococcus.

A second case concerned a woman of fifty-five years of age,
who pricked her finger with a safety-pin while nursing a child
sick with scarlet fever. There was no local reaction so far as
she could recall, nor did the arm swell, but on the fourth day
she began to have pain in the pectoral region on the same side,
and rapidly developed a huge, painful swelling beneath the
pectoralis major. Systemic symptoms were severe. The
abscess was opened four days later by free incision along the
outer margin of the muscle, and amelioration of symptoms and
recovery rapidly took place. The infecting organism was the
streptococcus.

The remaining case was that of a man twenty-three years
of age, whose history and condition were more difficult to inter-
pret. Several months previously while in the army he had
received antityphoid inoculations in the left arm. He felt sick
and the arm was sore, but this passed off. Three weeks later
a small abscess (from his description apparently a furuncle or
pustule of the skin) appeared in the axilla, and was opened,
healing taking place promptly and without incident. Some
weeks after this he noticed a slight soreness in the left pectoral region and thought it was a little swollen. About this time he was mustered out, and being anxious to take up his civilian work he did no more than mention the condition to the examiner, who after a brief examination attached no importance to it. However, after his discharge the swelling and discomfort increased. He consulted his physician, who sent him to an eminent surgeon. The latter diagnosed cold abscess and advised a small incision at the outer border of the pectoralis, which was done by the physician, evacuating a considerable amount of rather thin yellowish pus. The swelling diminished greatly, but discharge continued. I saw him six weeks later and found that there was a large slough in the cavity which interfered materially with drainage. This was removed, and in the course of a few weeks the sinus closed. However, within a month two small subcutaneous abscesses appeared at the sternal margin just below the sternal clavicular border, and a few days later there was a rapid reappearance of the subpectoral collection. Under general anesthesia the abscess was evacuated and found to run beneath the muscle to the site of the two small subcutaneous abscesses. Incision here showed small sinuses penetrating the intercostal muscles in the first and second interspaces. It was clear that there was retrosternal suppuration. The sternal end of the second cartilage was removed and a cavity filled with soft granulation tissue was curetged and packed. The subpectoral abscess now closed and remained so, but in order to complete the cure it was necessary later to remove the central portion of the sternum almost to the ensiform in order to uncover a suppurating sinus which lay in the anterior mediastinum immediately behind the sternum. After this was done healing was rapid and complete. Bacteriologic investigation of this case was inconclusive because the abscess had been opened several weeks before coming under my observation. At different times the streptococcus and Staphylococcus albus and aureus were recovered. The slow development of the condition and relatively afebrile course suggested a tuberculous condition, but guinea-pig inoculations were negative and x-ray study of the chest showed no recognizable tuberculous process.
Almost nothing has been written within the last few years concerning subpectoral abscess, and few text-books or systems of surgery even mention the condition. Riesman in 1915 (N. Y. Med. Jour., ci, 658–660) reports 2 cases and calls attention to the sudden onset and severity of the condition. In 1900 Musser (Amer. Jour. Med. Sci., November, 1900) reported 3 cases and collected 23 from the literature which did not, however, include all the cases previously reported. Most of the cases were from French sources, and in the days before early and thorough surgery was the rule the mortality was high. Musser notes the two clinical variations: (1) the acute or phlegmonous, (2) chronic or cold abscess. In some cases traumatism appears to play a part, and it is probable that a subpectoral hematoma may at times be infected by way of the blood-stream. In the vast majority of instances the infection reaches the subpectoral space through the lymphatics from a focus situated either superficially or deeply anywhere within the lymphatic drainage area. It is evident that some of the cases reported in the literature are instances of empyema necessitatis. Musser was impressed with the frequency of transmission of infection from the pleura either by extension with evident gross avenues of communication or by lymphatic transmission without such evidence. One case reported showed a connection with an abscess of the anterior mediastinum very similar to that reported herewith. More accurate means of diagnosis and earlier resort to surgery has greatly diminished the cases falling into this group. Nowadays the condition is most often due to lymphatic metastasis from the upper extremity or occasionally from the tissues of the shoulder or breast. Although not common the condition is important because of its dangerous nature, and the fact that its unusual location tends to delay recognition and appropriate treatment. While the termination in the cases here reported was fortunate, this is by no means the invariable rule, and the danger in at least two of these cases was greatly increased by delay in resorting to free incision into the infected area.

There is described an anteropectoral group of lymph-glands
lying beneath the lower border of the pectoralis major, anterior to the long thoracic artery at the level of the second and third intercostal spaces. Below this level, in the fourth and fifth intercostal spaces, in relation to the long thoracic artery are sometimes found several small nodes known as the inferopectoral group. It is easy to see that infections derived from the thoracic cavity or deeper structures of the adjoining chest wall would be likely to localize in these deep nodes. Of course, intrathoracic infection rarely penetrates the parietes, the pleura usually constituting an impassable barrier, just as the parietal peritoneum confines its contained infective processes until actual ulceration affords an outlet. On the other hand, it is a matter of every-day observation that lymphatic infections of the upper extremity are arrested at least temporarily by the axillary nodes. It seems probable in the case of subpectoral abscess evidently derived from a primary focus on the upper extremity without involvement of the axilla that an anatomic abnormality of the lymphatics exists comparable to the frequently observed abnormalities of the blood vascular system. Such an arrangement is difficult to demonstrate, but it is also difficult to account for the phenomenon on any other basis. More attention is now being given to the rôle of the lymphatics in the propagation of infection, especially in connection with the etiology of such conditions as cholecystitis and pancreatitis, and a more accurate knowledge of the constitution and behavior of these structures in infection is destined to influence greatly our ideas of the pathogenesis of many infective disorders.

The treatment of subpectoral abscess is summed up in early and efficient drainage and the employment of our modern resources in the handling of infection as illustrated by the first case.
SURGICAL LESIONS OF THE ULNAR NERVE AT THE ELBOW

Summary: Superficial Position of Ulnar Nerve at Elbow Exposes it to Trauma, Direct or Indirect; Illustrative Cases; Variety of Causative Trauma; Mouchet's Syndrome; Diagnosis; Symptoms and Signs in Detail Illustrating the "Dissociated Syndrome"; the Law of Contracture d'amont. Variations in Course and Distribution of Ulnar Nerve that Might Mislead; "Progressive Ulnar Paralysis"; Treatment Should Be Operative; the Four Methods of Operation; Rapidity of Postoperative Restoration of Function; Bibliography.

Unlike other nerves of the body—with the exception of the external popliteal where it winds around the neck of the fibula—the ulnar nerve in its groove behind the internal epicondyle is peculiarly exposed to trauma, direct or indirect, which usually soon or late gives rise to sensory and motor disturbances in the ulnar territory of the hand, whose etiology—especially in the indirect trauma—is often at first glance obscure.

Case I. Elbow Fracture Followed by Compression Neuritis of Ulnar Nerve.—O. R., male, aged forty-two, steamfitter, on December 15, 1919 fell in shipyard a distance of 28 feet, landing on palm of right hand, spraining wrist and shoulder and injuring right elbow. He was taken to a hospital where, four days later, the fractured head of the right radius was resected. We first saw him about a year (December 29, 1920) after the accident, at which time he stated that there was no strength in the right elbow, that it was very painful, and that he could not bend it on account of the pain.

Physical Examination (December 29, 1920).—Little and ring fingers of right hand are cold; there is diminished sensation in
these fingers; there is slight atrophy of the hypothenar eminence. Our attention now being directed to the elbow, we found there *exquisite tenderness along the ulnar nerve* in its course in the olecrano-epicondylar groove, with definite filling-in of the latter. The joint motions *per se* were good, but the slightest degree of flexion caused intense pain in the ulnar nerve. Skiagram (Fig. 123) reveals traumatic osteo-arthritis, with filling-in of the olecrano-epitrochlear groove. There is, too, crepitation on movement of the joint.

The diagnosis was immediately made of compression neuritis

Fig. 123.—Filling in of groove for ulnar nerve from traumatic osteo-arthritis following fracture of head of radius.
of the ulnar nerve following elbow injury; the patient was advised to submit to operation, the purpose of which would be to release the nerve from the pressure in its groove and transfer it to a position before the internal epicondyle; a good prognosis

![Ulnar nerve compressed by fibrous band](image)

as to the relief from pain and as to recovery of function of the ulnar nerve was given.

**Operation** (January 10, 1921).—Local anesthesia. Incision along course of ulnar nerve in the olecrano-epitrochlear groove. Ulnar nerve exposed and found compressed by a fibrous band (Fig. 124), against which it was pushed by proliferation from the underlying bone. The nerve was released and transferred
to a position before the internal epicondyle, where it was placed upon the deep brachial fascia and retained by suturing the divided superficial fascia over it (Fig. 125). Immediately the patient could flex his forearm 2 inches more than before operation, and with much less pain. Dry dressing applied; wrist put in sling.

Postoperative Notes (January 11th).—Patient states that pain in elbow disappeared immediately after operation, and that for the first time since the injury he could touch his forehead with the fingers. The little and ring fingers, however, are still numb.
January 20th.—Stitches removed; healing per primam throughout.

March 11th (two months after operation): Tenderness over ulnar nerve is no longer present. The numbness is now confined to the finger-tips, which are "sore." With the arm abducted the patient is now able to touch the top of his head. Rotation of the radius is increased in range. The patient feels that the electricity and baking are doing him good. Insomnia has wholly disappeared.

June 17th (about five months after operation): The ulnar nerve where transposed is palpable and freely movable from side to side beneath skin and fat, showing its complete freedom from tension. In the little finger epicritic sensation is absent, but protopathic is present. Skiagram reveals bone proliferation about olecranon and coronoid, apparently limiting flexion to just beyond a right angle. Girth of arm 1¼ inches less than on sound side; girth of forearm ¾ inch less.

October 10th (nine months after operation): Patient feels he is improving so rapidly that he will be able to resume his trade of steamfitter early in the new year. (This would be about one year after the operation, which is approximately the time nerve function is fully restored after operation in the average case.)

Case II. Elbow Laceration Followed by Compression Neuritis of Ulnar Nerve.—W. A., male, aged sixteen, cord worker, while at work in the cording room suffered laceration of the right elbow on June 2, 1918; the wound was treated by a bandage alone. The patient states that directly after the injury the little and ring fingers felt numb, and that he was unable to extend these fingers. When first seen by us (April 8, 1919), about ten months after the accident, the patient complained of partial anesthesia of right hand with partial loss of power in same, and stated that there has been no improvement since the time of the accident.

Physical Examination (April 8, 1919).—Analgesia of little finger, ulnar side of ring finger, and adjacent palmar and dorsal aspects of right hand. Proximal phalanx of little finger hyper-extended, that of ring finger to less extent; middle and distal
phalanges of same fingers flexed. Hypotenar eminence and dorsal interosseous spaces—including adductors of thumb—withered. Examination of the right elbow shows an irregularly circular cicatrix of skin between olecranon tip and internal epi-condyle, and over the point of the elbow a small skin ulcer the size of the little finger-nail. There is no sign of bone injury or callus.

The diagnosis was made of cicatricial compression neuritis of the ulnar nerve, due to an old lacerated wound of the elbow. Operation was advised and prognosis was made as in Case I.

Operation (April 9, 1919).—Local anesthesia. Semilunar incision—convex outward—made over internal condyle anteriorly, 4 inches in length. This incision passed through healthy skin, anterior to scar-tissue area; below, it terminated opposite lower crease of elbow. Incision divided skin and half of thickness of fat beneath skin, the deep portion of fat being allowed to remain attached to deep fascia covering origins of flexor muscles of forearm. Flap elevated and turned inward, exposing internal epicondyle, olecranon, and ulnar nerve groove between. Cicatricial tissue was found binding nerve down in its groove. Just above the cicatricial area—\textit{i.e.}, just above the internal epicondyle—the ulnar nerve was the seat of a spindle-shaped neuroma, which was enclosed in a definite capsule. The nerve was freed at upper angle of wound by dividing neuroma capsule and freeing latter, and also at lower angle, where it disappears between heads of flexor carpi ulnaris; between these two points the nerve was released from compressing scar tissue. The nerve had apparently not been divided at the time of the injury, but when released seemed to be in continuity as normal nerve-fiber tissue—although of lessened diameter—except at site of neuroma. The nerve was drawn forward without tension to before the internal condyle. The deep layer of fat was now reflected from this area, beginning at the border of the condyle; the nerve was then sandwiched between this fat layer and the deep fascia; the fat layer was tacked down in place again around the margin of the internal condyle, using interrupted sutures of No. 00 plain gut. Skin edges apposed by continuous fine silk-
worm-gut suture. No drainage. Dry gauze dressing. Wrist suspended in sling.

Postoperative Note.—The very next day after operation the patient stated that feeling was returning to the ulnar side of the ring finger, and as time went on not only were epicritic and protopathic sensations completely restored, but power gradually returned to the small muscles of the hand supplied by the ulnar nerve.

Fig. 126.—Ulnar nerve displaced anteriorly and compressed against trochlea by fragment from internal epicondyle (Payr).

There is a large variety of traumata that may eventuate in surgical neuritis of the ulnar nerve. The presence of a supracondylar process may sufficiently irritate the nerve to produce symptoms and signs. The occasional receipt of a simple, direct contusion of the nerve has led the laity to coin the term "crazy bone"; but the effect of a contusion or sprain may be more serious by leading to the formation of an arthropathy, through the sequence of hematoma and osteophyte production. The nerve in its groove may be subjected to scar tension following a
burn, laceration, etc., and a scar may even lift the nerve out of its groove. Fracture of almost any portion of the elbow may affect the nerve directly or indirectly. Thus, Payr reports a fracture of the internal epicondyle with displacement of the fragment to the anterior surface of the trochlea, the fragment carrying with it the ulnar nerve and compressing it upon the trochlea (Figs. 126-128). If the fragment is not displaced, fracture of the internal epicondyle may eventuate in ulnar neuritis in the same way a contusion does, by scar tissue or callous formation. Fracture of the external condyle (usually in
infancy) resulting in cubitus valgus, and this, in turn, eventually in ulnar neuritis from stretching of the ulnar nerve, is the mechanism described by Mouchet in 7 cases (Fig. 129), although the neuritis usually manifested itself long after the injury—twenty and even fifty years. (Cf. cervical ribs.) Diacondy lar fracture of the humerus, epiphyseal separation of the lower end of the latter, fracture of the olecranon, and luxation of the elbow have all been reported as causes of surgical ulnar neuritis, as have deformities following infectious arthritis. The writer recalls the case of a locomotive engineer who developed a mild ulnar neuritis from leaning upon the right elbow while at his post of duty. And finally there are the direct injuries, such as incised, stab, and gunshot wounds involving the nerve at the bend of the elbow.

Fig. 129.—Diagram showing the tension of the ulnar nerve upon the internal border of the olecranon in the deformity of cubitus valgus following fracture of the external condyle (Mouchet).
The diagnosis of surgical neuritis of the ulnar nerve due to one of the above-mentioned lesions at the elbow will probably be made in most cases by working from effect to cause; i. e., attention will be attracted by the more or less well-developed gryffe, and then physical and x-ray examinations of the elbow will be made for a scar or bony lesion. The examiner must bear in mind, however, the traumatic neuritis of the ulnar nerve in the hand resulting from repeated contusions to the hypothenar eminence, such as occurs in industrial workers (carpenters, dyers, calico printers, shoemakers, etc.); cervical rib neuritis; disease of the central nervous system, and the occasional selective localization in the ulnar nerve of chronic alcoholism, chronic lead-poisoning, and infectious diseases, such as variola.

The symptoms and signs may be few and mild, especially in the early stage, or there may be a well-marked gryffe with trophic disturbances. Studies of the ulnar symptom-complex made upon soldiers injured in the World War have shed much light upon this subject; let us select one of these studies and see if it does not facilitate an understanding of this complex.

Déjerine and Mouzon presented before the June 3, 1915 meeting of the Société de Neurologie of Paris a report upon 2 patients who were afflicted with partial lesions of the ulnar nerve from injury of the nerve just above the ulnar groove. In the first there was involvement of the inner part of the nerve; in the second, compression of the outer surface at the same level. Reference to the accompanying excellent diagrams will show at a glance the different effects of these dissociated lesions (Figs. 130, 131). The heavy shading indicates complete loss of sensation or of muscle power; while partial or less conspicuous losses are shown by lighter shading and stippling.

Case I.—Dissociated paralysis of the ulnar nerve from bullet interruption of the inner third of the nerve just above the ulnar groove. Predominance of disturbances in the sensory fibers—cutaneous (Fig. 130, d), osseous (Fig. 130, e), articular (Fig. 130, f)—in the hypothenar eminence (Fig. 130, c), and in the interossei of the last spaces. Slight gryffe cubitale (Fig. 130, a, b). Operation revealed a defect in the inner third of the cross-section of the nerve.
Fig. 130.—Findings in Case I of Déjerine and Mouzon seventy-four days after injury: \(a\), attitude of hand at rest; \(b\), maximum flexion of fingers; \(c\), voluntary and electric contractility of the muscles; \(d\), cutaneous sensibility; \(e\), bony sensibility; \(f\), joint sensibility.

**Case II.**—Compression of the outer surface of the ulnar nerve in the lower third of the arm. Dissociated syndrome. Patient wounded by shell fragment. Complete paralysis of the
Fig. 131.—Findings in Case II of Déjerine and Mouzon seventy-one days after injury: a, Attitude of hand at rest; b, maximum flexion of fingers; c, voluntary and electric contractility of the muscles; d, cutaneous sensibility; e, bony sensibility; f, joint sensibility.

flexor carpi ulnaris, of the inner fibers of the deep flexor, and of the adductor of the thumb (Fig. 131, c). Paralysis of the inter-
ossei, more marked in those of the first spaces than of the last spaces. Paralysis of the muscles of the hypothenar eminence. Irritation of the superficial anterior cutaneous branch of the hypothenar eminence (Fig. 131, d). Integrity of the dorsal ulnar branch (Fig. 131, d). Slight irritation of the median. Impaired bony sensibility of the phalanges of the ring and little finger, especially the terminal phalanx of the latter (Fig. 131, e). Absence of griffe cubitale (Fig. 131, a, b). Operation by Gosset revealed outer surface of ulnar nerve compressed by dense scar tissue.

These 2 cases show that the distribution of the disturbances, or their predominance in different territories—cutaneous, muscular, or osseous—varies as the lesion involves the internal portion of the ulnar nerve in the arm, or its external portion; and also the absence of griffe cubitale in the case in which the lesion involved the external portion of the ulnar nerve, and its existence in the case in which the lesion involved the internal portion. As to the different effects produced when the ulnar nerve has been injured above or below the elbow the following studies have been made by Ducosté and verified by him in 50 cases.

Ducosté states that—as so frequently happens in peripheral nerves—"cubital paralysis" is a mixture of contracture and of paralysis. Thus, if the ulnar nerve is divided in the arm, i.e., above the origin of the upper branches to the flexor carpi ulnaris and two inner bellies of the flexor profundus, these muscles are paralyzed; while if it is divided in the forearm, i.e., below the origin of these branches, these same muscles immediately contract. In the latter case there is seen the clinical picture shown in Fig. 133, 16: flexion of the second phalanx of the little and ring fingers by contraction of the flexor profundus (inner heads) and, by contraction of the flexor carpi ulnaris, flexion of the fifth and secondarily of the fourth metacarpals, and rotation of the ulnar border of the hand upon the radial border; paralysis, on the other hand, involves the interossei, the two inner lumbricals and the hypothenar muscles, and the adductor of the thumb and its short flexor are the seat of paresis. To these
Fig. 132.—Studies of *main en griffe*, from mild to severe, by Ducosté: 5, High lesion of ulnar nerve—limit of flexion; 6, same as 5—limit of extension; 7 and 8, lesion just below elbow—initial period of *griffe*: abduction of little and ring fingers; adduction of index, which passes under the middle finger; extension of proximal phalanx according to 5 to 2; abduction of first metacarpal; 9, incomplete lesion in lower forearm—initial period of *griffe*; feeble *contracture d'amont*; 10, same hand as 5 and 6—initial period of *griffe*.

contrary effects Ducosté applies the term "the law of *contracture d'amont," and states the contractures of the flexor carpi ulnaris
and flexor profundus persist in natural sleep, disappear under a general anesthetic, to return when the patient awakens, but
disappear immediately after injection of 1 or 2 c.c. of alcohol into the ulnar nerve at the ulnar groove.

The classic formula of sensory disturbances of the ulnar nerve is limitation of anesthesia to the little finger, to the inner half of the ring finger, and the inner border of the hand as far as the wrist. The symptoms and signs of lesions of the ulnar nerve have their maximum at the inner border of the hand and of the forearm and diminish progressively from the fifth to the second fingers, from the fifth to the second metacarpals, and from the inner to the outer border of the forearm, therefore "5 to 2." Vasomotor and trophic disturbances are present, also varying in intensity from "5 to 2"; excretion of sweat and growth of nails are suspended in complete lesions, but increased in the incomplete; hypertrichosis, keratosis, and desquamation of skin decrease from "5 to 2"; atrophy of the interossei is late and progressive, begins in the fourth interspace and is always more pronounced there (Figs. 132, 133); osteoporosis affects in the beginning the innermost phalanges and metacarpals, the pisiform, unciform, cuneiform, semilunar, os magnum, and lower extremity of the radius, but very rapidly all the bones become rarefied, and the process is more marked in the epiphyses. As to the articulations, anesthesia involves not only the finger-joints, but also the wrist-joint, and at times the metacarpophalangeal joints are painful to pressure.

In certain cases there is pemphigoid eruption with ulceration of the skin, and there may be acute edema of the subcutaneous cellular tissue, which Mougeot designate as false phlegmon.

The electric reactions should be determined in every case, not only to find out the extent to which the nerve is involved but also after treatment, in order to estimate the improvement. These electric reactions have generally been omitted, but Neel has recently (1919) reported 10 cases of ulnar neuritis developing as late as fifty years after injury to elbow sustained in childhood, in which the electric as well as physical examinations are given in detail.

There are certain variations in the course and distribution of the ulnar nerve that should be borne in mind. In the first
instance it may cross the elbow before instead of behind the internal epicondyle, in which case it would probably escape the injuries to which we have referred. Again, Forrester-Brown observed in the Edinburgh War Hospital several cases where the median nerve supplied all the intrinsic muscles of the hand, though not the whole ulnar skin area; one case was seen where some of the median muscles were supplied by the ulnar, though again not its skin distribution. These cases are impossible to diagnose with certainty before operation, and they are liable to be reported as rapid recoveries, unless they are early and carefully examined after operation.

Adson refers to this lesion as progressive ulnar paralysis, stating it is a clinical condition which has long been recognized, but has rarely been treated surgically; and that it has been diagnosed as progressive muscular atrophy and as a form of muscular dystrophy. The lesion is truly progressive, in conformity with the underlying cause; and permanent cure, therefore, is only to be expected as the result of operative treatment. In early cases great improvement follows rest, but relapse takes place when the patient resumes the use of the limb.

As to treatment, when the signs of interference with the functions of the nerve are not complete (incomplete division), means must be taken to remedy the deformity and so prevent injurious pressure upon and irritation of the nerve. When the signs of interference with the functions of the nerve have advanced to the establishment of the reaction of degeneration (Sherren), when at operation tests with the electric excitor (faradic current) do not show the presence of living axons, the damaged portion of the nerve (scar, neuroma) must be removed, and the anatomic continuity must be restored.

Among the operative measures employed to cure surgical neuritis of the ulnar nerve at the elbow the earliest was probably simple liberation of the nerve from the pressure in the groove, as practised by Potherat in 1897, but this can in no way permanently relieve the tension to which the nerve is subjected. Recurrence may also be anticipated after the second method, namely, deepening of the ulnar groove, as carried out by
Sengensse in 1898, by Guillemain and Mally, and by Sherren, the last adding to it resection of the neuroma; in this procedure recurrence may take place from the irritated periosteum reproducing bone, or from adhesions arising between the denuded bone and the nerve.

The third method is the one of choice in the majority of cases and consists of freeing the ulnar nerve from its groove and transposing it in front of the internal epicondyle, where its bed is established either between the superficial and deep fascias or beneath the muscles; this method was practised by Roux, Bastianelli, Leclerc, Murphy, Curtis, and others, and is simple and satisfactory. In carrying out this procedure it is the writer's practice to divide the superficial fascia along the inner border of the biceps tendon, dissect it from the deep fascia toward the internal epicondyle, place the transposed ulnar nerve between it and the deep fascia, and then close the incision in the superficial fascia; the advantage of this over the technic in which elevation of the superficial fascia is begun at the internal epicondyle and carried laterally is obvious. By this third method, also, lengthening of the nerve is obtained in case end-to-end suture is necessary; to secure the greatest mobility it is necessary to extend the incision sufficiently far to free the nerve well above and at the point where it pierces the internal intermuscular septum, and when freeing it below from the heads of the flexor carpi ulnaris its branch to this muscle and to the inner heads of the flexor profundus digitorum should be dissected away from the main trunk for a considerable distance upward, as suggested by Naffziger, until this important branch is of sufficient length to take its course through the ulnar groove, even though the main trunk is placed in front of the epicondyle.

The fourth method was employed by Mouchet in cases of tension of the ulnar nerve in fracture of the external condyle with cubitus valgus deformity; here supracondylar cuneiform osteotomy of the humerus was performed to correct the deformity, no effort being made to expose the ulnar nerve, nor even to touch it.
When by any of these methods the undivided ulnar nerve has been released from the tension to which it has been subjected there is often a surprisingly rapid return of function of the nerve, sensation reappearing within the first few days after operation. The motor return is slower, and when the nerve has been severely damaged, complete restoration of function may be delayed a year or more.

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UNUNITED FRACTURE OF RADIUS AND ULNA: INLAY BONE-GRAFTS

Summary: Illustrative Cases; Comments—Satisfactory Results with Albee Technic and Albee Electric Tools; McWilliams' Analysis of 1390 Bone-graftings; Discussion of Murphy's Intramedullary Method; Difficulty of Obtaining Union in Fractures of the Middle or Lower Third of the Radius or Ulna; Applicability of the Intramedullary Graft in Restoring Upper Portion of Humerus.

Case I.—J. P., male, aged twenty-seven, farmer, on October 30, 1920 was attacked by a bull and thrown upon the ground, receiving an injury to the right forearm that turned out to be a simple fracture of lower third of radius and ulna. He was taken to a nearby hospital where, on December 29, 1920, at open operation, the overlapping of the fragments was overcome, and the ends were freshened and held by catgut. Non-union resulted, and the patient was referred to the writer on March 29, 1921—five months after injury.

Physical examination of right forearm revealed in its lower third a deformity with convexity at ulnar border and flail-like motion at a point about 2 inches above wrist-joint. Skiatogram (Fig. 134) showed non-union of both bones with slight angular deformity: there was rotation of the proximal end of the radius, and callus was more evident in relation with the ulna fragment ends.

Operation (April 1, 1921).—Ether. Through the usual incisions the fragment ends were exposed and found the seat of pseudarthrosis; they were trimmed and squared, and the rotation of the upper fragment of the radius was corrected in relationship with the lower. Using the Albee technic bone-grafts were obtained from the right tibia, inserted into gutters made in the fragments, and retained with kangaroo tendons encircling host and graft. Care was taken to give the grafts plenty of length, the distal ends were driven well into the cancellous tissue of the distal fragments, and bone crumbs were
distributed about the ends of the fracture fragments to act as individual foci of osteogenesis. The deep tissues were approximated with catgut, and the skin incisions were closed with the same material. Dry gauze dressing. Plaster-of-Paris support. Before the patient came out of ether the fingers were passively hyperflexed on account of the slight stiffness in the interphalangeal joints that was noted at the time of physical examination.

Postoperative Notes.—April 4th, three days after operation, non-bacterial edema of fingers and hand up to lower margin of plaster case, eased by nicking latter.

Fig. 134.—Preoperative skiagram showing ununited fracture of lower third of radius and ulna.

April 8th, one week after operation, wound reaction apparently sterile.

May 16th, six weeks and four days after operation, plaster-of-Paris case and dressing removed; there is firm union between the fragments. Light yucca board dressing applied and skiagram taken. Skiagram (Fig. 135) reveals union with fragments in normal anatomic relationship. The pressure of the encircling kangaroo tendons has caused atrophy nicks most pronounced at interosseous border of radius fragments, showing the presence in the bones of a rarefying reaction. Massage requested.

June 14th, two and one-half months after operation, union
firm. Rotation of radius good. Limitation of motion in wrist-joint, which was present previous to operation, still exists, but, together with finger movements, is disappearing with massage and use. Skin still slightly glossy and edematous.

June 28th, three months after operation, motions still steadily increasing in range. Swelling gradually subsiding.

July 28th, four months after operation, patient writes: "I am working now and am getting along very nicely."

November 1st, seven months after operation, patient is steadily working at his occupation as a farmer with gradually increasing strength in right forearm and hand.

Fig. 135.—Postoperative skiagram showing union obtained by inlay bone-grafts.

Case II.—T. M., male, aged twenty-eight, structural iron worker, on March 1, 1921 fell 20 feet, landing on first floor with right forearm behind him, receiving an injury that turned out to be a simple fracture of radius and ulna below the middle. He was taken to a nearby hospital, where the fracture was set and splinted. Union not resulting after two months, an operation was performed, the nature of which is not known, but probably consisted in catgut “wiring” of the fragments. Non-union of the radius resulted, and the patient was referred to me on July 27, 1921—almost five months after the injury.

Physical examination of right forearm reveals, about a hand-breadth above the wrist-joint, a concavity of the radial border,
solution of continuity and preternatural mobility of the radius, and non-rotation of upper with lower fragment of latter. The ulna just above this level presents a slight convexity toward the inner border, but union is firm and position satisfactory. Skiagram (Fig. 136) shows transverse fracture of ulna 4¼ inches above its styloid process, united in good position with strong ensheathing callus still evident, and transverse fracture of the radius 3¼ inches above its carpal articular surface, with non-union, irregular patches of callus, approximation of rounded upper end of lower fragment toward ulna and probable union with same, and rotation of upper fragment in relation with lower; there is at no place end-to-end contact, the lower end of the upper fragment lies lateral to the upper end of the lower fragment, and there is slight overriding, with stripping of periosteum.

*Operation* (July 28, 1921).—Ether. Through the usual incision the radius fragments were exposed, trimmed, and squared. There was a pseudarthrosis, and the upper end of the lower fragment was firmly united to the ulna. The malrotation of the upper fragment was corrected. A transplant was cut from the right tibia, inserted into grooves made in the fragments, and retained by kangaroo tendons. Bone crumbs distributed about ends of fragments. Deep tissues approximated with catgut;
skin incision closed with same material. Dry gauze dressing. Plaster-of-Paris support.

Postoperative Notes.—July 29th, day after operation. Thumb beginning to swell; distal end of plaster case trimmed away.

August 4th, one week after operation, patient sent home. Skiagram (Fig. 137) reveals good alinement of fragments.

September 13th, seven weeks after operation, small stitch abscess present. Apparent bony union. Yucca boards applied.

October 21st, three months after operation, radius rotates well and through a large arc. Wrist-joint motion limited, but greater than before operation.

December 28th, five months after operation, skiagram reveals firm end-to-end union of radius fragments, but apparent osteoporosis of the graft, the upper portion of which has become sprung from its groove; the graft will be removed, as it forms a bulky projection lateral to the radius, while the purpose for which it was inserted has been accomplished.

In bone-graft work we get our best results with the unmodified Albee technic, using the original method of inlay and the Albee electric tools. McWilliams (Annals of Surgery,
from an analysis of all graftings reported in the literature, together with the results obtained from a questionnaire, has drawn the following conclusions.

From 1390 bone-graftings he found:

1. That there were 82.3 per cent. of successes, with 17.6 per cent. of failures.

2. In the order of successes:
   (a) With bone-pegs, 95.8 per cent. were successful.
   (b) With the osteoperiosteal method (Delageniere), 87.3 per cent. were successful.
   (c) With the end-to-end method (without inlaying), 82.5 per cent. were successful.
   (d) With the inlay method, 80.9 per cent. were successful.
   (e) With the intramedullary method (Murphy), 76.6 per cent. were successful.
   (f) With the combined intramedullary (at one end) and the inlay (at the other), 60 per cent. were successful.

3. The presence or absence of periosteum seems to exert no influence on the success of bone-grafts.

4. Suppuration occurred in 121 cases, or 8 per cent.; 32 per cent. of these succeeded.

5. The conclusion is reached that the most successful method of bone-grafting is by the osteoperiosteal method, which is as applicable to large as to small bony defects.

6. The cause of many non-successes is due to defective immobilization, or to undue curtailment of its duration. From four to six months' immobilization is ordinarily required for complete success.

7. There is sufficient evidence to prove that the most effectual treatment of non-union of fractures is bone-grafting.

8. The causes of failures of bone-graftings, summarized, are:
   (a) Improper method of grafting.
   (b) Suppuration.
   (c) Insufficient immobilization, or over too short a period of time.
   (d) Fracture and dislocation of the grafts.
   (e) Atrophy of the ends of the bone to be grafted.
9. The intramedullary method of grafting should be discarded.

10. Despite a few opinions to the contrary, bone-graftings should not be performed in infected fields.

Murphy was a strong advocate of the intramedullary method of bone-grafting; a diagram of his method will be found in Murphy's Clinics, August, 1916, 674, Fig. 137. He writes: "Failures of union in fractures of the middle or lower third of the radius or ulna are the most difficult in which to obtain union following a transplant, excepting aplastic conditions of the lower end of the tibia and fibula." In conjunction with McWilliams' statistics showing the smaller percentage of successes obtained by the intramedullary method, it is our opinion that this method is based upon false anatomic premises, for the medullary cavity is reamed out, and the important endosteal cells are destroyed, while the graft is not inserted so that corresponding layers contact (periosteum to periosteum, etc.), as Albee suggests. Particularly in the case of the radius and ulna, the bones are small, the intramedullary grafts cannot be much larger than a matchstick, and it is almost impossible to insert them in one bone after the other. In the case of restoration of the upper portion of the humerus after loss by resection, etc., the intramedullary graft has been found by us to act admirably.
COMMINUTED FRACTURE OF HEAD OF RADIUS: RE-
SECTION OF HEAD

Summary: Illustrative Case; Operation; Comments—Observations Based
Upon a Study of These Fractures; "Wincing" Tenderness Often the
Only Sign of Fracture of Head or Neck; Resection of Head Should Be
More Frequently Performed in These Cases; Technic of Avoiding In-
stability of Cervical Stump.

R. G., MALE, aged twenty-two, grocery clerk, on July 17,
1921 fell off a wagon on to the street, striking upon right elbow.
He went to a hospital, where he was treated by immobilization
and later massage and motion for a period of three and one-
half months. The improvement not being satisfactory, he was
referred to the writer by an interested party on November 3,
1921.

Physical examination of the right elbow revealed 50 per
cent. restriction of rotation of radius, tenderness over head of
latter, and incomplete extension. The grip was weak; motion
at wrist-joint normal. Skiagrams (Figs. 138, 139) showed com-
minuted fracture of radius head with anterior displacement
of fragments; in the profile view there is a suggestion of bony
filling-in of the olecranon fossa, against which the olecranon
tip impinges, accounting for the incomplete extension. In
view of these findings we felt that the restricted rotation of the
radius was due to mechanical block from impinging of a deformed
portion of the circumference of the head against the lower edge
of the lesser sigmoid fossa, and that the obvious procedure,
therefore, was removal of this mechanical block by resecting
the head, removing at the same time the detached and dis-
placed fragments.

Operation (November 4, 1921).—Ether. Longitudinal in-
cision 2 inches long over radiohumeral joint, dividing skin,
subcutaneous tissues, and capsule of joint; synovia escaped
freely. Orbicular ligament pushed downward until neck of
radius was exposed. Gigli saw passed around neck of radius close to head, and bone divided at this level. Examination of the head showed that the larger and denser of the two anteriorly displaced fragments was adherent to the head and came away with it; search was therefore made for the smaller and less dense fragment, which was found in front of the operative field, lying against and slightly embedded in the inner layer of the anterior capsule of the elbow-joint. The fragment was removed and the wound was closed, the subcutaneous tissues being approximated with catgut and the skin edges with silkworm-

Fig. 138.—Comminuted fracture of radius head: Front view.
gut. No drainage. Dry gauze dressing. No splint. Elbow held in sling.

Postoperative Notes.—November 12th, eight days after operation, stitches removed—healing *per primam*. Patient advised to practice the "screw-driver" movements.

December 28th, two months after operation, rotation of radius practically restored to the normal range. It is not thought that the limitation of extension from olecranon fossa block will interfere with the patient's occupation as a grocery clerk.

![Comminuted fracture of radius head: Profile view.](image)

Fig. 139.—Comminuted fracture of radius head: Profile view.

The specimen of the radius head when examined after operation showed a vertical fracture, in addition to the two fragments of comminution. The circumference of the head instead of being smooth, was irregular, so that it could not articulate properly with the lesser sigmoid fossa.

In a study of 299 fractures made by us in 1913 (International Clinics, Vol. II, 23d Series) there were 54 fractures of the radius alone, of which 5 involved the upper end. Of these 5, 2 were of the head and 3 of the neck, of which one showed, in addition, a small chip separated from the anterior lip of the head. One
patient had no swelling, no ecchymosis, and no separation of the head from the shaft—merely pain on the screw-driver movement and definite localized tenderness over the neck. Since that time we have seen many cases with just as few signs, and many have been diagnosed clinically by the localized “wincing” tenderness alone—a sign that always justifies the taking of a skiagram. We have also found when the head or neck of the radius has been fractured by direct violence that the external epicondyle is apt to be chipped by the same trauma.

We believe that in cases of fracture with prolonged disability the head of the radius should always be resected to remove the mechanical interference with rotation of the shaft. Postoperative instability of the cervical stump can be prevented by preserving the orbicular ligament by pushing it distally, and then removing the head at its junction with the neck, the result being a long cervical stump gripped by the orbicular ligament.
UNUNITED FRACTURE OF TRANSVERSE PROCESS OF FIFTH LUMBAR VERTEBRA WITH MASSIVE CALLUS: ABLATION OF DISTAL FRAGMENT WITH CALLUS

Summary: History of Case; Operation; Comments—Importance of Routine x-Ray Pictures of Back Injuries; Advantages of the Buckey Diaphragm; Citation of a Somewhat Similar Case.

W. M., male, aged fifty-six, laborer, on May 21, 1921 was jammed between a ladder and paddle of tub on which he was working, receiving an injury to the back. About four months later the patient was referred by the Referee of the Compensation Board to Dr. A. S. Ross, Surgeon of the New Jersey Rehabilitation Commission, Camden Clinic, for examination, from whose report I quote: "I find that this man is very tender over the fourth and fifth lumbar vertebrae. It hurts him to stoop and then resume the erect posture. Skiagram (Fig. 140) shows that the transverse process of the right fifth lumbar vertebra has been injured, and callus has been thrown out to such an extent that apparently it has united with the crest of the ilium. This picture doubtless explains the patient's pain on motion. I would advise, from the x-ray, that an incision be made and this mass of callus removed." There was also pressure neuritis of the fifth lumbar nerve, the patient complaining of shooting pains along its path, which kept him awake at night. Through Dr. Ross the patient was referred by his employer to the writer for operation.

Operation (October 22, 1921).—Ether. Inverted goblet-shaped incision over right iliac crest, the cup of the goblet following the curve of the crest, and the stem passing upward a short distance along the outer border of the erector spinae. Skin, superficial and lumbar fasciae divided; erector spinae reflected from ilium and sacro-iliac groove and elevated toward midline until the callus mass was encountered. This callus
mass was freed from the surrounding soft tissues, chiseled away from the ilium, and removed together with the distal fragment of the fractured transverse process. As soon as the mass was chiseled from the ilium it was found to be loose, the absence of a proximal bony attachment proving the non-union of the fracture. The erector spinae was now replaced, and the lumbar fascia was sutured over it with catgut. Superficial fascia closed with catgut, and skin edges apposed with silkworm-gut. No drainage. Dry gauze dressing.

Postoperative Notes.—October 23d, the day after operation, patient states that when he came out of ether he noticed the shooting pains were gone.

October 29th, one week after operation, stitches removed. Wound healed per primam. Patient feels much relieved.

December 16th, eight weeks after operation, the patient
states that since the operation he has been able to sleep soundly at night, and that he no longer has the shooting nerve pains. There is still a little stiffness lingering in the back, but the patient feels able to return to his laboring work.

Doctor Ross, through whose hands thousands of compensation cases pass annually, tells me that within the last year he has sifted out about 15 cases of fracture of one of the processes of a vertebra, and that most of these cases had previously been treated for "lumbago." He uses the x-ray routinely in all back complaints and finds the Buckey diaphragm of the greatest aid in clearly defining a lesion of this type. (See also Potter, Amer. Jour. Roentgenol., February, 1921, 8, 61.)

A case in some respects similar to the above was reported by Magnuson and Coulter (International Clinics, Vol. II, Series 30) under the title Lower Lumbar Injury with Callus Formation. This patient, through a fall from a height, "severely traumatized the articular facets in the lower lumbar spine, at the same time tearing loose the attachments of muscles on the lamina, and also received an injury to fibers of the lumbo-sacral ligaments which tore loose periosteum which has since formed the callus that is apparent in the x-ray." This skiagram shows a "narrow low-lying fifth lumbar vertebra with ragged callus formation the size of a hazelnut to right of body and between fourth and fifth vertebrae; also a long lateral process on the same (right) side, which impinges on the ilium." The authors state: "It is a matter of common knowledge that these long processes in the lower lumbar region may be present for years without any symptoms, but that a sudden strain or wrench will develop symptoms which grow progressively worse. This seems to be analogous to the pathology of cervical rib. . . . The long fifth lumbar processes carried to a greater degree constitute the sacralization of the fifth lumbar, which is not unusual, and which is more easily injured than an upstanding fifth lumbar."
UNILATERAL RENAL TUBERCULOSIS ASSOCIATED WITH STRicture OF URETER, HYDRO-URETER, AND HYDRONEPHROSIS

The patient whom I shall bring before you today presents the following history:

Miss E. H., aged twenty-four. Previous medical history: In 1913 an appendectomy was performed, and in 1917 she had a second operation, at which she was told the stump of the appendix was removed. No other illness.

Present Illness.—Her chief complaints are marked frequency of urination and pain in the right loin and lower right abdomen. For ten years or more she has had pain in the right loin and right lower abdomen, at times of a dull aching character, at others very sharp and shooting. The operations above referred to were performed with the idea that the appendix was the cause of this pain, but on neither occasion did she experience relief from the operation. With the sharper attacks of pain she has noticed a radiation toward the bladder, associated with urgent desire to void urine, and she feels a sensation of straining, but is not always able to void. For a number of years she has had marked frequency and urgency of urination, at times finding it necessary to void every ten or twenty minutes. These urinary disturbances are present both by day and by night. At no time has she noticed blood in the urine. She has considerable epigastric discomfort after meals, with a sense of heaviness and nausea, and occasionally she vomits thin, watery material. The bowels have always been somewhat constipated. There has been no loss in weight and her general
health seems to have remained about the same. She has experienced no difficulty in menstruation, with the exception of an occasional painful period.

In looking over this history, therefore, we find the chief symptoms requiring our interpretation are, first, frequent and painful urination, and, second, pain in the right loin and right lower abdomen. These symptoms have been present for over ten years, antedating her operations for appendicitis, and were in no way affected by these operations.

*Physical Examination.*—Temperature, pulse, and respirations normal. The heart and lungs show no evidence of disease. On abdominal examination there is tenderness in the region of the right kidney, but no enlargement of the kidney can be detected. There is also tenderness along the course of the ureter of the right side.

The left kidney is not palpable and we can make out no abnormal findings in other abdominal organs. Pelvic examination is likewise negative.

Urinalysis: Cloudy, specific gravity 1018; acid, albumin very faint cloud, sugar negative.

Microscopic examination shows 2 to 4 red blood-cells and from 85 to 100 white blood-cells to the field.

On cystoscopic examination the bladder capacity is reduced to 4 ounces. The base of the bladder and both ureteral orifices are normal, showing no evidence of any infection. The top of the bladder shows edema, and in the center of this edema to the left of the median line is an area of intense congestion in the center of which are two small superficial ulcers, each about the size of a pinhead. Just to the right of the median line about 2 cm. further back than the ulcers above referred to is an area of scar formation on the apex of which an ulcer of considerable size and two smaller ulcers are visible. The left ureter was catheterized and the catheter met no obstruction in its passage to the kidney. The flow of urine from the catheter was normal. On attempt to catheterize the right ureter an impassable obstruction was encountered 6 cm. from the ureteral orifice, and even the smallest catheter could not be entered beyond this point.
Urine flowed through the catheter, however, and appeared quite turbid. Indigocarmin appeared from the left ureteral orifice in copious quantities and as a dark blue stream in less than eight minutes. On the right side there was no appearance of the dye until fourteen minutes, and then it came as a faintly blue stream with no increase in the intensity of color at the end of twenty minutes. At a second cystoscopic examination the same obstruction was encountered at the lower end of the right ureter. In the hope that we might be able to demonstrate a hydro-ureter above the stricture, a 25 per cent. solution of sodium bromid was injected into the right ureter and a pyelogram made. The plates, however, showed that none of the solution passed above the site of obstruction, nor was a calculus shadow visible in either kidney or ureter.

Examination of the urine collected from the right ureter showed a large amount of pus and sterile culture; tubercle bacilli or other bacteria were not demonstrable by smears.

![Cystoscopic picture showing normal ureteral orifices and bladder base (A). (B) The inflammatory area containing five small ulcers, situated at vertex of bladder.](image)
Cultures of urine taken from the bladder were likewise sterile and inoculated guinea-pigs showed no evidence of tuberculosis.

Examination of the blood showed a moderate leukocytosis, namely, 10,500 white blood-cells; Wassermann reaction negative.

**Summary of Objective Findings.**—1. Sterile pyuria in specimens obtained from both the bladder and right ureter. This is strongly indicative of a tuberculous infection, but not necessarily pathognomonic. Failure to demonstrate the tubercle bacillus by smear does not mean that such an infection is not present, for in our experience positive findings have been reported in only about 60 per cent. of cases proved tuberculous by operation. We have found that guinea-pig inoculations give positive findings in between 75 and 80 per cent. of cases of renal tuberculosis. But here again a negative test does not rule out the presence of the lesion. Repeated examinations of smears and guinea-pig inoculations will often give positive findings when the first examinations have been negative.

2. Examination of the urine collected from the left kidney shows its anatomic integrity. The early and free elimination of indigocarmin indicates its normal functional activity, and the frequent contractions of the ureter with the ejection of large streams of urine warrant the conclusion that it has undergone a compensatory hypertrophy. The delay as well as the diminished output of the dye and the demonstration of pus-cells in the urine from the right kidney show it to be the seat of an infection which has greatly impaired its function.

3. Stricture of the right ureter. At each of our examinations an impassable obstruction has been met 6 cm. from the ureteral orifice, but on leaving the catheter in situ urine could be collected, showing the obstruction to be incomplete. A negative x-ray makes the presence of a calculus unlikely, although in this position a calculus may easily escape detection. Failure of the sodium bromid solution to pass above the point of obstruction indicates an organic lesion and not merely the engagement of the catheter tip in a fold of mucosa or against the wall of the ureter which has abruptly changed its direction. We have encountered such apparent obstructions in several instances,
especially in the presence of a cystocele, and one must bear these possibilities in mind before concluding that a true obstruction is present.

4. The right ureteral orifice and the surrounding mucosa present a normal appearance, showing no evidences of infection, and urine can be seen to appear with each ureteral contraction, confirming the evidence obtained from the ureteral catheter that the obstruction is not a complete one. In long-standing renal infections the ureteral orifice of the diseased side commonly shows such changes as edema, redness, or ulceration. This applies especially to tuberculous infection of the kidney and quite characteristic changes are practically always present in cases of long standing unless we have to deal with the so-called closed lesion when the orifice and bladder may be normal. These facts, together with the apparent duration of the disease, certainly point against a tuberculous infection as being responsible for the lesions in this case.

5. An ulcerative cystitis affecting only the top of the bladder. In women, a primary cystitis is extremely rare and no case should be considered as such until definitely determined by appropriate examinations. It usually arises secondarily, most frequently from renal infection, but may take its origin from a neighboring infection in the pelvic organs. This case typifies the general rule in that the bladder changes are incident to a disease in the kidney. Rarely we encounter cases of ulcerative cystitis which are apparently primary in the bladder, and further on I shall discuss this lesion at length because of its interest and importance. Based upon these deductions our preoperative diagnosis was as follows:

1. Incomplete inflammatory stricture of the right ureter, probably non-tuberculous.

2. Infection of the right kidney with considerable destruction of the renal parenchyma, the type of infection not determined.

3. Anatomically and functionally normal left kidney.

4. Ulcerative cystitis simulating the elusive ulcer of Hunner in its cystoscopic picture.
Operation.—In order to definitely determine the character of the stricture and at the same time the condition of the ureter above it, a small median incision was made. On palpation of the lower end of the ureter a localized thickening was found situated at a point determined by our examinations and about 1½ cm. in diameter; it was distinctly fusiform in shape, tapering off toward the bladder. Below this the ureter was normal. Above the stricture the ureter was greatly dilated and thinned out, its caliber being almost that of the small intestine. On following up the ureter this dilatation extended to the kidney
which was the seat of a large hydronephrosis. The pelvic organs were normal. Through a lumbar incision the enlarged and densely adherent kidney was exposed and removed, together with about 7 inches of the ureter. Because of the density of the obstructed area the possibility of a small calculus was thought of, and a wax-tipped bougie was passed, but this showed no scratches. The stricture was dilated so that a No. 13 catheter was easily passed into the bladder. The wound was closed without drainage. Examination of the specimen showed a large hydronephrosis with marked dilatation of the calyces, although a considerable amount of normal appearing renal parenchyma was still present; situated at the upper pole of the kidney and apparently not communicating with the pelvis was an abscess the cavity of which measured 4 cm. in diameter and was evidently tuberculous in origin. The walls of the renal pelvis and ureter were very thin, the lining was perfectly smooth, showing no evidences of a tuberculous infection. Microscopic examination of these tissues confirms these findings. We must explain these findings, therefore, upon an unusual manifestation of a primary renal tuberculosis with secondary stricture formation within the ureter which led to an enormous dilatation of the ureter and renal pelvis. It is not a far stretch of the imagination, however, to place another conception upon the development of these lesions, namely, that the ureteral stricture with the secondary changes in the ureter and kidney was a primary lesion and that because of the diminished resistance on the part of the kidney a tuberculous infection had been secondarily engrafted upon it. Such a conception is borne out, first, by the cystoscopic picture; second, by the pathology found within the ureter; third, the duration of the disease. The question of ureteral strictures has been receiving considerable attention of late, due largely to Hunner, who has reported a very large series of cases. We have been very much interested in this question, but in spite of every effort to detect them we have not been able to demonstrate their presence by any means so frequently as Dr. Hunner would lead us to believe they may be found. According to him, these lesions may be either single
or multiple and are usually situated in the lower portion of the ureter. Such lesions are not tuberculous in origin, but in Hunner's opinion arise secondarily from some focus of infection, such as teeth, tonsil, sinuses, etc., and start as an infection of the peri-ureteral lymphatics. According to him the symptoms are quite characteristic both from the subjective and objective standpoints and treatment by means of dilatation has been satisfactory in its results. While I cannot concur with Hunner in his opinion regarding the frequency of ureteral strictures, I do feel that he has called our attention to a lesion which should always be borne in mind in cases of obscure lateral abdominal pain, and that every effort should be made to prove the integrity of the ureter in explanation of these symptoms.

The findings in this case likewise show the great importance of careful study in arriving at conclusions concerning abdominal pain. Each year we have admitted to the clinic a number of cases who have had operations of various kinds, but especially appendectomy for right-sided pain, and in whom on more careful examination we have been able to discover some lesion in the urinary tract to explain the symptoms. I cannot impress upon you too strongly the importance of a careful cystoscopic examination in all patients presenting vesical symptoms. We make it a rule to cystoscope every patient with vesical symptoms irrespective of the nature of the pelvic pathology which might well explain these symptoms, and it is rather surprising with what frequency we find lesions of the bladder or kidneys in no way related to the pelvic pathology, which are responsible for the patient's urinary complaints. Of course in most cases, such as prolapsus, tumor formation, pelvic inflammatory disease, etc., the vesical symptoms are directly due to the pelvic lesion, but their demonstration is a study of the greatest interest, and one will occasionally find an associated lesion in the urinary system that will render the gynecologic lesion of secondary importance.

A cystoscopic examination in women is easily performed, can be quickly done, and the value of such a procedure can only be appreciated by one who has pursued this plan in a large series of cases.
As previously stated, a primary cystitis in women is to be looked upon as a rare occurrence. In the case which we have just discussed the picture presented closely simulated that of the type described by Hunner as elusive ulcers of the bladder, with the very important exception that there was an associated renal lesion, while in the elusive ulcer the kidneys are always normal and the bladder lesion exists independently of any other demonstrable pathology so far as the pelvis and urinary tracts are concerned. Since Hunner first described this lesion in 1914 we have been very much interested in the subject, and to date have had 17 such cases under our observation.

While this type of lesion is by no means common, it occurs with sufficient frequency to warrant a careful examination in every case presenting marked bladder symptoms. We feel confident that the condition is often overlooked not only because of the failure to make a careful inspection of every portion of the bladder, but also to lack of proper interpretation of the findings, which in the early cases may show very little variation from the normal so far as gross changes are concerned.

Because of the difficulty often experienced in locating these ulcers Hunner has described them under the name of elusive ulcer, a nomenclature, of course, which in no way describes the pathology with which we are dealing. Grossly, the lesion is characterized by more or less thickening of the entire bladder wall, with edema and minute superficial ulceration of the mucosa. The disease is practically always limited to the vertex of the bladder, although rarely it may extend downward and laterally on one or both sides to within a few centimeters of the trigone. The disease is never patchy in distribution, but is limited to one section of the bladder. The inflammation may extend beyond the bladder confines, involving the paravesical tissues and adjacent peritoneum. The mucosa is thickened and edematous and the diseased area stands out in sharp contrast to the normal bladder. The ulcers may be single or multiple and in our series the latter has occurred more commonly. The areas of ulceration are always minute and very superficial. The lightest touch of the ulcer area produces severe pain and is always followed immediately by bleeding.
Microscopically the picture is that of an inflammation involving the entire bladder wall and perivesical tissues, with increase in the amount of connective tissue, round-call infiltration, and rather extensive edema. These inflammatory changes are also evident in many instances in the tissues surrounding the bladder.

**Symptoms.**—An analysis of the symptoms presented by our patients gives one common to all, namely, bladder pain with intense urgency and frequency of urination. The pain occurs during, more especially after, urination, and the bladder never feels empty. Often the dysuria is exaggerated at night. Not infrequently the patient complains of pain in the lower abdomen, usually just above the symphysis on one or both sides of the median line, and this is doubtless due to the extension of the inflammation to the peritoneum. For this reason the majority of our patients have had one or more operations performed upon the uterus or the adnexa for the relief of their bladder symptoms. The pain may be localized to the bladder and lower abdomen or may be referred, the points of reference being to the perineum, the vagina, or one or both thighs. The severity of symptoms varies in different patients, of course, and one will often find more or less of a periodicity of exacerbation and remission lasting several weeks and entirely independent of treatment. Often the bladder symptoms are exaggerated for a few days prior to and during the menstrual flow. The symptomatology is usually one of long standing. In our series the duration varied from six months to fourteen years, the average being about four years. The characteristic picture of the urine in such cases is grossly normal, with the presence of a few leukocytes and red blood-cells on microscopic examination. In 2 of our patients the history of free hematuria was given. In most cases the urine is sterile.

**Etiology.**—We are at a loss thus far to explain the cause of this condition, but believe with Hunner that it is due to an infection, probably hematogenous in origin. The tubercle bacillus is certainly not responsible, for in all of our sections, which have been very carefully studied, there has never been
any indication of a tubercle infection, nor have we been able to demonstrate by various methods of examination tubercle bacilli in the urine. Likewise the cystoscopic picture which these cases present gives nothing suggesting tuberculosis. We have made it a special point to examine very carefully for foci of infection in all cases presenting these symptoms, and have been unable to convince ourselves that the teeth, the tonsils, or sinuses can be held responsible.

**Treatment.**—We have tried various methods of intravesical applications in the treatment of these cases, and have come to the conclusion that no form of treatment will suffice except complete excision of the inflammatory area. As previously stated, one will meet occasionally remissions of symptoms which one might ascribe to certain types of treatment, but such remissions occur in spite of rather than on account of treatment, and the severity of the symptoms will recur sooner or later. Therefore, when such a case presents herself we now advise excision rather than temporizing with other forms of treatment which we feel confident will prove a failure. Briefly, the operative treatment consists in complete excision of the diseased area of the bladder wall and the limits of excision are determined not by the ulcers, but by the area of edema. Anything short of this will result in failure. The amount of bladder wall removed necessarily varies with the extent of the lesion; in some of our cases the capacity of the bladder has been reduced by operation to 3 ounces, but it is remarkable how quickly the bladder expands, for within two or three months after operation its content is practically normal.

**Results of Operation.**—Fourteen of our cases have been operated upon and the results following excision have been excellent. In 2 cases there has been a recurrence of the ulceration. In one of these the patient was perfectly well for eight months, when she contracted influenza at the time of the great epidemic. During this attack the bladder symptoms recurred and cystoscopic examination subsequently revealed two small ulcers in the top of the bladder. A second excision was performed and this patient is now well a year and a half after her
second operation. The second patient was free from symptoms for two years. She has been seen only recently on account of the recurrence of her symptoms, and we find a small ulcer again at the top of the bladder which will doubtless require excision.

We are of the opinion that the so-called Hunner ulcer is a distinct pathologic entity with a definite symptomatology, in which the only hope of cure lies in the complete excision of the inflammatory area. The results are most satisfactory in the great majority of instances, and will bring relief to patients whose suffering has been intense and extending often over a period of many years.
CONTRIBUTION BY DRS. G. M. DORRANCE AND J. W. BRANSFIELD

PHILADELPHIA

BURNS, WITH SPECIAL REFERENCE TO THE ACETIC ACID TREATMENT

A study of the surgical literature of superficial burns and their treatment will convince any reader that while much has been written, we are still more or less ignorant of the causes that produce the pathology and altered physiologic functions.

The general and local treatments suggested, by their very diversity of numbers, show that surgeons are dissatisfied with their results, and are willing to try, for a time, any new method suggested by any clinic or well-known clinician.

Recently, on visiting several institutions where a large number of burns were admitted yearly, we were struck by the fact that the care of these cases was largely entrusted to the house staff and the pupil nurses.

Any treatment to possess value must be employed for a definite reason, and a knowledge of the accepted facts in the causes of the altered physiologic changes and pathology of burns is essential.

All burns which involve one-tenth of the body surface, regardless of the degree, must be looked upon as serious; burns involving one-third of the body surface are most serious and those involving two-thirds of the body surface are nearly always fatal.

Children stand burns poorly; women are more serious risks than men; the Caucasians have more marked general symptoms than the negro. These facts suggest that the type of skin texture is a potent factor. The location of the burn is important. Burns about the face, particularly around the mouth or involving the distribution of the fifth nerve, burns
involving the genitalia, and burns on the flexor surface are more serious than in other locations.

The depth of the burn does not appear to be nearly as important as the extent of the surface involved. We have seen one extremity, charred to the bone, recover without exhibiting any of the shock or general symptoms seen in a superficial extensive burn of the back.

Eliminating the cases of burns which exhibit emotional symptoms caused by fear or anxiety, a patient admitted to a hospital with a moderately extensive superficial burn shows evidence of shock—the pulse is rapid, the skin and mucous membrane are dry, and the temperature is subnormal. In some cases the patient is suffering horribly, while in others a sort of apathy exists.

Blood-pressure shows the systolic pressure to be reduced. The average readings in our cases varied from 110 to 90.

The urine is scanty, highly colored, of high specific gravity, and frequently the first specimen shows a faint trace of albumin, but no acetone or diacetic acid.

The blood-picture in the first three or four hours shows a marked increase in both the red blood-cells and the leukocytes; variation of the erythrocytic count from 5,000,000 to 16,000,000 occurs; the hemoglobin varies from 95 to 120, while the white blood-cells show a count in some cases as high as 80,000, with the polymorphonuclears disproportionately increased. Blood-smears reveal the presence of numerous platelets and foreign bodies and the erythrocytes show irregularities. The coagulation time is decreased as low as two minutes in some cases with the Dorrance-Bransfield coagulometer. We have been able by the blood-picture to make a prognosis. In cases where the red blood-cells are over 10,000,000 and the leukocytes over 50,000, death is imminent.

Unless death occurs in the first twenty-four hours these patients show improvement. The blood-pressure returns to normal, the pulse-rate drops, the temperature becomes normal or is slightly elevated, and the blood-picture returns to normal about the third day.
The urine on the second day, as a rule, shows an increase in the albumin, but rarely diacetic acid or acetone occurs. These later substances occur on the third day.

The causes of these constitutional symptoms have received many explanations. Those which have been looked upon with favor in the past decade are, (a) toxemia, (b) thrombosis, and (c) vasomotor changes.

Dr. Charles R. Barden, after performing 5 autopsies on cases dying within eight hours after injury, concluded that poisonous substance was present in the plasma of the blood. These poisonous substances are some sort of toxalbumins, the nature of which and their mode of origin is as yet unknown.

Dr. Salvioli, Markusfeld, and Steinhouse performed a most interesting and instructive experiment on rabbits. They found that if the ear of the rabbit is burned, the blood-supply having been previously cut off, little constitutional disturbance resulted. On the other hand, if the blood-supply is left intact and the nerves are severed, severe constitutional disturbance results.

Clinically the fact that the toxemia in the circulation plays an important part in the production of shock was demonstrated during the war. It was observed that patients admitted to the advance hospitals with severely crushed limbs on which a tourniquet had been applied frequently went into a state of shock when the constriction was removed. Cannon subsequently demonstrated this fact on dogs; he crushed the muscles and then applied a tourniquet. Shock was delayed until the tourniquet was removed. In cases where no tourniquet was used shock occurred immediately after the injury.

The toxalbumins appear to be formed immediately after the burn or injury. One might describe their effect as a biochemical explosion.

We attribute the increase in the blood-cells to a vasomotor paralysis with stagnations of the blood in the capillaries; there is likewise a loss of the blood plasma, with a thickening, as it were, of the blood. The same explanation accounts for the decrease in the coagulation time.

The autopsy table in the early cases reveals a pathology
which we attribute largely to the effect of the toxalbumins in the blood.

The most important finding in these early cases, according to Barden, is a focal degeneration in the lymphatic tissues and in the liver. A mild parenchymatous degeneration of the kidneys can likewise be demonstrated.

To anticipate a little, we will describe here the findings which occur in later autopsies, i.e., those cases which lived more than two days from the time of their burn. In these cases we find the presence of minute thrombi throughout the viscera, advanced parenchymatous nephritis, enlarged spleen, with areas of necrosis, cloudy swelling of the liver, degeneration of the heart muscle, duodenitis, and even ulcer formation. These advanced pathologic findings are due to the absorption of more toxins from the burned area.

To return to the study of our cases: the improvement noted after the first day in mild cases continues, dependent upon the treatment employed, but in the more severe cases we find on the second or third day an increase in temperature, pulse, and respiration, a marked restlessness, with alternating apathy. These symptoms are caused by a secondary invasion of more toxic material from the burned area.

Parts of the burn show a scab-like formation, and under this as well as under the dried burned skin a coagulation necrosis occurs and produces the symptoms enumerated and the pathology described above.

The urine in the case will now show an increased amount of albumin and acetone will appear in large amounts. A blood count taken now will show a beginning anemia which in the severe cases will go on to grave secondary anemia. Complications of tetanus, assuming no antitoxin was given, and scarlet fever may occur. If the patient survives this stage, the slough will disappear and a granulating surface is exposed. Following this healing by granulation cicatrical tissue is formed, and the resulting contracture may produce another complicating factor.

It has been our experience that burns caused by fluids, pro-
Acetic acid treatment of burns

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Ducing the so-called scalds, are more serious (area for area) than other types of burns.

Treatment.—Basing our treatment on the physiologic and pathologic changes caused by burns, we feel that we are at present obtaining better results with burns than we did in the past.

Our course of treatment is given in outline form to cover the main issues in moderately severe cases with some reference to changes indicated in the most severe types.

As soon as the patient is received into the hospital, if in pain, a hypodermic injection of morphin and atropin is given, despite the oft-repeated precautionary advice of the text-book against locking up the kidneys with opimn. We know that with our forced fluid intake we do not get kidney suppression; at least, we do not feel that morphin is contraindicated. The atropin is given to counteract the paralysis of the vasomotor system; 1500 units of antitetanic serum is given at this time.

The average patient is in shock; the temperature is subnormal, therefore heat must be applied. If the shock is marked, we put the patient in bed without even undressing him, cover him with heated blankets, and use the electric light cradle, without making any effort to give local treatment.

When the shock has abated the patient is immersed in a hot saline bath; the clothing is cut away under water so as to float the inner clothing off with as little effort as possible. The temperature of the water should be maintained at 110° F.

The first dressing consists of 1/2 of 1 per cent. sterile acetic acid. Gauze is not used, but sterilized turkish toweling, which retains the heat and moisture. The dressings are kept saturated at all times. As soon as the patient is placed in bed after the bath and applications of the dressings, 1000 c.c. of salt or glucose solution is given intravenously; in mild cases hypodermoclysis may be substituted. This is repeated every eight hours if necessary. If the patient’s temperature is below 98° F., a cradle fitted up with electric-light bulbs is placed over the bed and covered with blankets. A special nurse for the first three days is essential in the proper treatment of these cases.
Water must be given at frequent intervals, and, if possible, a continuous Murphy drip should be instituted. If the location of the burn or other circumstances prevents this, small enemas of tap-water should be employed. The keynote of this second step in the treatment is the forced intake of fluids, the purpose being to dilate the toxins in the blood and to stimulate their excretion. The baths are given twice daily after the first twenty-four hours. On the second day we begin giving liquid petrolatum at frequent intervals, our purpose being to offer a bland soothing substance to the congested lining of the gastrointestinal tract, as well as promoting evacuation of the bowels. We know that on the second or third day we get the secondary absorption of toxins from the burned area, and our efforts are now directed toward preventing this.

John A. Hartwell, of New York, revived the acetic acid treatment. He felt this caused a digestion of all necrotic tissue and established healthy, clean granulations. We agree with him, but the acetic acid must come in contact with the necrotic area to accomplish this, hence we devised the scheme of cross-cutting the hardened, tanned, charred skin with a safety razor blade, making the cuts through the entire skin thickness. The cuts are arranged like lattice-work, thus forming squares 2 x 2 cm. This procedure is well shown in the illustration (Fig. 143). Following this procedure we avoid to a large extent the reabsorption of this necrotic tissue; the acetic acid almost eats this material and the bidaily bath washes off the excess.

Acetic acid is a clean, easily obtained material, and we feel it possesses a decided advantage over the picric acid, alumen acetate, carron oil, or any of the ointments. The acetic acid is employed until we have a clear, clean granulating surface. We have been impressed by the fact that we frequently find isolated islands of epithelial tissue under the slough. When the granulating surface covers a large area and skin-grafting is necessary, the granulations must be made sterile. We have found that the best way to render this granulating surface sterile is to give the area a good scrubbing with a fairly stiff brush and warm green soap. An anesthetic is often necessary for this
procedure in order to do it properly. The bleeding is controlled by moist saline compresses for twenty-four hours, and then Dakin's solution or dichloramin-T is applied. No attempt at skin-grafting should be made until you find less than 6 bacteria to the field; the presence of any hemolytic types contraindicates skin-grafting.

We have had more success with the full thickness graft of Wolfe or Krause in these burn cases than with the Thiersch method.

It is necessary before skin-grafting to remove the faint bluish cicatricial edge which is usually found around the margin of the wound. The grafts should be placed closely together and covered with the usual paraffin mesh; over this mesh we apply a tight saline compress. We feel that pressure on the graft is one of the most important factors in obtaining a "take." When the area is small, simple strapping of the granulating surface with strips of adhesive plaster will be sufficient to effect a cure. Occasionally, an area which does not respond to adhesive strapping and for some reason or other skin-grafting cannot be done, may be treated with equal parts of castor oil and balsam.

Fig. 143.—Cross-cutting charred skin to permit escape of toxic material.
of Peru. This can be used for a day or two; then restrapping the area for forty-eight hours, and returning to the balsam treatment for another few days. By alternating the various procedures, or using them in combination, most granulating surfaces will respond.

The question arises that if we are seeking to get rid of the slough, why not remove it surgically or do a débridment on admission or a few days later. Theoretically, this would be ideal, but we are dealing with a sick patient, one who, as a rule, is not in condition to withstand either the shock or the anesthetic. In burns of a limited area of an extremity this method or its modification could be employed, but the danger of removing much normal tissue by a débridment must be considered.

Nature is much more conservative with tissue than we are, and unless delay is dangerous it is better to wait until the slough is outlined by its line of demarcation.

We have used Dakin's solution in some of the milder cases and have had success from the start, but we have not felt it was of value in the extensive burns and scalds outlined above.

The use of proper apparatus to obtain extension and the keeping of adjacent raw surfaces apart, as in burns of the fingers, is understood. We felt that we may err sometimes in starting too early on these procedures.

In a very sick patient we should attempt to offer him at all times the most comfortable posture, even though we may obtain a deformity by doing this.

The early use of cumbersome, painful appliances frequently renders the patient so uncomfortable that we defeat our first purpose by preventing the essential necessary rest and sleep.

If cicatricial deformities result they should be repaired early. We advise the use of the single or double pedicle flaps. The sliding flaps are not to be used for two reasons: (1) they have a poor blood supply, and (2) their vitality has been interfered with because of their adjacency to the burned area.

The use of the single or double pedicle flap permits a complete excision of the cicatricial tissue, thus rendering the possibility of cancer formation less.
Keloids can be prevented by the judicious use of x-ray, and scar tissue in the healed area should have light massage early.

Some of the special types of burns, as sunburn, radium, and x-ray burns require special consideration.

The prophylactic treatment here naturally occupies the first place.

Sunburn can be avoided by the use of acetic acid before exposure to the sun. Apply it liberally over all the parts to be exposed, and permit it to dry on the skin before going out in the sun or water.

Following exposure, continuous wet dressings of \( \frac{1}{2} \) of 1 per cent. acetic acid will, as a rule, prevent the excessive pain. Blistering seldom occurs. The lifeguards obtain their healthy bronzed color by using vinegar.

When the burn has occurred we use continuous wet dressings of acetic acid. Morphin is given if the pain is sufficiently severe to prevent sleep.

When radium and x-ray are used in large dosage over a long period of time burns are likely to occur.

When treating malignancy one must at times disregard this possibility in order to give any help to the patient.

If a dermatitis occurs, dry zinc oxid powder is perhaps the best treatment. If sloughing follows, the slough must be removed and the wound treated by the usual surgical procedures. Because of the frequency with which carcinoma occurs in such type of burns, it is good surgical judgment to completely excise all devitalized cicatricial tissue.

The deformity is corrected by the pedicle flap, using a large pedicle or, if indicated, a double pedicle flap. The flap is selected from an area which has not been exposed to the radium or x-ray.

The experienced surgeon, knowing that flaps will shrink at least one-third of their original size after the pedicle has been cut, is governed by this fact in selecting the area from which the flap is raised.
I wish to show to you this morning a married woman of thirty-two who was referred to me by Dr. C. J. Hoban. When admitted to St. Agnes' Hospital January 24, 1922 she complained of pain in the abdomen "just under the ribs on the right side and also in the back."

Her 4 children are living and well and she has had no miscarriages. She never suffered from typhoid fever or other infectious disease.

For the past six years, at irregular intervals, she has been constipated, has suffered from headache; her abdomen has been distended and occasionally she has been nauseated. Now and then in the epigastrium or right hypochondrium there has been paroxysmal pain radiating to the back of the thorax (both sides). These seizures have lasted from a few minutes to three or four hours. In the last few months these paroxysms have been increasing in frequency, and a particularly violent one on January 22, 1922 caused her to agree to surgical interference. At no time, before or since her admission, has she been jaundiced.

I did not see the patient during an acute attack. When I examined her there was considerable distention of her abdomen and a palpable, tender swelling in the right hypochondrium. Her temperature was 98\(\frac{3}{8}\)° F., her pulse 82, and her respirations 20. Urinalysis was negative. x-Ray negative. Hemoglobin, 70 per cent.; erythrocytes, 3,990,000; leukocytes, 9800; coagulation time, seven minutes.

Dr. E. M. Heckert assisted me in the operation January 28, 1922, and I shall quote him from his record: "The patient's
abdomen prepared in usual manner (iodin and alcohol). Kocher incision. Gall-bladder distended, indurated, diseased. Chronic obliterative appendicitis. Appendix removed and stump peritonezed. Gall-bladder freed from multiple, dense adhesions, which bleed freely. Gall-bladder excised. All bleeding controlled except some oozing from liver. One piece of iodoform gauze applied to the oozing surface. Except for small aperture, to accommodate iodoform gauze, abdomen closed in layers with chronicized catgut No. 2. Skin sutured with silkworm-gut (interrupted). Anesthesia, ether. Anesthetist, Sister Melchior. Remarks by operator: Uterus and adnexa normal; right kidney a trifle low; left kidney in good position; stomach apparently negative."

Today (January 31, 1922), three days since the operation, her temperature is 99° F., her pulse 90, and her respirations 20. She is as well as can be expected at this early date. I shall remove the gauze after two more days.

When the gall-bladder was opened there were found 50 to 60 stones of various sizes. At least half of these were small enough to pass through the duct and furnish her with attacks of gall-stone colic for years to come, indulgently presuming that no other condition (such as carcinoma) intervened. The gall-bladder itself was hypertrophied and manifestly diseased.

I do not remove the gall-bladder merely because it contains stones. If its walls are thin and it is apparently healthy, I rest with a cholecystostomy. This, however, was a gall-bladder that was obviously diseased. I am not entirely convinced that the gall-bladder has no function, and I know that the surgical management of recurrent gall-stones is easier following cholecystostomy than after cholecystectomy.
GUNSHOT WOUND OF THE CHEST

The next patient to engage our attention is a young married woman of nineteen, who on November 6, 1921 was shot in the chest. I arrived at St. Agnes' Hospital a few moments after the patient had been admitted. The projectile had pierced the soft tissues (anterior portion of the biceps) of the patient's right arm, apparently doing little damage there, and had penetrated the right side of her chest. Closer inspection of the chest showed that the wound of entrance was in the fifth intercostal space on the midaxillary line of the right side. There was no wound of exit. The patient was in shock (pulse 160, temperature 97° F., and respirations 28), but there was very little, if any, respiratory embarrassment. The abdomen was quite soft. The wounds of the arm, as well as the wound in the chest, were iodinized and dressed with sterile gauze. The entire right side of the chest was immobilized by means of strips of adhesive plaster. Antitetanic serum was given; external heat applied; normal saline solution administered by vein and morphin injected.

Examination of the bullets remaining in the weapon with which the patient was wounded showed them to be of the unjacketed, cylindroconoidal type and of 0.32 caliber. She was wounded by the ordinary revolver of civil life. She was shot at close range. The development of this last fact was due to no diagnostic perspicacity on my part, but solely to the fact that the patient had told me that the effective shot was fired by one in the same small room with her.

Dr. Alfred S. Doyle, roentgenologist to St. Agnes' Hospital, localized the bullet in the right side of the pelvis. Meanwhile the patient reacted promptly from shock, and, in the absence of definite clinical symptoms ascribable either to the thorax or to the abdomen, I decided not to interfere.
Twenty-four hours later, on November 7th, there were present the physical signs of a moderate amount of fluid in the right pleural cavity. This was verified by my colleague of the medical side, Dr. Francis J. Kelly. The abdomen continued soft. The temperature arose to 103° F., the pulse was 120, and the respirations 36, but regular and quiet. In the following three or four days the temperature, pulse, and respirations returned to normal. The patient gradually improved and went home in three weeks (November 27, 1921).

At no time have there been symptoms or signs attributable to the kidney, ureter, bladder, or intrapelvic organs; at no time did we feel justified in exploring the abdomen; at no time did the hemothorax cause serious pressure.

Today the patient returns to us for examination. It is about three months since she was wounded. She has gained in weight. Her general health is excellent. Expansion of both lungs is equal. The hemothorax has apparently been absorbed, because, as far as physical signs can tell us, it would now be difficult to say which lung has been involved.

I hesitate to advance even a speculation as to how the bullet became deviated into the pelvis. I shall not interfere with the bullet in the absence of symptoms. Were it lodged in the lung instead of the pelvis, and without symptoms, I would not attempt to remove it. If, however, a lodged bullet excites inflammation of the pulmonary tissues in which it is embedded and causes fever, pain, expectoration of blood, or cough, I believe that an attempt ought to be made to remove it—either by means of the bronchoscope as suggested by Chevalier Jackson\(^1\) or with the aid of the fluoroscopic screen according to the method of Petit de la Villeon, as described by E. Robin\(^2\) and Le Conte.\(^3\) Certainly these two comparatively safe methods should be considered before resorting to one of the more formidable thoracotomies.

The possibility of removing a bullet from the lung by means

\(^1\) Keen's Surgery, vol. viii, 1921, p. 322.


of the bronchoscope has been demonstrated by Dr. Chevalier Jackson on a patient on whom Dr. J. Chalmers DaCosta pronounced thoracotomy unjustifiable. Dr. Jackson,\(^1\) by means of an instrument manipulated within his bronchoscope, bit through the wall of a bronchus, seized a bullet which had penetrated through the chest wall into the lung, and extracted it by bringing it out within his bronchoscope.

\(^1\) Jour. Amer. Med. Assoc., 1921, lxxvii, p. 1178.
DOUBLE AMPUTATION THROUGH BOTH LOWER EXTREMITIES

This patient, a young man of twenty-three, on the morning of November 29, 1921 was riding in a wagon which was struck by a locomotive engine. When he was picked up he was unconscious, but regained his senses on the way to St. Agnes' Hospital.

Examination in the receiving ward showed that his left leg had been practically amputated, that his right foot and ankle had been crushed beyond redemption, and that he had received multiple lacerations, abrasions, and contusions of the scalp, face, and thighs. The skin and soft parts surrounding the left knee-joint had been destroyed and the left leg was united to the left thigh in ever so small a degree by a few strands of torn tendon. The tarsal and metatarsal bones of the right foot were crushed; the right ankle-joint was wide open and disorganized; longitudinal fractures traversed the lower third of the right tibia and of the right fibula. The right foot was cold and blue. Neither the circulation of the right foot nor of the right ankle was perceptible. The patient's several wounds, lacerations, and abrasions were contaminated by cinders, coal-dust, and greasy soil. A tourniquet had been applied to the left thigh. From the wound in the right ankle-joint hemorrhage was slight.

On admission the patient's temperature was 97° F., his pulse 120, and his respirations 26. While his wounds were examined and cleansed, antitetanic serum and appropriate stimulants were injected and external heat applied.

About one hour and a half after admission the patient, having reacted from shock, was etherized and operated upon. Both his lower extremities were removed: the left, by an amputation through the junction of the lower and middle third of the thigh; the right, by an amputation through the junction
of the middle and lower third of the leg. Doctors W. J. Ryan and P. F. Newman assisted me in the operation. Both in the thigh and in the leg anterior and posterior flaps, including muscle, were used.

The thigh stump healed by first intention in nine days, in spite of a badly infected laceration about 3 inches above the line of amputation. The leg stump became infected and healed more slowly, leaving a small area of the anterior surface of the tibia exposed. January 10, 1922 I reamputated the right leg, sawing through the tibia about 2½ inches higher than the site of the first section. The second amputation, as you can see, is through or a trifle above the middle of the leg—a location more suitable for the wearing of an artificial leg.¹

When Dr. W. J. Taylor kindly consented to see this case with me on January 18, 1922 (over seven weeks after the original operation) the thigh stump was 11 inches in length, as measured from the great trochanter; the leg stump, 7 inches, as measured from the lower border of the patella. As the leg stump had not entirely healed, Dr. Taylor counselled a delay of a few days in the consideration of the particular type of prosthesis applicable to this case. For the thigh stump immediately, and for the leg stump, as soon as healing took place, he advised daily massage, flannel bandage, measures calculated to improve their circulation, exercises to harden them, and to render them weight bearing.

Today (January 31, 1922) both stumps are almost healed and nearly ready for temporary artificial legs. Under the guidance of Dr. Taylor I shall endeavor to apply to this case some of the prosthetic principles formulated by F. Martin² and explained in English by Le Conte.³

Cathcart⁴ believes that the phrase “seat of election” ought

¹ Taylor, W. J., in Keen’s Surgery, vol. viii, 1921.
² La Prothese du Membre Inferieur, Masson et Cie., 120 Boulevard Saint-Germain, Paris, 1918.
³ United States Naval Medical Bulletin, vol. 13, No. 2, April, 1919, p. 244.
to be dropped. Formerly, when speaking of amputating through the leg, the surgeon used the phrase “seat of election” for an amputation a handbreadth or so below the knee, because, then, most patients were equipped with peg-legs only. A thigh stump was fitted into a wooden bucket and a patient with a below-knee amputation bore the weight of his body on his bent knee which rested on a pad on the peg-leg. It was necessary, therefore, in the case of the below-knee amputation to fashion a stump just long enough to be knelt upon without projecting backward so far as to be in the way—2 or 3 inches was long enough. The art of artificial limb making, however, has advanced to the point where “below-knee” buckets can be manufactured, and these, instead of peg-legs, can be supplied to those cases with stumps long enough to enable their possessors to move their own knee-joints.

Today “seat of election” means the length of stump most valuable for a “below-knee” bucket. Surgeons and limb makers differ as to the length of stump most suitable for this purpose.

For these reasons Cathcart prefers to saw the tibia at or a little below the middle of the bone. He declares that 4 inches is the shortest length of tibia which can be satisfactorily fitted with a below-knee bucket. He says, however, that he has seen in a few cases with sound skin covering a good result with 3 inches.

Dr. W. J. Taylor says that in all amputations of the leg below the middle, which is the point of greatest value for the wearing of an artificial limb, the flaps are wanting in vitality, while above this point there is diminished power of leverage. The same authority believes that the femur ought to be sectioned as low as possible in order to favor the greatest amount of leverage in the stump of the thigh.

The question of flaps has engaged considerable attention of late. In 1913 Estes reported 724 major amputations from civil practice, and 674 of these were performed for crushing injuries received on railways, in mines, and in factories. In this report he said: "As to flaps: There is no set rule in regard

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to them except that they must be wide and long enough fully to cover the stump without tension. It is preferred so to shape the skin-flaps that drainage is facilitated by the lines of incision. As much muscle as practicable is included in the stump." To me this advice seems as sound in 1922 as it was in 1913.

Frequently a brakeman or a switchman has been the victim of injuries necessitating multiple amputations; this was so in the 2 cases reported by Montgomery Russell.¹

Usually it is a male who suffers in this manner, but an exception to this rule is the case reported by Casse.² Casse operated upon a schoolmistress of thirty-seven whose legs were caught under the wheels of a moving train.

My case is not one of synchronous amputation in the sense in which Estes³ uses the term "synchronous." "At the clinic at St. Luke's Hospital," writes he, "the multiple operations are done synchronously. That is to say, the chief operator and the chief assistant operate at the same time on different extremities, each with a proper corps of assistants." I operated upon the thigh first and upon the leg immediately afterward. Now whether you consider these two amputations as two acts of the same operation, or as two operations under the same anesthesia, or as two sections at the same séance, the fact remains that the removal of the left extremity antedated the removal of the right extremity.

¹ Northwest Medicine, Seattle, April, 1904.
² M. E. Casse, Paris Chirurg., 1910, ii.
THE TOXEMIAS OF PREGNANCY AND THE Puerperium

The patient is a young woman thirty years of age; her medical history is entirely negative, having had no illnesses other than the usual run of diseases of childhood; she has had no surgical operations. Her previous obstetric history is that she has had two pregnancies that were successfully completed by the birth of two normal children. Her last menstrual period would bring the time of her admission to the hospital at about two weeks short of term. She had had no prenatal care from any clinic. The history of her condition during this pregnancy is not obtainable.

Upon admission the patient was unconscious and subject to frequently repeated general convulsions; her face, hands, and feet were edematous; her output of urine had almost completely ceased. A vaginal examination disclosed the fact that labor had not commenced. Her blood-pressure was, systolic 240, diastolic 160.

The history of this case with its physical findings is perfectly typical of the text-book picture of eclampsia. Let us go on with the treatment that was carried out in this case. The treatment of eclampsia, as we see it, is dependent largely upon the type which the particular case that is being studied may be and upon the progress of that case under the treatment as instituted. In other words, we do not believe that it may be said for all cases of eclampsia do thus and so. Each case must be treated according to its progress. This particular case exemplifies this fact. Naturally, the most important one factor in the treatment of this condition is the removal of its cause,
that is, the emptying of the uterus. Now we believe that removal of the cause should be done in that manner which is of the least shock to the patient; if possible to deliver the child by vagina it should be done in this manner as soon as possible.

When this particular case was admitted to the hospital, as stated in our history, she was not in labor; she had a high blood-pressure and almost complete suppression of urine. She was, therefore, eliminated in the usual manner, that is, we take it for granted that if her kidneys have ceased to functionate the chances are the rest of her abdominal organs have done likewise. Her stomach was washed out and large quantities of undigested food recovered. Her lower bowel was washed with a high enema. She was then given, through a stomach-tube, 2 ounces of castor oil and 2 drops of croton oil. Following this procedure she was put in a vapor bath, I mean by that we have a portable cabinet in which the patient receives moist heat; in cases in which the convulsions are not marked and there is no sign of cardiac failure these vapor baths are given every four hours. It so happens that very frequently the convulsions and their treatment are, fortunately, a cause for the commencement of active labor. When this has been accomplished the labor is allowed to progress of itself as long as the patient's general condition remains good.

In this case rapidly increasing frequency in the convulsions, vapor baths, free catharsis, and all the rest of the attendant treatments had no effect whatsoever in even commencing labor. As time wore on the convulsions became increasingly more violent and the intervals between shorter and shorter.

Eight hours after admission the convulsions had become so violent and so frequent, heart action becoming more and more rapid, the patient was given \( \frac{1}{3} \) grain of morfin, repeated in an hour with \( \frac{1}{4} \) grain. She still continued having convulsions, although this morfin had decreased their severity and frequency. At the end of ten hours we were confronted with the fact that we had a woman in whom neither the condition itself nor various methods of treatment had brought on labor. Furthermore, to all intents and purposes, elimination and
sedatives had been of very little value. We therefore felt it was a matter of very grave importance that her uterus should be evacuated. This was done by cesarean section under nitrous oxide anesthesia. The patient has made, as you see, a complete recovery, but, however, this has not been calm and peaceful, but followed by an exceedingly stormy postoperative convalescence.

With this case as a text we can go into the classification and treatment of the toxemias of pregnancy and the puerperium.

For the sake of their treatment let us classify these toxemias as follows: (1) Toxemia of early pregnancy which may advance to a condition of pernicious vomiting; (2) the toxemia of middle pregnancy, that is the condition occurring between the fourth and the seventh month; (3) the toxemia of late pregnancy in which the liver breakdown predominates; (4) the toxemia of late pregnancy in which kidney breakdown predominates; (5) the toxemia of the puerperium which may be similar clinically to either of the two preceding.

The toxemia of early pregnancy is familiar to all of us, and I will not go into the treatment of it at this time. This second class is one which I have brought out because it is rather rare, at least we do not often see it in hospital cases. The clinical picture is that of high blood-pressure, some headache, some slight defects in vision, very few urinary changes, very little edema. These cases present a very difficult problem. Should they be allowed to go on to term without interference? As a matter of actual fact they frequently decide the problem themselves with a premature labor of a stillborn child. In other words, I believe that these cases are caused by one of two things, namely, an underlying interstitial nephritis or these patients are syphilitic. Fortunately, we meet this type of case very rarely.

We now approach the third and fourth classification, which are important in that one must determine to which of these classes a given case belongs before we may go on with the treatment. This is not particularly difficult, and fortunately for our mortality the class of toxemia in which the liver predominates is comparatively rare. We may consider them both as
having progressed to the convulsive stage; they, therefore, then are both known as eclampsia. Their differentiation lies precisely in the one fact, that in the one liver breakdown predominates and in the other, kidney. This may be determined, and it usually is, by observing the three points: blood-pressure, urine, and the clinical picture of the patient herself. In the liver type the blood-pressure is low, there are albumin and casts in the urine, but not in as large quantity as we would generally look for. The patient is usually jaundiced, though not always, and the edema is not as marked as in the kidney type. My experience of this type of case is most discouraging. In its treatment weakening elimination must be avoided and cardiac failure carefully watched for. The mortality in this particular type is extremely high. The other type of case in which the kidney breakdown predominates is the usual typical text-book eclampsia, and the picture is that of the case which we have just seen.

It has always been taught, and I believe rightly so, that it is dangerous to make a prognosis in any case of eclampsia. However, for our own satisfaction we have evolved this scheme which was brought out some years ago in regard to the prognosis of uremia. When the diastolic pressure is to the pulse pressure as 2 is to 1 the prognosis should be good. When it is as 3 is to 1 it is doubtful. When as 4 is to 1 and higher, absolutely bad. In other words, taking the normal blood-pressure of 120 systolic and 80 diastolic, we have a relationship of 80 to 40 or 2 is to 1. When that normal relationship between the two continues we feel that the organism is maintaining its fight, at least in so far as the heart is concerned. It is our firm conviction that patients recover or die depending upon whether or not the heart stands up under the strain. We believe that high systolic blood-pressure per se is not a definitely bad prognostic symptom. A systolic blood-pressure of 240 and diastolic of 160, which is exactly double the normal, is much better to deal with than a systolic blood-pressure of 160, with a diastolic of 130. I remember a case which clinically looked no worse than the ordinary run, but on the admission showed a systolic...
blood-pressure of 160 and diastolic of 140. This gave a relationship between diastolic and pulse-pressure of 7 to 1. A bad prognosis was immediately given and the patient was dead in less than six hours. Personally, I have seen tremendously high blood-pressures frequently recover, while those in the neighborhood of 150 with a high diastolic almost invariably died.

In our treatment of the case shown you may note there was very little medication nor was venesection done. It is generally conceded venesection is of value, but I believe that this should not be resorted to purely on account of the high blood-pressure, but only when it would seem that the right heart is distinctly embarrassed.

The treatment of eclampsia is definitely divided into three great groups: First, eliminative; second, sedative; and, third, operative. For many years each of these methods has had its advocates among noted investigators and clinicians. We believe that all three have their place, and that in a great number of cases a combination of the three may be resorted to in the same case. I know that the advocates of the Stroganoff treatment (that is, the sedative) believe that that alone will give the best mortality figures. And if under this treatment a mortality of better than 10 per cent. can be accomplished those who rely on it are getting about as good results as is possible, but, unfortunately, all mortality figures must of necessity be so dependent upon the time and the progress of the illness when the treatment was instituted that it is extremely difficult to accurately determine. In the Obstetrical Clinic of the Hospital of the University of Pennsylvania over a period of more than thirty years each one of these three systems has been tried out separately, two in combination and finally all three together as the case seemed to indicate. We believe that our results from the use of all three treatments are the best. The custom of operating immediately every case of eclampsia, that is admitted to the hospital, is doubtfully efficient. If the emptying of the uterus can be accomplished without too great shock in any other way than cesarean section we believe it should be done,
but where there is no sign of labor, where the os is contracted, with a not easily dilatable cervix, and where the patient is becoming progressively worse, in spite of eliminative and sedative treatment, it seems to me that cesarean section gives her the best chance for life. Up to the present I have said nothing about the more recent laboratory studies on these cases—blood urea examination, etc. This should be done wherever possible for investigation purposes, but, unfortunately, our decision as to what must be done for the patient cannot wait for the results from these laboratory studies in all cases, and up to the present they have not been shown to be of any great value.

In touching upon the last classification, that of the toxemia of the puerperium, or postpartum eclampsia, there is very little to be said. Personally, I can think of no more discouraging type of case to be confronted by than this. The accepted cause of eclampsia has been removed and still the condition exists. Naturally, in this type of case all we may do is to promote elimination and control the convulsions by morphin. I have had physicians say to me, "Would you give morphin in a case where you have kidney breakdown as in all these cases of eclampsia?" The only reply to that question is that where you have acute suppression of urine the kidneys are about as bad as they may be. The patient eventually dies when she dies from cardiac failure. Continued frequent severe convulsions bring this about. It seems to us that although we unquestionably are doing no good to the kidneys when we give morphin, we cannot make them much worse, and by stopping the convulsions, if we are able to do so, we are at least giving the heart a rest.

Until such time as we are enabled to discover the etiology of eclampsia we shall be, as we are now, groping in the dark and doing the best we may.
INJURY TO THE CAUDA EQUINA

Spinal injuries are comparable to cranial injuries, but it seems to me that an exact diagnosis can be made earlier and with more accuracy than is the case in the latter type of injury. We do not propose at this time to discuss such injuries in general, since the pictures produced are so definite and, for the most part, well understood. There is a type of injury to the spinal column and the contents of the spinal canal, however, that is not as frequently seen as others, and therefore its symptomatology and the prognosis from the operative point of view is not so well appreciated. I refer to injuries to the cauda equina. In general, the prognosis of such injuries is much better than injury to the cord itself. The following case well illustrates an injury to the lowermost segments of the cord and cauda equina. The patient, a white male, fifty-two years of age, a teamster by occupation, was brought to the hospital in agonizing pain, referred to his back and lower limbs, with the following history: He was driving his team into the stable when upon entering the door a beam over head caught him, striking his shoulders, causing violent anteflexion of the body and thus squeezing him between this beam and the seat of the wagon. He was apparently bending forward, trying to dodge the beam. He could not move his legs upon admission at all, and, as stated, he was suffering from severe pain. I saw this patient shortly after his admission to the hospital, and because of the paralysis of the lower limbs accompanied by extreme pain, made a diagnosis of probable fracture-dislocation below the level of the twelfth dorsal ver-
J. STEWART RODMAN

tebra and asked for an immediate consultation with the neurologist of the hospital, Dr. Cadwalader.

His report was: "The patient complains of severe spontaneous pain which is fairly well localized to the outer surface and lower portion of each leg below the knee. This pain seems to be worse on the outer surface of the left leg than on the right. It is difficult to estimate the exact extent of motor paralysis because of pain; only the adductor of the right leg contracts, however. The knee-jerk and Achilles' reflexes are all absent. There is no plantar reflex or Babinski's sign present. Manipulation of the limbs causes pain. There is no spasticity, the limbs being flaccid. Sensation is greatly impaired, but touch and pinpoint over the outer surface of each leg below the knee and to a less extent over the inner surface and dorsum of each foot; over the buttocks and posterior portion of each thigh there is diminution of sensation, but it is not abolished. Over the abdomen and thighs on each side sensation seems normal. It would seem that the lesion in this case does not extend above the level of the second lumbar segment of the cord. The character of the pain, as well as other findings, strongly suggest a lesion of the roots more than destruction of the cord substance, or both conditions. There is a distinct depression between two vertebrae, the twelfth dorsal and first lumbar." An x-ray taken immediately showed fracture-dislocation of the last dorsal and first lumbar vertebrae. Inasmuch as there seemed little doubt, taking into consideration the history of the case and the physical findings confirmed from the neurologic aspect of the case, that there existed a fracture-dislocation of the vertebrae resulting from indirect violence due to forcible overflexion, an immediate laminectomy was done. In the midline of the back and extending well to either side there was swelling and ecchymosis, the tearing and hemorrhage into the lumbar muscles becoming apparent after the incision was made. The skin incision was made over the spinous processes beginning on a level with the eleventh dorsal vertebra, downward for 4 inches. After separating the torn and lacerated lumbar muscles from the vertebra on either side a fracture-dislocation was found of
the twelfth dorsal and first lumbar. The spines and laminae of these vertebrae, as well as the vertebrae immediately above and below, were removed. There was no free blood upon the dura, which, however, was swollen and rather tense. Upon opening the dura a bloody fluid escaped, and after the incision in the dura was enlarged the spinal cord itself appeared swollen and edematous in its terminal segments, and the cauda equina also had this appearance. The dura was not sewn, as it was thought well to provide for relief of pressure. The muscles were closed in tiers and because of the hemorrhage into them a drain was inserted below. The skin was closed in the usual way. On the following morning the patient's condition was, in general, satisfactory, although the pain had persisted the same in character as it was before. At the end of forty-eight hours the drain was removed and there had been quite a marked

Fig. 144.—Fracture-dislocation of vertebra.
return of sensory impressions throughout the entire legs and feet.

Fig. 145.—Swollen and edematous tip of cord and cauda equina. (Semi-schematic in order to show distortion of normal anatomic structures.)

At that time there was no appreciable difference in the motor function, the patient still being entirely paralyzed in
the lower extremities. However, it was impossible to tell just how much of this was voluntary, as the patient refused to make an effort to move any muscle of the legs, stating that any such attempt would cause great pain. His general condition had improved. After the second night the pain had improved to such an extent that morphin was no longer required. There had been no involuntary passage of feces and urine, the patient’s bowels being opened by enema after the first forty-eight hours. He still, however, had to be catheterized and, in fact, this persisted for several weeks following the operation. Convalescence in so far as the general condition was concerned became established after the third day, and a gradual improvement was noted both in sensory and motor functions in the lower limbs. The patient, however, was not able to void voluntarily until approximately three weeks following the operation and, unfortunately, had developed, by reason of the necessary catheterization, a cystitis in the meantime. This had been treated by bladder irrigations of 1:10,000 silver nitrate solution and by an indwelling permanent catheter. Approximately three weeks after the operation neurologic examination showed a distinct and clear voluntary contraction of the adductor and quadriceps muscles on each side; the right, however, being somewhat stronger than the left. There was no movement detected of the muscles below the knees. The wound healed normally, pressure sores, which developed on the heels due to necrosis, gradually cleared up, and the patient was discharged, much improved, at his own request, three months following the injury.

This patient, now nine months following the injury, is able to walk with the aid of crutches, has entire control over both bladder and bowels, normal sensation has returned in the lower limbs as well as voluntary movement, with the exception of the dorsum of each foot and ankle. I believe that with further massage and electricity, which he has had at biweekly intervals for the first three months following the operation, he will ultimately recover well enough to take a useful position, although not in his former occupation of teamster.

From a consideration of this case we can learn the lesson, first
of all, of a greater hopefulness in traumatic lesions of the cauda equina, particularly, than we are justified in entertaining in regard to traumatic lesions of the cord. We can also learn that when the benefits of a decompressive operation are given early the results are better. The point in the history of this patient which at once should lead us to expect a caudal lesion was the tremendous pain in the lower limbs and the apparent lack of complete paralysis below the level of the lesion. It seems to me that in handling traumatic lesions of the spine and spinal cord a nicety of surgical judgment is required in order to select the case suited for operation. There is no question that operation is often not only inadvisable, but harmful. Of course, where the paralysis is immediate and complete below the level of the lesion, this complete paralysis involving not only voluntary motion, but involuntary reflexes, there has been a complete division of the cord and operative intervention is useless. There has never been a case on record of regeneration of damaged cord tissue where the injury has resulted in a complete division of the caudal substance. Drs. Harte and Stewart reported a case of gunshot wound of the cord operated upon by Dr. Stewart some years ago at the Pennsylvania Hospital. In this case there had been an apparent return of some function following suture of the cord, and for years it was quoted in the literature as a probable instance of cord regeneration. We now know as a result of Riddoch's work on such lesions growing out of the recent war, and as the result of Cadwalader's careful study of the aforementioned case, that such regeneration did not take place. It is true that a flaccid paralysis gave way to a spastic type and that there was an apparent return of some control over the bowels and bladder, but Cadwalader clearly showed that the case had lived for years in a stage of "mass reflex," so clearly pictured by Riddoch, who showed that the sequence of events in complete cord division was, first, spinal shock, into which the case passed immediately after the injury, this stage being characterized by complete paralysis below the level of the lesion as well as a complete loss of all sensation and power of control over the bladder, bowels, and sexual functions. This
stage was followed by the second after the lapse of three or four days if the patient had not succumbed to the original shock of the injury, by the stage of "mass reflex" in which there was a change of the paralysis from the flaccid to the spastic type and return of knee reflexes, Babinski phenomena, and the automatic control of the bladder established. One of the most interesting features of this stage of "mass reflex," as pictured by Riddoch, is this automatic control of the bladder. He showed that when such bladders were filled with a given amount of urine, say 300 c.c., that automatic stimulation resulted and emptying followed; this he expressed as "firing off of the bladder." The stage of "mass reflex" persists in some cases for years, although as a general rule after several weeks or months of such apparent return of control the third stage followed, namely, that of "diminishing reflexes," in which the spastic type of paralysis returned to the flaccid type, automatic control of the bladder was lost, and the patient ultimately died of secondary infection, usually of the kidneys.
Traumatic Fracture of Mandible

Preoperative Preparation; Type of Bone-graft; Adaptation of Bone-graft.

This patient is a male, twenty-five years old, who one year ago accidentally had the "family shotgun" go off in such a manner as to open up the right side of his face, blow out a portion of the right side of his mandible, and expose the buccal cavity. He was given first aid by the local physician, who closed the wound as well as possible after a débridement.

Following the accident for a period of three months there was a discharge, at first purulent and later a thin yellow, from a sinus at the center of the scar. There have been no pieces of metal or bone pass out since the initial closure. The separated portions of the mandible have never been immobilized. He entered with the request that the fractured jaw be repaired.

Physical Examination.—A male, well nourished, ambulatory, who was essentially negative except for the surgical condition.

Surgical Condition.—There was a loss of contour over the right side of the mandible, with a vertical retracted scar 6 x 2 cm. running from the right corner of the mouth down over the right submaxillary region. The scar and contiguous tissue were quite hyperemic and over the center of the scar were some yellow crusts (dried serum). The patient had no voluntary control of the depressors of the right angle of the mouth. The remaining portion of the right side of the mandible was tipped
so as to lie obliquely, was drawn in to the midline and held so by the dense scar, with the result that the teeth missed occlusion with the corresponding upper teeth by 1 cm. This right portion of the mandible moved separately from that of the left side. There was a dense scar over the site of the gunshot wound and a loss of 1.5 cm. of bone. The scar was somewhat spider-like, depressed the right anterior angle of the tongue, had strands running to the fractured ends of the jaw, and contained a few palpable pieces of indurated areas (metal) close to the mucous membrane side.

There were no signs of active inflammation, so the patient

Fig. 146.—Preoperative and one and a half months after the accident.
was advised to see a dentist and have his teeth cleaned and prepared for immobilization of the lower jaw in view of an operation.

A bone-graft from the tibia to the mandible was attempted, but eventually had to be removed on account of a necrosis, due to the undermining, at the center of the scar and an infection. Bone-grafts have been known to be successful in some instances of infection, but in this it was too severe. The lack of success was attributed to two factors: first, lack of proper nourishment for the overlying scar tissue, since at the time of the operation it was not yet fully adapted to the area; and, second, micro-organisms were undoubtedly lying dormant in the tissues.

The above causes are commonly met with in plastic surgery and must be eradicated to insure success. Micro-organisms have been known to live for many months in such tissue. One should always wait for a period of three to four months in an

Fig. 147.—Roentgenogram showing defect in the mandible.
infected area before attempting any bone-grafting or the like. He should be certain of no active inflammation, and if there is any doubt, should carry out procedures to eliminate it.

Therefore the patient was sent home. For seven months he has been carrying out light massage to the area, local applications of moist heat to the tissues twice daily, and forced motion outward to the right mandible so as to bring the lower and upper teeth in proper occlusion.

Five months ago, under local anesthesia (1 per cent. novocain), the vertical scar was excised and the normal tissue approximated so that a linear scar 6 x 0.25 cm. in its widest extent remained. Today we observe that the tissues are in as normal condition as those of other parts of the body. The scar is quite mobile; it has no redness and no tenderness. The patient is able by the force of his tongue to hold the remaining portion of the right mandible out so that the upper and lower teeth appose. Dr. F. V. Simonton, of the University of California Dental School, by bands on the teeth with interlocking pins immobilized the two portions of the mandible in proper apposition.

Operation.—A curved incision, convexity downward, is made from the right parotid region down to the level of the hyoid and up to a point 1.5 cm. on the opposite side of the symphysis menti. This is employed so as to insure an excellent covering of soft tissue immediately over the bone-graft and thereby not allow a direct connection between the graft and the surface. Should there be any infection of the wound, involvement of the graft is less likely to occur. The fractured ends of the mandible are exposed and rongeured back to where viable bleeding bone is met. Likewise on the outer surface of each fragment for a distance of 1 1/2 cm. the periosteum is removed and the bone freshened to where it bleeds freely. Now that the bed for the graft is prepared and one hole drilled through each end of the mandible, the bone-graft will be obtained.

In an instance where there has been no loss of bone one can employ a rib for stabilization purposes. In this case the area of destroyed bone is too great, and we know, as pointed
out by Eloesser,¹ that such a graft is too fragile. Grafts from the tibia, obtained with one of the electrically driven motor saws, as described by Albee² and Phemister,³ have been employed successfully. Yet we know that the bone with which we graft should be as near like the original bone as possible; should possess a slight curve in order to conform to the contour of the jaw; should be easily obtainable and, preferably, incapacitate the patient the least. Bone-grafts from the ilium, as employed by Chubb,⁴ have undoubtedly met best the above requirements.

¹ Eloesser, Leo: Archives of Surgery, vol. i, p. 428.
Bone-grafts from the ilium simulate more closely in character the bone found in the jaw. They are obtained easily with a chisel, osteotome, and hammer, and can be fashioned with the same. Should one need to replace the symphysis menti, he can obtain a bone-graft of excellent contour from the anterior superior iliac spine. It is not necessary to take more than one-half the depth of the ilium. Should the fascia and muscle attachments be necessarily disturbed, they can easily be replaced. The patient may be allowed around on a crutch within a few days after operation, and eventually back to his work more quickly than by any other method.

Therefore by a curved incision, for reasons similar to those previously mentioned, the external crest of the right ilium is exposed. The origin of the fascia lata is separated. With the chisel, osteotome, and mallet the graft, \( \frac{1}{2} \) cm. in thickness, with the periosteum attached and cancellous bone on the inner side, is obtained. The graft is now fashioned by use of the chisel so that it will fit in between the ends of the mandible and along
the outer side as well. This, as you observe, gives added strength to the immediate fixation, and, what is needed especially in bone work on the jaw, greater surface for eventual bony union. Holes are drilled through each end of the graft so as to correspond to the holes previously drilled through the ends of the mandible.

The graft is now put into position and held so by a kangaroo tendon (heavy) ligature through the drilled holes and around the lower margin of the mandible. The wound is closed in three layers—the deeper muscle and tissue, the platysma, and the skin, respectively. A dry dressing and Barton bandage complete the operation.

The wound over the ilium is easily closed, the origin of the fascia lata being resutured to the inner crest of the ilium.

The patient will be allowed to assume the most comfortable position and in three days will be about on crutches. The function of the bone-graft will be judged by its clinical appearance and by monthly x-rays.

Postoperative Convalescence.—The patient was about on
crutches on the third day, left the hospital on the sixteenth day, and was walking normally on the twenty-second day, assisting in his duties as a rancher.

The jaw was released for one-half hour at the end of one month, and finally released from all immobilization at the end of two months, when there was bony union clinically.

The important points illustrated by this case are the need of eradication of infection and improvement of circulation in scar tissue, accomplished by physiotherapy; location of the best type of bone with the desired contour for grafting a large defect in the jaw; ease of obtaining the graft; the least incapacitation of the patient; and the increased area for bony union on the sides of the mandible, which means, in turn, added strength.
ANTHRAX PUSTULE

Diagnosis; Treatment. Value of Antianthrax Serum.

This patient, who is a male aged forty-six, of Spanish descent, and employed as a ranch hand and butcher, entered the hospital with the complaint of an infection of the left forearm, with pain and swelling.

Family History.—Negative.

Past History.—Rancher and butcher ever since boyhood. No history of any previous similar illness. Venereal denied. Average weight, 240 pounds.

Present Illness.—Five days ago the patient skinned a diseased cow and lifted the hide into a wagon in such a manner as to have it come in contact with his bared forearms. The following day he noticed a slight itching sensation upon the flexor surface of his forearm and scratched it through his underwear. That evening he noticed a "boil" on his left forearm and put some tincture of iodin upon it and about it. Three days ago it became quite painful and the arm was slightly swollen, so he rubbed on some spirits of turpentine morning and evening. He observed that several small blisters had appeared close to the "head of the boil." The latter he had punctured, with the liberation of a straw-colored fluid. Two days ago he consulted a local physician, who took a culture and dressed the arm first with ichthyol ung. 10 per cent., and on the following day with "chlorozone." The patient at the time of entrance complained of a very severe swelling of the left upper extremity; a dull, aching, non-radiating pain localized to the entire arm, and a marked feeling of lassitude and general weakness.


Circulatory and Respiratory Systems.—Negative.

Genito-urinary System.—Nycturia II.
Physical Examination.—Shows an immense male with an expression of marked fatigue, a pulse of 112, but otherwise negative except for the surgical condition.

Surgical Condition.—The left arm is swollen throughout its entire extent to twice the normal, with a tense, non-pitable edema. This edema extends over the shoulder and chest so as to involve the scapular, clavicular, and left breast areas. In the lower third of the arm proper and the upper two-thirds of the forearm, more marked on the flexor surface, are many

Fig. 152.—Patient sixteen days after initial injection, nine days after last antianthrax serum. Edema of left hand and arm still present.
unruptured and ruptured vesicles and bullae containing clear yellow fluid. On the flexor surface of the forearm in its upper third, over an area 8 cm. in diameter, the skin is deeply hyperemic and the bullae contain a serosanguineous material. There is an area 5 cm. in diameter within the hyperemic area, where there is a definite gangrene of the skin. There are no special lines of lymphangitis and only a few medium-sized non-tender
lymph-glands in the axilla are observed. The more deeply hyperemic portion of the forearm in the upper third on the flexor surface is tender to deep palpation and is the site where the initial lesion originated.

Pulse 112; temperature 38.2° C., and respirations 18.

Laboratory.—White blood-cells, 14,600, with polymorphonuclears 76 per cent.; small mononuclears 13 per cent.; large mononuclears and transitionals 9 per cent.; and myelocytes 2 per cent.

Two blood-cultures on the fourth and fifth days of the disease, respectively, were taken, and proved to be negative after five days of incubation.

The primary requisite before treatment can properly be given is to establish a correct diagnosis. The differential diagnosis lies between a furuncle with skin irritation from local application of drugs and a venous thrombophlebitis, a diffuse cellulitis, erysipelas, an anaerobic infection, and an anthrax infection.

Diagnosis.—A furuncle with some skin irritation from use of local drugs is a likely possibility, for the vesicles and bullæ are localized to where the iodin and turpentine, and later, mercuric bichlorid,* have been applied. The central area does not show the characteristic oval swelling, the tenseness, or as severe tenderness as would be expected; neither is there any sign of creamy pus that one finds at this stage. On the contrary, the area shows a slight gangrene at the center, no pus, but a yellow fluid discharge, an elevation unchanged from the contour of the entire arm, too extensive unless further complications, as a thrombophlebitis, might have ensued. The latter is eliminated by the lack of tenderness along the course of the vein and the absence of any chills or sweats. It is not a localized streptococcus infection for obvious reasons. The extensive edema without tenderness, the absence of any localized area of pus, and the lack of involvement of lymph-nodes are against cellulitis. An anaerobic infection, as Vibrion septique,

* Unfortunately, the patient maintained no iodin had been used on the arm, so a bichlorid of mercury bath was employed for a few hours.
Bacillus edematiens, or Bacillus welchii, occurs in deep wounds where there is muscle present—not subcutaneously as in this instance—and with an edema of this degree would show signs of gas in the tissues, a greater degree of toxicity, and would have involved only the forearm group of muscles primarily.

The patient’s occupation and the history of his skinning a diseased cow suggest the possibility of some unusual infection, such as anthrax. In order definitely to establish such a diagnosis the micro-organism must be demonstrated. Therefore a smear was taken from the content of one of the deeper colored bullæ. With a methylene-blue stain single rods and short chains of square-ended and concave-ended rods (an appearance similar to a jointed bamboo rod) were observed. A Gram stain demonstrated they were Gram-positive. No spores were seen, but this was not to be expected, since anthrax does not form spores in the human body. Fortunately, the referring physician made an agar culture forty-eight hours before, and so we made a smear from this. Again chains of large square-ended bacilli were seen, and in the center of many of the bacilli were oval spores similar in size to the width of the bacillus itself. The above corresponded to the description of the anthrax bacillus and its spore formation as originally described by Robert Koch in 1876.

Treatment.—Until 1920 the medical literature advised all forms of treatment—sustaining the patient’s general condition without local treatment; radical excision and cauterization; excision with cautery, injection of carbolic acid; employment of normal beef-serum; and, more recently, the employment of antianthrax serum has been urged. It is unfortunate that one is led into such a dilemma, for the several methods do not give equally good results. However, a study of the pathology aids in deciding the rationale of treatment.

The organisms are found in the deeper layers of the skin just at the level and around the subpapillary vascular net in the lymph-channels and in the immediate local capillaries, which they mechanically block. About them and in the subjacent cellular tissue is a wall of leukocytes. There are few to no
leukocytes among the micro-organisms, and as a result a characteristic thin yellow discharge is observed in contrast to the thick pus of a staphylococcus infection.

Incision as in a furuncle would then be obviously out of order, for it would only open new areas into which the infection could spread. Excision unless in the first twelve to twenty-four hours—and the infection is not recognized as anthrax at that early hour as a rule—is open to the same criticism, since one cannot tell the distance to which the organisms have invaded. Hiss and Zinser\(^1\) were unable to prevent the spread of the infection in guinea-pigs by immediate excision. Scholl\(^2\) cites definite cases where the infection spread coincident with surgical measures.

Excision with cautery is open to criticism for its mutilating effect, the indefiniteness of getting around the infection, and the sealing of all pores of exit for the serum and lymph in washing out the toxins and broken-down material from leukocytic reaction and bacteriolysis. Regan\(^3\) observes that anthrax is a local condition primarily in man, and any of these measures that tend to generalize the infection are entirely wrong, since in many instances they lead to septicemia. Injection with carbolic acid is unscientific, since one must act blindly and is most likely to destroy the protective ring the body has built. The employment of local applications of all types of antiseptics, of powdered ipecac, extract of Bacillus pyocyaneus, and what-not have their respective advocates, but it is doubtful if they are as effective as reported.

Kraus, Penna, and Cuenea\(^4\) have employed normal beef-serum locally and intravenously, with most favorable results. The explanation of this is as yet not understood, unless perhaps the cattle have already an established racial immunity. Kolmer,\(^5\) experimentally, did not find that normal beef-serum possesses protective and curative value, although it has some antibactericidal properties.

Antianthrax serum has been known ever since 1895, when Marchoux, of France, and Sclavo, of Italy, independently reported their investigations. It has been used prophylactically
and therapeutically in cases for some time, and of late quite extensively in human infection in Italy, England, and Argentina. Since 1918 the antianthrax serum has been employed in this country, and most encouraging reports are made. Cases in a septicemic state and regarded as hopeless by other treatments have been cured with the serum. The percentage of cures with this method is unanimously higher than that from other treatments. The report by Hubbard and Jacobson, of the New York Health Department, is especially illustrative.

<table>
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<th>Deaths</th>
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<td>14</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Antianthrax serum and incision</td>
<td>5</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Antianthrax serum and excision</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Antianthrax serum and cautery</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Chemical cautery and incision</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Antianthrax serum, excision, chemical applications</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Chemical application</td>
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<td>Chemical application, yeast</td>
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<td>0</td>
</tr>
<tr>
<td>No treatment recorded</td>
<td>4</td>
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Is it logical to employ an antianthrax serum? No true exo- or endotoxins have ever been demonstrated, yet Kolmer notes, “local lesions develop so rapidly and become so quickly ulcerative as to suggest very strongly the action of some local toxic substance.” Vaughan has shown that anthrax protein possesses toxic qualities, and it may be that the bacteremia produces an accumulation of toxins. Clinically, excellent results have been obtained when the antianthrax serum was employed properly. Yet in the majority of instances too small a dose (20–30 c.c.) and lack of subsequent doses and too late administration in the course of the disease have defeated the value of this form of treatment. A large amount (80–200 c.c.) should logically be employed, and the method of choice should always be the intravenous administration. The effect of the serum and the additional administration should be judged by the patient’s temperature curve, pulse-rate, and general condition.
In the case presented the following course of treatment, as advised by Dr. Karl F. Meyer, of the Hooper Research Foundation, was employed. After desensitizing the patient: (1)

Fig. 155.—Anthrax pustule infection of left arm with graphic chart showing reaction of pulse, temperature, and respiration with antianthrax serum treatment.

150 c.c. of Cutters' antianthrax serum was given intravenously at 7.00 A.M. This was followed by no apparent improvement.

*One minim of horse-serum intracutaneously to determine degree of sensitization; one hour later 1 c.c. subcutaneously; and one hour later 1 c.c. intramuscularly, without any untoward reaction.
in the temperature curve, a slight drop in the pulse-rate, and no improvement in the patient's general condition. (2) At 4.00 p. m. (nine hours later) 100 c.c. were given intravenously, followed by 150 c.c. of 2.5 per cent. soda bicarbonate solution, with no apparent improvement. (3) At 8.00 p. m. (four hours later) another 100 c.c. of serum were given intravenously, followed by 75 c.c. of 2.5 per cent. soda bicarbonate solution. Coincidentally with this the temperature fell to 38.2° C., the pulse-rate decreased 20 points (to 112), the respiration fell 7 points (to 24), and the patient showed a moderate improvement. His temperature again rose the following afternoon to 38.8° C.,

![Image](image_url)

Fig. 156.—Anthrax pustule case showing gangrenous area of skin.

the pulse remaining at 120, and he did not feel so well, so at 6.00 p. m. (twenty-two hours later) he was given 150 c.c. of serum intravenously, with a coincident drop in the temperature to 37.2° C.; pulse 92; respiration 20; a marked improvement in the general condition and a noticeable decrease in the edema. His clinical course from this point on was characterized by a gradual decrease in the edema until thirteen days after the last serum treatment, when it had practically disappeared, and the occurrence of a gangrene of the skin, 8 x 6 cm., at the site of the original lesion. The latter was eventually skin-grafted.

The local lesion was treated with boric ointment since the skin was so evidently irritated and because the local area was
so apparently large as to render it most inadvisable to employ surgery.

Local therapy with antianthrax serum was obviously impossible in this case. It is employed, however, with the injection of 2 to 3 c.c. into the base of the lesion every twenty-four hours. This has never resulted in any apparent harm, has clinically been of benefit, and has theoretically seemed to be of greater value than all other forms of local treatment, since it reaches directly the original source of the infection.

Therefore the conduct of a case of anthrax pustule should be as follows:

Diagnosis:
1. History of probable exposure.
2. Lesion—non-purulent, center gangrene, marginal vesicles, surrounding edema.
3. Typical organism from pustule or (in first thirty-six hours only) from a vesicle.
4. Spores from a culture.

Treatment:
1. General supportive.
2. Antianthrax serum (2 to 3 c.c.) locally every twenty-four hours.
3. Antianthrax serum in large doses (80 to 200 c.c.) intravenously, observing the pulse and temperature curves and the general condition as a guide.

BIBLIOGRAPHY
TUBERCULOSIS OF THE CERVIX WITH CASE REPORT*

In 1886 Hegar\(^1\) called attention to the fact that tuberculosis of the female genital organs was not so rare as had been previously considered at that time. This observation has since been abundantly substantiated by different observers in various parts of the world, for wherever a routine microscopic examination of gynecologic specimens removed by operation has been systematically carried out it has been demonstrated that tuberculosis of the genital tract is a fairly common finding.

Greenberg,\(^2\) in a recent publication on tuberculous salpingitis, based on a clinical study of the records of 200 patients suffering with genital tuberculosis, estimates that nearly 1 per cent. of all surgical gynecology shows tuberculosis of some part of the genital tract, and that from 5 to 10 per cent. of all fallopian tubes removed because of inflammatory conditions appear microscopically to be tuberculous.

As long ago as 1894 Williams,\(^3\) in his monograph on tuberculosis of the female genital organs, stated that one operation in twelve for inflammatory disease of the pelvic organs had been found upon microscopic study to be tuberculous, although in 75 per cent. of the patients the tuberculosis was not suspected until the laboratory examination had been made.

From the experience of Martin, Kroenig, Schmorl, Pankow, and others about 2 per cent. of all pelvic pathology has tuberculosis as its base.

Estimating the incidence of genital tuberculosis from another point of view, Murphy\(^4\) states that 53 cases of genital tubercu-

* From the Division of Obstetrics and Gynecology, Stanford University, School of Medicine.
losis were found in a series of 4470 routine autopsies performed by Schramm, von Winckel, and Donhoff, which gives an incidence of 1 case of genital tuberculosis in 84 autopsies, while in 270 autopsies on tuberculous women, 24 cases of tuberculosis of the genital organs were found, or an incidence of 1 case of genital tuberculosis in 11 patients with general tuberculosis.

While the most common site of genital tuberculosis seems to be the fallopian tubes, the uterus is also frequently affected, although it is quite rare for the infection to descend below the internal os. It is generally admitted that tuberculosis limited to the cervix is a rare pathologic condition.

Greenberg,\(^2\) in his study of 200 cases of tuberculous salpingitis, found only 7 cases of tuberculosis of the cervix, or 3½ per cent., and states that Labhardt, in a study of 73 cases of genital tuberculosis, did not find the cervix involved in any. Eden and Lockyear, in their Text-book on Gynecology, state that 8 per cent. of genital tuberculosis involves the cervix. Norris\(^5\) found in 66 tuberculosis specimens of the female genital organs only 1 case of tuberculosis of the cervix.

When one studies the literature for case reports of tuberculosis limited to the cervix, it is surprising to find such a small number of cases reported. For instance, in 1908 Vineberg\(^6\) could find only 22 cases of tuberculosis limited to the cervix, and of this number, only 4 met the requirements of Amann,\(^7\) who stated that to prove tuberculosis primary in the cervix it was necessary that the woman be autopsied and that no tuberculosis be found in any other part of her body. Of course, such a requirement is out of the question for all of those patients who recover, or for those who unfortunately die some are not submitted to autopsy examination.

It is probable that about 135 cases of tuberculosis limited to the cervix have been reported in the literature, but of this number many reports would have to be eliminated because no laboratory examination had been made of the pelvic organs except the cervix, and many diagnoses have been based upon clinical findings.

In the Women's Clinic of Stanford University School of
TUBERCULOSIS OF THE CERVIX WITH CASE REPORT

Medicine it has been our routine to examine histologically every placenta and every specimen removed at operation since the clinic started in 1912. To date, 6005 specimens have been examined, about one-half of which are from gynecologic operations. Of this number, the cervix has been examined 704 times, and only once has the diagnosis of tuberculosis of the cervix been made, although there are in the laboratory a number of specimens showing tuberculosis of the uterus above the internal os.

Considerable discussion has taken place regarding the method of tuberculous infection of the cervix. Some doubt exists as to the possibility of infecting the healthy cervix by instruments, fingers, or other direct means, while it is known that many men suffering with genital tuberculosis of the testicles do not infect the pelvic organs of their wives. Moreover, it has been observed that tubercle bacilli may be obtained from the secretions of the cervix without there being any local infection of the cervix, the tubercular germs being passed downward from an infection of the tubes. Nearly all cases of genital tuberculosis seem to have a tuberculous origin in some other part of the body, the tubercle bacilli being transported to the cervix by way of the blood-stream. It is possible that in some cases the cervix is infected by direct continuity with a tuberculous endometritis, although pathologic findings seem to point to the fact that tuberculous endometritis is usually limited to the internal os.

The symptoms of tuberculosis of the cervix may be very few in number, and the general health of the patient may be so good that she may suffer with the condition for many years without consulting a physician. On the other hand, it may be because of symptoms of pulmonary tuberculosis that she seeks medical aid. She may be the picture of good health, or may be emaciated with pyrexia, hemoptosis, anorexia, night-sweats, etc., due to the condition of general tuberculosis. She may complain of pain in the lower abdomen with menstrual irregularities, due probably to either tuberculous peritonitis with tuberculous salpingitis, or tuberculosis of the endometrium.

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With tuberculosis limited to the cervix the most usual symptom is leukorrhea with occasional blood-stained discharge. These symptoms are particularly suggestive in a young individual. On examination, the picture seen with the speculum depends upon the variety of the tuberculous process, which probably means the state of development of the tuberculous infection.

In different parts of the cervix many varieties of tuberculosis may be found. There may be ectropion with hypertrophy of the cervix, or the cervix glands may be cystic, at times reaching the size of a cherry, which many contain sebaceous material like in a dermoid; but the usual finding is some variety of a tuberculous ulcer. The ulcer may be papillary, resembling the cauliflower form of carcinoma of the cervix; or the ulcer may be well defined with undermined edges, surrounded by normal tissue or surrounded by typical tubercles. These ulcers are usually covered with gray exudate which, on being wiped away, show a yellow base. The vaginal portion of the cervix may be studded with tubercles or the tubercles may be localized to the superficial epithelium of the glands, the glands being filled with masses containing tubercle bacilli. This variety has been named by Schütt "bacillary catarrh."

Beyea described four varieties of tuberculosis of the cervix: (1) ulcerative, (2) papillary, (3) miliary, and (4) interstitial, these varieties being in the frequency of incidence.

On palpating the tuberculous cervix the ulcer feels more like an erosion than like a carcinomatous ulcer, and while some bleeding may follow the examination, it is not nearly so common an occurrence as that with carcinoma of the cervix.

To diagnose the tuberculous condition of the cervix from carcinoma, venereal lesions, or other forms of ulcer of the cervix, resort must be had to the laboratory.

Babbs called attention to the fact that tubercle bacilli could be demonstrated in the discharges from the uterus or in the tissue removed for examination, as long ago as 1883. The usual experience is that the finding of tubercle bacilli in the discharges or in the tissue is many times not successful, but
almost invariably the accepted picture of tuberculosis with the formation of epithelial tubercles and giant-cells may be found with ordinary histologic methods. Some pathologists deny the fact that this picture always means tuberculosis, and insist on the finding of the tubercle bacilli for accurate diagnosis.

The prognosis of tuberculosis of the cervix is always serious. The disease usually slowly progresses, and no one has as yet observed a spontaneous healing of this condition, although Murphy\(^4\) states that spontaneous cure is possible, though uncommon.

Sterility is found to be present in over 60 per cent. of the patients, or if pregnancy occurs, the puerperium may be complicated by an extension of the tuberculous process, which may lead to the rapid death of the patient. Diagnostic curetage is dangerous, while New\(^10\) states that he has seen cases rapidly progress following attempts to cure tuberculosis by injections. Even cauterization of the tuberculous ulcer does not seem to cure the local lesion. He states that of 77 women under treatment for genital tuberculosis in the Medical Clinic in Berlin observed from 1902 to 1910, of 55 patients operated upon, 75 per cent. are still living, while of 22 patients treated conservatively, 52 per cent. are still living, and because of the bad prognosis advises radical operations.

Beyea\(^8\) reports that in 10 cases treated by hysterectomy, 3 patients died immediately after operation. Of the remaining 7 patients, 1 lived for four months and the other 6 patients were cured and remained well for many years.

In treating the patient the same general plan should be followed that has been found to be so successful with tuberculosis in other parts of the body; not that fresh air and good food will succeed in curing tuberculosis of the cervix, but these measures tend to build up the resistance of the patient, so that better results may follow surgical interference.

Attempts have been made to cure the lesion by various light rays, particularly the use of the Kromayer lamp or by use of the x-ray. Cauterization with chemicals or with the Paquelin cautery has been attempted, and while it may change
the course of the disease it is not curative. The generally accepted plan of treatment for tuberculosis of the cervix seems to be either a high amputation of the cervix or, what is far better, either a vaginal or abdominal panhysterectomy.

Because of the rareness of this condition and because the patient was so long under observation and had submitted to various lines of treatment, including x-ray, with final cure following abdominal hysterectomy, the following case report is made:

CASE REPORT

A young Italian woman, twenty-three years of age, who had never been pregnant, registered in the Women's Clinic at Stanford University School of Medicine on March 15, 1921. She could speak very little English, but the complaint seemed to be that she had had no pregnancies, although she had been married for nine months. There had been a scant white vaginal discharge for seven years, and since marriage this had occasionally been blood tinged. She denied previous illnesses.

Her menstrual flow began at fifteen, was regular, of the twenty-eight-day type, lasting five days, without pain. Bowels were regular; there was no bladder frequency. Husband was well and denied ever having had venereal disease.

Physical examination was negative in regard to thyroid, heart, and lungs. Blood-pressure 135 systolic, 84 diastolic. Abdominal examination was negative. In the left breast, beneath the nipple, was a firm, round, freely movable, not tender mass. Pressure on this mass was followed by some whitish fluid from the nipple.

x-Ray examination of her chest showed evidence of pleural thickening between the lobes of the right lung. The heart vessel shadow was displaced to the right, but was otherwise normal. The lung fields were comparatively clear. The hilus and bronchial tree shadows were within the normal limits. The conclusion was an old pleurisy on the right side, but no x-ray evidence of active disease in the chest.

Examination of the urine showed an occasional granular
cast, with some increase in the number of leukocytes and repeated findings of red blood-cells.

Examination of the blood gave 80 per cent. hemoglobin, with 9000 white cells, 65 per cent. polymorphonuclear, and 34 per cent. lymphocytes. Wassermann examination was negative.

Vaginal examination: The vulva and glands of Bartholin and Skene were negative. The cervix was raw and bleeding. There was a very granular papillary growth on the cervix, involving the vaginal wall posteriorly. This ulcer bled readily on sponging, but was not friable, and felt soft to palpation. The vault of the vagina was granular and soft. The fundus was in good position and the adnexæ were thought to be slightly thickened. There was a marked odor to the vaginal discharge.

The impression from this preliminary examination was chronic cervicitis (questionable) or carcinoma of the cervix (questionable), and a piece of the ulcer was removed for microscopic examination.
The microscopic examination of the ulcer on March 21, 1921 showed marked adenomatous condition with plasma-cells in the stroma. There was typical epithelial tubercle formation, with giant-cells in the stroma. A diagnosis of granuloma of the cervix, probably tuberculous, was made (Fig. 157).

Beginning March 24, 1921 a series of x-ray treatments over the whole lower abdomen and pelvis anteriorly was carried out at intervals of every three weeks until August 23d. The x-ray dosage was very small, consisting in 15 milliampere minutes, at 20 inches, 10-inch spark gap, with 5 millimeters aluminum filter. This treatment was associated with local treatment in the clinic with various antiseptics, but without the slightest signs of improvement.

On September 6, 1921 the patient entered the hospital for operation. At that time the cervix presented a ragged, crater-like ulcer on the left side, and from this ulcer nodules continued down on the left wall of the vagina for about 1 inch. There was a profuse purulent discharge and the ulcer had a soft granular feeling and bled slightly on examination. There was a ring of granular vaginitis for about 1 inch below the cervix.

On September 16th the following operation was carried out: The vagina was sterilized with 25 per cent. silver nitrate solution. Laparotomy was done by the usual midline incision below the umbilicus and carried well down to the symphysis. Exploration of the abdomen showed a large soft gall-bladder; both kidneys were smaller than normal. The appendix was adherent to the right ovary by the tip. This adhesion was freed and the right ovary was removed by clamping, cutting, and tying the right broad and round ligaments and the vessels to the ovary and tube, with chromic catgut. Clamps were then placed on the left tube, broad and round ligaments at the uterine end, and these were freed from the fundus and the vessels ligated with chromic gut. A complete hysterectomy was then done by dissecting off the bladder fold and clamping, cutting, and tying the uterine and vaginal vessels and the sacro-uterine ligaments. The anterior vaginal vault was opened
into below the lowermost ulcer and the excision was carried posteriorly, distal to the diseased area, by sight. The vaginal vault was then approximated and suspended by the sacro-uterine, broad and round ligaments by means of a continuous purse-string suture of chromic catgut. The raw surfaces were covered over. Appendectomy was done in the usual manner by inverting the stump with one purse-string Pagenstacher suture. Closure: Plain continuous catgut was used for the peritoneum, fascia, and skin; interrupted gut for the muscle and fat; five silkworm stay sutures were used.

The patient remained in the hospital for fifteen days and made a normal recovery without wound infection. There was only one rise in temperature over 100° F., which occurred on the morning following operation. The pulse-rate varied between 80 and 100.

The discharge examination on October 2, 1921 showed the vaginal mucosa to extend about 6 or 7 cm., beyond which a soft canal could be felt about one-third the diameter of the vagina, and about 2 or 3 cm. in extent. On palpation, a small amount of light yellow fluid came away. Speculum examination showed the vaginal wall clear to about 7 cm., where the vault was open for a diameter of about 2½ cm. and the presenting tissue was slightly necrotic and invaginated for about 3 cm. The chromic sutures were still in place. There was no odor noted. The patient was discharged, with a request to return to the clinic.

The pathologic examination of the tissue removed in the operation was as follows: “Specimen consists of uterus which is 8 x 6 x 3 cm. The cervix is almost completely destroyed, with the ragged ulcer having undermined edges. A portion of the vagina attached to the cervix was 2 x 8 cm. and was ulcerated nearly to the incised edge. The right tube was 6 cm. long, closed, otherwise normal. The right ovary was normal, 3 x 4½ x 1½ cm. (Fig. 158). The appendix was bent at the distal end and bound down by adhesions 9 cm. long.

Microscopic examination showed: Chronic appendicitis with no evidence of tuberculosis. There was fibrosis of the ovary
with no signs of tuberculosis. The fallopian tube was normal. The endometrium was normal above the internal os. The wall of the uterus was normal. The cervix showed hyperplasia of the glands with extensive area of tubercle formation, showing epithelioid cells and many giant-cells. Section of the vaginal wall gave the same picture of tuberculosis as shown in the cervix (Fig. 159).

The patient returned to the Clinic on February 3, 1921, stating that she had felt so much better that she did not see why the social service workers insisted upon her returning.
The vaginal discharge had entirely disappeared. The pelvic examination was negative except for an area of redness in the region of the scar in the vaginal vault. Several small pieces from this region were removed for microscopic examination. This examination showed no tubercles or giant-cells. The vaginal epithelium was normal, but underlying this normal epithelial layer was a thick layer of plasma cells and round cells. The evidence so far presented seems to show that the patient is cured of her tuberculosis of the cervix, although there still remains some inflammatory reaction in the upper part of the vagina.

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From the Division of Neurological Surgery, Department of Surgery, University of California Hospital

SPINAL CORD TUMORS (ARACHNOID FIBROBLASTOMATA)

From a series of spinal cord tumors this single group has been selected for study. The designation most popularly applied to them is that of "endotheliomata," although they are frequently called fibromata. They represent one clinical and pathologic group which is particularly amenable to surgical treatment, and of all types of spinal cord tumors probably give the most brilliant clinical results.

With all the attention that has been called to the surgery of spinal cord tumors, the diagnosis of the condition is not usually made until the paralyses are far advanced and the patient has been through many hands. For each of the cases here presented there have been from four to twenty medical attendants before the diagnosis was made and treatment given. It would seem that the feeling that spinal cord tumors are very infrequent is largely responsible for this and also that syphilis is given undue prominence. The diagnosis of spinal cord compression is not difficult. A slowly oncoming paraplegia or quadriplegia with a constant upper level of sensory involvement usually tells the story regardless of the details of the involvement.

The degree of permanent damage to the spinal cord from compression depends chiefly upon the rate of its progress and the degree of compression. Sudden acute pressure upon the cord causes a measure of contusion not at all comparable to the result of a slow pressure over many months. In each the degree of compression may be the same.
The degree of permanent change in the cord from compression determines the amount of improvement after relief from the pressure. A rapidly growing hard bone tumor of the vertebral canal may be expected to produce different results from a slowly growing soft tumor in the same location.

In view of such factors a search of the literature on spinal cord tumors has been made, and it is to be noted that in the writings spinal cord tumors are usually reported in one group regardless of the type of tumor, its rate of growth, or the degree of cord compression. From a consideration of all the types a common clinical picture has been built up as to the symptomatology of spinal cord tumor. It seems true that prior to operation or to identification of the tumor a diagnosis of its type will always be difficult and frequently impossible. Still, in a consideration of symptomatology and very particularly in prognosis, the rate of growth and the degree of compression are important. These enable us in some measure to forecast the results of treatment. In the cases presented here these factors in varying degrees have been noted. In all there have been marked paralyses, and in most it has been extreme. The after-course following relief of pressure has in some been beyond our expectations.

The proper classification of these tumors, all of which are of the same pathologic type, has been a matter of some discussion. For a study of all of them we are indebted to Dr. Glanville Y. Rusk, whose opinion has been expressed as follows:

"The group of tumors here encountered arising presumably from the superficial cells of the arachnoid, in intimate association with the dura, come under the designation of endotheliomata of the dura, according to the nomenclature all but universally employed. This terminology predicates that the cells from which the tumor takes origin, i.e., those lining the apposed surfaces of dura and arachnoid, have in their development taken on characters differentiating them from the subjacent connective tissues and so justifying their inclusion with endothelium. It is explained that the tumors which may occur from this tissue and which invade the dura and at times the overlying
bone, and are more or less cellular, acquire a stroma and vascular supply from the invaded structures. It not infrequently happens that the fibrous character of the resulting new growth is such that it is impossible to distinguish the tumor cells proper from the stroma, except perhaps in the whorl formation. It must be admitted that the above explanation is often far from satisfactory in interpreting the microscopic pictures encountered.

"It is with a sense of relief, then, that one encounters the studies of Mallory (Jour. Med. Research, 1919–20, v. xli, p. 349), who finds that the layer of flattened cells on the surface of the arachnoid are fibroblastic in character and possess fibrogial and collagen fibrils; that there is no dural endothelium; that the frequently encountered arachnoidal thickenings show a marked tendency to invade the dura, may include dural fibroblasts in their meshes, and may show a tendency to whorl formation. The more complete details may be read in Mallory's article. In brief, it is on this basis that such tumors arise, and being from a tissue which always possesses fibroblastic qualities the resulting tumors have potentialities to and do actually form fibrogia, collagen, and elastic fibrils. They then should be classed as fibroblastomata, and out of respect to their various peculiarities the designation 'arachnoid fibroblastomata' is suggested by Mallory. This suggestion is adopted in the diagnosis above given."

Of these 6 cases the first 5 have been followed for periods ranging from two to ten years. The sixth case has not been under observation since leaving the hospital. The histories and repeated neurologic notes have been condensed and then abstracted to include only positive statements and findings.

**CASE I**

University of California Hospital, No. 29,032:

White woman, married, housewife, aged thirty-one years.

**Final Diagnosis.**—Spinal cord tumor—arachnoid psammo-fibroblastomata, level of eleventh or twelfth dorsal lamina.

**Complaint.**—Pain in back and hips, with progressive paralysis of legs and impairment of bowel and bladder control.
Abstract of History.—One brother had tuberculosis. Some contact with patient. Patient has dyspnea upon moderate exertion. Apart from some acute attacks of pain in the right lower quadrant of the abdomen, with interval digestive disturbances, there is nothing else of note up to the present illness.

Present Neurologic Trouble.—The patient connects some occurrences ten years ago with her present trouble. During a pregnancy at that time she had formication over the sacral region more on the left side. From that time on this trouble progressed and was worse during menstruation. No other symptoms up to four months ago, when she was awakened at night with severe pain in the left side of her back in the low lumbar region. This pain was severe and gradually radiated to hip and around the abdomen. The pain was intense and not relieved by hypodermics. Later it moderated, but some pain persisted, with occasional severe paroxysms. The pain was worse on reclining or sitting and relieved by standing or walking. While this pain was still present there came a feeling of numbness in the right foot. Two days later it shifted to the left knee and progressed downward to the left foot. It has persisted since then, and with it a feeling as if the leg were in a tight cast. Difficulty in control of the leg next appeared. She stumbled and felt as if walking on rubber balls. The left foot turns inward and the toes upward. Sensation in the rectum became gradually impaired. Next difficulty in voiding, particularly in initiating urination, appeared. Following a spinal puncture all of her symptoms became definitely worse, and control of the right leg was difficult. Upon entry the patient was bedridden—unable to walk.

x-Rays: Slight curvature convex to left in region of the tenth or eleventh thoracic vertebra. Fifth lumbar vertebra partially sacralized on right side with joint between transverse processes and sacrum.

A second spinal puncture was reported: Fluid clear. Wassermann, 0.2, 0.3, 0.5 negative, with two antigens. Protein normal. Globulin 0; cell count 6. Gold chlorid, 004332100. Luetic curve (?)..

Neurologic Examination.—Cranial nerves negative. No abnormalities above middle of trunk.

Spine: No deformities apparent. No fault in mobility. Occasional variable tenderness at about the tenth dorsal spine.

Motor: The patient is bedridden from lack of power and of control of lower extremities. Spasticity is marked in both legs, but greater on the left.

Abdomen.—When lying and attempting to sit the umbilicus moves to the left. This is constant, and corresponds with the lessened contraction of the abdominal muscles on the right as shown by palpation. The movement is directly lateralward. No up or down movement. The left side of the thorax also moves more on the right.

Lower extremities:

<table>
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<th>Right</th>
<th>Left</th>
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<tr>
<td>Hips: Weak voluntary flexion.</td>
<td>Flexion entirely lost.</td>
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<tr>
<td>Extension weak,</td>
<td>Extension very weak.</td>
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<tr>
<td>Internal rotation moderately strong.</td>
<td>Internal rotation lost.</td>
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<tr>
<td>External rotation lost.</td>
<td>External rotation lost.</td>
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<tr>
<td>Abduction strong.</td>
<td>Abduction very weak, almost lost.</td>
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<tr>
<td>Adduction weak.</td>
<td>Adduction extremely weak.</td>
</tr>
<tr>
<td>Knees: Quadriceps fully extends the knee.</td>
<td>Quadriceps extends the knee, but much weaker.</td>
</tr>
<tr>
<td>Hamstrings—internal and external strong.</td>
<td>On palpation are felt to contract, but their power is negligible.</td>
</tr>
<tr>
<td>Ankle and toes: All muscles supplied by the internal popliteal nerve act, but are weak.</td>
<td>All muscles supplied by the internal popliteal nerve act, but are very feeble.</td>
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<tr>
<td>All muscles supplied by the external popliteal act, but are weak.</td>
<td>All muscles supplied by the external popliteal nerve act, but are very feeble.</td>
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Atrophies.—Some wasting of the lower extremities, more on the left.

Measurements:

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<td>Leg</td>
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Reflexes:

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<td>Patellar clonus</td>
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Sensory Examination.—The accompanying charts represent the conclusion of a large number of studies. Certain findings are worthy of additional comment. It should be emphasized on account of frequent errors in interpretation that the areas of hyperesthesia were areas in which the type of sensation was normal. The character of sensation was normal, but appreciation of it abnormally acute. It was not simply an increased sensitiveness of a slightly abnormal or painful type such as is often loosely termed "hyperesthesia."

The loss of vibration sense reached a higher level than any other lost sensation. In the lower extremities the area over which appreciation of heat was not recognized was larger than the area anesthetic to cold. Vibration sense was tested with a tuning-fork (256 C.). Joint position: No appreciation of passive movements of any toes or of either ankle. Movements of the knees are appreciated.

Operation.—Subperiosteal laminectomy—seventh, eighth, ninth, tenth, eleventh, and twelfth dorsal spines.

The dura showed definite pulsation at both upper and lower limits of the exposure. The dura in the region of the eleventh and twelfth lamina showed several vessels of considerable size (Fig. 160). Above this and shining through the dura could be
seen numerous white plaques varying in size from 1 or 2 mm. in diameter to nearly 1 cm. There were perhaps twenty-five in all (Fig. 161). Upon opening the dura the tumor was found on the dorsal surface of the cord at about the junction of the eleventh and twelfth dorsal vertebra (Fig. 162). It was about
the size of the terminal joint of a man's thumb and markedly compressed and excavated the cord. About three-fifths of the bulk of the tumor was to the left of the midline. Removal of

Fig. 162.—See text.

the tumor and overlying dura. It should be noted that the small white plaques seen above the tumor were confined to this region. None were present below the growth. Weight of the tumor was 6.6 gm. (Fig. 163).
Fig. 163.—See text.

Fig. 164.—x-Ray of cervical spine. "No Roentgen evidence of pathology."
Fig. 165.

Hypersensitivity to touch, pain and temperature, but loss of vibration sense.
Lessened sensation to cotton, touch, pain and temperature. Impaired compass, point discrimination and vibration sense below this level.
Loss of thermic sensibility.
Loss of all forms of sensibility including deep heavy pressure.

Fig. 166.

Below this level diminished sensations to touch, pain, thermal, and deep sensibility. Muscle and joint sense in toes and ankles entirely lost.
Cold is perceived as painful stinging sensation and through experience is recognized as such. It is called correctly more often than heat.
From day to day the sensations alter.
Patches of greater sensibility and patches showing more involvement of sensation occur at various places. The upper level of involvement remains constant, however. Below this level there is in all areas some disturbance of sensation although these are minor differences in different areas.
Vaso motor disturbance complaint of coldness of left leg. Upon examination, it was found warmer than the right. Muscle sense is much more impaired on the left. No tendency to Brown-Sequard type. At times the level of diminished sensation would rise about 3cm and laterally would include the anterior and posterior axillary folds and part of the axilla.

Below the 11th dorsal segment pain, touch, deep sensibility and temperature senses are diminished or lost.

Cold is felt a little lower than heat on both sides.

Temperature more disturbed on the right.

Fig. 167.—Sensory examination.

Fig. 168.—Sensory examination.
Pathologic Report.—"Microscopic examination of the tumor shows it to be composed of compactly growing cells often spindle shaped (Fig. 170 from the more cellular portion of growth). Characteristic of the tumor is the occurrence of great numbers of whorls of cells, many of which show marked hyaline degeneration, and still others, calcification. In the areas relatively free from whorls the intercellular substance is uniformly fibrous, as if composed of collagen. The blood-vessels in this growth are scanty and some show thickening of the endothelium. Some of the whorls appear to form about vessels.

Around many of the vessels there occurs a collar of cells with deeply staining nuclei, some about the size of lymphocytes, and others with more abundant cytoplasm, apparently wandering cells. These nests appear to have no relation to the cells of the new growth."

Diagnosis.—Arachnoid psammofibroblastoma.

Postoperative Notes.—In twenty-four hours following operation deep sensibility returned to feet.

In four days, appreciated passive movements of toes, and localizes toes on left foot. Feels pressure at all points. Recog-
nizes pin-prick over left leg and foot. Does not recognize touch.

By the tenth day the left hip could be fully flexed with the leg extended at the knee.

On the eleventh day all movements at toes, ankles, knees, and hips are restored. The rotations of the left hip are still weak, however. Abduction and adduction strong on both sides. The Babinski and ankle-clonus persist on the left. The areas of hyperesthesia present before operation (see chart) persist and are but little changed. The area of total loss in black has been replaced by sensation as in the area of hypesthesia. No bladder or rectal difficulties.

By the thirteenth day the clonus and Babinski disappeared.
Walking began on the seventeenth day. The upper level of the hyperesthesia disappeared first on the right side, then on the left. The hypesthetic areas cleared rapidly in a patchy way. Examination a few weeks after discharge and seven weeks from time of operation showed no neurologic abnormalities. Recovery has been complete.

Comment.—The history in this case is of ten years' duration, but the symptoms during the last four months came with great rapidity. The pain in the back low down on the left was probably to be regarded as a root pain, as it disappeared after operation. It was of the type, however, commonly seen with a sacralized fifth lumbar, and was so regarded. While the nerve findings could not, of course, be explained by this anatomic abnormality, it added a complication in interpreting the cause of the pain. The appearance and development of subjective sensory disturbances prior to any motor disturbance is what would be expected with a tumor in a dorsal position and more on the left than on the right.

In the sensory findings it is of interest that loss of vibratory sense was more wide-spread than the loss of any other sensation. It has been our experience that sensibility to deep pressure or a hard squeeze is the last to disappear in progressive sensory loss, and is among the first if not the first to return. Considerable variation in sensory findings occur from day to day. Some time is required and many studies to build up an accurate conception of the sensory changes.

The slight curvature of the spine at the tenth and eleventh thoracic vertebra, while indeed slight, was very definitely localized and was sufficient to be noted in the x-ray report as suggesting a tumor. This finding we have noted in other instances, and in such a case is suggestive.

Lumbar puncture with removal of fluid gives varying effects. Symptoms may be temporarily exaggerated or improved by it. Occasionally it will make the upper level of the sensory involvement easier to recognize or may even cause a slight shift in the sensory level.

The white plaques seen in the arachnoid have no patho-
logic significance. They are common findings with or without tumor. Pathologic examination is reported as showing them to be fibrous plaques. It is remarkable but unexplained why in this case they should have been limited in their distribution to the region above the tumor.

The type of tumor and the knowledge of the rate of growth in similar cases makes it seem reasonable that the symptoms in this case dated back ten years.

CASE II

University of California Hospital, Admission No. 2126: Female, white, American, housewife, age thirty-three years.

Diagnosis.—Spinal cord tumor; arachnoid fibroblastoma at level of the ninth dorsal vertebra.

Abstract of History.—Patient has frequent recurring attacks of tonsillitis with abscesses for years. Teeth were so badly carious that all were drawn at the age of nineteen years.

Three years prior to admission had a fall from a buggy, following which there was pain in the back for some months. Nothing else of note in the past history.

Present Trouble.—Was well up to fifteen months prior to entry. First awakened every morning at 4 A. M. with pain low down in the back. The pain was steady, not severe, and did not radiate. It disappeared upon arising.

In two months this pain ceased and bilateral pains in the lower abdomen and groin appeared. This was steady, dull, relieved by pressure, and did not radiate. This lasted for a few weeks, and then, except for irregular attacks of backache, there were no symptoms until eight months ago, when lameness and stiffness in the left leg commenced. Gradually lost control of this leg, although for a long time it did not seem weak. The difficulty seemed to be a stiffness.

Three months later there was burning urination. For the past three months there has been incontinence of urine, and during the same time the right hip has developed stiffness and soreness.

For nearly three months there has been entire loss of rectal
control. Menstruation unaffected, although the last flow was scanty, pale, and shorter in duration.

**General Examination.**—Scars of a few healed ulcers on left shin, said to have followed injuries and healed in four weeks. No signs of lues. Wassermann negative. Nothing else of note in general examination or laboratory reports. Spinal fluid not examined.

**Neurologic Condition.**—The patient is bedridden. Legs very spastic, but show a little movement. Unable to walk, but can stand. Bladder and rectal incontinence.

**Reflexes.**—Upper extremities and trunk negative.

<table>
<thead>
<tr>
<th>Reflex</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominals</td>
<td>++ (normal)</td>
<td>++</td>
</tr>
<tr>
<td>Patellar reflex</td>
<td>++++</td>
<td>+++</td>
</tr>
<tr>
<td>Achilles</td>
<td>++++</td>
<td>++++</td>
</tr>
<tr>
<td>Patellar clonus</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Achilles' clonus</td>
<td>++++</td>
<td>+++</td>
</tr>
<tr>
<td>Babinski</td>
<td>+</td>
<td>+?</td>
</tr>
<tr>
<td>Oppenheim</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

**Operation.**—Subperiosteal laminectomy showed dural pulsations down to the ninth dorsal vertebra.

Several whitish plaques showed through the dura. At the level of the ninth lamina a tumor 2 x 2 x 1 cm. was found on the left posterolateral surface of the cord. It was attached to the dura, at which point a vessel entered the growth. It was encapsulated, smooth, firm, and readily enucleable. The dura was resected with a margin.

**Pathologic Diagnosis.**—Arachnoid psammofibroblastoma.

**Postoperative Progress.**—On the thirteenth day after operation patient was able to control and to pass urine voluntarily. The spasticity of the leg had disappeared. Knee and Achilles' jerks normal, but a trifle livelier on the left. Plantar reflexes normal. Pin felt everywhere, but sharper on the left. Muscle sense still defective, although it has improved a little on the left. No pain in abdomen, back, or extremities.

Twentieth day, muscle sense in right toes normal. Slight impairment on left. Sensations to pin normal.
Five years after operation this patient was last seen. Recovery had been prompt and complete. No residual symptoms or findings.

Comment.—Case II is in many ways similar to Case I. At the time of coming under observation just prior to operation the findings were practically symmetric, although the history was definite regarding the side first involved. This corresponded with the left-sided location of the growth.

In both Case I and Case II the first pains experienced were relieved by standing.

In a spinal cord compression in which there is not a complete physiologic block it is to be noted that the sensory changes below the level of the lesion are not uniform. Occasionally even patches with nearly normal sensation may be found. Ordinarily, however, comparison of areas which on first testing seem to be normal with areas elsewhere on the body well above the level of the lesion, show some diminution in sensation, and make it evident that there is slight impairment. Likewise these areas vary from day to day.

CASE III

University of California Hospital, Admission No. 6486:

Diagnosis.—Spinal cord tumor; arachnoid fibroblastoma at the level of the second dorsal vertebra.

Abstract of History.—White, male, American, unmarried. Age thirty-eight years. Nothing of special note in history up to the

Present Illness.—Fifteen months prior to admission the right thigh about the middle felt as if asleep. A little later the left thigh was similarly affected. These sensations were of a stinging character, not radiating or sharp. This sensation has persisted, and for the past three months the legs and knees have been stiff. The sensation in the thighs now is of pins and needles. Control of bladder and rectum was lost for a few days and then returned. Eight weeks ago following a spinal puncture control was again lost temporarily. Urination now is slow in being initiated. There has been some pain in the right
lower abdomen, of the same sharp stinging character, and it spreads up over the left side of the thorax to the nipple. Weakness in the left leg first appeared seven months ago and has progressed. There is much complaint of coldness in the left leg and but little on the right.

**General Physical Examination.**—No findings apart from the neurologic condition which have a bearing on present trouble. Wassermann on blood and spinal fluid negative. Spinal fluid negative. Blood and urine negative. Clonus rate at ankles, 5.75 per second and equal on both sides.

**Neurologic Examination.**—The patient is an unusually strong, well-muscled man, able to walk with difficulty. Gait is spastic, the left leg swings out and is evidently very weak. It appears slightly smaller than the right. While under observation the paralysis increased so that he became unable to walk without aid.

Cranial nerves and upper extremities uninvolved. Lower extremities weak. Weakness more marked on left. All movements, however, can be performed.

**Measurements:**

<table>
<thead>
<tr>
<th></th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calf</td>
<td>34.8</td>
<td>34</td>
</tr>
<tr>
<td>Lower thigh</td>
<td>43</td>
<td>42.8</td>
</tr>
<tr>
<td>Upper thigh</td>
<td>52</td>
<td>51.5</td>
</tr>
</tbody>
</table>

**Reflexes:**

- Patellar: +++ Very lively ++++
- Achilles: ++ Very lively +++
- Knee clonus: +
- Achilles' clonus: +
- Oppenheimer: +
- Babinski: +
- Upper abdominal: -
- Lower abdominal: -
- Cremasteric: -
- Sphincter ani: -

**Operation.**—Subperiosteal laminectomy. Opposite the third dorsal lamina was found a tumor 2 x 1 1/2 x 1 cm. lying beneath the arachnoid. It lay just to the left of the midline posteriorly.
After incision of the arachnoid it was easily shelled out. The tumor was smooth and firm.

Pathologic Report (Fig. 171).—"The microscopic examination in this case is made from a single section which has been preserved. The relation of the growth to the dura cannot be made out from the section. On one side the growth consists of a laminated, moderately cellular structure, the outline of the cell protoplasm cannot be made out, but between the nuclei is a homogeneous intercellular material suggesting collagen material. Further inward the structure changes to a quite irregularly disposed layer, again moderately cellular, the nuclei varying slightly in size. In the meshes of this tissue is a moderate amount of edema. Within this layer again the growth,
appears irregularly more cellular, the cells tending to form concentric whors, not about themselves, but about the blood-vessels and rarely about hyaline masses, which apparently are derived from blood-vessels. In between the cells the intercellular material is uniform and has the appearance of collagen fibers so far as one can judge from hematoxylin and eosin staining. The tumor is quite vascular, the vessels in general being relatively large with thickened hyaline walls; some of the vessels show evidence of being thrombosed, with subsequent recanalization, this apparently being responsible for some of the occurrence of the larger fibrous masses. In some such areas cells containing pigment, apparently derived from blood, occur in these hyaline masses."

**Diagnosis.**—Arachnoid fibroblastoma.

**Postoperative Notes.**—In twenty-four hours after operation the patient stated that he could use his leg better. Less spasticity present. Cold over the lower abdomen now gives a normal sensation. On the fourth day the upper level of sensory change had disappeared. Passes urine without difficulty. Sensation to pin seems everywhere normal. There is less exaggeration of the patellar jerks and ankle-clonus has disappeared.

Discharged in one month, walking alone without difficulty. Six weeks later no neurologic abnormalities were present. Recovery was complete. Had been doing hard labor for several months.

This patient was seen and examined four years after the operation. No symptoms and negative neurologic findings. Recovery complete.

**Comment.**—In Case III, as in Case I, there was an alteration in symptoms following lumbar puncture. Following it there was a temporary incontinence of bladder and rectum which disappeared in a few days.

The initial symptoms were paresthesia in both thighs on the antero-external surfaces. These were obviously not root pains on account of their location. The patient's description of them suggested the possibility of a separate condition—meralgia paresthetica, although they were bilateral and progressive.
About one and a half years after operation the patient wrote back a doleful letter complaining that the operation had undoubtedly done him permanent damage, as for two weeks he had been having pain between his shoulders at the site of the operation. This complaint was accompanied by no other statement. He was urged to return for examination, which he did. It developed upon questioning that he had been working as a teamster driving a pair of mules. In a runaway the wagon was overturned and the driver thrown a distance of 15 feet, striking on his back and shoulders. The soreness and pain followed this, but had practically disappeared when he was examined three weeks later. His neurologic examination was negative. This demonstrates once more not only the incompleteness of patient's reports, but what trauma a laminectomized spine can tolerate without damage.

CASE IV

Children's Hospital, No. 13,539:

Diagnosis.—Spinal cord tumor; psammofibroblastoma.

Abstract of History.—White woman, married, fifty-eight years of age. Eight months prior to admission began to have a dull boring intermittent pain in left hip. Six months ago its severity was great enough to confine patient to bed for four days. One month after onset the right toes felt as if there was a cushion under them. Five months ago numbness began in right foot and six weeks later it appeared on the left. As these sensations gradually appeared, pain in the left hip decreased. The numbness gradually extended to above both knees, but more pronounced on the right. Never any shooting pains or paresthesia. Ataxia accompanied the numbness. Unable to walk in the dark and walks poorly, unless assisted. No gastric symptoms. Urination is imperative, but no incontinence or retention. Has been nervous all of life. This has increased during present trouble. Has had exophthalmos for twenty-five years, much worse in the last four years. Uniform enlargement of lower neck for many years. Perspires but little, although palms are always moist. Never any diarrhea. For the last
three years has palpitation upon exertion. No dyspnea. Has had non-productive irritable cough for five years. Has lost 8 pounds in weight in the past year.

**Progress.**—This patient was under observation and medical treatment for two months. During this time the paraplegia became complete.

Nothing of note in family or past history except that the patient has had exophthalmic goiter for years and arthritis of finger-joints with nodes.

**General Physical Examination.**—The patient appears older than her age, shows marked exophthalmos, with a moderate uniform thyroid enlargement. Erythema over neck with marked pulsation in neck vessels. Fine tremor. Enlarged heart 3 cm. outside nipple line in fifth space with a systolic murmur over apex. While at rest in bed pulse-rate averages 98 per minute.

There is an arthritis of finger-joints. Nothing else of note in general examination.

x-Rays of spine are negative except for a hypertrophic arthritis. Spinal fluid showed 12 lymphocytes per cubic millimeter. Noguchi and Nonne faintly positive. Wassermann negative. No alteration in neurologic findings following spinal puncture. Blood-pressure varies from 250 to 265 systolic. Diastolic not noted.

**Neurologic Condition.**—When the patient first came under observation about six weeks prior to operation she had a spastic paraplegia and was unable to walk without assistance. The lower extremities showed hyperactive patellar and ankle-jerks on both sides. There were repeated jerks, but not a well-sustained clonus at knees and ankles. Babinski and Oppenheim reflexes present on both sides. No atrophies were present. The motor weakness was greater on the left, evident in the knee flexors and extensors, and in all ankle movements. The belly muscles contracted equally and well.

Sensory changes just above the crests of ilia. Below this level the degree of sensory involvement increased toward the feet, with some tendency to a Brown-Séquard syndrome.
Temperature sense markedly involved on the right below the level of the great trochanter. On the left there was but slight disturbance, and this was confined to leg and foot. Muscle and joint and deep sensibility seemed equally disturbed on both sides, and was completely gone in toes, ankles, and knees. The disturbance of touch and pain was slight and variable.

**Examination of Back.**—Shows some general stiffness of spine. No alteration in alinement. No tenderness.

**Six Weeks Later.**—The patient is now bedridden and unable to make any movement of the extremities except an almost imperceptible movement of the right great toe. The spasticity of the extremities has given way to complete flaccidity, with lost deep reflexes and complete incontinence. The sensory changes have deepened. Loss of temperature, touch, pain, and most forms of deep sensibility is now everywhere marked. Very deep heavy pressure of calves and feet can, however, be appreciated.

**Operation.**—Subperiosteal laminectomy.

Opposite the bodies of the ninth and tenth dorsal vertebra an intradural extramedullary tumor was found in the left posterolateral position. There was no attachment to dura. The tumor was about 1½ cm. in diameter, smooth, firm, and glistening. Readily enucleated without bleeding. A very marked deep hollow remained in the cord, which appeared to be reduced to about one-half its thickness.

**Pathologic Diagnosis.**—Arachnoid fibroblastoma.

**Postoperative Course.**—On the third day after operation the patient suddenly became irrational and developed a psychosis, to which it was thought her thyroid disease was a contributing factor. Her mental condition cleared up completely in five weeks.

Examination in five weeks showed voluntary movement through about half the normal range at hips and knees. Very slight movement at ankles and none at toes. Knee-jerks both present. Achilles present on the right, absent on the left. Plantar responses atypical on the right and absent on the left. No clonus at knees or ankles, but a few jerks present on the left.
The patient was able to recognize the position of all joints except toes. Other forms of sensibility all show marked improvement.

In two months after operation this patient reported by letter that she was up and about the house and had walked to a post-box one block away without a cane or other assistance. The sphincter disturbances had cleared up. There has been no opportunity to determine the later course of this case.

It seems certain that this patient must have improved greatly following the last report. The degree of improvement at that time was satisfactory.

Comment.—This patient was in poor physical condition, and on account of her thyroid disease and high blood-pressure was a poor operative risk. It is to be noted particularly that at the time of her operation her paraplegia had changed from a spastic to a flaccid one. In view of the presence of flaccidity a very doubtful prognosis was given, and it was with some surprise that her improvement was followed. The flaccidity had, of course, been of very short duration.

CASE V

University of California Hospital, Admission No. 26,822:
White woman, married, housewife, American. Age sixty years.
Diagnosis.—Spinal cord tumor. Arachnoid psammofibroblastoma at level of fifth dorsal vertebra.
Complaint.—Paralysis below level of lower ribs.
Abstract of History.—Family history of cancer on father's side. Patient has had two miscarriages and one son died of convulsions as an infant. Patient had thyphoid at age of seven years. At the age of twenty-five years fell from a carriage and injured back. Recovered in a few days. Has had dyspnea and palpitation on exertion. No other facts of importance until

Present Illness.—Has had a weak and painful back for many years. Five years ago first noticed that her legs were weak and painful. Her legs often jerked involuntarily. The pains were of a dull, aching character. She grew progressively more weak and suffered more pain. Her gait, she states, was
stiff and at times reeling. She would bump against people with whom she was walking. Two years ago she was forced to use a cane. One and a half years ago she could not get about without crutches. Just before this time she began to pass urine and feces involuntarily. Her incontinence has persisted to date. She has not had retention of urine at any time necessitating catheterization. One year ago she was forced to take to her bed. She has not walked since that time. Her pains have persisted in the legs and are of a dull, aching character. Around the waist line she has a numbness with marked sensation of pins and needles sticking her.

Examination.—The patient is a tall and very stout woman weighing 255 pounds. On general physical examination nothing of importance as having bearing on her neurologic condition was found. The abdomen shows numerous scars of burns from too hot applications.

Blood-pressure 140/88.

Aside from numerous hyaline and granular casts in the urine there were no abnormalities in laboratory work, including blood, blood Wassermann, complete spinal fluid examination, roentgenograms, etc. No neurologic abnormalities in cranial nerves or upper extremities.

Neurologic Status.—The patient is completely paralyzed below the waist. The only voluntary movement is a very faint movement in the toes, and this is not always present. There has been complete incontinence of bladder and rectum for over one and a half years. The lower extremities are moderately spastic. The patient states that the left leg has been more affected both in power and deep sensibility. All the involved parts below the upper level of paralysis feel compressed.

Reflexes:

<table>
<thead>
<tr>
<th></th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominals</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Patellars</td>
<td>Greatly increased</td>
<td>Greatly increased</td>
</tr>
<tr>
<td>Achilles</td>
<td>Greatly increased</td>
<td>Greatly increased</td>
</tr>
<tr>
<td>Patellar clonus</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>Babinski</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>Oppenheim</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Gordon</td>
<td>Absent</td>
<td>Absent</td>
</tr>
</tbody>
</table>
Spinal puncture produced no alteration in findings.

Sensory Examination.—

Operation.—Laminectomy.

An extramedullary tumor measuring $2\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{2}$ cm. found at the level of the fifth dorsal lamina. It occupied a right lateral position. The cord was dislocated to the left and pressed against the dural canal. The growth was attached to the dura. After removal of the tumor and resection of the dura the cord appeared indented to about one-third of its normal thickness.

Pathologic Report (Fig. 172).—"Microscopic examination shows growth composed of spindle-shaped cells, with varying amount of intracellular substance. In some areas the cell masses form interweaving strands. The intracellular substance..."
varies considerably. Quite characteristic of the growth is the occurrence of numerous whorls, some quite cellular and a few hyaline, but most of them extensively calcified. With a Weigert's elastic tissue (Fig. 173) stain there is abundant formation of elastic tissue derived from tumor-cells as well as the occurrence of the same tissue in and about the whorl formation."

Diagnosis.—Arachnoid psammofibroblastoma.

Postoperative Notes.—Third day—able to move great toes. Fourth day—able to move all toes. Sixth day—slight movement of left ankle. Nineteenth day—flexes knees slightly. Thigh flexors move. Toe and ankle movements are stronger. All movement greater on left than on right. Power and sensation slowly returned.

Comment.—The tumor in this case was the largest of the
series, and the thinning of the cord from the compression was the greatest. The paralysis was of long duration and dated back five years. It had been practically complete for one year and the loss of bladder and rectal control for one and a half years. The patient's mental attitude of utter hopelessness, her inaccuracy and inattention to sensory tests, and her huge size added greatly to the difficulties.

It seemed extremely unlikely that with such a paralysis and the long-continued incontinence that any very great improvement could occur. The only favorable feature was that the compression had been slow.

This case demonstrated what we have seen in others, namely, that a functional paralysis may remain even after actual recovery has occurred. This patient was returned home in an ambulance three weeks after operation. Movements as noted in the history were present. She was not seen again by the writer for several weeks. Her mental attitude was unchanged. She would admit of some return of movement, but denied any power. She was still bedridden and knew she would remain so. Her mental depression, unwilling to make any effort, was striking. Her attitude was one of complete resignation.

It was possible in one week to have her up and moving from bed to chair, and in a few weeks she was about the house using a cane. The long-continued paralysis had entailed, of course, great muscular weakness. While there was some joint stiffness, it was not marked, and was, particularly in a person of her age, in marked contrast to the greater joint stiffness seen after long-continued disease or immobilization in various other conditions.

In view of the history recovery was remarkable. In eight months after operation this patient was doing her own housework. She walked slowly and carefully, but steadily. After sitting there was stiffness upon arising. There was no incontinence of bladder or rectum. Recovery of their functions seemed complete. Her deep reflexes were slightly hyperactive, but there was no spasticity and no sensory changes were present.
CASE VI

University of California Hospital, Admission No. 35,701:
White woman, married, twenty-four years of age. American.
Diagnosis.—Spinal cord tumor; arachnoid fibroblastoma at the level of the fifth and sixth cervical vertebra.

Abstract of History.—Malaria at nine years. Frequent sore throats till tonsillectomy three years ago. Three years ago some small tumors of unknown nature removed from left forearm and left ankle. Some trouble with hemorrhoids for several years. Nothing else of significance in family, past, menstrual, or marital history.

Present Illness.—Three and a half years prior to admission began to have a stiff neck with aching, as if she had received a blow. This radiated to the left shoulder. This was aggravated by jarring, as in riding in a machine. This trouble was intermittent, but became progressively worse. In two months from the onset the left hand began to flex and became weak until it was difficult to open the hand. No atrophy noticed. Two months after the onset the left hand began to trouble her, the left foot was noted to drag slightly in walking, and the toe of the shoe was worn. Was able, however, to walk and dance. Gradual improvement was noted in the next few months, and one and a half years after the onset of her trouble she was having but little difficulty with either the hand or leg, although her parents noted that they were not used normally. The condition then remained stationary until six months ago, which was at the time of a confinement. Shortly after the birth of the baby the fingers of the right hand began to flex just as the left hand had begun three years before. This rapidly became worse, and in ten days the right leg had become so weak it could not be drawn up in bed. The ache in the neck again appeared, usually being in the midline and radiating to the left shoulder. During the past three months the ache has not been so troublesome, but the loss of power in the right side has progressed rapidly, and to a less extent the former paralysis of the left side has returned. At present is unable to walk and the right hand has shrunked. Has never been able to move the
right ankle since the leg became involved. No movement in
toes. Slight movement in right hip and knee. Recently urina-
tion has been imperative, but no incontinence of bladder or
bowel.

Examination.—Nothing of particular note in general physical
examination other than a marked deflection of nasal septum, a
few carious teeth, and much injected tonsils. Thorax, abdomen,
and pelvic organs essentially negative. Blood-pressure 96 sys-
tolic, 60 diastolic. Blood-count and urinalysis negative. Wasser-
man in blood-serum negative. Stool examination negative. The
significant findings were:

A well-nourished young woman, bedridden, with a paralysis
of all extremities which is not quite complete. There is obvious
atrophy of the intrinsic hand muscles on both sides and bilateral
foot-drop.

Upper Extremities.—The right upper extremity shows a
marked atrophy of the thenar and hypothenar eminences and
of all the intrinsic hand muscles and their movements are lost.
The hand remains flexed and the grip is almost nil. The long
flexors are spastic and the fingers straighten with difficulty.
Slight flexion and extension of the wrist are possible, but are
greatly weakened. There is slight atrophy of the forearm
muscles. Movements at the elbow complete. Biceps very
much stronger than triceps. Movements of the shoulder girdle
show little if any impairment.

The left upper extremity shows in the hand the same findings
as on the right, though less in degree. The grip is, however, fairly
good. The long forearm extensors and flexors are quite strong.

Abdomen.—The recti and oblique muscles seem spastic on
both sides equally.

Lower Extremities.—The right leg is extremely spastic.
Foot-drop complete. No power in the external popliteal group
of muscles. Slight power in gastrocnemius and soleus. No toe
movements. The iliopsoas acts slightly, moving the hip-joint
only about 15 degrees. The quadriceps and hamstrings are
weak, but contract. Much adductor spasm.

The leg can be moved fairly well, but is spastic. There is
foot-drop, but slight voluntary power is present in the dorsal extensors of the foot and toes. Posterior calf muscles strong. Movements at knee nearly complete, but moderately weakened. Iliopsoas weak. Much adductor spasm.

Reflexes.—No pupillary changes. No Horner syndrome. Tendon reflexes in the upper extremities were hyperactive, but equal on both sides. Abdominals not obtained on either side.

In the lower extremities tendon reflexes greatly increased both at knee and ankle, with ankle-clonus on the right. The left patellar was more lively than the right. Clonus not sustained on the left. Babinski positive on both sides. Oppenheim present on the right, absent on the left. No Gordon or other pathologic reflexes found.

Sensory Examination.—The positive findings were as dia-
grammed. No sensory changes were made out in the upper extremities. The various forms of deep sensibility were unimpaired on either side. This examination was difficult and the patient tired quickly.

First spinal puncture: Only a very small amount of fluid was obtained, insufficient for all examinations. Wassermann on this was negative.

Combined cistern and lumbar puncture under ether gave the following striking results. Fluid readily obtained at both sites. No fluid withdrawn (Fig. 174).

**Manometer Readings**

(Millimeters of spinal fluid)

<table>
<thead>
<tr>
<th>Cistern.</th>
<th>Lumbar puncture.</th>
</tr>
</thead>
<tbody>
<tr>
<td>272</td>
<td>262</td>
</tr>
</tbody>
</table>

Four c.c. were then drawn from the lumbar needle. After two minutes the readings were:

<table>
<thead>
<tr>
<th>Cistern.</th>
<th>Lumbar puncture.</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>156</td>
</tr>
</tbody>
</table>

The oscillation of the column of fluid in the lumbar manometer was slight, showing only a faint respiratory movement. At the cistern the fluctuation was much greater, showing both respiratory and pulse oscillations. The discrepancy in the readings remained approximately constant for several minutes. Then the level of the lumbar manometer rose, and finally both became stationary.

**Readings**

<table>
<thead>
<tr>
<th>Cistern.</th>
<th>Lumbar.</th>
</tr>
</thead>
<tbody>
<tr>
<td>360</td>
<td>232</td>
</tr>
</tbody>
</table>

Eighteen c.c. were then withdrawn from the cistern needle, with immediate drop in that manometer.

Readings after several minutes:

<table>
<thead>
<tr>
<th>Cistern.</th>
<th>Lumbar.</th>
</tr>
</thead>
<tbody>
<tr>
<td>270</td>
<td>225</td>
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Pressure over the jugulars released:

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<th>Cistern.</th>
<th>Lumbar.</th>
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<td>137</td>
<td>206</td>
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The cerebrospinal fluid from the cistern was water clear. That from the lumbar region was slightly xanthochromic—faintly straw colored.
The importance of this difference and the value of comparative examinations of these fluids was vitiated by the fact that a first spinal puncture a few days before had caused a little bleeding, to which the xanthochromia and increase in protein could be due. The cistern fluid examination, cell count, globulins, gold chlorid, sugar reduction, and Wassermann were normal in all respects.

The combined puncture, however, gave ample proof that there was not free circulation of spinal fluid between the cistern and the lumbar levels. The pressure adjustments were slow and incomplete. The marked respiratory and pulse oscillations in the cistern pressure are noteworthy as compared with the absence of pulse and the slight respiratory excursion in the lumbar manometer. Also the insignificant pressure changes in the lumbar region as compared with the cistern on compressing the jugulars and causing cerebral venous conjunction.

**Operation.**—Subperiosteal laminectomy with removal of spines and lamina from the fourth, fifth, sixth, and seventh cervical and the first thoracic vertebra.

Pulsations of the dura could be seen at the upper limit of the exposure, but not below. Upon opening the dura it was found that the cord was elevated and unusually prominent at the level of the fifth lamina (Fig. 175). A rounded bulging of the cord was evident at the right of the cord. The growth involved the right lateral portion of the cord and seemed to fuse with it. No definite line of demarkation or cleavage was apparent. While the lower margin of the enlargement seemed fairly definite, it gradually fused and was lost above. Careful separation at the region where its limits were best defined was begun, and it was found that the neoplasm extended from the right side over the ventrolateral and ventral surfaces of the cord. It was not an infiltrating growth, but seemed to invade the cord by being pushed into it from in front. The total length of the growth was 2½ cm. It was crumbly and friable and clinically resembled the arachnoid fibroblastomata. The lateral portion of the growth and as much of the ventral portion as could be taken without injury to the cord was removed. It
appeared that the growth had originated on the ventral surface of the cord approximately in the midline, and that it had grown back, pushing its way into the cord, and finally toward the right lateral surface, so that the cord was dislocated dorsally and to the left. After removal of the bulk of the tumor the cord still appeared prominent, and the dura over this region and
the right side of the cord was excised and allowed to remain open for decompressive purposes.

**Pathologic Examination** (Fig. 176).—“Microscopic examination of the growth shows it to be composed of interweaving strands of tissue, the cells of which are spindle shaped, and there is relatively abundant intercellular substance which gives

![Fig. 176.—S. 21, 1947. General appearance of tumor. Hematoxylin and eosin stain. (See text.)](image)

the analin blue reaction of Mallory after zenkerization. No elastic tissue was found in this growth. There is also a total absence of whorl formation. The growth is fairly vascular and diffusely unusually edematous.”

**Diagnosis.**—Arachnoid fibroblastoma.

**Postoperative.**—Convalescence was rapid and uneventful. No retention of urine. No abdominal distention. On the
fourth day improvement began in the use of the right leg and a
lessening of the thermic and tactile disturbance in the left leg. 
Patient states that there is no appreciable difference in the
sensations upon comparing left leg with the right leg and face.

On the eighth day there was a slight improvement in the
intrinsic hand muscles on the right, shown by weak abduction
and adduction of the fingers.

Reflexes show little change from the preoperative state.

The patient was discharged to her home at some distance and
not seen later than four weeks after operation, at which time
power was still improving in the right arm and leg. The hyper-
esthesia about the neck had disappeared.

The final condition of this patient is not known, although
reports by letter show gradual improvement. Complete re-
covery is not expected and a second-stage operation is contem-
plated, in the hope that with the cord decompression and partial
tumor removal the growth will extrude further and be accessible.

Comment.—In Case VI the history as given by the patient,
providing it is to be relied upon, suggests that this growth anterior
to the spinal cord grew first toward the left and after a sta-
tionary period began again to enlarge and principally to the
right.

The sensory changes are restricted chiefly to the lower
extremities. This finding may be well questioned, but repeated
examinations failed to reveal other changes than those noted.
The compression, although sufficient to occlude the subarachnoid
spaces as shown by the result of the combined puncture, may
still have been insufficient to physiologically interrupt all of the
tracts below. The localized atrophies in the intrinsic hand
muscles indicate, of course, the area of direct cord involvement.

It is in just such a case as this that the combined cistern and
lumbar puncture as advocated by Ayer is of marked value.

Differentiation of an intramedullary degenerative process
from a lesion which blocks the subarachnoid spaces is a highly
important finding for both diagnosis and treatment. It is
when such a question arises that the occipito-atlantoid puncture
proves a decided addition to neurologic diagnosis. It is not
needed in routine work, nor is it advocated. Possibly even with the increasing knowledge which is being derived from it our knowledge of the normal physical variations in pressure adjustment of fluid in a manometer connected with a spinal needle at lumbar puncture alone will be increased. Also the response shown by lumbar manometer to alterations in intracranial pressure can be readily tested at will. With this accomplished and with accurate quantitative knowledge of the spinal fluid content, it may well be possible to draw deductions from lumbar puncture alone which at present we must obtain by combined cistern and lumbar puncture.

As a means of diagnosis the combined puncture has a valued place. As a means of furthering by comparative methods our knowledge of the physics and chemistry of the fluid in the lumbar region it may give us still more.

Cistern puncture if not properly done is a far more dangerous procedure than lumbar puncture in the same hands. Properly done and after sufficient familiarity with the anatomy has been gained, the risk is very slight. Certainly it is far less than risk of permitting the condition for which it is done to remain unrecognized or at least uncertain, or to resort to an exploratory operation.

In this clinic about 30 cistern punctures have been performed for a variety of conditions. In 2 puncture was not completed, owing to the fact that fluid was not obtained after it was felt that the occipito-atlantoid ligament was punctured. In all others fluid was readily obtained. There was no difficulty except that we were unsuccessful in getting fluid twice. In none were there any untoward after-effects.

The work of Ayer has given us great help in a variety of spinal cord conditions, and to him is due the credit for a diagnostic accomplishment that is of great value.

Of the 6 cases, the last is too recent to give the final outcome.

In the other 5 all have recovered from their paralyses. They have all regained bladder and rectal control and are all carrying on their former occupations. In 3 of them no symptoms and no neurologic findings remain to indicate any previous trouble
whatever. Of the other 2, one, an elderly woman, uses a cane and is slightly spastic, but is about and able to perform all of her household duties; the second has not been re-examined, but was walking unaided two months after operation. All of these patients but one were women. The average age was forty-one years. The duration of symptoms varied from a few months to ten years. These growths may long be present and obtain considerable size before causing any marked symptoms.

In the surgical treatment liberal resection of the area of dural attachment has been practised. These growths are not, however, invariably attached to the dura. There have been no recurrences.

While laminectomy for the removal of these tumors requires attention to detail in the prevention of hemorrhage and delicate handling of intradural structures, the operation presents no particular technical difficulties, and does not involve a great tax on the physical resources of the patient.

We have compared in our own series the results of a considerable number of spinal cord tumor removals with the arachnoid fibroblastomata. Of all types the individuals with arachnoid fibroblastomata have shown the most brilliant results.
Because of the rarity of enteroliths the possibility of their presence is seldom considered in a patient suffering from intestinal obstruction. While many of the case reports show that the patients have suffered from acute or chronic intestinal obstruction, statistics indicate that intestinal concretions are the rarest cause of such obstruction. Bernard\(^2\) states that at the London Hospital during a period of thirteen years there were 669 cases of bowel obstruction, 69 of which were attributed to fecal accumulations, 15 to gall-stones, while only 1 was due to an enterolith.

A review of the literature of enteroliths, however, shows that while obstruction demanding prompt surgical intervention finally occurred in many cases, the patients had complained of a fairly definite train of symptoms for periods of months or years before obstruction took place, and that the preoperative diagnosis was seldom made, the enterolith being discovered at operation or at postmortem examination.

If we exclude appendoliths, which are now well known to surgeons, and the case reports of obstruction due to gall-stones, we find few records in the literature of concretions of the small and large intestine. In 1901 Gant collected 50 cases, to which he added 3 of his own; the present review does not include any of the cases in the above report. Gant gives a synopsis of the cases in which the composition of the concretion is noted. In most of the later reports little or nothing is said concerning the chemical composition of the concretion.

The classification of enteroliths has been based largely on their inorganic constituents, little attention having been given

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\(^1\) Bernard\(^2\)
to the organic substances which they contain. Treves gives the following classification: (1) Those formed in great part of phosphate of lime, or of phosphate of magnesia, or of the triple phosphate, or stones formed of mixtures of these salts. These calculi may contain also some carbonate of lime together with soda, and are nearly always combined with a certain amount of animal matter and occasionally with a little cholesterin. They are heavy and stone-like, and on section show a concentric arrangement of chalk-like or dirty white layers which often alternate with layers of a brownish color. They appear to be formed around a nucleus of some indigestible substance, such as vegetable fibers, husks, hair, fruit stones, biliary calculi, pieces of bone, or other small foreign bodies that have been swallowed accidentally. (2) Avenoliths, "oat-stones," or enteroliths of a low specific gravity and of irregular form which are porous in appearance and have the consistence of compressed sponge. They are composed mainly of densely matted together masses of vegetable fragments mixed with particles of fecal matter and with a certain amount of calcareous material similar to that in the first group. (3) Concretions formed of insoluble mineral substances that have been swallowed as medicines. These are most frequently of magnesia, iron, and bismuth subnitrate.

More recent analyses of enteroliths in which special study has been made of their organic constituents show that they are similar in chemical composition to appendoliths and true intestinal sand, and it is from a comparative study of these that some interesting data have been obtained which throw light on their probable mode of origin.

Appendoliths have long been considered to be inspissated fecal masses, but recent study of their chemical composition shows that these small concretions are undoubtedly formed in the lumen of the appendix itself by the successive deposition of layers of material formed by the mucous membrane. Microscopic examination of the appendices containing concretions shows atrophy of the mucosa and submucosa with varying degrees of fibrosis of the submucosa and subserosa without leukocytic infiltration, the lumen usually contains considerable
cellular débris. In Mr. Parker's case there was a constriction in the appendix behind which was a dilated portion filled with a pultaceous material. Analysis of this by Williams showed it to contain calcium soaps and a fair quantity of calcium carbonate. Williams concludes that appendoliths are due to the secretion or excretion into its lumen of material rich in calcium soaps, the fatty acid radicles of which are of the saturated type.

Closely allied in chemical composition to the above is the so-called true intestinal sand, case reports of which have appeared in the literature from time to time. This material appears as small semisolid particles adhering to the vessel from which the feces have been emptied. It is colorless or gray to brown when mixed with small quantities of fecal material. When washed and dried it appears as small grains of sand, but does not have the solid, gritty feeling of the latter. The larger particles look and feel like ordinary soap. Chemical analysis of this material shows varying proportions of organic and inorganic constituents. In the analysis made by Williams there was 55.6 per cent. of organic material and water and 44.4 per cent. of inorganic material. The total fatty acids amounted to 18 per cent. Of the total calcium present, only 34.1 per cent. was calcium phosphate, the remaining 31.5 per cent., he shows in his table, was not combined with any inorganic acid. In Roesser's analysis (quoted by Williams) he found that 10 per cent. of his specimen contained fatty substances soluble in ether.

Stones found in the small intestine have been generally considered to be gall-stones largely because of their cholesterin content. There are many case reports in which a large gall-stone giving rise to obstruction has been found, and also others in which a gall-stone has formed the nucleus of an enterolith, which has increased in size by accretion, principally by the deposition of organic matter impregnated with phosphates, forming the so-called phosphatized gall-stone. In certain case reports there has been a definite history of one or more attacks of gall-stone colic with or without jaundice, preceding by varying periods of time the finding of a stone in the stool or at opera-
tion. In cases in which a stone in the small bowel has given rise to obstruction and laparotomy has been performed, little is said as to the condition of the gall-bladder, whether or not there were adhesions of this viscus to the duodenum, indicating a fistulous communication. Even a temporary fistulous communication should leave a legacy of fibrous adhesions. If no evidence of such communication was found, it has been taken for granted that the stone had passed into the duodenum by way of the common duct, and that it had gradually increased in size by accretion during its stay in the bowel until it became large enough to cause obstruction. Most of these calculi have been fairly large, yet a smaller stone by inducing enterospasm has caused obstruction. In the absence of a fistulous opening of the gall-bladder into the duodenum it hardly seems possible that a stone small enough to pass the ampulla would remain in the intestine, for the narrowest portion of the lumen of the intestinal tract, namely, the ileocecal valve, is many times larger than that of the ampulla. There is evidence to show that some of these so-called phosphatized gall-stones are formed in the lumen of the intestine and are wholly independent of a gall-stone nucleus.

In Mr. Paul’s case of acute intestinal obstruction a stone the size of a small Tangerine orange was found in the upper part of the jejunum. Examination of this by Williams showed the nucleus to consist of a raisin, around which was a pultaceous mass held together by a stroma of vegetable matter. Chemical analysis showed it to contain 31.4 per cent. of fat, of which 74 per cent. was present as combined fat, having the low iodin content of 18 per cent. The unsaponified material was isolated and proved to be cholesterin. This indicates very definitely that the enterolith had its origin in the bowel and was not a phosphatized gall-stone, although it contained cholesterin. In a second case reported by Williams an enterolith causing partial obstruction was found in the lumen of the small intestine at the lower end of about 10 inches of hypertrophied gut, which was firmly contracted around it. This concretion was about 4 inches in diameter, round, white, concentrically laminated, with
a nucleus probably of degenerated epithelium. The whole mass was soft and friable and had a soapy feel and appearance. The dried material contained 33 per cent. of calcium, 25.6 per cent. of neutral fat, and 7.7 per cent. of combined fat, with a fair amount of phosphate and oxalate and traces of other inorganic salts. In a third case, reported by the same writer, the patient suffering from mucous colitis passed a number of concretions per rectum over a period of some months. These were oval in form, averaged 1 inch in length, and consisted almost entirely of neutral fat. The patient had not previously taken any oil or fat in excessive quantity and the fat in the concretion was saturated. On administration of olive and cod-liver oil (unsaturated) the concretions ceased to appear, the mucus disappeared from the stools, and the patient gained 20 pounds in weight in three months, with relief of all symptoms.

We have observed similar material filling the rectum of a patient with a colostomy performed three years and ten months previously for a supposed carcinoma of the uterus involving the rectum and giving rise to an obstruction. She presented herself at the clinic with the request that the artificial anus be closed. Rectal examination showed the bowel distal to the colostomy opening to be filled with a mass the color and consistency of putty. It had a distinct soapy feeling, and was thought to be the contents of a dermoid cyst that had perforated into the bowel. The hospital record shows that the bowel distal to the colostomy opening had been cleansed by irrigation before the patient had left the hospital, and as none of the contents of the bowel above the abdominal opening could enter the rectum, this material must, therefore, have been the product of secretory or excretory activity of the rectal mucosa with degenerated desquamated epithelial débris. Operation revealed a bicornuate uterus with many fibrous adhesions. After closure of the colostomy opening the normal function of the bowel was restored.

Schmidt states that the intestinal mucosa excretes inorganic salts, such as those of iron, calcium, and phosphoric acid, and also fatty substances. Hermann isolated a loop of gut, joining its ends together, so that a continuous ring was formed.
The continuity of the gut was then restored by suturing its two free ends. After some weeks the isolated loop was found to contain a semisolid material similar to feces in appearance, consistency, and chemical composition. It contained a large amount of phosphoric acid, lime, and iron.

There have been few reports of the chemical analyses of the larger and more dense concretions found in the large bowel. Where such analyses have been made they have been qualitative, yet they reveal the same constituents, though obviously present in different proportions, the inorganic constituents predominating.

There are two theories of the mode of origin of enteroliths: (1) Williams suggests that concretions are due to an excretion of the mucosa of the intestine or its appendages. It is known that the intestine eliminates the heavy metals and it is probable that calcium is excreted into the bowel. As to the presence of fatty acids, he believes that the intestine is an excretory organ for waste products of fat metabolism; this is not due to local disease, but is the outcome of a general metabolic disorder, which throws upon the intestine or its appendages the onus of excreting deleterious products.

(2) Adami suggests the following theory of the mode of their development. He states: "We deal, that is, in general, with the results of a catarrhal process—an inflammation—whereby, in the first place, there is exuded into the passage a mucinous discharge, together with exfoliated cells. The disintegration of the latter affords the products of proteolysis and the fatty matters, and in such a matrix, just as in necrotic areas within the tissues, there next occurs a deposit of calcareous salts, through diffusion into the mass of serum of the inflammatory exudate, as again, of the secretion normal to the passage." There is, also, probably a deficiency in the amount of normal secretion leading to increased dryness of the feces and constipation so commonly associated with the formation of these concretions.

Enteroliths, therefore, are not mere fecal accumulations, but the result of some abnormal process of the intestinal mucosa.
ENTEROLITHS WITH CASE REPORT

This is borne out not only by their chemical composition but also by certain findings, which will be mentioned later. The character of the food which formed the diet of patients with enteroliths has not always been a determining factor in their origin.

In considering the clinical aspects of these cases we find that most of the patients have been over thirty-five years of age; the youngest in the present review was a boy of twelve years (Greig\textsuperscript{14}), the oldest a woman of eighty-two years (Eliot\textsuperscript{9}). About two-thirds of the cases occur in the female. The shape of the concretion is usually round or oval and its surface is smoothly polished by peristaltic action. Enteroliths vary in size from that of a cherry stone to one measuring 15.4 x 12 x 10 cm. (Coerr\textsuperscript{8}). This latter concretion weighed 945 grams. They vary considerably in density. Greig's specimen was globular, felt solid, measured 2\frac{1}{2} inches in circumference, but weighed only 24 grains. This is important from the roentgenographic standpoint. Their number has varied from 1 to 59 (Gabbi\textsuperscript{12}), their size usually being in inverse ratio to their number. They occupy the lumen of the bowel and are not found in sacculi, favorite sites for fecal accumulations. They are never as large as the latter, and most of them exhibit a stony hardness which is in marked contrast to the doughy consistence of fecal accumulations.

That enteroliths increase in size very slowly is evident from certain case reports. In Mackenzie's\textsuperscript{18} case, which occurred in a woman of seventy years of age, the concretion was irregularly cuboidal in shape and about the size of the astragulus. Its nucleus was probably a fragment of an upper central incisor swallowed sixteen years before.

In Ferguson and Reuter's case\textsuperscript{10} the patient, a woman thirty years of age, had been operated upon twelve years before for an abdominal tumor, and was informed at the time that this had grown around and into the intestine and could not be removed. The enterolith was removed from the lumen of the small bowel about 15 inches from the ileocecal valve.

The writer's case, a woman of twenty-seven years, had had
an appendectomy performed nine years previous to the removal of the concretion from the sigmoid. At the time she was told that she had a cyst of the left ovary the size of a small orange, though this organ was subsequently seen to be of normal size.

While it is thus seen that enteroliths may take years to develop before they attain sufficient size to cause obstruction, they do not necessarily remain dormant. In many cases, however, the onset of symptoms is so insidious and their progress so slow that the patient seeks relief only when obstruction supervenes, yet a careful anamnesis reveals the fact that the clinical pictures correspond fairly well in all cases. That many of the symptoms are caused by the presence of the concretion and are not attributable to the condition of the intestine to which they owe their origin is shown by the fact that with the spontaneous evacuation or operative removal of the stone, practically all symptoms disappear.

Persistent constipation is common to all, even the young. Following this, after varying periods, digestive disturbances, as anorexia, nausea, vomiting, flatulence, meteorism, long-continued colics, occasional attacks of diarrhea, general abdominal soreness or local sensitiveness to pressure and actual pain, exaggerated by the taking of food, are frequent complaints. Blood, mucus, or even pus may be observed in the motions. The patient may discover an enterolith in the stool, and subsequently pass a number of them, with relief of all symptoms.

As the concretion increases in size by accretion it may act as a ball-valve, giving rise to intermittent obstruction, or by inducing enterospasm or becoming wedged at a flexure may cause an acute obstruction demanding prompt surgical relief, as many case reports show. If the enterolith arises in the small bowel the most common site of obstruction is the lower ileum as it ascends from the pelvis. In Anderson's case two stones were present, the larger of which was fixed in the ileocecal valve, the other being free in the lower ileum. If situated in the large bowel it may be passed on by peristaltic action to the rectum and evacuated with or without discomfort, or remain above the sphincter and cause pain, a feeling of weight and
tenesmus, with passage of blood and mucus. In the large bowel the cecum or flexures are favorite sites of arrest. Temperature, pulse, and respiration remain normal unless some complication arises. A study of the literature bears out Treves' statement that the most important symptoms indicative of the presence of enteroliths are those of persisting, incomplete, and inert obstruction of the bowel which may continue for years.

Physical examination often reveals a hard, palpable, freely movable mass with local tenderness to pressure. The mass has been discovered by the patient whose attention has been directed to it by local soreness or actual pain. Similar findings may be obtained by palpation per rectum or vaginam. Because of its free movement within a dilated portion of the bowel the elusive concretion may be found at one examination, missed on several subsequent ones, and finally appears at a later examination. The laboratory findings, where stated, have usually been negative.

As many of the recorded cases came to operation because of acute obstruction, no Roentgen-ray examinations were made. In those with chronic obstruction, mention of such examination is made in but a few cases.

In the present review x-ray study made or confirmed the diagnosis in the cases of Anderson, Pfahler and Stamm, and LeWald (quoted by Pfahler). As the enterolith lies within the lumen of the bowel and not within a diverticulum, it is apt to be missed in a routine gastro-intestinal series, for the opaque material flowing about it will render it invisible. If the enterolith is of sufficient density, examination by the fluoroscopic or radiographic method made before the administration of barium or bismuth will demonstrate its presence; if the density of the concretion is not sufficient it is quite apt to be missed before the administration or during the passage of the opaque material, but may appear at a later examination for the reason that it is coated with a layer of the opaque material. When situated in the colon and its presence can be demonstrated before the administration of barium, an opaque enema will reveal its position within the lumen of the bowel and not in a sacculus, a
common site for fecal accumulation, and the segment of the bowel containing the concretion has invariably been found symmetrically dilated for varying distances. The dilated portion is fusiform and its walls hypertrophied, which is in marked contrast to the atonic condition of the bowel in the simple fecal accumulation. The gradual increase in size of the concretion makes possible the gradual adaptation of the bowel wall to this unusual object and permits the passage of the more fluid contents about the enterolith. When the concretion is carried into the distal narrower portion of the fusiform enlargement, obstructive symptoms manifest themselves. It may now either drop back into the dilated portion, when there is rapid relief of all symptoms, or induce enterospasm, or become wedged and cause an acute obstruction. Pressure necrosis ulceration, perforation, or gangrene may follow. Congestion and ulceration give rise to diarrhea, mucus, blood, or even pus in the stools. Inflammatory changes in the bowel wall, extending to surrounding viscera, mats them together, producing a palpable mass, which, because of the findings in the stool examination and the cachexia sometimes seen in these patients, is mistaken for malignancy. In Machardy's case ulceration and adhesions necessitated the resection of 13 inches of the lower ileum, while in the case reported by Greig, intestinal obstruction caused by an enterolith, was spontaneously cured by its evacuation through an umbilical fistula.

Case Report.—E. T., a graduate nurse, age twenty-seven years, was admitted to Stanford University Hospital January 14, 1921, complaining of general abdominal sensitiveness, most marked in the epigastrium and left hypogastrium, which had been present, though varying in intensity, since November, 1920.

Past history elicited the fact that she had had "stomach trouble" as long as she could remember. As a child she frequently had regurgitation, her appetite has always been poor, and she has suffered from constipation.

In 1911 she suffered from colicky pains in the abdomen, flatulence with marked borborygmus, and abdominal distention. This seemed to be most marked after the principal meal at
noon. At this time she had occasional attacks of diarrhea. In 1912 an appendectomy was performed, after which she had considerable relief for a period of six months. The abdominal distress gradually disappeared, the bowels became more regular, and she gained in weight. This improvement she now attributes to a carefully selected diet. At the time of the appendectomy she was told that she had an ovarian cyst the size of an orange. After this brief period of relief constipation and gaseous distention recurred, and within one year all of her former symptoms had returned and she lost 40 pounds in weight. She now suffered from indigestion, acid regurgitation, and pyrosis, which usually appeared about one hour after the noon and evening meals. She also had frequent headaches. By being extremely careful with her diet she managed to get along fairly well until 1914. Indigestion now became worse in spite of any dietary treatment, epigastric sensitiveness appeared, and there was "soreness" in the back between the shoulder-blades. The diagnosis of duodenal ulcer was made and a posterior gastro-enterostomy was performed with a Murphy button, which she passed after a period of forty-nine days. She was again relieved for about a year, during which time she regained her normal weight.

In 1917 she entered Lane Hospital as a pupil nurse. During her training she stuck rigidly to her diet, for she noticed that any deviation from this gave rise to abdominal distress and flatulence. She could not eat fruit, cereals, or soups. Her diet consisted of meat (except pork), toast, vegetables, milk and cream, which she took in small amounts. Her appetite was fair; she often became hungry between meals, but hunger was relieved by a small quantity of milk. If she ate a regular meal she felt distended, had acid regurgitation, and flatulence. Constipation became more marked and the stools were often dry and hard.

In 1920 she graduated, and in October of that year went on night duty. Her hours on duty increased; the time of her meals became irregular, epigastric sensitiveness returned, and with this "soreness" in the back between the shoulder-blades reap-
Her appetite became poor, she lost weight, and suffered from recurring attacks of colicky abdominal pain, vomiting and gaseous distention, and constipation became more marked. These attacks were usually followed by several liquid bowel movements and the passage of a large amount of gas, after which she felt much relieved.

During her stay in the hospital her temperature, pulse, and respiration were normal, save for a moderate rise in pulse-rate during the attacks of abdominal colic. On admission to the hospital she weighed 117 pounds. She was given a modified Sippy diet, which did not influence the recurrence of abdominal distress. Stomach lavage and flaxseed poultices to the abdomen did not help her. Enemas gave her relief and were always followed by the expulsion of considerable gas.

*Physical examination*, except for slight general abdominal sensitiveness to pressure and a palpable, hard, tender, freely movable mass about the size of a small orange in the left lower quadrant of the abdomen, immediately above Poupart’s ligament, was negative. That the mass was freely movable was shown by the fact that while on several examinations it could not be felt through the abdominal wall, it was easily felt by rectal palpation in the lower portion of the pelvis. Laboratory findings, including examination of the blood, urine, stomach contents, stools, and the Wassermann reaction, were negative.

*Roentgen-ray Examination* (January 19, 1921).—Fluoroscopically the heart and lungs were negative. Barium entered the stomach without delay at the cardia and promptly began to leave the stomach through the stoma. Later a considerable amount of barium left the stomach through the pylorus. The stomach was in normal position and showed fair tone. Peristalsis was vigorous, but not abnormally so. There was a point of tenderness just to the right of the duodenal cap. No defects were made out in the stomach or duodenum. At six hours there was a very small amount of barium remaining in the antrum and also in the duodenal cap. The head of the meal was in the ascending colon. The ileum and cecum appeared normal. At twenty-four hours barium was scattered through
the colon. The splenic flexure was extremely high and filled with gas.

Conclusion.—The stasis in the duodenum without visible defect suggests adhesions in that region. There is no x-ray evidence of recurrence of ulcer.

During the examination the barium flowed around the enterolith and rendered it invisible. As symptoms of intermittent obstruction continued, a second Roentgen-ray examination was made February 5, 1921. This revealed a large, rounded shadow in the pelvis, loosely connected with another mass of about the same size in the left hypogastrium. The upper mass was quite tender to pressure, but freely movable. No connection could be demonstrated between this mass and the stomach, small intestine, or colon as far as the sigmoid. At twenty-four hours the barium extended from the ascending colon to the sigmoid, the mass in the abdomen seemed to be about the same size. The shadow of the mass in the abdomen and that in the pelvis was very much denser than at the last examination, indicating that they had been coated by the opaque material.

Fecal accumulation in the rectum and sigmoid. After catharsis and cleansing enemata an opaque enema was given February 15, 1921. Before the enema there was one fairly large opaque mass in the pelvis, nearly spheric in shape and measuring 6 or 8 cm. in diameter, palpable and tender. The barium ran rapidly up the rectum and lower sigmoid, which showed good tone. It left the mass and gradually extended into the upper sigmoid, which was considerably dilated. The descending colon showed good tone. The rest of the colon was not filled out. The opaque mass was still considered to be a fecal accumulation.

As the patient continued to have symptoms of intermittent obstruction, operation was performed February 21, 1921. The abdomen was opened through a lower midline incision.

Examination of the pelvic organs showed them to be normal. Within the lumen of the sigmoid there was a large, hard, round mass which could be displaced freely upward to a point about 2 inches from the junction of the sigmoid and descending colon.
Fig. 177.—Enterolith removed from sigmoid. Measured 3 x 2\(\frac{3}{4}\) inches and weighed 45 grams. Dried surface appears rough, it having lost some of its peripheral coating.

Fig. 178.—Radiogram of enterolith in sigmoid with smaller shadow of barium to side.
Fig. 179.—Drawing to show position of enterolith in the sigmoid and its ball-valve action in the dilated and hypertrophied bowel.

Fig. 180.—Enterolith in large bowel observed in routine radiographic examination of kidneys. This was later evacuated spontaneously.
JOHN F. COWAN

and downward to within about the same distance from the rectosigmoid junction. There was a fusiform dilatation of the sigmoid, its largest central portion being about three times the normal diameter and its walls were hypertrophied. When the enterolith dropped down into the dilated curve of the sigmoid it could be seen to exert definite traction on the rectosigmoid junction. The mechanism of the obstruction could be easily determined. The enterolith acted as a ball-valve. As it was carried toward the rectosigmoid junction it occluded the lumen of the bowel and obstructive symptoms appeared. When it dropped back into the dilated curve of the sigmoid relief came with the expulsion of gas and fecal material. As the concretion could not be displaced downward into the rectum it was removed through a transverse incision through the upper portion of the sigmoid opposite the mesosigmoid. The patient made an uneventful recovery and there was a rapid disappearance of all her symptoms. At present she is enjoying excellent health and is engaged in her profession. She weighs 128 pounds and her diet is much more liberal than at any time since her first operation.

The enterolith was nearly spheric in shape, of stony hardness, its surface smooth, and it measured $3 \times 2\frac{3}{4}$ inches. It weighed 45 grams. The sawn surface was equally dense throughout, its central portion was of a dark greenish color, while the periphery was laminated with alternate layers of dark green and dirty gray material.

Chemical analysis of this by Mr. F. A. Cajori, of the Department of Chemistry, showed the following composition:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat and free fatty acids less than</td>
<td>1.0 per cent.</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>0.8</td>
</tr>
<tr>
<td>Fatty acids from soaps</td>
<td>16.7</td>
</tr>
<tr>
<td>Calculated as calcium stearate</td>
<td>17.9</td>
</tr>
<tr>
<td>Ash</td>
<td>36.3</td>
</tr>
</tbody>
</table>

Analysis of ash:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CaO</td>
<td>12.3 per cent.</td>
</tr>
<tr>
<td>MgO</td>
<td>15.5</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Qualitative tests for carbonates, trace.
A few text-books merely mention the subject of enteroliths. The only review found was that by Gant. The isolated reports are few and are mostly short and meager, with the result that when confronted with a case we are not alert as to the possibility of the presence of the enterolith.

Since finding the concretion in the above case we have observed another during the routine Roentgen-ray examination of the kidneys. It was round, fairly dense, and clearly defined in 8 radiograms. The patient had not had a barium meal or an opaque enema. Later radiographic examination showed it to be absent.

While the clinical history and physical findings are in most cases suggestive, the diagnosis is made chiefly by Roentgen-ray examination.

As has been said before, the review of case reports amply confirms Treves' statement that the most important symptoms indicative of the presence of enteroliths are those of persisting, incomplete, and inert obstruction of the bowel which may continue for years. This is well exemplified in the present case report. The finding of a hard, freely movable, and often tender mass, palpable through the abdominal wall or per vaginam or rectum, is also suggestive, but this has been mistaken for an ovarian cyst or movable kidney.

Radiographic examination should be made before the barium meal or opaque enema is given. As most of the enteroliths are sufficiently dense, they will appear in the roentgenogram. If the opaque material is given before radiographic examination the concretion may be rendered invisible, and is, therefore, likely to be missed.

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THE RADICAL TREATMENT OF CARBUNCLE

CARBUNCLE has for ages been recognized as a menace and a nemesis. If undisturbed, multiple lesions of similar character, either locally or at remote points, are of frequent occurrence. Recurrences are explained either by contiguity or through the blood-stream or the lymphatics. Many fatalities and a vast amount of human suffering have been hereby entailed.

The clinical history of the disease is, briefly, as follows: Its inception is in a small focus of infection beneath the true skin. This exists as an indurated, shot-like, sensitive point whose presence is first manifested by itching and later by a stinging sensation. After a brief interval the area becomes slightly elevated and painful, especially at night. There is a varying temperature, and the patient complains of unrest and general malaise. A slight chill is not infrequent. Suppuration occurs centrally at an early period. The indurated area enlarges rapidly and all symptoms are exaggerated. At the end of one or two weeks the fluid content finds exit through a small skin perforation, which exudes a few drops of serum and later a small amount of pus. If still neglected the outlet becomes multiple, each perforation draining, inefficiently, a separate reservoir. Meanwhile adjacent tissue becomes involved more or less widely, natural barriers are obliterated, and general conditions become menacing. Pain is constant and excruciating; sleep is disturbed and systemic involvement results. As a consequence, there is entailed a very considerable loss of time and earning power dependent upon method of treatment and the patient’s resistance.

In the early ages sufferers from carbuncles were the victims of procrastination and ignorance. Later, surgical treatment has run the gamut of poultices, with their slimy nastiness, of multi-
ple puncture, of larger or crucial incisions, curetment, and finally of vaccines, all of which are dependent ultimately upon the suppulsive process to eliminate a formidable infectious residue, to be followed by protracted healing by granulation. Meanwhile secondary foci appear with a repetition of foregoing experiences. In my opinion none of these procedures is scientifically defensible.

In this paper attention is called to a plan of campaign which is simple, safe and radical, and affords complete protection from secondary involvement. The method is specially adapted to early cases before the central pool of pus has found exit. Under this plan a hospital residence is unnecessary, as the operation can be done without embarrassment in any modern office. A liberal supply of trichloracetic acid should be provided, and 15 grains, placed in a watch-glass, are liquefied by adding a few drops of water. A dozen or more toothpick applicators armed with cotton are provided and a local anesthetic is administered. The office nurse then grasps with both hands the adjacent skin on opposite sides of the mass. Firm pressure will adequately control hemorrhage and render the entire operation bloodless.

With a sharp scalpel the surgeon makes a rather liberal incision over the convexity of the mass, care being exercised not to penetrate underlying infected tissue. The skin is then deflected from the area and the tumor is isolated and extirpated.

Fig. 181.—Hands of assistant applying compression for hemostasis. Dotted line shows extent of incision.
by a free dissection through healthy tissue. While the blood-supply is under control the wound cavity is freely swabbed with trichloracetic acid until its entire surface is heavily in-crusted. On removing pressure one or more bleeding points may appear. These are again and again treated until the surface is dry. A light pack of gauze tape is introduced, a small protective dressing is applied, and the patient is instructed to return in two to four days for observation. Meanwhile he is allowed to resume his usual occupation. The packing is not removed until it is loosened by exudate. The incrustation will extrude at the end of a week, leaving a healthy granulating surface. The wound margins can then be approximated with adhesive plaster and prompt healing follows. The resultant scar is negligible. Following this procedure there is absence of pain and other symptoms. Section of the specimen will disclose a small purulent focus centrally which has existed thus far within its protective barrier.

Later and graver cases, associated with extensive suppuration and undermining of tissues, are treated in a similar way. A circumscribing incision is necessary following as nearly as possible the normal skin margin. A very wide dissection is made and the entire mass is removed en bloc. It is essential that all indurated infected tissue be eliminated, and to this end all burrowing cavities should be included. All bleeding vessels should be ligated and the entire wound area should be carefully inspected, to the end that fragmentary infected foci may be removed. In this class of cases it has been my practice to swab the resulting cavity with pure carbolic acid and alcohol or camphor-phenol. The wound is then packed with gauze. Frequent dressings are necessary during the first week. For this type of cases a well-appointed operating room and hospital care are essential. By this procedure weeks, sometimes months, of time are saved, convalescence is rapid, and in the absence of grave systemic involvement more serious consequences are inhibited.

This departure from routine practice marks a well-defined advance in surgical procedure.
Here are 2 patients who have come to the clinic on account of pain in the knee. As they lie on their tables, each covered with a sheet, you observe through the window in the sheet of each that the knee is swollen. Other than this you observe nothing at all. There is no redness, no external evidence of inflammation. Remember this well. A swollen joint is simply a swollen joint, and tells nothing except that there has been injury or disease in that locality. By palpation and by manipulation we shall bring out other salient points, but, as you will see, while we can go a long way in making a pathologic diagnosis by a clinical examination, in the last analysis, when it comes to the etiology of the disease, we shall depend less upon the local examination of the joint than upon the history of the case (what the patient tells us). Let us remove the covering from the patients and, for convenience, let us call the patient upon your left A, and the patient on your right B.

Patient A is a clerk, thirty-one years old, married, with 2 children. He gives a history of general previous health. He had the usual diseases of childhood, typhoid ten years ago, and pneumonia twice, once five years ago and once two years ago. He denies venereal history. His mother is alive and well, his father died of unknown disease when the patient was very young. Four brothers and sisters alive and well, one died in childhood of meningitis, and one at the age of twenty of "pneumonia" after an illness of six months.

One year ago, without known cause, the right knee began to be painful and stiff. The onset was very gradual, and the
patient is unable to say exactly the date of onset. The pain and the stiffness have slowly grown worse, not with a steady progression, but more or less by fits and starts. They have been aggravated on several occasions by slight strains. Generally the pain is made worse by use, and in the past has subsided when the joint was at rest, but recently it has been more or less constant. The patient thinks he has lost some weight, but is not conscious of having had any fever. Parenthetically it may be remarked that his temperature yesterday evening was 99.5° F., and this morning it was 98.4° F. No history can be obtained of any sore throat since childhood or of any particular trouble with the teeth. No other joint has been involved at any time.

You have already noted the swelling of the knee. Please observe also that the joint is in semiflexion, that the patient walks upon the ball of the foot, limps, and seems to walk very carefully, as if something hurt him. The atrophy of the thigh and calf are perceptible to the naked eye, and this atrophy accentuates the appearance of swelling in the knee.

I shall ask two or three of you to place your hand first on the left knee, and then on the right. What do you feel?

Answer: The right knee is warmer than the left.

That is correct. The difference is quite perceptible. Now if you will palpate the knee, you will perceive a thickening of the tissues, but you will be unable to say whether this thickening is altogether in the soft parts, or whether some of it is bony. The soft tissues have a sort of boggy feel and the synovial membrane is sensitive where it can be reached by the examining finger. The swelling is practically all proximal to the joint line, and no fluid can be demonstrated in the joint; the patella does not "dance," and it moves but slightly from side to side upon the condyles of the femur. In other words, it is adherent to them.

When you look at the limb from the side you notice that the knee is flexed at an angle of about 40 degrees, and that it cannot be extended beyond that. Flexion is also decidedly limited. The joint has a range of motion of about 30 degrees,
and any attempt to force the range causes pain and muscular spasm.

Taking into account the pain, the swelling, the increase of temperature, the sensitiveness, and, above all, the interference with function, we are now able to diagnose an inflammation in

![Image of a knee joint](image)

Fig. 182.—Tuberculous knee, anteroposterior view.

the joint, or, in other words, an arthritis. The x-rays I pass around show, in the first place, an irregularity of structure of the tibia, femur, and patella in the neighborhood of the joint. The bones look as if they had been gnawed by rats. The joint interval is narrower than normal, as if the cartilages were thinned or absent, and the ends of the bones are irregular and
hazy. The soft parts are swollen, but there is no evidence of any bone production at the joint line.

The symptomatology and the x-ray picture enable us to put this case in a great group of the arthritides caused by bacterial infection. The members of this group, while they differ

more or less in detail, nevertheless resemble each other so strongly in their pathology and in their symptomatology that they can rarely be positively differentiated without the aid of the microscope in the laboratory. Each has its peculiarities, which enable one to recognize it with a fair degree of certainty in many cases, but the identification is never positive. Thus,
tuberculosis is uniarticular, is slow and insidious (usually) in its onset, gives a positive constitutional reaction to old tuberculin, is wont to be very painful, and is prone to the formation of cold abscess. It rarely attacks the joints of the fingers. Infections from the tonsils are often multi-articular and often involve the finger-joints, especially the metacarpophalangeal and the proximal interphalangeal joints. Arthritis from an infection in the deep urethra may be single or multiple, is found most often in the lower extremity, frequently in the feet, and is sometimes accompanied by the characteristic involvement of the bone in the region of the calcaneal tubercle—the so-called gonorrheal periostitis. Parenthetically it may be remarked that a gonococcic arthritis is probably never chronic. The chronic arthritis is almost undoubtedly due to a secondary infection of the deep urethra grafted on the original gonococcic one.

Typhoid arthritis usually occurs in the late stages of typhoid fever or in convalescence, may or may not be painless, and affects by preference the hip or spine. In the latter case it is wont to be horribly painful. I speak from experience.

Syphilitic arthritis has no definite peculiarity that I have ever been able to discover. It may affect any joint in the body at any age. It may break down at any time or may remain closed indefinitely. It may involve one joint or many and it may be painless or very painful. The patient may or may not have a positive Wassermann reaction. Often one will discover by careful search the characteristic thickening of a shaft involvement, but the best way of all to differentiate is by the therapeutic test. In fact, it is a safe rule to follow never to do a radical operation on a chronic arthritis until syphilis has been ruled out by a course of antisyphilitic treatment. If you will remember this you will save yourselves from many a humiliating mistake. We may even remember it, but, disregarding it occasionally, have cause to rue our carelessness.

These are the chief members of this group. Most of the rules for treatment can be easily deduced from the pathology and the etiology. Suspected tonsils should be removed, lesions
in the deep urethra should be cleaned up. Syphilitic arthritis demands mercury, the iodids, and salvarsan. Note that this is the only form of arthritis which is really benefited by internal medication or external applications. In the other cases they are useless. If you like the odor of oil of wintergreen, rub it into the floor, and you will do your patient just as much good.

In tuberculous arthritis we are forced to proceed on principles different from those applicable in the other members of the group. Into all the details of the treatment of a tuberculous joint I cannot enter here, but I will ask you to remember what I have taught you both in the laboratory and in the clinic, and not to depend upon the word of any man when it is in conflict with what you have seen with your own eyes. Tuberculosis in the bones, when it is uncomplicated by a secondary infection, is strictly a disease of the lymphoid marrow and of the synovial membrane. The presence of these two tissues seems to depend in some way upon function. If function be abolished, these two tissues disappear. If these two tissues disappear, the disease dies out. It is literally starved out. Hence the first rule of treatment—deprive the joint of function. In the adult the treatment is radical. Operate with the sole idea of destroying function in the joint.

In the child the treatment is practically always non-operative except in disease of the spine. In Pott's disease do an ankylosing operation, the Albee, or, better yet, if you will take the time and pains to master its difficult technic, the Hibbs operation. In all other joints continue your conservative measures until all hope of saving the limb is gone. Then amputate to save life. Resist stoutly the wiles of those who would have you resect tuberculous joints in children. I cannot denounce the procedure in terms too strong.

To which member of the group, then, does this case belong? No other joint has been involved, examination of the deep urethra fails to reveal any evidence of infection, and the joint is steadily growing worse. This persistence and progression in one joint points against the tonsil. Again, in an arthritus from infection in the tonsil the bone damage is rarely as extensive as the
x-rays show here. Most of the damage in "tonsillar" joints is in the soft parts. The family history and the personal history point strongly toward tuberculosis. Syphilis remains. We shall have a Wassermann test done, and, whether it be positive or negative, we shall prescribe a few weeks' course of antisyphilitic treatment. If at the end of that time a decided improvement has not taken place we shall urge a resection. If we do a resection we shall do it with only one idea in mind, and that is the destruction of the joint. We shall not bother to dissect out the synovial membrane or concern ourselves with the condition of the bone left behind. We shall get bare bone apposed to bare bone, sew the wound up tight, and immobilize the knee until it has thoroughly stiffened. Bony union itself will hardly take place before about a year.

Another rule you must remember: Avoid secondary infection. Do not scrape, drain, and pack these joints, but after operation close your wound up tight. When we attempt to provide by drainage for the exit of tuberculous material we actually provide for the entrance of pus germs and seal often the death warrant of our patient.

As you well know, when a patient has a tuberculous joint he has also some other tuberculous focus in his body and presents a two-sided problem—a constitutional and a local side. Therefore from the start we do everything we can to improve his general condition. Here, then, we have the three rules of treatment in tuberculous joint disease: 1, Deprive the joint of function. 2, Avoid secondary infection. 3, Improve the general condition.

Let us turn now to patient B. He is sixty-five years old, a railroad man by occupation, who has had pain and stiffness in his right knee for many years. Little can be learned from his past history. He is married and has 4 children, all alive and well. Like the majority of patients he denies venereal history. He had pneumonia once twenty-five years ago and influenza during the epidemic of 1918. His left knee causes him some discomfort at times, but not nearly as much as his right. At times he has been troubled with sciatica and lumbago. He
has not had a sore throat since he can remember, but has had
a great deal of trouble with his teeth. A number of them have
been extracted during the past decade on account of abscesses
at their roots. You observe that the few remaining teeth are in
very bad condition. He attributes the pain in his knee to trauma,
because he first noticed it immediately after an accident, but
when we question him closely we find that he had pain in the
knee before the accident occurred. Recently it has grown
much worse, and often keeps him awake at night. It is always
made worse by use, and generally is better in dry weather. He
has had a great deal of trouble with his digestion, and the
symptoms in the knee are sometimes aggravated by errors in
diet, so that he has learned to choose his food carefully.

On examination you see that the joint is in very slight flexion
—about 20 degrees—and is swollen. In contradistinction to
the last case the swelling is not only proximal to the line of the
articulation between the tibia and femur in the quadriceps
pouch, but about the joint line as well. The thigh and calf
are possibly a trifle atrophied, but the atrophy is not nearly as
well marked as in the previous case. The local temperature
is not perceptibly raised and the swelling seems more resistant
than in the other case. In other words, it seems more bony.
The joint contains a small amount of fluid and the patella is
not adherent to the femoral condyles, but grates coarsely on
them when it is moved from side to side.

When we start to move the joint we find that full extension
cannot be carried out, but that the knee can be flexed without
difficulty to an angle of about 110 degrees, when motion comes
to a sudden definite stop as if it were checked by bony obstruc-
tion. The motion is accompanied by a palpable and audible
grating, but you notice the absence of muscular spasm so prom-
inent in the preceding case, also the sensitiveness to pressure.

Here, then, we have again an arthritis of the knee, but an
arthritis which differs greatly in its symptomatology and in
its history from the other, and when we come to study the
α-ray film we notice a prominent feature which we missed in
the other film, namely, a peculiar lipping and spurring at the
margins of the joint, in the region of the attachment of the capsule. This spurring and lipping sets the disease off sharply from all the known bacterial arthritides, and is responsible for the many names which have been bestowed upon this form. This

is the arthritis deformans of the Germans, the osteoarthritis of the English, the hypertrophic arthritis of Goldthwait, the degenerative arthritis of Nichols and Richardson, the metabolic arthritis of some, the destructive arthritis of others. This is the chronic rheumatism of the elderly, and when it occurs in the
terminal interphalangeal joints, a favorite site, it is called Heberden’s nodes, and is often mistaken for gout. When it occurs in the hip it is often called morbus coxae senilis, and different combinations of it in the hip and spine have received peculiar names from those who have described them, in the belief that they constituted special diseases.

The cause of this form of arthritis has never been proved. Like practically every other disease of bones and joints, so this
has been attributed to trauma, and yet trauma could not possibly cause the changes which, as we shall see, are characteristic of this disease. It is a simple thing, easy of comprehension, yet universally ignored, that a bone cannot be injured in any way unless it is fractured. It cannot be bruised, sprained, or strained. Trauma is never the cause of this disease itself, but is often the cause of the symptoms. The x-rays teach us that the changes of this type of arthritis may have made marked advances without causing any symptoms whatever, but you can readily appreciate that a joint thus damaged is a poor machine and is easily sprained. As in many instances in medicine, we have put the cart before the horse. The sprain does not cause the disease, but the disease really causes the sprain or, rather, predisposes to it.

Rather a popular theory of the causation is that this form of arthritis is due to errors in metabolism; to some mysterious chemicals floating in the blood. Metabolic error, dyscrasia, and diathesis are rather meaningless terms with which we are wont to cloak our ignorance, and they delude us into thinking that they mean something, and so stifle progress. Just at present the error in metabolism is supposed to be caused by an excess of carbohydrates in the food. A while ago it was an excess of proteins. There is no more pathetic delusion in the therapy of chronic arthritis than the dietary. The pendulum swings back and forth.

On the other hand, diet, like trauma and mental emotion, plays a rôle, and the rôle is easy to understand when we find the key to the problem. They all may be regarded as contributing causes.

A theory of the causation which keeps cropping up is the infectious theory, but until recently no reliable evidence in this direction ever has been adduced. Not only the symptomatology of the disease but also its pathology, both gross and microscopic, are sharply marked off from that of those bone and joint diseases caused by bacteria, and we have been uniformly unsuccessful in our efforts to find bacteria either in the joint fluid or in the bone-marrow.

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This form of arthritis is essentially a disease of middle and later life. This is well known. It never occurs in infancy or in childhood. Arthritis deformans juvenilis is a misnomer. On the other hand, we find that it may occur as early as the third decade of life in patients with abscesses at the roots of their teeth. This alveolar infection is almost invariably present in patients with this type of arthritis. Only about 3 of our patients, more than 200 in number, suffering with it had sound teeth, but, of course, these 3 cases negative alveolar infection as the sole essential cause, and relegate it to a subsidiary rôle.

The whole pathology of this disease indicates that an infection of some sort is at the bottom of it. What, then, is the non-bacterial infective agent which gains access to the system through the bone at the roots of dead teeth, and, carried to the marrow in the region of the joints, sets up an arthritis which is aggravated by trauma, errors in diet and emotional disturbance, and never in any circumstances results in suppuration? Presumably it is some form of organism, domiciled in the gastrointestinal tract, which, ordinarily comparatively harmless, gains access to the system through the atria at the roots of the teeth. Errors in diet and emotional disturbances, by their influence on the digestion, would make this organism more active. All the evidence points to some form of protozoön as the culprit, and here at Stanford we are bending our energies to finding out its identity. Professor Kofoid, of the University of California, thinks he has found the Amoeba histolytica in one of my specimens, and if we can substantiate his findings we shall have solved the problem.

We turn now to the pathologic anatomy. The bone and cartilage changes give the disease its stamp and have been well described by several writers, who think they are the primary and essential changes of the disease. Neither in this nor in any other disease is this the fact. As you have learned in our course in surgical pathology, bone and cartilage are purely passive tissues which, not capable of inflammation themselves, simply react to disease in the synovial membrane and in the marrow.
The primary and essential change in the second great type of arthritis is an aseptic necrosis in the marrow near the joint. The bone and marrow in a greater or smaller compass die, and are replaced by fibrous tissue, containing cysts and sequestra. Naturally, the bone becomes rarefied, and this rarefaction and the sequestra can almost always be detected even in the x-ray film, if they are sought. Now, as if to wall off this necrotic mass from the joint, nature builds a layer of dense bone beneath the cartilage—eburnated, ivory-like bone. The cartilage becomes fibrillated, tattered and calcified, and then, shut off from its nutrition by the dense underlying bone, wears away. The exposed bone becomes polished and grooved in the line of joint motion, and new bone is laid down at the periphery. This new bone constitutes the lipping, the "border exostoses," on which the diagnosis is based.

The necrotic areas themselves are painless, and the patient may have the disease for a long time without knowing it, but the resulting bone and cartilage changes damage the joint as a machine, and it is easily sprained by a slight trauma. Hence, the patient ascribes the disease to trauma. Perhaps the arthritis itself, that is, the inflammation of the synovial membrane, is really traumatic.

You are now in a position to understand also why an elderly patient, by a slight twist, fractures the neck of a femur already largely necrotic, and why, in such a fracture, union is hard to secure. Why is it that when an elderly patient with marked alveolar infection suffers an intra-articular fracture of, say, the radius, the wrist-joint becomes the seat thereafter of a persistent arthritis? Why, indeed, except that he has opened up a long-standing infection in the end of the radius?

The result of the second type of arthritis is an ankylosis, a limitation of motion, caused solely by the maladjustment of the bone ends entering into the articulation. Union, whether by fibrous tissue or bone, never occurs, as in the first type, except in the spine where the vertebral bodies may be united by a mass of bone poured out over their anterior aspect, like syrup from a jug. On the other hand, damage, once done, is permanent, even
after the cause ceases to operate. The joint never returns to normal, as it does in an arthritis of the first type.

The treatment of this form of arthritis is predicated on what has been said. The first indication is to remove the focus of infection at the roots of the teeth. When the dead teeth are removed the joint often returns to a state approximating normal and the pain subsides, though, as the anatomic changes are permanent, it never functions perfectly and is always liable to injury.

Recently we have been investigating the stools of these patients for amebae, but as yet have found the organisms in only 2 or 3 cases.

As a palliative measure heat is almost always grateful in this disease. Witness the tendency of old people with "chronic rheumatism" to "hug the fire." Hydrotherapy sometimes relieves the pain, as does the Bier treatment by passive hyperemia in the joints of the extremities. For some unknown reason the intramuscular injection of a foreign protein will benefit some cases. Drugs externally or internally are practically useless. Employ them only as a last resort.

Sometimes the disease in the hip-joint is very painful. Then your best procedure is a resection, followed by immobilization in plaster of Paris in abduction for two or three months. A very painful knee also should be resected.

Passive motion only does harm by grinding the roughened and distorted bone ends against each other. Do not forget that there are no adhesions to break up in this type of arthritis.

Let me impress upon you in conclusion the importance of founding all your ideas of diseases of the bones and joints upon a sound knowledge of pathology. To attempt to judge from inspection of the surface what is going on within is futile. When you operate upon a bone or joint do not throw away the material removed, but take it to the laboratory, cut it up, and study it. The bone-marrow, rarely studied, is one of the most interesting, important, changeable and complex tissues of the body, and one of the earliest to respond to general infections. You cannot do better than to study it intensively and exhaustively. The study will pay you well in reputation and in entertainment.
CONGENITAL PYLORIC STENOSIS

Patient is a male baby one month old (eight months premature). He weighed 6\(\frac{1}{2}\) pounds at birth and now weighs 4\(\frac{1}{2}\) pounds. He comes from the country, reaching the city one hour ago. As you will see, he is markedly dehydrated and hardly as large as a fair-sized cat. This is the typical picture of this disease when it has been left too long before coming to surgery. This baby started to vomit and to lose weight two weeks ago. The vomiting at first was exactly the same as vomiting due to other causes. As the tumor at the pylorus thickens and closes the lumen, the stomach gains in muscular strength by its efforts to empty itself. The vomiting then becomes characteristically projectile and should be mistaken for almost nothing else, especially if the child is placed in a good light and one sees the distinct wave which is made by the violent contractions of the stomach in the upper abdomen. Added to these signs, the rapid loss of weight and the change in the character of the stools, even without waiting until they have become almost nothing but mucus, will clinch the diagnosis. The use of bismuth and x-ray we consider superfluous. We have knowledge of more than 100 of these babies operated upon here in San Francisco, and only one patient failed to show the typical, hard, large, pyloric tumor.

Dr. Botsford, who has given the anesthetics for some 30 of these babies for us, remarks that this is the smallest one we have yet seen. The proper giving of the anesthesia to these little patients is a very important point in connection with the operation.
We will prepare the region of the upper abdomen with 5 per cent. picric acid in alcohol, which we are now using altogether as a skin antiseptic.

Fig. 186.—A, Stomach with tumor at pylorus showing bloodless area. B, Cross-section of tumor. C, Sagittal section of stomach and tumor.

We will make the high right rectus incision which was suggested by Dr. Butler, a former assistant, because, as you will see in a moment, the liver is behind this incision and protects it from a hernia and from the protrusion of the viscera. We have opened through the peritoneum, and we are lifting up the edge
of the liver with the knife handle, and there you can see the stomach much distended even though it was washed out thoroughly before the operation. The anesthetist will please put a catheter into the stomach, and, you see, the stomach collapses. In pulling the pyloric end of the stomach out you see we have delivered the tumor, which is typical and of rather large size for

Fig. 187.—A, Incision through bloodless area with forceps introduced. B, Cross-section of tumor open with mucous membrane bulging. C, Stomach and tumor with tumor divulsed showing projecting mucous membrane.
a baby of this age. You will notice that there is a pale line along the upper and the anterior border of the pylorus. This is the area where the blood-vessels coming around from behind barely meet. It is through this bloodless area, parallel to the lumen of the pylorus, that we now cut the serosa barely into the tumor tissue. We now take a pair of small, curved Kelly forceps and force them into the middle of the cut and to the middle of the tumor, and as we open them you will notice that the tumor splits from end to end with great ease. These tumors seem to have a grain like wood, and unless you make your cut parallel with this grain or the lumen of the tube you will be amazed to find that the tumor does not split as you naturally expect. You will notice the mucous membrane bulging up into the wound being held down here and there by a few little bands which are easily divided. As you see, the tumor has not been cut, but has been opened practically altogether by divulsion, and we are spreading the forceps carefully at each end, particularly at the duodenal end, where it is so easy to open into the lumen of the bowel. By opening down to the mucous membrane this way you see there is very little danger of opening the lumen. If such should happen, however, one need not worry. We have opened the lumen of the bowel in 3 cases, and whipped it up with a few stitches of very fine catgut, and all 3 of the babies in whom this happened are well today.

This is all that is necessary to be done. The tumor is dropped back into the abdomen, the liver falls down over the stomach, and shuts off this wound. We will close the abdomen in layers, exactly as in an adult, with stay sutures of silkworm-gut over a small bolster. We will now inject 20 c.c. of 3 per cent. glucose solution under the skin of each axilla.

The anesthetist states that the operation from opening to closing has taken just twenty minutes.

This baby will be put to bed in an upright position and will be given glucose solution as soon as he is conscious enough to swallow. He will get the drip with the funnel method (see California State Journal of Medicine, March, 1922) immediately by bowel, of glucose and bicarbonate, which will be discontinued
after a day or two, or as soon as he is taking plenty of fluids by mouth. The mother's milk will be fed to him diluted, beginning tomorrow morning, and in probably three days he will be nursing the breast, the mother leaning over the bed.

The second patient is a male, eleven weeks old, who has vomited for less than a week. As soon as the pediatrician found that the baby was losing weight he immediately brought him for operation. You will notice that he is a fine, healthy baby, although he is having the markedly projectile vomiting, the mucus stools, the loss of weight, and the marked wave in the upper abdomen. One can see at once that when a baby comes in in as good condition as this one there should be absolutely no mortality following surgery.

This is the twenty-eighth patient upon whom we have done this operation since the spring of 1919. We lost 2 of this number. One came in with a very marked enteritis which may have been due to the thickened feeding which was tried. That baby died three weeks following the operation from the enteritis which had continued.

The other baby was also one which had been left too long and was very weak, and, as many of these babies do after the operation, vomited for a few days. This baby vomited a small amount the morning after the operation, aspirated into his lungs a good deal of the fluid, and promptly died. This brings to mind an important point in the care of these little patients. One must be very careful that one has nurses who are unceasing in their vigilance, watching for just such a calamity as this, and who know enough to rapidly turn the patient on its side or even head down.

It is rather unfair to count either one of these deaths a result of operation, because we believe if they both had come to surgery when the diagnosis could have first been made, and when a few days of careful medical attention did not show improvement, they could both have been saved.

I believe that there would be no mortality following this simple operation of Fredet's if the babies were brought to operation early enough.
In connection with this operation it might be interesting to say that when we were first doing it in 1915 here in San Francisco we were calling it the Rammstedt operation. In looking over the literature we found that Dr. Pierre Fredet, of Paris, had reported the operation in 1910, and he distinctly made the statement therein that it is unnecessary to do more than just split the tumor without any stitching, exactly as we are doing now; we have, therefore, given his name to the operation since then. We received a reprint of an article by Fredet, read in April of 1921, in which he recommends that gastro-enterostomy is a better operation. Later our attention is called to an article which he published in October, 1921, in which he again mentions that gastro-enterostomy is a good operation in the hands of experts, but that he then considered his own operation of splitting the tumor an excellent one. He should be pleased to know that his operation is the only one advised by the majority of surgeons with experience in this disease in America.

The complicated but beautiful technic of Straus is mentioned only to be condemned, even though he is able to report almost the smallest mortality of any surgeon.

There is no necessity, even should you puncture the mucous membrane into the lumen of the bowel, to stitch the omentum over the wound, as suggested by Rammstedt. The omentum will be found firmly attached to the wound within a few hours after operation in any case.

In other words, the simplest technic has been proved without question to be the best. The least possible handling of tissues of these little patients naturally is the best, and, as we have said before, with this simple procedure, if these patients are brought to operation early, before their vitality is wrecked by starvation, one should expect to lose none.

Postoperative Note.—Both of these babies made good recoveries and are now in perfect health.
MECKEL'S DIVERTICULUM

The patient is four years old and was taken suddenly ill with cramps in the abdomen three days ago. He has gone on with a perfectly typical picture of an acute appendicitis. He started with pain, cramp-like, in the abdomen, followed by nausea and vomiting, and today his doctor finds him with a temperature of 101° F., with localized tenderness in the right lower abdomen and with marked guarding of the muscles. The leukocytes show a count of 17,000, with 83 per cent. polys.

Our diagnosis is acute appendicitis with probable perforation. We are so satisfied that this is an appendix that will probably need drainage that we are going to make the gridiron incision. We notice, now that the child is thoroughly relaxed, we are able to feel a mass right under McBurney's point. As we open the peritoneum, after separating the muscles thoroughly, there is a free discharge of "leukocytic milk," and as the finger is worked around in the abdomen we here deliver a mass which is adherent to the anterior peritoneum. It proves to be a coil of bowel wrapped around about by the end of the omentum, and as the omentum is freed it proves to be a Meckel's diverticulum perforated at its end. You will notice that it is about 1 inch long and about half the diameter of the small bowel coming off at right angles with a distinct mesentery of its own. We had one other perforated Meckel's diverticulum in a child about six months ago which had a diameter fully as large as that of the small bowel, but it had no mesentery whatever.

I am unable to give the differential diagnosis between this condition and appendicitis, which, if it were possible, is unnecessary, as the condition is so evidently surgical. In both these patients the diagnosis of appendicitis was made.

We are clamping across the base of the diverticulum and removing it with a knife, whipping over and over the forceps with fine chromic catgut, and as we remove the forceps the stitch is drawn taut and we now run a reinforcing stitch with plain cat-
gut. We used the same technic on the last case, which made a good recovery.

Because of the perforation and the nearness to the end of the ileum, with a possibility of colon bacilli in the cavity, we will place a drainage-tube to the bottom of the pelvis and will remove it in three days.

Fig. 188.—Two types of Meckel's diverticulum, both blunt ended: A, Without a mesentery. B, With its own mesentery.

Postoperative records show that this patient had a rather stormy time for two days, but with the use of the glucose and sodium bicarbonate solution constantly by bowel with the funnel method, in spite of vomiting the patient received plenty of fluid and nourishment and made a good recovery. The drainage from the wound stopped in a week's time.
A TUMOR OF THE SCAPULA

This patient is a healthy, hard-working, well-developed man of thirty-four. His tumor first appeared six years ago as a small elevated area at the point of the right shoulder. Six months previously he had had a serious trauma to this region. There had been no swelling immediately following his injury, but pain and tenderness had been present for a week or two. Twice since then there has been direct trauma to the tumor, five years ago and five months ago respectively, while there was severe wrenching of the shoulder five days ago. Following each trauma there has been a definite growth in size, slow but continuous after the first trauma, and rapid for the past few months. During the whole interval the patient has had some limitation of function, but not enough to prevent him from working or to impel him to seek the services of a physician. His last injury was totally incapacitating and brought him to the hospital. He now has moderate pain and quite pronounced tenderness in the tumor, with nearly complete limitation of movement of the shoulder.

Examination reveals a mass occupying the position of the right scapular spine and acromion process. It measures about 5 x 10 cm.; it has rounded and sharply limited edges; it has a firm but elastic consistency. Pressure at one point gives a ping-pong crepitus. A bony collar or rim is palpable at the junction of the tumor with the remaining healthy bone of the scapular spine. There is pronounced atrophy of the rhomboids and trapezius, which, together with considerable soreness all over the shoulder-joint, accounts for the high degree of disability.

x-Ray plates (Fig. 189) show a pronounced uniform expansion of the scapular spine throughout its whole length from the base
to the acromioclavicular joint. The periosteum everywhere is intact and there is a dense wall of bone between the tumor and the marrow cavity of the spine. Faint shadows of trabeculae are to be made out, but no areas of bony proliferation are seen. Other special examinations, such as blood Wassermann, complete blood-count, von Pirquet, both human and bovine, and x-ray plates of the chest are negative.

Fig. 189.—x-Ray chondrosarcoma of scapular spine and acromion process. Clavicular joint uninvolved. Capsule is nowhere broken. Line of demarcation between tumor and uninvolved scapular spine is sharp.

**Diagnosis.**—This is a medullary tumor of the spine of the scapula. Medullary tumors of bone comprise bone-cyst or ostitis fibrosa, giant-cell tumor, chondroma, myxoma, fibrosarcoma, spindle- and round-celled sarcoma, and chondrosarcoma. This is a benign tumor or a malignancy of recent development within a benign tumor. Primary malignancy in this tumor of six years' duration is ruled out by an absence of periosteal erosion, general symptoms, or chest involvement. Osteosarcoma is excluded by the lack of bone in the tumor. Chondrosarcoma cannot be eliminated, but the slow growth and small
A TUMOR OF THE SCAPULA

size make this condition extremely unlikely except as a recent development. Among the benign tumors bone-cyst is ruled out by the fact that this tumor developed in middle life, while benign bone-cyst, according to Bloodgood's studies, does not begin after twenty. Myxoma is not to be considered on account of the rarity of this tumor as a central lesion outside the phalanges, and the fact that erosion of the periosteum is a fairly early development in myxoma. There remain now but two possibilities, giant-cell tumor and chondroma. The weight of clinical evidence is in favor of chondroma, because this is the most common new growth of the scapula, and giant-cell tumor is extremely rare. Furthermore, pain which is absent in this instance is an almost constant symptom of giant-cell tumor. Fortunately, it is not necessary to determine beforehand which one of these two conditions we have, because the surgical procedure in this case would be the same for both tumors.

Operation.—Resection of the spine of the scapula with simple disarticulation at the acromioclavicular joint is the operation of choice in this instance. Generally speaking, in giant-cell tumor it is preferable to simply curet out the tumor and carbolize thoroughly the walls of the cavity, but in this case, where it would not be mechanically feasible from the standpoint of complete removal of the tumor and the control of hemorrhage, resection must be employed.

In the course of the operation it turns out that the surrounding tissues are only moderately vascular, the acromioclavicular joint is normal, the capsule or periosteum is unbroken, and the bone at the base of the scapula directly in contact with tumor-cells is smooth, compact, and quite avascular. The removal of the tumor with its periosteum leaves in the wound, therefore, no tissues that have been in direct contact with tumor-cells except the area of eburnated bone. After thorough carbolization of this area the wound is closed.

Pathology.—The gross specimen cuts without resistance throughout its whole length. The color of the cut surface is a homogeneous, grayish white; the consistency is rubbery and not granular. There is no necrosis or degeneration, but occasional,
irregular, somewhat darker areas suggesting hemorrhage are made out just beneath the capsule. The absence of red color and relatively soft consistency excludes giant-cell tumor. The blue color of cartilage is also lacking, but with this exception the picture fits chondroma. The absence of cartilage in a chondroma would indicate the failure of the tumor-cells to reach full development and might mean malignancy.

Fig. 190.—S. 20, 2080. Chondrosarcoma. Cartilage cells with slight amount of intercellular matrix.

The study of the microscopic sections (Fig. 190) show cartilage cells for the most part undifferentiated, closely packed together, and undergoing frequent mitoses. In some areas the cells have thrown out a slight amount of intercellular chondromucin, but have not developed true cartilage. This tumor, therefore, is a chondrosarcoma.
A BONE-CYST OF THE HUMERUS

This patient was brought to the hospital by a pathologic fracture which occurred five days before while throwing a baseball. His first intimation of trouble was a sudden pain accompanied by a dull snap in the region of his right shoulder. At the same instant his arm fell to his side and he has subsequently been unable to abduct it. Symptoms leading up to this event are totally lacking. He is unable to recall any aches, soreness, or pains of any sort in this shoulder, and he has never had a lame arm from throwing a baseball. From the general physical standpoint he is an exceptionally healthy boy and very large for his age. He is sixteen years old, weighs 155 pounds, measures 5 feet, 10 inches in height, is well muscled and well proportioned, and has never been sick except for measles, mumps, and pertussis in early childhood. He has played at baseball, football, tennis, and other violent sports, and for the past year or two because of his large size has done quite heavy work.

x-Rays (Fig. 191) show the typical picture of bone-cyst. In the extreme upper end of the diaphysis of the right humerus is a sharply outlined, elongated, non-trabeculated central cavity associated with slight expansion of the bone and marked thinning of the cortex. The outline against the medullary cavity is sharp. The periosteum and cortex are unbroken except along the line of fracture.

Discussion.—The proscribed treatment for bone-cyst is any procedure which results in a break in the cyst wall and subsequent reparative reaction. In pathologic fracture these ends are realized. The treatment, therefore, of bone-cyst in the upper end of the humerus complicated by pathologic fracture is simply proper alinement and support till the fracture is healed. These rules are not applicable, however, in this particular instance because the patient is just entering the age of central sarcoma and has passed the age when the clinical history and x-ray pictures can be accepted as conclusive.
The central bone tumors are: bone-cyst, ostitis fibrosa, giant-cell tumor, myxoma, chondroma, and sarcoma. Giant-cell tumor may be dismissed as a possibility on account of the extreme rarity of this tumor before the age of twenty and because of the absence of pain and trabeculations. Central chon-

![Image](https://via.placeholder.com/150)

Fig. 191.—Benign bone-cyst of upper end of humerus. Line of demarcation between tumor and medullary cavity is sharp. The epiphyseal line is unbroken. The break in the periosteum on the side is the result of pathologic fracture.

droma and central myxoma are equally rare. Bloedgood's statistics show but one case of giant-cell tumor under twenty years of age, while the combined cases of myxoma and chondroma at all ages constitute but 8 per cent., and there is but one case, a myxoma, occurring before twenty. On the other hand, between the ages of fifteen and twenty years sarcoma constitutes 50 per
cent. of the central tumors. From the standpoint of clinical findings the weight of evidence is decidedly in favor of bone-cyst or ostitis fibrosa and equally unfavorable for central sarcoma. The absence of pain is typical for bone-cyst, while the presence of pain in sarcoma is invariable, and oftentimes precedes the demonstration of the tumor in the x-ray. Pathologic fracture is common with bone-cyst and is frequently the initial symptom, while it probably does not occur in central sarcoma. Uniform expansion without periosteal erosion is typical of bone-cyst, but has not been observed in central sarcoma of this size. In spite of the apparently conclusive clinical evidence in favor of bone-cyst an exploratory is immediately imperative, because central sarcoma cannot be positively ruled out without a consideration of the pathology.

The treatment of central sarcoma is resection with a good margin of healthy tissue. The same rule applies to chondroma and myxoma. Amputation is never justifiable except where resection would mean a useless limb. This principle is based upon the fact that it is not local recurrence, but rather pulmonary metastases which kills the patient after resection. Exploratory incision as a preliminary procedure in malignant cases does not detract from the patient’s chances except in myxoma, while in benign cases it sometimes means the preservation of a bone. Myxoma is so highly transplantable that it is never advisable to cut into one, but this condition is so highly improbable in this instance that it need not be considered.

**Operation.**—The exploratory reveals a large blood-clot beneath the deltoid muscle, some fragments of bone, and a cavity within the humerus filled with a bloody serum. There is no lining nor are there masses of tissue within the cavity except along the lines of fracture, where a fair amount of firm, friable, reddish-brown tissue bridges the gap in the bone. The inner bony surface is smooth and shiny and gives a distinct click to a metallic instrument. In other words, this is a benign bone-cyst without lining or partitions.

Without further interference the wound is closed and the proper support for fracture of this part of the humerus is applied.
A CASE OF CLINICALLY DOUBTFUL BREAST TUMOR

The first consideration in dealing with breast tumors is the recognition and proper treatment of cancer. This has become a very simple matter with the development of the exploratory incision for cases that are clinically doubtful. Breast tumors fall into three clinical groups—benign, malignant, and doubtful. The factors which determine this grouping are the age of the patient, nipple retraction, and skin changes. In this connection nipple retraction is significant only when acquired and unilateral, while skin changes include all degrees of involvement of the skin overlying the tumor from the slightest shortening of trabeculae to cancerous infiltration. A single tumor without associated skin or nipple changes in a woman under twenty-five is benign; with associated skin or nipple changes at any age it is malignant. In women over twenty-five all tumors without skin or nipple changes are clinically doubtful.

This case exemplifies the clinically doubtful group, in that the patient is forty-six years old, the tumor is single, and there are no skin or nipple changes. Since a further consideration of the clinical findings could lead us no closer to a positive diagnosis, the study of the pathology at the exploratory incision is the next step. It is interesting to speculate, however, as to the possibilities in this case, and in the history we find the following facts: The only symptom is tumor. It appeared ten years ago, and has maintained its original size in spite of four pregnancies and two children, with a five months’ period of lactation with each child. The mass lies in the upper portion of the lower inner quadrant; it is sharply limited, slightly bosselated, and fluctuant; it measures 2 x 1 cm.; it moves about freely under the skin over the muscle. The surrounding breast gland is normal or possibly atrophic. Other findings, such as enlarged axillary glands, mediastinal involvement, anemia, or loss of weight, are negative. The above facts point to a benign cyst, but the proof
is lacking that there is no cancer alongside the cyst, and since the only concern is the patient's safety, we must explore.

**Exploratory.**—The incision is made in a radius of the circle of which the nipple is the center. It is not advisable to make the incision in the circumference of such a circle because that would entail the division of the radial lymphatics, a highly undesirable state of affairs in case of cancer. Furthermore, should it be necessary to carry the incision into the breast gland proper, many ducts would be cut across, causing permanent blocking distal to the point of division. As the skin is incised there pops into the wound a "blue-dome," which is recognized at once as a cyst containing serous fluid. A similar cyst in our series contained a straw-colored fluid, but also a few shreds of papillomatous structure, and just outside the wall on the under side a fully developed, small scirrhous carcinoma was found. The incision must be continued, therefore, through the cyst and deep into the underlying breast gland. In this instance the fluid is serous, the walls smooth and shiny, and there are no papillomatous growths, but in the breast gland against the cyst on the nipple side is a solid mass about 11 cm. in diameter. This tumor is quite definitely limited, but is not encapsulated. The surrounding breast tissues do not retract, but remain closely attached at the edge. The consistency is that of moderately firm rubber. The cut surface is grayish pink, slightly furrowed, and is dotted with a few yellowish-gray points.

What is the nature of this tumor? It is not a fibro-adenoma or periductile tumor, because it is not encapsulated. It could hardly be chronic cystic mastitis with such sharp limitations, small size, and absence of cysts. Cancer cannot be ruled out in the presence of yellowish-gray points suggesting necrotic plugs and the absence of a capsule. On the contrary, the pinkish tint, the lack of definite radiating connective-tissue markings, and the high degree of elasticity are decidedly against cancer, because infiltrating carcinoma invariably is a dead grayish white, has definite connective-tissue markings, and had a boardlike cut surface. The only malignant tumor in our series which had a pinkish tint and elasticity was a cystadenoma
with a small carcinoma in its center. The picture which this tumor presents is typically that of a localized, non-encapsulated cystadenoma, but our diagnosis is still in doubt, so a frozen section must be made. Accordingly, a small piece is removed from the center of the mass, the whole wound is carbolized till white, and packed with alcohol gauze.

Fig. 192.—S. 21, 1452. Benign localized cystadenoma of ten years duration. Tumor associated with single cyst containing straw-colored fluid, measured 1 cm. in greatest diameter, was encapsulated. Breast gland atrophic.

The question may arise as to the possibility of dissemination from the exploratory operation. This danger is reduced to a minimum when the exploratory is done with a few strokes of the knife, and the phenol is applied within a few seconds of the incision. In case the tumor is infiltrating cancer, a single glance is sufficient to recognize the fact, and the interval between the incision and the carbolization need not exceed five seconds. The danger would be great in case the exploration entailed the
enucleation of the mass or removal of the breast gland, because such procedures are time consuming and mean the division of every lymphatic vessel leading from the tumor to the mediastinum and axilla. Bloodgood states that statistics in his series show no untoward effects in the explored cases.

The sections (Fig. 192) show the typical picture of benign cystadenoma without evidence of beginning malignancy or fully developed carcinoma. A complete operation is imperative, however, for the following reasons: Positive proof that there is no cancer somewhere about this tumor is lacking; a complete operation means 100 per cent. chances of a cure, while a partial operation in the presence of cancer would reduce the chances to 10 per cent.; cancer frequently is found developing from or associated with benign cystadenoma. Bloodgood reports 18 cases of localized cystadenoma in his collection. Among these, 1 showed cancer; 17, including the malignant case, had the
complete operation, and all of them were cured. In our series of 4, 3 were malignant and all had a complete dissection. Case I (Fig. 193) showed a benign tumor associated with a moderate degree of chronic cystic mastitis. Case II was one of bilateral carcinoma. Cystadenoma was found on each side buried in the midst of the cancerous growth (Fig. 194) and in the portions of the breast remote from the cancer (Fig. 195). Case III was a combination breast hypertrophy, lipoma, and cystadenoma. The tumor lay immediately beneath the lipoma and was discovered by accident after the fatty tumor had been completely divided. There was skin dimpling in this case which was explained by the lipoma. Grossly the condition was benign, but microscopically there were areas of adenocarcinoma replacing a large portion of the cystadenoma (Fig. 196).

**Complete Operation.**—The objective in a complete opera-
tion is the removal of the tumor and the safeguarding of the patient against recurrence or the subsequent development of pathologic conditions in the breast. To attain this end it is necessary to remove every shred of breast tissue, and in one piece with this all subcutaneous and axillary lymphatic structures which have any relationship to the tumor and breast gland. The first consideration is the margin of healthy tissue to be removed with the tumor.

Fig. 195.—S. P. 22, 31. Area of benign diffuse cystadenoma in breast remote from carcinoma. Same breast as Fig. 194. At extreme top is area showing large pale pink-staining cells, typical of ectatic type of senile parenchymatous hypertrophy.

The type of skin incision is of no importance except from the standpoint of closure of the wound, and this, in turn, has no bearing upon the cure of the disease. A margin of skin never less than 5 cm., and depending upon the nearness of the tumor to the skin or the amount of involvement, is marked off with the knife as the first step. Secondary incisions for the exposure of the axilla are then worked out.
The subcutaneous dissection is carried back medialward as far as the opposite border of the sternum, superiorly to the clavicle, inferiorly to the ninth rib, and latterward well out over the surface of the latissimus dorsi muscle. All fatty tissues are thoroughly cleaned off from the skin-flaps overlying the breast for a distance of at least 5 cm. from the edges, because leaving fat might mean leaving breast tissue or subcutaneous lymphatics.

Fig. 196.—S. P. 22, 16. Areas of cystadenoma in the midst of scirrhous carcinoma. Rest of breast showed mild parenchymatous hypertrophy, and overlying this tumor was a lipoma. Patient had x-ray treatment for two years on a diagnosis of cyst. Sense of fluctuation was given by lipoma.

The lymphatic vessels in the skin and subcutaneous tissue have been divided well beyond any possible areas of cancerous involvement; the next move is the blocking of the lymphatic channels from the breast to the mediastinum and to the secondary axillary glands. The more important of this twofold procedure is the protection of the mediastinum because this region is inaccessible. The first step, therefore, is the part of
the chest wall dissection which blocks the lymphatics to the mediastinum, that is, the paring away of the sternal portion of the pectoralis major muscle from off the ribs and sternum.

A perfect axillary dissection means the removal with the tumor of every lymph-gland in the axilla. This necessitates the cleaning out of all loose areolar axillary tissue, and since the most important glands lie immediately against the vein wall, this vessel is laid bare of its outer sheath by sharp dissection. The muscular walls of the axilla are now clean, while the plexus and vessels stand out in detail as if they were polished. With the completion of the chest wall dissection and the removal or delivery of the mass, the curative part of the operation is accomplished.

The return to normalcy and the maintenance of function of the arm may now be considered. These are vouchsafed by the proper closure of the axilla, the prevention of infection, and early use of the arm. In the closure of the wound there is no tension, the axillary flap is tucked up snugly against the vessels, and this flap is long enough to allow the wound to be dressed with the arm in complete abduction. Infection which results in the swelling of the arm will be prevented by the most scrupulous asepsis of even the most minor defect in the skin until all is completely healed. Use of the arm will be insisted upon as early as the day following the operation. In the great majority of the cases a proper margin means insufficient skin for closure, and consequently means skin-graft. This will not be done at the primary operation because the grafts will prevent the proper packing of the axilla, and the introduction of foreign skin will increase the chances of infection. The grafting will be done on the fifth day at the time of the first dressing.

Examination of the gross specimen shows an atrophic breast without other tumors or cysts. This case, therefore, is one of single localized, non-encapsulated cystadenoma. The use of the term “cystadenoma” has led to a good deal of confusion, because it has been erroneously employed to mean certain types of chronic cystic mastitis. There is this difference between the two terms, the one refers to new growth, while the other means a
dilatation or hypertrophy and hyperplasia of the duct or alveolar structures constituting the breast parenchyma. While cystadenoma is a new growth, it may depart somewhat from the usual characteristics of tumors, in that it is sometimes diffuse and is non-encapsulated without infiltration. These two phenomena may have some bearing on the fact that malignancy does develop in these tumors, while as yet there are no proved cases of carcinoma in the midst of true encapsulated fibroadenoma.
SOME SURGICAL COMPLICATIONS OF AMEBIASIS

Formerly considered a disease of tropical countries, amebiasis is now known to be fairly wide-spread in its distribution, and here in California is becoming of increasing importance. Since the war a more general interest has been aroused as a result of the great number of cases of dysentery occurring among the troops returned from Europe. When we know that too often a dysentery is considered the overshadowing symptom in cases of infection with this organism and that as many if not more harborers of the Amœba histolytica never suffer from looseness of the bowels, we begin to appreciate the place the disease occupies. While one, and probably the most important, symptom of amebiasis is dysentery, many cases suffering from amebæ never have this. Rather do they manifest a long list of gastrointestinal disturbances often referable to the upper portion of the digestive apparatus. Many complain of actual constipation.

Amebiasis has for years been considered fairly common throughout the United States, more especially in the South, where, generally endemic, numerous epidemics have occurred. One symptom of the disease, dysentery, has emphasized these outbreaks and no attempt of any importance has been made to determine the number of inhabitants complaining of the other equally important, if less definite, symptoms of amebiasis. If this were done at least an equal number of cases would come to light.

It is not infrequently stated in the literature that the amebæ of dysentery are found in the stools of healthy persons. While this may be possible, it is usually not so. If a careful history is elicited it will be made out that the person infected will complain
of some more or less obscure symptoms referable to some portion of the digestive canal. Further, if such cases be followed, it is not unusual, sooner or later, for active and incapacitating symptoms to arise.

While many of our cases of amebiasis can blame a more or less extended residence in the tropics for their infection, as many more have necessarily contracted the disease within the confines of the United States. This is no doubt due in a measure to the ever greater interchange of population between our country and the Phillipines, Japan, and the Hawaiian Islands, the increase here in California of house-workers from the former country being of especial importance.

While the treatment of amebiasis is in the large majority of cases medical, probably well over 90 per cent. yielding to, at most, the third course of drug therapy, a certain number will fail to be cleared of the organism or will fail to even improve. Of these, a certain percentage should become surgical. In addition, certain complications of the disease require operative intervention.

The cases of amebiasis requiring surgical measures may be grouped under three main heads:

1. Those cases in which operative intervention is demanded for the relief of pathologic processes set up within the bowel by the amebae themselves.

2. Those complications following a diffusion of the organism and its implantation beyond the limits of the bowel.

3. In certain so-called "incurable" cases with the object of removing at operation organs known lately to be the point from which reinfection of the gastro-intestinal canal occurs, after temporary clearing by medical means. This last group comprises cases where the amebae have become implanted in structures accessory to the gastro-intestinal canal and in which sites the drug treatment employed has failed to wipe them out, probably because the drug has not reached the organisms in sufficient concentration.

Group 1: In the first group are cases exhibiting a dysentery as their important symptom. These may be either acute or
chronic and have failed to clear or show signs of improvement, or become worse, slowly or rapidly, in spite of thorough treatment medically. These require surgical assistance.

Likewise in those cases in which it is impossible, even in the absence of active dysenteric symptoms, to establish proper conditions of nourishment, surgery should be considered. Further, it should be considered early, before the patient has become weakened as a result of improper food assimilation. Such cases will relapse when an attempt is made to increase their diet, the diseased bowel refusing to function properly.

Our treatment, then, in this class of cases should aim at putting the diseased large bowel as completely as possible at rest. Formerly the desire was to do this in such a manner as would combine the best condition for its lavage. This question of colonic lavage is now believed to be of secondary importance, since it has been shown by means of opaque enemata that all parts of the large bowel are readily and promptly accessible by way of the anal opening. The question of rest then becomes the important one.

Three methods are available for use in this connection: (a) appendicostomy, (b) cecostomy, and (c) ileostomy.

Appendicostomy was introduced to facilitate lavage of the large bowel when this method of treatment held an important place in the therapeutics of dysentery. At the period of this treatment it was not considered possible to reach all portions of the large bowel with fluids introduced per rectum, and a through-and-through washing out was introduced by means of the appendical tube. However, appendicostomy has lost much of its importance in this respect since the x-ray has demonstrated the great facility with which all portions of the colon and cecum may be reached by fluid introduced from below. As readily shown under the screen it requires but a few moments for an opaque enema to travel from rectum to cecum and to be brought into contact with all parts of the lining mucosa. The appendix as well may be filled in many cases. Appendicostomy, however, in spite of this fact, is of itself an extremely useful measure in certain cases. Beneficial results undoubtedly follow.
the operation. In addition to the destruction of a focus for reinfection of the large bowel, improvement at times follows promptly on appendicostomy with through-and through lavage where the rectal route only had been previously used.

Of greater importance in many cases of amebic colitis is the question of absolute rest of the diseased bowel, and which method of bowel interruption best accomplishes this. Here must be considered those cases of severe type with persistence or increase of dysentery in spite of rest, vigorous medical treatment, and diet. The large bowel is so thoroughly diseased and irritable the slightest amount of material from above serves to keep up the diarrhea and weaken the patient. Without recourse to surgery rest of the large bowel is not possible.

As mentioned above, two procedures are available—cecostomy and ileostomy, and in choosing between these several factors must be taken into consideration.

Of the two operations, cecostomy is the more simple, in that it is more readily performed and the resulting opening more readily closed when it has accomplished its purpose. Moreover, it allows of more direct access to the large bowel if lavage be considered advisable. It does not, however, result in a condition of complete rest of the gut below, as not all the bowel contents will be evacuated through the opening. Some fecal material will continue to be discharged along the colon.

Ileostomy, on the other hand, is followed by absolute rest of the large bowel, and it is at times remarkable with what rapidity this rest is followed by cessation of symptoms. In patients who have been passing small quantities of blood, pus, and mucus every few minutes, each passage accompanied by severe tenesmus, the relief is at times immediate.

The operation, however, as compared with cecostomy, is less readily accomplished and, in addition, will necessarily be followed later by an intestinal anastomosis to restore the continuity of the intestinal canal. Further, lavage of the large bowel is not facilitated by ileostomy, but this factor is not as important as was formerly believed. In spite of the greater facility of cecostomy, therefore, this advantage over ileostomy
is nullified by the more complete rest following the latter, especially when combined with the fact that lavage of the entire large bowel is feasible from below.

Group 2: Those complications following a diffusion of the organism beyond the limits of the bowel. Under this heading occur cases of abscess.

These may be confined to the substance of the liver or extend through the diaphragm, and result in empyemata or pulmonary abscesses, or, having taken an opposite course, produce abscesses within the abdomen.

Under the influences of the amebae the liver may become the seat of pathologic changes varying from a simple hepatitis to almost complete destruction by single or multiple abscesses. During the stage of hepatitis and in some cases where the abscess is in its earlier stages medical treatment will still avail. Where the abscess has attained any considerable size from necrosis of liver substance the treatment necessarily becomes surgical and free drainage must be instituted. This involvement of the liver may be surprisingly acute at times, seemingly a matter of days. In others the course is extremely chronic and may follow the intestinal infection only after an interval of months or even years. In 2 cases of our series of liver abscess the extensive collections of pus apparently developed simultaneously with the acute bowel symptoms. In another more than fifty years had elapsed, the patient having remained free from any symptoms until he developed a large abscess of the right lobe of the liver. Active amebae were recovered from the walls of this abscess, although none was found in the stools in spite of repeated examinations.

Amebic involvement of the pleural cavity is secondary to penetration of the diaphragm from a focus in the contiguous portion of the liver. The process may arrest here without gross involvement of the neighboring lung, or may extend and form a second abscess within it. Naturally, this complication is met with most frequently in cases of abscess situated in the upper portion of the right lobe of the liver, although at times hepatic abscess of the more central and lower portion will
point upward and even posteriorly, and involve the neighboring diaphragm, burrowing through and spreading upward in the chest. Care in diagnosis must be exercised in suspected cases of this condition, as in a majority of abscesses of the liver situated toward the dome the lung on the opposite side of the diaphragm yields physical signs.

Lung invasion may remain localized and become more or less firmly encapsulated, but not infrequently rupture of the abscess occurs into a bronchus, with the appearance of amebae in the expectorated material. At time this sequence of events may lead to a cure provided the opening is large enough to establish sufficient drainage. This result was attained in 2 cases of our series.

In the majority of cases, however, insufficient drainage is thus established along a tortuous route, and additional free drainage must be supplied below, generally at the most dependent portion of the cavity. This is accomplished by opening into either the abscess cavity in the liver, the subdiaphragmatic collection, or both. At times we have found it necessary to obtain drainage above the diaphragm as well, opening the lung abscess direct.

Opinions as to the best approach in cases of liver abscess differ, some writers of experience advising the transpleural route. We have come to prefer drainage from below after exploring thoroughly the liver and its environs through a laparotomy incision. The transpleural route affords too restricted a field and does not allow a view of the distant portions of the liver, gall-bladder, and other viscera in relation with the under surface. The great advantage to the patient is the abdomen may be thoroughly explored before attacking the abscess.

If liver involvement be suspected and medical treatment appears to have remedied the condition, care must be exercised lest the patient be declared cured too early. Too often the symptoms of a hepatitis or even beginning abscess disappear with the rest in bed and drugs, only to reappear with increased severity after the patient has assumed his normal activities, with the liver lesion far from perfectly healed.
Abscess within the abdomen, accompanied by more or less surrounding peritonitis, is secondary not only to abscess originating in the liver and pointing downward but also follows perforation of the bowel the result of ulceration. When one sees a badly diseased colon from a case of active amebiasis one wonders not that cases of perforation and peritonitis occur, but that they are not encountered more frequently. Leakage at the point of perforation takes place and, where few or no adhesions have been permitted, the escape of infectious material occurs directly into the peritoneal cavity. Depending upon how effective the patient's resistance is as evidenced by protective walling off, the peritonitis may be local or general. In such cases we are dealing with added bacterial infection where the pus from abscesses confined to the liver or resulting from this location is, at least at first, bacteriologically sterile.

Perinephritic abscess is a complication of amebiasis more frequent in some reported series of cases than in others. In our personal series we have never encountered this condition. There are two pathways possible for infection—from the colon direct and secondarily to abscess of the liver pointing toward the kidney region.

Before leaving the subject of intra-abdominal inflammation mention must be made of amebic granuloma. This condition is an inflammatory mass developing in association with the wall of the large bowel and involving a portion or the entire circumference of the gut. One or another of the flexures of the colon are often the site of such a mass, which may attain a considerable size, be readily palpable through the overlying abdominal wall, and suggest strongly true new growth of the bowel. In one such case we saw resection of the colon for malignant disease done, a previous examination of the stools for amebæ having been neglected.

These granulomata will usually disappear if the proper medical treatment for amebiasis be instituted. Only rarely will surgical measures become necessary to relieve obstruction.

As a possible sequel of any of the above group of lesions must be mentioned adhesions. These are often serious, and if
they fail to cause acute obstruction will produce a long list of complaints accompanied by more or less incapacitating symptoms.

Cases of amebic abscess of the brain and spleen have been reported. It is not remarkable that these should occur when it is entirely possible that cases of generalized amebiasis are met with.

3. In the final group we have placed those cases of chronic or recurring intestinal amebiasis in which well-directed medical treatment has failed. This formerly comprised a considerable percentage of persons infected, but with later methods of drug exhibition the group has been greatly reduced. In addition, we have included under this third class the so-called "latent" cases or "carriers." We use this latter term of carrier advisedly, for in spite of the fact these individuals show few if any symptoms, none of them incapacitating, symptoms nevertheless exist and will be brought to light if sufficient care in searching be practised.

The question of first importance here in both types of cases—the chronic or recurring and the carrier—is naturally, When should we consider medical treatment has failed?

My colleague, Dr. Herbert Gunn, whose extensive experience with amebiasis and its treatment allows him to speak authoritatively, makes it a rule to consider the case incurable medically if there is a reappearance of the amebae in the stool during a course of combined emetine and salvarsan treatment after the salvarsan has been administered, as well as cases that do not respond to the drug treatment promptly.

In regard to carriers Gunn holds the case to be incurable medically if amebae reappear in the stool after three thorough courses of the above-mentioned combined treatment as advocated by him, such a course of treatment extending over a period of three full weeks, the patient being in a hospital and confined practically to bed.

This last group, then, comprises those cases in which the organism may be gotten rid of in the immediate gastro-intestinal tract only for a shorter or longer period followed by reinfection
from some focus within the body. It has been possible at best
to clear the stools of such persons only temporarily, and when
the course of drug treatment has been completed the amebæ
reappear in the stools sooner or later for at least a time without
symptoms. It is in these cases that the amebæ have become
firmly implanted in structures accessory to the gastro-intestinal
tube, where apparently the drugs employed cannot be brought
into contact with them in sufficient concentration to destroy
them.

That the appendix may be such a focus from which rein-
fection occurs is undoubted and has been recognized for some
time. Cases the stools of which have been temporarily cleared
repeatedly have become permanently cured following the
removal of their appendices in which amebæ have been demon-
strated both in scrapings from the mucosa and in microscopic
sections. In one of the more striking cases of our series, too ill
for a general anesthetic, repeated clearing of the stools was
followed by a severe recurrence of symptoms leading to rapid
downhill progress. Removal of a large infiltrated appendix
under local anesthesia was followed by prompt recovery, the
patient having remained well when last seen seven years later.

Appendix pain is not uncommon in intestinal amebiasis, and
while often due to changes in the cecum, at times the appendix
itself is the seat of amebic ulceration and accompanying inflam-
matory changes.

The demonstration of amebæ in the wall of the gall-bladder
several years ago by Crowell in Manila and confirmed on several
occasions by Gunn in San Francisco more recently, called our
attention to this organ as a possible site from which reinfection
might occur.

Whether the gall-bladder harbors amebæ in all cases of intes-
tinal amebiasis and the drugs used in medical treatment reach
this organ in diminished concentration only in certain patients
is not definite. It is certain that cases considered incurable by
medical measures after repeated trials extending over long
periods have cleared promptly following cholecystectomy, amebæ having been later demonstrated in the mucosa of the
removed gall-bladders. In these cases the appendix had been previously removed.

To summarize: The drug treatment for amebiasis if properly carried out will cure a large percentage of the cases with one course. A smaller number will require a second, and a still smaller number a third, course of drugs. Of the remaining small number a certain percentage suffer reinfection from a focus situated either in the appendix, gall-bladder, or both. Removal of these foci will be followed by permanent cure.

In such a report as this one must not conclude without emphasizing the fact that in this country infection with the Amœba hystolytica is much more wide-spread and of greater importance than is generally believed. The importance is such that this organism must be considered in a differential diagnosis of a great many diseases of the gastro-intestinal tract. No at all obscure abdominal condition should be treated surgically until a careful search of the stools has been made for amebæ, and by a competent, trained person.

The importance of this is appreciated when one recalls that infection with the Amœba hystolytica does not necessarily mean dysentery with blood and pus in the stools. Often the condition is a chronic one from the beginning, and the symptoms may never call attention to the colon, but refer to the upper gastro-intestinal region, with gas, acidity, loss of appetite, nausea, and allied symptoms combined with loss of weight and strength.
THE SURGICAL TREATMENT OF CANCER AT THE RECTOSIGMOID JUNCTURE

The subject of bowel anastomosis has always been a fertile field for experimental and clinical discussion. It has had its fascination for surgeons the world over, evidenced by the fact that at least three hundred methods have been described in the literature. But, as Halstead very recently stated, "The last word on the subject of intestinal suture may some day be written, but surely not until much experimental work has been done with an exactness not hitherto contemplated in investigations of this nature." The variety of methods used at different clinics for anastomosing the bowel at the rectosigmoid juncture, where the difficulties are considerably greater than elsewhere, and the interest again shown in the literature on the subject, confirm the fact that we are still far from an accepted type of operation, which, both by experimentation and by practice, has proved its worth. Nor have we proved beyond question either the principles on which intestinal anastomosis should rest or the technical details by which it should be carried out.

Some years ago we had an unfortunate fatality from infection. The case was that of an extremely corpulent woman in whom we attempted an end-to-end anastomosis by the "tube method of Balfour" for cancer at the rectosigmoid juncture. This experience led us to search for another method by means of which the bowel ends could be brought together with less exposure of the lumen in the operative field, thereby diminishing the possibility of infection. In other words, we wished to make this operation as safe from infection as is a gastro-enterostomy. The method finally chosen was that developed by Parker and
Kerr and described by them in the Johns Hopkins Hospital Bulletin for May, 1908, an experimental study entitled: "Intestinal Anastomosis Without Open Incision by Means of Basting Stitches." For several years we adopted this method for small bowel anastomoses as carried out in their experiments. The method was successful in its ease of accomplishment as well as in its final results.

We did not find an opportunity to use it for cancer at the rectosigmoid juncture until 1917. At this time we were asked to see a patient in consultation with Drs. Moffitt and Schmoll at the Children's Hospital. She was a strong, healthy woman, aged forty-one. A severe rectal hemorrhage was her first symptom. This came on suddenly on August 23, 1916, six months previously. It is of interest to note that there were no premonitory symptoms of any kind to draw attention to the bowel condition, neither constipation pain, colic, nor abdominal soreness. From time to time following this, however, many symptoms developed suggestive of carcinoma of the bowel, but undiagnosed until the patient consulted Dr. Moffit. A proctoscopic examination on February 1, 1917 discovered carcinoma near the rectosigmoid juncture. Operation was performed on February 6, 1917 according to the method about to be described, without preliminary colostomy. We were surprised at its ease of performance and at the smoothness of the patient's recovery. Neither infection nor hemorrhage followed the operation. The bowels moved readily following a light cathartic on the seventh day. Since that time the patient has had no evidence of obstruction or stricture. A proctoscopic examination has been made on three occasions, and discovers the site of anastomosis with difficulty. The patient is alive and well, with no evidence of recurrence at the present time, some five years after.

Before describing the operation in detail a word should be said about preliminary colostomy as an adjunct to the main operation. We have come to look upon the preliminary colostomy as almost essential. It is seldom a mistake, and its omission oftentimes a source of regret. Its advantages are manifold, even in cases which do not present symptoms of obstruc-
tion, either acute or chronic. Following its performance the patient's general condition is markedly improved. This is brought about in many ways. If hemorrhage is the dominant symptom, it is lessened. If pain, tenesmus, and frequent stools are exhausting the patient, they cease and a comfortable rest is given. The inflammatory reaction and the consequent absorption at the site of the cancer are modified. The movement of the fecal stream over the ulcerating surface with active peristalsis is done away with. The operation, while imperative in any acute or subacute obstruction, is a valuable aid even in chronic types, as it is often impossible to cleanse the bowel properly without it. Finally, the presence of a colostomy permits healing of the anastomosis with the bowel at rest and with no strain upon the intestinal suture. Moreover, the patient is relieved of the dangers of serious gas distention which commonly marks the convalescence of these cases. We feel that such a colostomy should completely divert the fecal stream from the field both before and after operation. We have, therefore, given up the use of a cecostomy where a spur is difficult to make, except in a few cases where the mesentery is very long. Our choice is the transverse colon drawn through a right rectus incision at about the level of the umbilicus. This mobile bowel allows the making of a good spur as well as complete diversion of the fecal stream, and has the added advantage of being away from the future operative site.

In those cases where conditions permit the performing of the operation in one stage, a cecostomy recommended by Stiles in the British Journal of Surgery, July, 1921, has some advantages. In this operation a small portion of the cecum is stitched to the peritoneum and muscle (not to the skin). A small catheter is placed in the cecum, extending through the ileocecal valve into the ileum. This tube acts as a safety-valve for gas and liquid fecal matter, increases the comfort of the patient, and relieves any strain on the suture line. It can be quickly done, and the opening usually closes by itself.

The anastomotic method for cancer at the rectosigmoid is as follows:
Patient placed in the Trendelenburg position, gradually assumed.

A long left rectus incision from the pubis to the umbilicus. Careful examination of the tumor and involvement of other organs or the peritoneum, the palpation of lymph-glands draining the cancerous area, and examination of the liver for metastases

Conditions being favorable for operation, the first step is the mobilization of the rectum and sigmoid by incision through the outer leaf of the mesentery. This incision is shown in Fig. 197. Its lower end extends across the base of the bladder in the male, and to the level of the uterosacral ligaments in the female. This transverse portion of the incision allows the rectum to be elevated by adding considerable length to the rectal segment, thereby permitting section of the rectum 2 or more inches below the carcinoma. The mesentery is now tied off to include all the bowel and such glands as are to be removed. The rectum and sigmoid are lifted free from their attachments and the operative field is surrounded by pads.

Right-angled Wertheim clamps are applied to the rectal segment 2 inches or more below the growth, and similarly on the sigmoid about 6 inches above the growth (Fig. 197). It is important to see that the two leaves of the mesentery of the sigmoid are brought together as nearly as possible around the bowel, and also that the outer leaf of the rectum should peritoneize as much of the raw surface of the rectum as possible. The clamps should include these edges in their grasp, as shown in Figs. 198, 199. This aids very much in bringing the peritoneal surface in contact at the time of anastomosis, and prevents leakage. Secondary clamps are now applied close to the first. They should crush the bowel to a thin ribbon and then be reapplied a short distance above. (This is not properly shown in Fig. 197. The bowel should not bulge between the clamps.) The actual cautery easily severs this thin ribbon of bowel between the clamps and the edges are well sterilized with heat.

The Parker and Kerr basting stitch is now applied, preferably with a Pagenstecher linen thread (Fig. 199). Note should
be made of the first and last stitches, which are longitudinal to the bowel, and of the other stitches, which are transverse to the bowel, and as close to the clamps as possible. This prevents an in-turn with a wide diaphragm. It might be stated in pass-

Fig. 197.—Method of mobilizing rectum. A longitudinal incision is made along the outer leaf of peritoneum and extending transversely across the culdesac of Douglas at the level of the uterosacral ligaments. Right-angled clamps have been placed above and below the tumor.
ing that the danger of obstruction from a wide diaphragm at the site of anastomosis is very slight. The experiments of Halstead seem to prove that this diaphragm speedily contracts and atrophies, and that very soon afterward no trace of it can

Fig. 198.—The mesentery has been tied off. The bowel is being burned with the actual cautery.

be found. In his experimental work little remained of the diaphragm on the tenth to the seventeenth day. This is verified in the specimen shown in Fig. 202, which was removed some two and a half months after the anastomosis. It was difficult
to tell where the line of suture was. The picture shows the anastomotic line just above the perforation in the bowel. The mucosa was perfectly smooth, and there was, as can be seen, a slight in-turn at the mesenteric border, which was the only indication of the anastomotic site.

Fig. 199.—Insertion of the Parker-Kerr basting stitch on sigmoid and rectal ends. Note beginning and end sutures and the bringing together of mesentery at the sigmoid end.

The clamps are now carefully removed in the usual manner and the two ends of the basting stitch drawn taut. The ends of the bowel are turned in without soiling the field, and small artery forceps grasp the basting stitch on either side of the
bowl, as shown in Fig. 200. If the sigmoid end is much larger than the rectal end, as often happens following long chronic obstruction, it is only necessary to pucker the bowel more on the sigmoid side with the basting thread. No other method accomplishes this purpose so readily.

The two ends of the bowel are now brought together for
anastomosis, care being taken that the ends meet without tension to avoid longitudinal strain. The sigmoid end is given a slight twist, as advised by Balfour in his "tube anastomosis," so that the two mesenteric surfaces uncovered by peritoneum do not come in contact (Fig. 200). Three or four mattress sutures of Pagenstecher now unite the two ends of the bowel posterior to the draw stitch, and a little distance from the closed ends (Fig. 200). These are tied (Fig. 201, A). The continuous suture which is to encircle the anastomosis is now placed. This
stitch is of No. 1 or 2 chromic catgut, begins on one side of the posterior surface, and passes around in front, the two ends being tied at the completion of the suture (Fig. 201, A, B). Three or four mattress stitches of Pagenstecher are now placed on the anterior surface (Fig. 201, C).

The anastomosis has now been completed without exposure of the bowel ends or fecal contamination. It is only necessary as a final stage to cut one side of either basting stitch which closes the bowel, and withdraw the other end. This opens up the anastomosis, and is facilitated by a gentle massage of the anastomosis between the fingers. On several occasions we have attempted to insert a rectal tube through the anastomosis per rectum. We have never been successful in doing this, and the amount of handling of the bowel necessitated thereby makes it inadvisable.

It has been our custom in performing this anastomosis to apply two rows of stitches, as described above: an inner circular, and an outer mattress stitch. The presence of a raw surface on the rectal and sometimes on the sigmoid side makes it impossible to have peritoneal contact throughout the anastomosis; therefore a double row of sutures, at least in these uncovered areas, seems advisable in order to avoid leakage.

Halstead, however, in performing his blind end anastomosis, makes use of a single row of mattress sutures only, while Parker and Kerr, in their experiments on the small bowel, give preference to a single continuous stitch encircling the bowel. They draw attention to the fact that "the tension to which intestinal stitches are subjected under ordinary conditions comes almost wholly from internal pressure in the intestinal tube. In hydrostatics the law which applies to such a case is that, in a thin-walled tube subjected to internal pressure, the circumferential strain upon the walls of the tube is double the longitudinal strain. As applied to circular suture of the intestines this means that the longitudinal strain which tends to pull the edges of the

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Fig. 202.—Bowel removed from Mrs. B.: a, Site of anastomosis. No evidence of diaphragm formation except in the tissues out beyond the mucosa; b, opening shown in bowel. Site of the perforation with bougie.
incision apart equals only half of the circumferential strain which tends to tighten the stitch if a continuous suture has been used.”

Whether a single circular, a single mattress, or both should be used is, therefore, still open for discussion.

Since adopting this particular method we have carefully scanned the literature for any improvement either in principle or in technic, but up to the present time we have found nothing that is so simple and easy of accomplishment. Shoemaker, of the Hague (Surgery, Gynecology, and Obstetrics, December, 1921), describes a closed method of anastomosis in which the mucosa is freed and grasped by hemostats, the latter not being removed until the last stitch is applied. This method is more complicated and would be difficult to carry out in the pelvis. The method of Holman for small bowel anastomosis (Johns Hopkins Hospital Bulletin, September, 1920) fails to meet the absolute requirement of closed ends, and is also complicated in technic. Methods have also been described by Horsley (Annals of Surgery, 1919), Balfour, “The Tube Method of Anastomosis,” mentioned before, Crile, (Amer. Med. Assoc., July, 1920), and Stillman, of San Francisco (Annals of Surgery, February, 1918). The latter closes the upper sigmoid with a purse-string suture, with the ends left long, holds the rectal and open with guy sutures, rims out about 2 inches of the rectal mucosa, then draws the closed sigmoid end into the rectal end by pulling the long purse-string suture out through the anal opening. All of these methods do not avoid possible contamination by working with an open bowel. Halstead recently (in the Annals of Surgery, March, 1922) describes a “Blind End Circular Suture of the Intestine, Closed Ends Abutted, and the Double Diaphragm Punctured with a Knife Introduced per Rectum.” This method is easier of accomplishment, perhaps, but requires the introduction of a knife blindly through the anastomosis, and it does not seem probable that it will ever become popularized.

We have now performed this operation on 10 cases without any difficulty and with an extremely smooth convalescence. There has been no shock, the pulse seldom going above 100,
and with a temperature rise no greater than in any simple operation. There have never been obstructive symptoms. The bowels have moved easily except in one case, which will be described later, where a technical error was made.

We have had two deaths. One occurred suddenly on the fifteenth day, due, we believe, to a pulmonary embolism following the giving of an enema. There was no autopsy, but, as far as we know, there was no trouble with the anastomosis. The second death is of considerable interest and perhaps deserves more extended comment.

Mrs. B., aged thirty-nine. Seen in consultation with Dr. Casper June, 1921 at the Mt. Zion Hospital. On examination a large mass was found in the left side of the pelvis, which was very tender, hard and irregular in shape, immovable, and fixed to the pelvic wall. Fluoroscopic examination by bismuth enema showed an annular constriction 2 inches wide in the sigmoid, and this, with her history of the passing of blood and mucus, extending over a year, made a diagnosis of carcinoma probable. There was some elements in the case, however: the high white blood-count (21,200, polys. 91 per cent.), the exquisite tenderness of the mass, and the acute symptoms which it had produced on occasion, especially at the time of menstruation, which could not exclude the possibility of a primary malignancy of the ovary, or of an inflammatory mass.

Operation was performed on June 27, 1921. A large mass was found in the left lower quadrant which could not be elevated and was composed of the sigmoid wrapped around and adherent to the left tube and ovary. The mass appeared to be inflammatory, and it was difficult to decide even then whether the trouble was primarily in the ovary or in the bowel. Our impression was rather that an old abscessed chronic inflammatory tube and ovary had ruptured into the sigmoid.

We made a separation through the friable indurated tissue and finally split the bowel off from the tube and ovary, expecting to enter a pus-pocket, but this was not the case. During the separation the bowel was exposed down to the mucosa for an area of 2½ to 3 inches. The edges of the bowel sur-
rounding this were indurated, and the mesentery for a considerable distance was thick and infiltrated, as were the epiploic appendages.

The tube and ovary were removed and it was decided to remove as well the involved sigmoid. An anastomosis was done in the manner already described. Because of the inflammatory reaction in the operative field and the difficulty of placing our stitches in sound tissue, and because of the doubt in our minds as to whether or not this was a case of cancer, we varied our usual technic and brought the anastomosed bowel up to the lower end of the abdominal incision with stay sutures, so that, should infection or leakage occur, it would be easy of access. Microscopic examination of the specimen by Dr. Bartlett, at the University Hospital, proved it to be carcinoma of the sigmoid.

Following operation the patient suffered practically no shock, voided urine, the temperature the following day reached 100.2° F., pulse 84 to 90. On the third and fourth days a small amount of fecal matter and gas were expelled through the rectal tube. On the fifth day cathartics and enema failed to give a result, and the patient began to be quite distended. The temperature and pulse remained practically normal. Distention and vomiting increased, however, and on the sixth day, not having obtained a bowel movement, we advised a cecostomy, which was done by Dr. Casper. This relieved the patient completely, and her bowels continued to move through the cecostomy opening. The patient was now going along very well, and at the end of a month was in every way in normal condition. On proctoscopic examination we were never able to expose the anastomosis. There seemed to be a block, although from time to time the patient would pass gas per rectum. About a month following the operation, against our wish, an attempt was made to pass a rectal bougie through the anastomotic opening, using the proctoscope to guide it. On one occasion this seemed to pass, but on repeating the maneuver the bougie evidently perforated the rectum below the anastomosis. The patient passed into shock and infection followed, from which
she finally died on September 15th, about two and a half months after the first operation. A partial postmortem was obtained. The specimen of bowel at the anastomosis is shown in Fig. 201. The cause of the obstruction, as can be seen, was not the anastomosis, but was a kinking brought about by the attachment of the bowel to the lower end of the abdominal wall. The specimen also shows the opening in the bowel which was produced by the bougie. At first it was difficult to locate the exact site of the anastomosis, and, indeed, impossible to be sure until microscopic section had been done. The bowel was smooth, the lumen was large enough for all purposes. The only contraction occurred in the tissue on the outer side. Unfortunately, it never occurred to us that the obstruction was due to a kink rather than to some fault in the anastomotic opening.

The 8 remaining cases made a perfect recovery. A proctoscopic examination has been made in 4 of them. The anastomoses could hardly be detected. In one, however, there is a slight narrowing, just admitting the proctoscope, but it gives no trouble whatever. The first case, as reported above, done in 1917, has now passed a few months over the five-year period.

In conclusion, attention should again be drawn to the fact that cancer at the rectosigmoid juncture for which an anastomosis must be done presents peculiar problems of its own, and other methods used where the bowel can be brought upon the abdomen are here technically difficult because of insufficient room. The dangers of infection are also greatly enhanced. The poorly nourished fatty tissues of the postrectal space become most readily infected. The space is difficult of drainage, and as Crile states in his own series: “Infection rather than hemorrhage or shock is the chief cause of death.” The swarming germ life of the large bowel is increased in virulence in cancer of the bowel, either because of obstruction or because of the ulcerating cancerous mass, so that methods adapted to anastomoses in other regions cannot be substituted here with the same assurance of success. With open bowel ends the transplantation of cancer cells is made possible. Furthermore, the closed end method allows of a more liberal section of the rectum distal to
the carcinoma than any other method. In fact, cases that would ordinarily have to be operated upon by the sacral route, can be safely carried to completion intra-abdominally.

It would seem to us that this method deserves a wider use than it has heretofore received.
INTRATHORACIC GOITER

True intrathoracic goiters are rare, but the term is used to include those in which a considerable part of the goiter lies within the thorax. About 7 to 10 per cent. of all goiters fall within the latter category. Accessory thyroids in the thorax may become goiterous and be entirely separate from the thyroid proper, but in the great majority of cases intrathoracic goiters are adenomas developing in either lobe or isthmus of the thyroid and gradually descending into the thoracic cavity. This descent is favored by the direction of growth of the tumor; by the pressure of the muscles anterior to the thyroid; by gravity; and by the repeated dragging effect of inspiration on a low-lying mass. In some cases the entire thyroid gland lies lower in the neck than normal—a condition of thyroptosis, which may lead to intrathoracic goiter.

Because of the factors which tend to produce intrathoracic goiters, they most commonly occur in older people. Congenital goiters are sometimes found encroaching on the thoracic cavity to such an extent as to prevent respiration at birth. In the Pathological Institute in Bern, Switzerland, there is a specimen of a congenital goiter which occupies nearly all of the thoracic cavity, the lungs being flattened into thin sheets.

Two types may be recognized—the plunging and the fixed. In the former the goiter may be forced into the neck by more or less violent respiratory movements, such as coughing, while in the latter the goiter remains in the thorax; either because of adhesions or, more commonly, because of its size or position, it cannot escape through the upper outlet of the thoracic cavity.
The symptoms produced by intrathoracic goiter are mainly due to interference with respiration or the circulation of the blood, or due to the toxic effects of the goiter itself. There is often direct pressure on the trachea, with resulting chronic dyspnea and cyanosis, or portions of the lungs may be so compressed that expansion is limited. Wheezing, paroxysmal coughing, and dyspnea may simulate asthma, and the true condition of intrathoracic goiter remain unsuspected for a long time. The trachea may be flattened to a marked degree, and with the absorption of tracheal rings from long-continued pressure there is the possibility of tracheal collapse, particularly after the supporting tissue is removed by operation.

The circulation of blood to the head and upper extremities may be much disturbed by intrathoracic goiters—even the superior vena cava may be completely blocked and the venous blood forced to return by way of collaterals to the inferior vena cava. One sees in these cases enormously dilated veins on the anterior chest wall.

Pressure on the aorta and its upper branches is not at all uncommon with deep-seated goiters, and it seems reasonable to ascribe some of the cardiac disturbances to that. Occasionally one finds unequal radial pulses when the goiter interferes with a subclavian artery.

Toxic effects from the goiter itself are not to be overlooked. The "innocent adenoma" is only innocent during its infancy—its maturity is early and its influence on the nervous system and heart is not a good one. A combination of toxic symptoms, referable particularly to the heart and nervous system, together with evidence of intrathoracic pressure, as shown by cough, dyspnea, or cyanosis, should always make us think of a toxic intrathoracic goiter.

Among other symptoms is dysphagia in a fair proportion of cases—the patient cannot swallow food easily without taking liquids at the same time. The dysphagia is usually from indirect pressure of the goiter through the trachea, while in other cases the goiter is in contact with the esophagus. Interference with the recurrent laryngeal nerve is quite often present, but as
the pressure on the nerve is gradual in its onset, the vocal cords accommodate themselves and it requires a laryngoscopic examination to detect the paresis. The normal excursion of the larynx may be inhibited by the fixation of the trachea by an intrathoracic goiter.

The important diagnostic points of intrathoracic goiter are: respiratory embarrassment, usually paroxysmal in character; a sense of continued pressure in the upper part of the thorax;

Fig. 203.—Exposure of goiter without division of muscles.
dysphagia; distention of the superficial veins of the neck and upper thorax; dulness on percussion in the sternal region; a mass in the upper thorax which moves with respiration, as shown by the x-ray; deviation or compression of the trachea, also evidenced by the x-ray; inhibition of the normal movement of the

Fig. 204.—Partial removal of goiter bearing connection with intrathoracic portion.
larynx; paresis or paralysis of one or both vocal cords; and, finally, the toxic symptoms of a goiter. Some of the signs and symptoms may be found with other intrathoracic conditions, such as mediastinal tumors or aneurysms. Goiters within the thorax usually rise on coughing to the level of the suprasternal notch, and on palpation they will impinge on the finger during the cough. The dyspnea is usually worse when the patient is lying down, owing to increased pressure on the trachea. Many patients are in the habit of sleeping in a semisitting posture.

The treatment of intrathoracic goiters is manifestly sur-
gical. Treatment by x-ray should not be tried, because by far the great majority of them are adenomas, which are not favorably influenced by radiation, and there is the danger of producing hypothyroidism by the effect on the normal thyroid tissue.

The approach to these goiters should be the Kocher collar incision in or parallel to the normal folds of the neck and rather low down near the sternum. It is seldom necessary to divide the sternohyoid and sternothyroid muscles transversely if one dissects up the skin and platysma a sufficient distance. Should the goiter be so large that delivery from the thorax is impossible the sternum may be split longitudinally and the fragments wedged apart. After a thorough exposure of the thyroid region one usually finds the intrathoracic goiter connected with the cervical portion of thyroid by a narrow cylinder, which is useful as a tractor. It is usually advisable to do whatever may be necessary in the neck, such as removal of other adenomas or ligations of vessels, before delivering the intrathoracic mass, retaining, however, the connecting cylinder if it be present. The blood-supply of the intrathoracic portion is usually from the inferior thyroid artery, but there may be other anomalous vessels and hemorrhage may be severe unless promptly checked. These tumors are encapsulated and, in addition, there is usually a pseudocapsule formed from fibrous tissue. It is important to get a line of cleavage in the right plane between the two envelopes, as thereby injury of large vessels or pleura or thoracic duct may be avoided. Separation along the planes may be effected by sweeping the finger around the tumor, or a blunt curved instrument like a Kocher dissector may be used. Then, by traction on the pedicle, aided by a soup- spoon, having a circular bowl as an elevator, the tumor can usually be delivered without much trouble. The plunging type of goiter may be brought into the field by the patient coughing. On one occasion I had the anesthetist momentarily stop the flow of gas and oxygen, when the patient fortunately coughed and delivered the tumor. After the removal of the mass coughing may embarrass the operator by provoking hemorrhage or even rup-
turing the pleura, as instanced by Ochsner, who now provides against the contingency by packing in a sponge.

The large intrathoracic goiters often tax one's ingenuity to extract them through the narrow outlet of the thorax. Evisceration of the contents by morcellation is attended by sharp hemorrhage, but by packing a strip of folded gauze firmly within the capsule and allowing it to remain a few minutes the smaller vessels will be closed and the larger ones can be picked up with hemostats. With the expansion of the lungs the greater part of the cavity is obliterated, but drainage of the remaining space is advisable, contrary to my usual practice with neck goiters.
RESTORATION OF FUNCTION AFTER CERTAIN INJURIES
OF THE EXTREMITIES

This discussion is concerned with problems of a sort frequently encountered in reconstruction surgery of the injured. For illustration 11 cases are presented. These fall into five groups. Roentgenograms of the cases in the first four groups are shown. No skeletal pathology was revealed by roentgenograms of the fifth group.

The problems which will be touched upon are:

I. Delayed union; the place and value of (a) immobilization, (b) physiotherapeutic modalities, (c) active use, (d) bone-grafts.

II. (a) Considerations which should determine the choice for or against operation in certain unreduced, partially reduced, or malunited fractures. (b) Should recent compound fractures be treated by bone-plating?

III. The limitations of traction as a measure for restoring length in an old malunion with shortening.

IV. Application of traction in right-angled abduction to certain fractures about the shoulder-joint.

V. Recognition and treatment of adhesions limiting motion in the shoulder-joint.

I. DELAYED UNION

Case I.—G. W. H. Age forty-nine. Sustained simple fracture of the right tibia and fibula at the junction of the middle and lower third, and a second fracture of the right tibia at the junction of the middle and upper third, June 20, 1920. The fractures were reduced and a plaster cast kept on until August 20, 1920. Inasmuch as union of the lower fractures had not occurred
on August 20th, bone-grafts were put in both tibia and fibula and plaster cast applied.

When seen November 19, 1920 this plaster cast had been on three months. There was no union of either tibia or fibula and evidence of some absorption of both grafts (Fig. 206). The circulation of the limb was very poor; there was marked atrophy of both calf and anterior muscle groups. The ankle was quite stiff with the foot in a position of marked equinus. The cast was removed, the patient fitted with a double-bar leg brace, and encouraged to put some weight on the foot, and vigorous physiotherapeutic measures, consisting in daily baking, massage and tapotement with a rubber hammer, were begun. Firm union of both tibial and fibular fractures had taken place March 15, 1921 (Fig. 207). A tendon lengthening operation had to be done to correct the equinus.

After sixty days' immobilization without evidence of union
in Case I the assumption that some further therapeutic measures were in order was justifiable. It is my practice to change immobilization in plaster for lateral support by means of a brace even earlier where there is not satisfactory evidence of callus formation. The brace is removed for daily physiotherapeutic treatments, prescribed to stimulate the local circulation and reparative processes, by baking, by hot baths or hot packs, by massage, by Biers' hyperemia (Hugh Owen Thomas called it "damming" and used it at least ten years before Bier), by vigorous hammering with a rubber hammer over the fracture site, and by active use of the limb, weight bearing, if it is the lower extremity. During all stages and phases of the treatment the site of fracture is carefully guarded against heavy lateral stresses or tortions.

Bone-grafting should be reserved until thorough conservative treatment has demonstrated that there is non-union instead of simple delayed union. The chance of a successful result from bone-grafting is much better where the tissues of the injured limb are restored to a condition approximating normal tone and vigor by a short course of such physiotherapeutic treatment as above outlined. Cases of the type of Case I frequently recover under such conservative measures as above outlined without operative procedure. I am of the opinion that much time would have been saved in the treatment of Case I if physiotherapy instead of surgery had been instituted at the stage when the bone-grafts were inserted, or even some weeks earlier.

II. TREATMENT OF MALUNION

Case II.—E. M. Male, fifty-four, oil well driller. Sustained compound fractures of the middle third of the right radius and ulna, the radial fracture much comminuted, on October 6, 1919. After three weeks in a splint the question of operative interference was raised on account of overlapping shown by the x-ray (Fig. 208), and the patient was brought to San Francisco.

When the splint was removed inspection revealed no signifi-
cant swelling, discoloration, or deformity of the right forearm. There was a small scar from a recently healed wound on the flexor surface midway between wrist and elbow. The forearm was in neutral rotation. Callus was palpable over the site of both fractures. No attempt was made to manipulate the limb vigorously or to encourage active motion, but some rota-

Fig. 208.—Case II. Roentgenogram three weeks after fractures of right radius and ulna showed a discouraging derangement of bony anatomy, but there was good functional recovery, with the fractured bones in the positions shown.

tion of the forearm was observed. Union was taking place. The patient confessed no discomfort. x-Rays showed a transverse fracture of the middle of the ulna and a comminuted fracture of the radius extending from the level of the ulnar fracture 2 inches toward the elbow. Position of radial fragments was good. The distal end of the upper ulnar fragment was displaced radialward and toward the flexor surface, over-
lapping the lower fragment about $\frac{1}{2}$ inch. There was extensive callus of both bones, with the upper fragment very close to the radial callus. The probability of a good functional result without operative interference was recognized. The forearm was immobilized in a position of complete supination. The cast was removed November 29th. There was firm union of both fractures. Definite rotation of forearm as noted. Baking, massage, and active exercises were begun at once. December 12th range of rotation was 90/145 and external appearance of forearm was normal. On January 3, 1920 rotation of right forearm was 120/145. Grip was not significantly impaired. Patient returned to his regular employment February 1, 1920. Duration of disability four months.

Case III.—G. W. Male, aged thirty-three. Concrete worker. Sustained compound fractures of left radius and ulna June 19, 1920, with considerable laceration, contusion, and friction-burning of left forearm. Both bones were plated one week after injury. Infection resulted; plates were removed and wires substituted; a purulent discharge was constant. The wires were removed about October 13th. Patient was transferred to San Francisco November 3, 1920. Examination on that date showed the extensor surface of the left forearm flat from long application of a board splint. There was atrophy of the forearm and hand musculature. No evidence of nerve lesion was noted except hypesthesia over the dorsum of the thumb and index-finger. The forearm was fixed in neutral rotation by a bridge of bone between the radius and ulna (Fig. 209). The wrist was in neutral position with fingers extended. A trace of motion was present in wrists and digits. Union of fractures was clinically rigid. Slight purulent discharge from sinuses leading to both radius and ulna was present. Extensive scars were adherent to both radius and ulna and the circulation in forearm and hand was very poor. Wassermann test was negative. The splint was discarded at once. Sinuses were protected by small dressings; physiotherapy was instituted, graduated from baking and light massage to heavier massage, active and resistive exercises and passive manipulations, as the
condition improved. All sinuses closed in approximately four weeks. Dorsiflexion of the wrist improved so rapidly that a cock-up splint was not used. Flexion straps were applied to the fingers. Treatment was discontinued February 1, 1921. Wrist and finger motion was practically normal. Grip was 40 (dynamometer reading). There were no clinical signs of persisting inflammatory reactions about the sites of the old infections. Skin scars were still adherent to both bones. Forearm rotation was nil. Patient was advised to go to work and to report after six months for operative removal of bony bridge between radius and ulna. He reported for observation on April 13, 1921, after working steadily firing a boiler since March 10th. He stated that he had discovered that he could rotate

Fig. 209.—G. W. Imperfect union with infection, sinuses, and interosseous bridge as the result of plating immediately after compound fracture. Plates removed several weeks before taking this radiograph.

Fig. 210.—Case III. One year later, complete union and absorption of interosseous bridge after vigorous physiotherapy and several months' active use.
the left forearm a little. Examination showed about 45 degrees rotation possible. x-Rays showed some absorption of the bony bridge. He continued to work and reported for observation November 15, 1921. x-Rays were taken and showed almost complete absorption of the interosseous bridge (Fig. 210). A plastic operation for removal of a small exostosis from the dorsum of the radius for freeing the skin from both ulna and radius at the sites of adherent scars was done November 17, 1921. On December 1, 1921 wrist and finger motions were normal. Rotation of left forearm was 110/180; supination, 80/90; pronation, 30/90; grip of left hand, 50. Note: An old injury to right hand precluded getting the exact fraction for grip. Duration of disability due to forearm injury two hundred and seventy-six days.

Roentgenograms which show definite malposition of fractured bone ends, after conservative measures have been tried and after considerable time has elapsed since the injury, have definite weight as evidence in determining whether or not operation should be done. Evidence on careful clinical examination that bony union is taking place without significant impairment of function should, however, outweigh all other evidence and determine that the bones remain undisturbed by operation.

Skeletal deformity is not a sufficient basis for any dangerous attack upon a surgeon’s reputation if it is counterbalanced by practically complete functional recovery. If the outlook for functional recovery is poor, then it is another story. Roentgenograms are now almost as easy to secure as the popular stamp photographs were twenty years ago. Certain irresponsible venders of skiagraphs often “throw in” an opinion, in which they seem prone to magnify the evils revealed by their art, as though seeking, by the means of such sensational “diagnosis,” to compensate the victim for the fee they charge him. Hence it comes that, in the existence of marked correctable skeletal deformity, coupled with anything less than practically perfect functional recovery, the issue may be forced by the roentgenographic evidence. Many an operation undertaken to improve a bad x-ray picture has resulted in a less useful limb.
Unfortunate results occur with particular frequency after the fixing of recent compound fractures by means of Lane plates or other metallic sutures. Rarely, if ever, is fixation of a recent compound fracture by the introduction of a foreign body such as a Lane plate justifiable. The chance of carrying extensive infection into the bone by such an operation under such circumstances is great, and cannot be eliminated by any technic of which surgeons are possessed. Osteomyelitis is so serious a disaster that “safety first” should be the rule.

A surgeon may be so fortunate as to escape infection after bone-plating in a large percentage of recent compound fractures, but this good fortune does not make such practice good surgery. Tragic results from the use of such methods are often seen. I am convinced that the average results of the most brilliant surgeon who plates recent compound fractures will, by his disastrous failures, be brought far below that of the surgeon who efficiently employs the best non-operative methods.

Conscientious and intelligent use of the procedures of splinting, traction, suspension, and lateral pressure, developed through the World War experience, secures in the average compound fracture of a long bone a result that closely approximates the best that could possibly be obtained by bone-plating. In the relatively few cases where operation upon a compound fracture is necessary for reasons other than to control already existing infection involving bone, incision should be deferred until a clean field of operation is a reasonable possibility.

In Case II the evidence of the roentgenogram was outweighed by the clinical findings; operation was not done and practically complete functional recovery occurred notwithstanding uncorrected skeletal deformity. In Case III compound fractures of the forearm bones were restored to anatomic reposition by immediate plating. Infection ensued, at the cost of much loss of time and much suffering to the patient, with finally a lesser degree of functional recovery than was secured in Case II. This patient was fortunate enough to escape the tragically disabling results which I have in many instances seen as the aftermath of infection of a plated compound fracture.
Case III is an interesting instance of absorption of a complete interosseous bridge between the radius and ulna. Absorption occurred late. Ability to rotate slightly was first observed about two months after return to active employment. It is to be noted that closure of sinuses and completion of bony repair both occurred after removal of all splints and after the patient had been given several weeks of physiotherapy.

III. LIMITATIONS OF TRACTION IN CORRECTING SHORTENING

Case IV.—C. E. Male, aged thirty-eight. Rancher. Sustained a comminuted subtrochanteric fracture of the left femur June 8, 1918. Splint applied and patient kept in bed seven weeks. About on crutches until January 1, 1919. Commenced doing chores about ranch in March, 1919, walking with a cane. When seen for the first time, September 20, 1919, he was walking with a cane and had a very marked limp. Sharp inward angulation of the lower fragment of the femur at the site of fracture had resulted in adduction deformity and 3 inches shortening of the leg. Flexion of the left thigh was limited to 90 degrees, of the left knee to 85 degrees. The circumference of the left mid thigh was 1 3/4 inches less than that of the right at the same level. x-Rays showed malunion of old comminuted fracture of the femoral shaft about 1 1/2 inches below the lesser trochanter and separation of the lesser trochanter (clinically fibrous union) (Fig. 211).

Patient was operated October 13, 1919. Through a lateral incision two holes were drilled transversely through the center of the femoral shaft, the first just below the site of fracture, and the second 3 inches distal. The anterior half of the femur was sawed through with a Gigli saw at the upper drill hole and the posterior half sawed at the lower drill hole. The intervening 3 inches of the shaft was partially split longitudinally with the Albee saw and the separation completed with a wide thin osteotome. The limb was abducted and the patient put up in a Jones abduction frame for six weeks. Heavy traction, by means of a Spanish windlass, was maintained for five weeks upon adhesive strapping to the leg below the knee. It was
hoped by this procedure to reduce the shortening by pulling down the lower fragment. X-Rays showed that this was unsuccessful. Massage of the thigh was begun in the sixth week. Treatment by hot packs, massage, and graduated active exercises was given. Patient was discharged March 24, 1920. On the date of discharge shortening of the left leg was 1 1/2 inches. Flexion of the right knee was possible through 100 degrees. There was slight lateral mobility of the knee in a position of full extension.

During the World War many cases of malunion of fractures of the long bones with overlapping and shortening were corrected by careful and persistent traction. There are records of cases of fracture of the shaft of the femur with malunion and several inches of shortening which were restored to normal length by several weeks of continuous traction in the Thomas splint, or by use of so-called "ice tongs" for direct traction upon the bone. Two fundamental conditions necessary to success in any case
so treated are: (1) that non-union exist, and (2) that traction, by whatever method, be efficiently maintained.

Case IV presented a problem of malunion of a femoral fracture with 2 inches of shortening due to overlapping and malalignment. The bony union had been complete for over eight months, when operation was undertaken. It was thought that possibly, in addition to the length gained by correction of the angulation, the shortening might be further reduced by doing a long osteotomy and pulling down the shaft fragment by heavy continuous traction maintained until bony union occurred. The patient co-operated well and heavy integral traction was maintained by means of the specially fitted Jones abduction frame and a Spanish windlass for five weeks. At the end of that period there was bony union and the x-ray showed that no length whatever had been gained by traction (Fig. 212).

In my opinion the principal reason why traction resulted in no further gain in length was that the shortened adductor muscles were already stretched very taut through bringing the leg into abduction, before traction was instituted. By measures of direct traction with caliper tongs a sufficient force could possibly have been exerted to reduce the shortening. The experience in this case, however, has convinced me that where shortening has endured long enough to permit the adaptation of so powerful a muscle group as the thigh adductors to a much restricted range, ordinary methods of traction will not avail to restore length to the limb.

IV. ABDUCTION-TRACTION IN FRACTURES INVOLVING THE SHOULDER-JOINT

Case V.—A. R. Male, aged fifty-five. Woods superintendent. Sustained a comminuted, impacted fracture of the head of the right humerus with very severe contusions of the soft parts September 13, 1920. When seen September 17, 1920 he had his right arm bound to his side. It was intensely swollen and bluish-black in color from elbow to shoulder. He was anesthetized and the right arm placed in abduction-traction splint. Traction was maintained until October 14th. Physio-
therapy was begun October 13th. The splint was retained until October 24th, when the patient was suddenly taken with very severe pleurisy. The splint was removed, physiotherapy suspended, and the arm allowed to come down to the side of the body. Physiotherapy was begun again after ten days. The arm was found very stiff and sore and abduction hard to regain. Treatment was continued until March 7, 1921. On dismissal there was \( \frac{3}{4} \) inch shortening from acromion to olecranon. The

Fig. 213.—Case V. A. R. Fracture of surgical neck of right humerus with some comminution of head. Maximum of scapulohumeral abduction regained. Angle of humeral shaft with lateral border of scapula 80 degrees.

Fig. 214.—Case V. A. R. Showing position of minimum abduction. Angle between shaft and lateral border of scapula 30 degrees. A comparison with Fig. 213 shows 50 degrees scapulohumeral abduction range.

range of motion in abduction and adduction in a lateral plane was from 15 degrees from side of body to 110 degrees from side of body. Patient could place the tip of the right index-finger on the middle of the opposite clavicle, on the spine of his fifth cervical vertebra, and in his right hip-pocket. X-Rays indicated that further motion between the scapula and humerus was probably inhibited by bony obstruction. A measurement of the angle made by the shaft of the humerus with the lateral
border of the scapula in the two x-rays showed the arc of scapulo-humeral motion in lateral abduction to be between 45 and 50 degrees (Figs. 213, 214).

**Case VI.**—J. L. Male, aged fifty-three. Carpenter. Fell 20 feet, sustaining comminuted, impacted fracture of surgical neck and head of right humerus, with extensive contusion of soft parts about the shoulder, on March 30, 1920. He was treated by traction in an abduction splint at right angles from the side of the body for five weeks. Massage was begun in the fourth week and followed by a carefully graduated course of active and resistive exercises. On August 23, 1920 there was \( \frac{\delta}{6} \) inch of shortening of the arm from acromion to olecranon. Motion was normal except for slight limitation of internal rotation. (Hand could be placed behind back not higher than the level of the lumbosacral joint). On January 19, 1921 he reported for observation after working several weeks at carpentry. He complained of some weakness, soreness, and cramping of the right shoulder muscles. Vertical abduction was limited to 135 degrees. The full range on the uninjured side was 155 degrees January 9, 1922. Abduction was normal; internal rotation was limited, as above described. There was no longer any manifestation of pain or weakness. The roentgenogram showed abduction of the shaft with some overlapping at the site of fracture (Fig. 215).

**Case VII.**—B. H. Male, aged eighteen. Laborer. Fell 17 feet, striking on his left shoulder, sustaining a comminuted fracture of the surgical neck of the left humerus, with anterior displacement of the upper end of the shaft on August 6, 1921. When seen August 10th his left arm was bound down to his side. Attempts at reduction had been unsatisfactory. The patient was too small to be fitted with any abduction traction splint available. He was put up in a cast, in traction, at an angle of 110 degrees, with elbow flexed to a right angle and arm in neutral rotation. On account of pain cast had to be cut, releasing to some degree the traction on the humerus. The cast was retained for four weeks. Physiotherapy was begun, and carefully graded up from hot packs and simple massage to
vigorous Indian club swinging, hanging and weight and pulley exercises. He was dismissed from treatment November 7, 1921. On discharge there was \( \frac{1}{2} \) inch shortening of the arm from olecranon to acromion, and slight weakness of the right shoulder muscles. The range of motion was normal. The roentgenogram showed slight adduction and lateral displacement of the shaft at the fracture (Fig. 216).

The treatment of fractures involving the head of the humerus by fixation in a position of adduction at the side of the body not infrequently results in scapulohumeral ankylosis. Quite often, notwithstanding that excellent apposition and alinement of fragments is secured by this method, a large degree of permanent loss of function results. The realization that poor functional results were so often the outcome of the treatment of such fractures in adduction led to the trial of the traction-abduction treatment upon 3 very severe cases of fracture of the surgical neck. Cases V and VI were both treated by traction in an abduction splint (Figs. 219, 220). Case VII, being too small to be fitted with any abduction splint available, was put up in a plaster cast at 120 degrees abduction from the side of

![Fig. 215.—Case VI. J. L. Showing deformity after treating case of surgical neck of right humerus in traction in right-angled abduction. Range of motion practically normal.](image1)

![Fig. 216.—Case VII. B. H. After treating fracture of surgical neck of left humerus in 120 degrees abduction in plaster cast. Range and vigor of motion not appreciably impaired.](image2)
the body, heavy traction being maintained during the application of the cast. In each of the 3 cases the forearm was held in a position of right-angled flexion in a horizontal plane, that is to say, in neutral rotation of the shoulder. In each of the 3 cases the degree of injury to the soft tissues about the shoulder was extensive. This was especially true of Cases V and VI, in each of which the swelling was extreme, and the entire injured shoulder and upper arm in each case bluish black from extensive extravasation of blood. It will be noted that in both Cases V and VI the action of the pectoralis major, the teres major, and the latissimus dorsi on the upper end of the lower fragment resulted in pulling the end down, so that union took place with definite abduction deformity (see Fig. 215). Notwithstanding this deformity Case VI regained a range of motion of the shoulder practically normal in every respect, except that internal rotation was limited so that the hand could not be placed upon the back higher than the fifth lumbar segment.

In Case V the injury to the shoulder-joint was most marked, such a case as would, if treated without traction and in an adducted position, probably have resulted in a complete loss of scapulohumeral motion. The patient had the misfortune to suffer a severe pleurisy, which interrupted physiotherapeutic treatment for ten days at a critical period in his convalescence. Notwithstanding this mishap and the conspicuous angulation at the surgical neck, caused by the downward pull of the pectoralis, teres major, and the latissimus dorsi, the patient recovered with between 40 and 50 degrees of scapulohumeral abduction and with both internal and external rotation better than 50 per cent. normal range (see Figs. 213, 214). A considerable portion of the final limitation of motion in this case was attributable to a definite shortening of the latissimus and pectoralis major. This had the effect of inhibiting the full range of scapular rotation and of abduction due to rotation of the scapula. The fact that, notwithstanding the very considerable limitation, the patient was able to place the tip of his right index-finger over his fifth cervical vertebra, on the center of the opposite clavicle and in the right hip pocket of his trousers, evidences that the
motion recovered was in the range of the greatest practical usefulness.

In Case VII bony deformity occurred by upward instead of downward displacement of the upper end of the humeral shaft (see Fig. 216). This was probably due to the greater degree of abduction maintained and to the use of a cast which gave a firmer axillary support than the abduction splint. It is to be noted that the greater the degree of abduction above a right angle, the more the pull of the pectoralis and the latissimus on the shaft is converted into end thrust, and the less is the tendency to abduction angulation at the fracture from muscular pull. The photographs of Case VII (Figs. 217, 218) show the range of motion regained in internal rotation and in vertical abduction.

Measured from acromion to olecranon, each of the 3 cases had about 1/2 inch of shortening; none had any of the weakness of the deltoid so marked and persistent after the treatment of severe shoulder injuries in the adducted position.

After such cases as VI and VII have returned to regular
work it is probable that strength tests, taken at intervals, would show a slight degree of general weakness in shoulder function persisting over a very long time. It is likewise probable that the degree of bony deformation would place some of the smaller shoulder muscles at sufficient mechanical disadvantage to cause these muscles to tire out quickly under continuous exertion. These cases are not presented as a plea for the abduction-traction method, but simply as illustrations of the possibilities, limitations, and results of the use of this method in such cases. In view of

![Figs. 219, 220.—Showing front and back views of traction abduction splint applied.](image)

the very poor functional results frequently noted following treatment of severe shoulder injuries in adduction the possibilities of the abduction-traction method make its use in all cases where the lesion threatens to result in scapulohumeral ankylosis justifiable.

The detailed construction of the abduction splint (Figs. 219, 220) has been described in a previous article. The splint is equipped for traction by adding a padded axillary belt and by extending the lateral bar of the forearm piece about 4 inches so
as to give room for traction straps and Spanish windlass between this bar and the flexed elbow.

V. ADHESIONS IN THE SHOULDER-JOINT

Case VIII.—F. B. Male. Garage worker. Sustained an injury to his right shoulder December 7, 1920. Fell 5 feet, caught right elbow on a wall, producing an upward thrust on the shoulder-joint. Had severe pain in shoulder-joint; was strapped with adhesive plaster; diagnosed subdeltoid bursitis; returned to work after four days; slipped and wrenched the shoulder again ten days later. He was treated by adhesive strapping; high frequency and active exercises. Complaint, when seen May 3, 1921, pain on all extremes of motion in right shoulder; severe pain at night; inability to abduct shoulder to a right angle. Physical examination of right shoulder showed slight atrophy of deltoid and of supra- and infraspinatus. Both active and passive lateral abduction limited to 75 degrees from side of body; external and internal rotation both limited; pain on palpation over anterior portion of joint capsule. x-Rays of shoulder negative.

Diagnosis: Adhesions of capsule after trauma.

Treatment (May 6, 1921): Patient anesthetized and arm brought to vertical abduction with scapular motion controlled by assistant. Snapping of adhesions could be both felt and heard during manipulation. Arm fixed in right-angled abduction splint for ten days. Baking and massage, with graded active exercises, begun and continued for five weeks. At the end of this time range of active motion in shoulder was normal and patient complained only of occasional twinges of pain at night.

Case IX.—S. B. Male, aged forty-eight. Oil well driller. On February 24, 1920 received an electric shock and was thrown heavily to the floor, fracturing the right scapula and severely confusing the shoulder. Arm bound to his side for four weeks. After that treated by baking, massage, and active exercise for two months. Condition of right shoulder on June 11, 1920 definite atrophy of right deltoid; lateral abduction limited to
70 degrees from side of body; very slight rotation possible; motion almost entirely scapular. X-Rays showed transverse fracture through body of scapula about 1 inch below the lower border of the glenoid, united with some overlapping.

Diagnosis: Adhesions in the shoulder-joint.

Treatment: Manipulation under anesthesia; heavy adhesions broken up, followed by abduction splint and physiotherapy as in Case IX. Discharged August 30, 1920 with range of motion fully regained. Patient still complained of some pain on abduction above an angle of 110 degrees from the side of the body.

Case X.—J. C. Male, aged fifty-six. Mine foreman. Slipped and fell November 23, 1919, striking on his left elbow and wrenching his left shoulder. Had a sensation of weakness and numbness in the shoulder. Diagnosis of arthritis made and all his teeth extracted. No other treatment. On June 18, 1920 he came complaining of pain in left arm and shoulder, and of inability to abduct the arm laterally more than 45 degrees from the side of the body. There was definite atrophy of the deltoid and almost complete loss of motion between the scapula and the humerus. X-Rays showed no pathology.

Treatment (June 24, 1920): Manipulation under anesthesia. The snapping of adhesions was audible across the room. Abduction splint was followed by physiotherapy as in Case VIII. Dismissed from treatment August 20, 1920. Range of motion practically normal; still some soreness and weakness. Reported for observation October 14, 1920. Recovery complete.

Case XI.—J. D. Male. Laborer. Fell 14 feet, striking on concrete floor on right shoulder and back, October 8, 1921. Severe contusion of right shoulder; no special treatment given. Condition when seen November 21, 1921 active and passive abduction of right shoulder limited to 90 degrees from side of body by adhesions. Pain and muscle spasm on attempts to abduct the arm further. X-Rays November 21, 1921 reported: "No Roentgen evidence of pathology." Heavy adhesions broken up by manipulation under anesthesia November 22, 1921. Physiotherapy begun November 25th. Patient discharged with recovery practically complete on November 30, 1922.
No apology is made for presenting a series of cases so simple as shoulder adhesions. Instances where disability has persisted and adhesions in the shoulder-joint have been unrecognized as the cause for periods varying from a few weeks to one or more years occur too often. I have not opened a shoulder capsule showing adhesions, but from clinical observation it is my opinion that, in addition to the bursal lesions so carefully described by Codman, Brickner, and many others, adhesions of synovial surfaces occur either where the capsule is folded upon itself or where it lies against the synovia-covered articular border of the bone. Obviously the latter mentioned condition might be expected to occur in the upper and outer portion of the shoulder-joint capsule with the arm hanging at the side, while in the axilla, adhesions of opposed folds of the capsule would be the rule.

Adhesions limiting motion in the shoulder-joint occur very frequently after trauma of all degrees of severity. Fixation with the arm at the side or even voluntary failure to raise the arm through the upper range of abduction for several weeks after the injury favors the formation of adhesions which limit abduction.

Subdeltoid, subscapular, or subcorocoid bursitis may one or all complicate the clinical picture. Sometimes the surgeon, impressed by the symptoms and signs recognized as typical of subacromial bursitis in particular, may fail to recognize the presence of adhesions unrelated to the bursa. Adhesions too dense to be stretched or broken up by the application of exercise and manipulation without anesthesia are simply irritated and made worse by such manipulation. By ill-advised physiotherapy a chronic reaction in one or more bursæ may be developed. It is our practice to try the effect of conservative treatment by hot packs, massage, stretching, manipulation, and exercises in every case of shoulder-joint adhesions which comes to our care without a history of having had a course of such treatment. In treating such cases the reactions of soreness and muscle spasm are carefully watched and frequent measurements of the range of motion of the injured joint taken. Should
severe reaction occur or a definite weekly gain in range of motion fail to take place, conservative measures are promptly abandoned and the adhesions are broken up under anesthesia. With increasing experience in the conservative method of treatment, excision of bursæ has become necessary in only a very small percentage of cases.

Support in right-angled abduction is the surest means of guarding against troublesome adhesions in an inflamed shoulder. We use the abduction splint as a routine for prevention of adhesions after recent injuries and after breaking up adhesions by manipulation.

As a criterion for deciding when the abduction splint may be dispensed with we use the patient’s ability to raise his arm in active abduction sufficiently to clear the splint. Applications of heat and massage are usually begun on the third day after manipulation. Physiotherapeutic treatments are continued until vigorous active abduction is performed throughout a practically normal range.

Some cases, as Case XI, for instance, recover completely within a few days after manipulation. Others, like Case VIII, require a much longer period of treatment. Cases complicated by a definite subacromial bursitis or by a shortening of the pectoralis major or teres major are likely to be very slow and take months rather than weeks of treatment before the maximum degree of recovery is obtained. There are, of course, cases where excision of the bursa or bursæ is advisable. Many cases of definite bursitis subside after adhesions are broken up.

It is, of course, possible to break up adhesions by forcible abduction without anesthesia. I consider this method unnecessarily cruel and uncertain as to results in the hands of anyone other than a master surgeon, such as Sir Robert Jones. If more gentle and conservative measures do not result in a gradual but definite progress toward recovery, then manipulation under general anesthesia is the safer alternative.
VI. SUMMARY

1. In delayed union of fractures physiotherapy is valuable. Immobilization should not be too long relied upon exclusively. Bone-grafting should not be considered until after vigorous and prolonged physiotherapeutic measures, failing to secure union, have at least restored the circulation and soft tissues to the best practicable condition.

2. (a) Degree of functional recovery and not roentgenographic evidence of reduction and alinement should be the criterion for decision as to the expediency of operative measures in fractures uniting in imperfect anatomic reduction. (b) Bone-plating recent compound fractures subjects the patient to an unjustifiable hazard. Such operations should be abandoned for the safe and adequate procedure of reduction and fixation by external splinting with traction, suspension, and adjustable lateral pressure pads.

3. Effort to restore length through stretching the soft tissues by integral traction failed in a selected case of malunion of the femur with marked shortening of many months' duration. The conclusion is that traction by ordinary methods is inadequate to stretch large muscle groups which have, for a long time, been shortened.

4. Traction in a position of right-angled abduction secured good functional results in cases of fracture of the surgical neck of the humerus, complicated by severe soft tissue trauma. Some anatomic malalignment of the fractures occurred in every case. In view of the frequent bad functional results from other methods the abduction-traction method is worthy of a thorough trial.

5. After trauma to the shoulder-joint adhesions limiting motion are common. Treatment by support in right-angled abduction is the best preventive. Adhesions are often accompanied by bursitis (subacromial, subscapular, or subcorocoid), and are frequently undiagnosed. If such adhesions do not yield to conservative physiotherapy, forcible manipulation under anesthesia, followed by a further course of physiotherapy, usually leads to early recovery.
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PREPARING A WOUND FOR SKIN-GRAFTING

Bold indeed is the surgeon who advocates a new method of skin-grafting. Certainly the man who would improve on Thiersch grafts exposed to the air until "taken" must be a genius. But experience has forced upon my attention the great value of one bit of procedure which does not seem generally recognized, namely, the application of paraffin (or ambrine) dressings a few days before grafting a granulating wound.

The condition of the surface to which they are applied is the deciding factor in the success or failure of skin-grafts. A soft, smooth-surftaced, clean granulating wound allows the grafts to adhere promptly to it and derive immediate nourishment—a hubbly, hard or dry granulating surface tends just as surely away from success. Granulating wounds dressed with ordinary dressing materials have hubbly, hard surfaces, those dressed with paraffin are soft, thin surfaced, and smooth.

The procedure followed is this: The surface to be grafted is dressed with paraffin (or ambrine)\(^1\) three days in succession.

\(^1\) A satisfactory formula is this:

\[
\begin{align*}
\text{Low melting-point paraffin} & \quad 23 \\
\text{High melting-point paraffin} & \quad 70 \\
\text{Yellow vaselin} & \quad 6 \\
\text{Eucalyptol} & \quad 1
\end{align*}
\]

There are three essential points in the use of paraffin dressings for any wound (burns or other): (1) The material must be hot. A camel's-hair brush is just as satisfactory as a special atomizer, is just as painless, much cheaper, and does not get out of order. If a brush is used the paraffin should be heated \textit{in a water-bath} and the entire water-bath brought to the bedside. If the paraffin is heated over a flame without a water-bath it gets too hot, and if the dish of paraffin be removed from the water-bath it will cool too quickly and
On the fourth day small Thiersch grafts, \( \frac{1}{2} \) to 1 cm. in diameter, are taken under novocain anesthesia from a convenient spot with a safety-razor blade held in a hemostat; \( \frac{1}{2} \) per cent. novocain solution is injected with a fine needle *intradermally* so as to make a wheal 8 or 10 mm. in diameter. Inserting the needle, again intradermally, through the edge of the wheal, its area is extended, and by thus adding a succession of wheals an area is outlined not more than one-third to one-half the size of the wound to be covered with grafts. The center of this skin outlined with wheals is then anesthetized by injecting novocain under it, introducing the needle through the line of wheals already produced. The patient should be unaware of any needle insertion after the first.

For uniform success the grafts should be thinner than half the thickness of the skin. They are placed in a bowl of warm salt solution and the denuded area temporarily dressed with a dry gauze. A generous vaselin dressing is prepared to replace this gauze after the remainder of the operation is completed, by which time bleeding will have ceased. If a vaselin dressing is not applied subsequent dressings of this denuded area will be extremely painful.

The grafts having been taken, asepsis may be dispensed with. The paraffin dressing is removed from the surface to be grafted, the discharge which always forms under a paraffin dressing is wiped away with cotton pledges, care being taken to avoid bleeding. A tissue forceps, grooved director, or other blunt-edged instrument is then very gently used to scrape off the thin film of slough-like material which will be found covering the granulations. Care should be taken not to start bleeding. The grafts are then spread out upon a finger and applied a thick rough coating of paraffin will result. (2) The paraffin must be painted well out over normal skin at the edge of the wound. If this is neglected the dressing sticks to the granulating edge and its removal is painful. (3) A layer of cotton is placed over the first coat of paraffin and another coat of paraffin applied, melting both coats and the cotton into one reinforced layer. The cotton must be extremely thin. A little pinch of cotton is teased out until it will barely hang together. If thicker layers of cotton are used, thick, heavy dressings result, which crack easily and are uncomfortable.
to the wound in the usual manner, leaving 2 or 3 mm. space between edges. The wound is left open to the air for three days, usually with a wire "cage" protection. At the end of three days a paraffin dressing is applied across grafts and scabbed discharge without any attempt at cleaning. Twenty-four hours later all the dried, crusted discharge comes away with the paraffin dressing, and a little wiping with pledgets of cotton leaves a clean healthy grafted wound.

So much for theory and method. The procedure works admirably in practice. Much of the technic was literally forced upon us in caring for Miss H., a graduate nurse who turned suddenly in an operating room, knocking a burning alcohol lamp over and spilling its contents down her back with resulting third degree burns of both buttocks, thighs, and calves. The shock and continued absorption from her wide granulating areas kept her pulse at 140 and her stomach nauseated for weeks, so that curing the wounds and applying grafts under general anesthesia was out of the question. Nor were Dakin's solution or other similar attempts to clean the wounds tolerated. Finally, in desperation, small Thiersch grafts taken with novocain were tried and proved uniformly successful. A hundred grafts were applied to the back of a thigh at one sitting without discomfort or fatigue on the part of the patient, and with an average of better than 95 per cent. takes.

The case of V. H. illustrates the value of paraffin as a preparation of granulation tissue for grafts. Large granulating wound following gunshot gutter wound of thigh. The wound was first dressed with Dakin's solution until free from pus, and immediately grafted as described without preliminary paraffin dressings. Result—one graft out of forty-eight successful. The following week the wound was dressed with paraffin three successive days, and again grafted in identical manner. Result—forty-two out of forty-five grafts "took" and the wound was completely epithelialized within eight days.

Mr. L. M. is a steamship captain who has been under severe strain during a long stormy trip, and developed an enormous carbuncle of the neck. It was excised three weeks ago. For
eleven days the wound was dressed twice daily with Dakin's solution packs until the granulation tissue base was nearly level with the surrounding skin. Followed three days of paraffin dressings. Then small Thiersch grafts, left open under a cage three days and again dressed with paraffin. Now, three weeks after excision of his carbuncle, an area the size of a man's palm is epithelialized and he is to take out his ship tomorrow.

Mrs. D. R. has spent six months in bed, first with typhoid fever, then with neuritis and temporary paraplegia, now just beginning to clear up. She obtained (in another hospital fortunately) bed-sores over the sacrum and over each hip, going down almost to the bone. Three weeks of scrupulous care and dressings with dichloramin-T have made only the very slightest impression on the size of the sores. At the evident rate of healing a year would elapse before closure. A week ago the sore over one hip was paraffined, then grafted as described. Eleven grafts were applied, and today seven have taken and are in excellent condition, and two-thirds of the deep granulating surface of this sore will be covered within another week.

The method, therefore, is ideal not only for burns, but for various other granulating surfaces. Its great advantage is that by it surfaces can be covered regardless of infection and amount of discharge as soon as granulations begin to form, thus conserving valuable time and reducing scar tissue contracture. Old granulating areas also may be covered without recourse to cureting under an anesthetic.
A BETTER PLAN OF APPROACH FOR FEMORAL HERNIA

There are two ways in which the sac of a femoral hernia may be approached—either from above or from below Poupart's ligament. The approach from below Poupart's is employed in the familiar operation of Coley. The hernial sac is directly exposed to view, freed from surrounding tissues, opened, contents reduced, and the sac clamped and ligated at its neck, drawn down through the femoral canal. In this old and familiar operation the hernial opening is obliterated usually by a purse-string suture applied from within the canal to the under surface of Poupart's ligament and then to the sides and floor of the canal. The procedure is a good one and satisfactory in its results.

But a much more satisfactory obliteration of the hernial opening in the femoral canal can be accomplished from above Poupart's ligament. The operation is that proposed by Dujarier, and in this country by Seelig and Tuholske. The inguinal canal is exposed by separating the fibers of the external oblique aponeurosis; the cord and its accompanying structures (or the round ligament) are carried aside with the free edge of the internal oblique by retraction or are held out of the way by a tape passed under them. This exposes the upper end of the femoral canal with the hernial sac entering it. The peritoneum is opened a short distance from the neck of the sac, and the sac is inverted by passing a forceps from within the peritoneum through the neck of the sac, and with it grasping the sides or fundus of the sac. The inverted sac is then ligated and excised from within the peritoneum and the stump so disposed that it will not act as a button tending to reproduce the hernia. Obliteration of the hernial opening is neatly and easily accomplished by approximating with interrupted sutures Poupart's ligament (or the roof of the canal) and the fascia over the pubic ramus ("Cooper's ligament"—the floor of the canal).
This method of closing the canal has many advantages over that of a purse-string suture applied from below:

1. It is accomplished in plain view, with good exposure, instead of in the recess of the canal.
2. Dependence is placed upon interrupted sutures instead of a single purse-string suture.
3. No dimple is left at the entrance to the closed canal.

(4) The inguinal canal is well reinforced, as closure of the wound is accomplished just as it is in operating primarily for inguinal hernia.

It is not always, however, smoothly carried out, for the hernial sac may refuse to be inverted from within. Several conditions common in femoral hernias may necessitate resort to direct exposure of the sac from below Poupart's—a small hernial
opening with sharp fascial edge; incarcerated contents or contents widely adherent in the sac, etc. Furthermore, the close relation of the transversalis fascia and the peritoneum in this region predisposes to oozing and difficulty in a clean approach.

I have found that a little modification in the sequence of steps in this operation makes it much smoother and more satis-

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Fig. 222.—Inguinal canal exposed from above Poupart’s ligament. The transversalis fascia has been divided to show relation of peritoneum and retracted stump of hernial sac. In practice, after splitting the fibers of the external oblique, exposure of Poupart’s and Cooper’s ligaments is accomplished by simple mass retraction of all the structures in contact with them. (After Seelig and Tuholski.)

factory. Instead of attempting to invert the sac from within and then being obliged to expose the sac directly in the end, I have gone first below Poupart’s ligament to deal with the hernial sac and then above Poupart’s to close the opening in the canal. The steps of the operation as in the case herewith illustrated are:
Incision parallel to Poupart's and almost immediately above it. The lower edge of this wound can be easily retracted to give excellent exposure of the sac, and it is an anatomically sound incision, which the incision across the groin is not. Painful contracture across the groin does not result.

The sac is exposed and cleared from surrounding tissues, opened, and the contents dealt with as usual. This accomplished, the neck is drawn down through the canal, ligated high, cut, and the stump allowed to retract.

The inguinal canal is exposed by splitting the fibers of the external oblique above Poupart's as in inguinal herniotomy, and the internal oblique and contents of the canal held away from Poupart's by gentle retraction, while the edges of the hernial opening are approximated by interrupted sutures.

The conjoined tendon and edge of the internal oblique are sutured to Poupart's ligament as in inguinal hernia operations, the structures lying in the canal remaining undisturbed. Closure of the external oblique and of the skin completes the operation.

The advantages of this procedure are obvious:

1. Every step is performed in plain sight.
2. No procedure is attempted which may have to be abandoned in favor of another, thus diminishing trauma and conserving time.
3. The peritoneum above Poupart's ligament is not opened and the danger of bladder injury is thus reduced.
4. At the same time the operation has all the advantages of the closure from above Poupart's—closure of the canal flush without leaving a dimple—use of interrupted sutures instead of a single purse-string, reinforcement against subsequent inguinal hernia in the course of closure.
INJURY AND TUMORS

With the constant increase of industrial accident surgery we have more and more frequently presented to us the problem of the relation of injury to the origin and also to the growth of tumors. Cancer and other malignant growths are an especially prolific source of dispute between injured employees and insurance carriers, and on account of the seriousness of their outcome the amount of compensation involved is frequently large.

The problem divides itself into two definite and distinct phases: (1) Does trauma cause the development of malignancy where none existed before? (2) Does injury increase the rate of growth of a tumor already present, or increase its rate of metastasis?

The first question—that of the part injury may play as a cause of tumor development—has been rather fully discussed from the industrial medicolegal aspect. Ophüls\(^1\) has recently summarized the situation. Briefly, it is rarely if ever possible to prove absolutely that the development of tumor after injury is not coincidence. Certain kinds of trauma, however—long repeated irritation, as of the tongue from ragged teeth, or a single injury of some benign abnormality, as a pigmented mole—have come to be generally regarded as definite factors in tumor development. Commissions and other judicial bodies have, therefore, tended to give the injured employee the benefit of any doubt. In order reasonably to place upon trauma the responsibility for the origin of a tumor, however, these points must be clearly established:

1. The fact of definite and reasonably severe injury at the site of tumor formation must be clearly proved.
2. It must appear that no tumor existed before injury.

\(^1\) Ophüls: Calif. State Journal of Medicine, xix, 1921, 54.
(3) There must be a sufficient lapse of time between the injury and the appearance of the tumor, and, on the other hand, the tumor must appear within a reasonable time limit after injury. Three weeks to three years are the limits usually set.

Case No. 2114, now at St. Luke's Hospital, illustrates the points mentioned: Mrs. E. A., forty-eight, married, history of five normal lactations. Eleven months ago a high oven door in a bakery fell against her, the handle of the door striking the upper outer quadrant of the right breast. The contusion was so severe as to demand medical attention, so that she was examined then and several times later by the physician to whom she was sent by the insurance company. The first two of the essential points noted were thus satisfied. The fact of injury is well established and it appears from the record of medical examination made immediately after injury that no tumor existed at that time. She now presents herself with a large cancer in this region of the right breast, already presenting one small skin metastasis. She has been aware of the lump at least two months, but the stage of the cancer makes it probable that a lump has existed somewhat longer than she has known of it. In other words, with no tumor previously existing she has developed a breast cancer at the site of a well-authenticated bruise within approximately six months or less.

The second phase of the problem—that of the effect of injury on the rate of growth of tumors or upon their rate of metastasis—has been less thoroughly discussed in the literature, though much more susceptible of positive proof. It is the consensus of opinion among surgeons dealing with cancer and based on observation of many cases that tumors tend to grow more rapidly after injury, and especially to metastasize more rapidly. Even such trauma as that of repeated examinations for diagnosis or rough handling during operation has been incriminated.¹ Tyzzer² demonstrated several years ago that less than one minute of ordinary massage of breast cancer in mice will cause

extraordinarily rapid metastasis. And within the past few months Leila Knox,¹ in a very beautiful piece of research, has corroborated and extended this observation, and has shown that the effect of gentle massage in producing wide-spread rapid metastasis is in direct relation to the grade of malignancy of the tumor.

The following case demonstrates positively the effect of injury on the growth of tumor tissue: E. L., fifty-five. All his life has had a dime-sized, smooth-surfaced, elevated black mole on the plantar surface of his fourth toe. Seven months ago his first intimation of change was the appearance of small lumps (skin metastases) on the backs of the second and third toes and on the skin of the foot. Four months ago (i.e., three months after first appearance of metastases) he was struck by the edge of an oil drum in such a way as to bruise the metastasis on the dorsum of the second toe, but none of the others. Since this injury the bruised lump has grown with great rapidity until it has reached the size of an egg, while the uninjured metastatic nodules have grown almost imperceptibly. This case, therefore, presents an opportunity to compare accurately the growth of injured and uninjured tumor tissue (identical in character) in the same patient under conditions identical except for the injury. (Microscopic examination of tissue in this case showed the tumor to be melano-epithelioma—the metastases non-pigmented.)

To the surgeon who goes into the abdomen with a fixed idea and with a determination to remove the gall-bladder it seems appropriate to sound a note of warning.

With the recognition of the part played by chronic infection, with or without stones in the gall-bladder, and the benefit of the operation of cholecystectomy, we have overlooked other problems of the biliary tract. As for cholecystectomy, surgeons seem to have abandoned all other maneuvers in this quadrant of the abdomen.

In all large clinics it is a common experience to see patients who have had their gall-bladders removed by some intrepid surgeon who has ignored the fact that the common bile-duct is permanently obstructed either by stricture, stone, or tumor. These victims of poor judgment, if they survive the assault, are the unhappy possessors of a chronic biliary fistula.

It is self-evident that the presence of stones high up in the hepatic ducts must necessarily result in a later descent and obstruction, even where the common duct has been cleaned. Concretions impacted at the ampulla are not always removable except by a transduodenal approach. Tumors at this site are much more common than we think.

Malignant involvement, either of the duct or the pancreas, prevents a form of bile stasis that must be relieved, even though it may be only a palliative measure.

With the conception of the gall-bladder as a focus of infection and secondary lymphatic invasion of the pancreatic structure with the production of chronic interstitial pancreatitis, we seem to forget that the ducts also are infected, drain into the
same lymph-channels, and contribute to the pathology. Removal of the gall-bladder will not necessarily relieve the condition. Therefore it is proper to lay emphasis upon the procedure of cholecystenterostomy. In this measure we utilize the gall-bladder as a vehicle of drainage. The outflow may be either through the stomach or the duodenum. The colon, though handy in location, is unsuited to our purpose. Here we have a method of obviating what otherwise must be a fatal episode in the life of the patient.

Cholecystenterostomy stands in the same relation to gall-bladder surgery that gastro-enterostomy does to stomach surgery. It is a subterfuge, an evil necessity, but a life-saving operation. The indications for its use are: Stones in the common or hepatic ducts that cannot be removed or where the surgeon is not certain of the absence of more than he sees; tumor or stricture at the ampulla, where it is not curable by a transduodenal operation; malignancy of the pancreas or stomach, producing obstructive phenomena; injury to the ducts incapable of surgical repair.

In the past ten years at the University Hospital and in my own private work this operation has been resorted to 16 times. The indications for operation were as follows:

<table>
<thead>
<tr>
<th>Indication</th>
<th>Cases.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malignancy with obstruction</td>
<td>6</td>
</tr>
<tr>
<td>Inoperable or impacted stones</td>
<td>4</td>
</tr>
<tr>
<td>Tumors of the ampulla</td>
<td>2</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>2</td>
</tr>
<tr>
<td>Chronic infection of tract</td>
<td>1</td>
</tr>
<tr>
<td>Acute suppurative pylephlebitis with obstruction</td>
<td>1</td>
</tr>
</tbody>
</table>

There were 3 postoperative deaths in this list, 2 in the malignant list, and the pylephlebitis case.

That done for alleged chronic infection was later followed by cholecystectomy because of its failure to benefit the patient. All the rest were eminently satisfactory for the purpose for which they were done. In good surgical risks the procedure is unattended by any particular danger.

Radiographic studies were made postoperatively in 2 cases of cholecystoduodenostomy. They showed a small amount of
barium entering the anastomosis, but no clinical evidence existed suggesting that this was in any way detrimental during the process of digestion.

The method of making the anastomosis is simplicity itself. The ducts are explored and, if necessary, drained. The gall-bladder is emptied of stones and sutured at its fundus to the second portion of the duodenum with a running chromic suture. The bowel is incised for the distance of an inch and the two mucous edges are sutured with a second running chromic stitch. The closure is completed by continuing the first suture over the anterior surface of the anastomosis. There is little danger of infection from either visceral contents and no tendency for the union to come apart.

Even atrophied and apparently functionless gall-bladders have taken up the service of bile drainage through this round-about way. Secondary exploration in 2 cases of this series has shown that thickened and damaged gall-bladders seem to improve in texture with this drainage. In fact, it is suggested by our experience that any gall-bladder demanding drainage, except of acute suppuration, preferably should be emptied into the intestine instead of the outer world.

The moral of this story then is that we should attack a surgical problem of the hepatic quadrant with an open mind. We should attempt to ascertain the exact pathology of the biliary system and adjust our surgical maneuver to meet the issue. There are indications still for simple drainage. There are situations best met with cholecystectomy.

Lesions in the ducts present some of the most difficult problems of abdominal surgery and require the best technical judgment and skill to solve. Cholecystenterostomy offers a way out of many otherwise impossible situations. We advocate it as a measure warranting more popularity than it does at present.

And last, but not least, we suggest that in the absence of demonstrable pathology of any of the structures of the hepatic system it is not a discreditable thing to leave the patient in possession of his gall-bladder and close the wound.
CLINIC OF DR. LEO ELOESSER

SAN FRANCISCO HOSPITAL

LEG ULCER

The poor always we have with us; likewise leg ulcers, for poverty and leg ulcer go together. They keep our municipal hospitals and charity institutions filled. They deserve more than the grudging and uninterested services ordinarily given them, for, aside from a certain interest attached to the ulcers themselves and their care, the sufferers uniformly have infirmities other than their ulcerated legs.

Hospital records and card catalogs file all leg ulcers indiscriminately as "varicose ulcer." Varicose ulcers, however, by no means make up the full list of leg ulcers.

Fig. 223.—Arteriosclerotic ulcer.

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H. E. is a case in point. He was a carpet layer, sixty-five years of age, who entered the San Francisco Hospital for the
last time on April 4, 1921. He had been in hospital twice before, in 1918 for four months, and again a year later. Besides the large ulcers shown in the photograph (Figs. 223–225) he showed incipient cataracts, a senile arc in both corneæ, and sluggish pupils. His gums and teeth were foul and his tonsils inflamed. His urine contained ablumin and hyaline casts; his

![Fig. 226.—Left leg, periostitis of tibia and fibula](image)

phenolsulphonephthalein output was 12 per cent. for the first hour and 5 per cent. for the second. The record of his blood-pressure is missing. A pulse was palpable in the left posterior tibial artery, but not in the right one; neither dorsalis pedis could be felt to pulsate. Radiograms of the legs showed a periostitis of the left tibia and fibula, with great osteophytic
masses penetrating through the interosseous ligament. There were no chalky deposits to be seen in the vessels (Fig. 226).

On April 19, 1921 the right leg was amputated below the knee. Immediately after amputation the vessels were injected with a barium-gelatin mixture and a radiogram was made of
the leg. Following the injection of barium-gelatin the arteries were injected with methylene-blue. The posterior tibial was stained blue; the anterior tibial was not penetrated by the stain.

Fig. 228.—Radiogram of amputated leg with injected arteries; anteroposterior view.

The radiograms show that the posterior tibial and peroneal arteries have filled with barium, but that none has penetrated the anterior tibial. The lumen of the arteries is very thin and has filled irregularly. There is a meshwork of fine vessels, espe-
cially marked in the substance of the calf muscle and in the foot, which is well injected (Figs. 227, 228). The main body of the blood-stream has, therefore, sought by-paths through the smaller vessels. The dorsalis pedis is missing on the proximal part of the foot, but reappears on the distal part from the base of the metatarsals onward. One can see small anastomoses winding their way through the sole from the thin plantar arteries to this small vessel on the dorsum of the foot. Radiograms of a cross-section of the leg through the lower third (Fig. 229) show

fairly plentiful small vessels in two places corresponding to the body of the calf muscle and to the anterior tibial. The peroneal artery is visible, a few small dots mark the site of the anterior tibial, the posterior tibial does not appear, having been dissected out of the specimen.

The cause of H. E.’s deep ulcers lay in his arteries rather than in his varicosities. His was not a varicose ulcer, but an ischemic one, the result of a localized patch of arteriosclerotic gangrene. The rôle of his accompanying periostitis cannot be

Fig. 229.—Radiogram of amputated leg with injected arteries; view of cross-section at lower third of leg.
estimated; whether this was the primary factor underlying both the arteriosclerosis and the ulceration, or whether it was merely secondary, remains uncertain.

A second patient, A. J., a bookmaker of fifty-seven years, shows an entirely different type of ulcer—a much more painful and an equally stubborn, although a less dangerous type. Like H. E., he also had been admitted to hospital several times. He had had a soft chancre twenty-nine years ago and gonorrhea half a dozen times as a young man. Six years ago he had a varicotomy done on the left leg. Three unsuccessful attempts were made to heal the ulcer with skin-grafts. The man was a heavy drinker and a constant cigarette smoker. Eight years ago both legs became edematous and a small sore appeared over each internal malleolus. The left one persisted until three years ago, when it was healed at this hospital and remained so under the use of zinc-gelatin bandages. The right one had been open for eight years. For the last six years the man had suffered from intermittent claudication. He could walk about a block, when cramps in the calves forced him to stop and rest. After resting a few minutes the cramp would cease and he could go on for another block. The patient looked about ten years older than his stated age. Both corneæ had a senile arc. The pupils were small. His teeth were foul and the gums inflamed.
There was a network of small dilated bluish venules in the skin of both legs; the anterior medial side of both legs just above the ankles was coppery brown (Fig. 230). Over the right internal malleolus was an ulcer about 1 cm. across, with a hard callous edge and a fibrous base. The ulcer was extremely tender; the patient complained of a burning pain in it day and night, and cried out loudly when the ulcer was touched. Radiograms showed a few minute chalky spots in the vessels below the knee.

Fig. 231.—Thrombophlebitic ulcer.

There was no pulse to be felt in either popliteal or in either posterior tibial, nor in either dorsalis pedis artery. The femoral arteries pulsated well on both sides. The blood-pressure varied from 126/70 to 136/72 at different times. The phenolsulphonephthalein output was 15 per cent. the first hour and 50 per cent. the second. The Wassermann reaction (twice repeated) was negative. The urine contained neither albumin nor casts. The eye-grounds showed arteriosclerotic changes. A pinch-graft was placed on the ulcer, and in thirty-one days the patient was dis-
charged with a zinc-gelatin bandage on the "practically" healed leg. After his discharge it healed entirely, but broke down again, so that our man was readmitted ten months later and spent another month in hospital.

These are but two samples chosen from a long list. They suffice to show what interesting matter may lie buried beneath an old leg ulcer.

Among the commoner causes of leg ulcer one may count: varicosities and their sequels (thrombophlebitis and perforation); deficiencies of the arterial blood-supply, arteriosclerosis, and the diffuse fibrosis that is the result of a chronic undernourishment of the tissues; infections, whether of the skin itself (eczema and other dermatitides) or of the deeper parts, periostitis and osteomyelitis; and finally, less clearly understood causes—the so-called trophic ones.

Each of these types of ulceration—the varicose, the arteriosclerotic, the infectious—are fairly well distinguishable; although often enough two or even all three of them may be combined in a single ulcer.

True varicose ulcers are usually small, rarely as large as a dime, lie directly over a small venule whose purplish course may be traced above and below them, and are covered with a black scab. Other ulcers, especially the infectious ones, may be accompanied by varicosities aggravating the infectious elements of ulceration. Thrombophlebitic ulcers may be large, several
inches across, usually have hard callous edges and a base covered with torpid dingy granulations, products of a slowly organizing blood-clot.

**Infectious ulcers** may be due to progression of a superficial skin infection into the deeper parts and may follow a small scratch or abrasion, or they may arise from a deeper infectious process, an old osteomyelitis, or a periostitis which invades the skin from underneath. Infectious ulcers arising from eczema or other superficial processes usually lack a sharply defined edge and heal rapidly if they are not complicated by disturbances in the blood-supply of the legs. They may penetrate deeply, but when they do it is quite characteristic that scattered about in the large ulceration there remain islands of epidermis. If one looks carefully one will see standing out in the granulating floor tiny white pearl-like knobs of skin which have escaped destruction; little islands of skin which the surgeon will hail with delight. They will spread out, grow larger and larger; from them as a center there will sprout islands of epithelium which will gradually flow together and fuse with each other and unite with the epithelium growing inward from the edge of the sore.

**Arteriosclerotic ulcers** are usually large. If they are the products of an acute occlusion of an artery, they are covered by a black or greenish slough penetrating very deeply and leaving after it demarcates the tendons or the periosteum exposed. They usually have perfectly well-defined punched-out or scalloped edges. If they are the products of a gradual fibrosis and under nutrition the slough is absent, but the ulcer may be very large. It also has a sharply defined scalloped-edge and a fibrous base covered with small granulations.

Besides these three types there is a form of ulcer that seems to have a less tangible cause, a cause having to do, perhaps, with the nerve supply. These "trophic" ulcers, if one so wants to call them (Bell described them in 1784 as "irritable ulcers"), immediately distinguish themselves from other leg ulcers by their exquisite tenderness. Most leg ulcers are, of course, painless. Patients with irritable ulcers, however, not only complain of a constant burning pain, but cry out outrageously
when the ulcer is touched. The ulcers are usually quite small, not more than \( \frac{1}{2} \) to 1 cm. across, round, sometimes fairly deep, sometimes superficial, sometimes punched out, sometimes flat; their edges are dusky blue or brown; their base is covered by dusky, sluggish granulations. The ulcers almost always lie at the internal malleolus, at the endings of the long saphenous nerve; rarely one meets a painful ulcer at the external malleolus.

Not uncommonly one finds combinations of all three of the ordinary causes of ulcer—varicosities, arteriosclerosis, and infection—especially in the long-standing ones. Most frequent is the combination of varicosities and infection, either as an infective thrombophlebitis or as the result of trauma. Infection with superimposed local arteriosclerosis and other arterial changes one finds in the chronic ulcerations that follow old infected fractures and old osteomyelitides.

Arteriosclerotic ulcers and many infectious ones commonly have sharply punched-out, round, or scalloped edges; the edges which text-books say are diagnostic of lues. But neither the infectious nor the arteriosclerotic type of ulcer is luetic; at least not gummatous. Lues may be an underlying factor in so far as the underlying arteritis or periostitis may be luetic, but the ulcers themselves are not luetic, nor will they yield to anti-syphilitic treatment. True gummas of the legs are rare in comparison to the frequency of ordinary leg ulcers. Among 76 leg ulcers at the San Francisco Hospital a positive Wassermann occurred but 11 times.

True varicose ulcers—i. e., those caused by a thrombosed and ulcerated or an ulcerated and bleeding venule alone—are fairly uncommon; varicosities usually ulcerate after some complicating infection. Thus we see varices at the anus—hemorrhoids—more frequently even than varices of the legs, yet an ulcer at all comparable to a leg ulcer never occurs at the anus. Only thrombotic ulcers and ulcers from perforation (the ulcers of thrombosed or bleeding piles), ulcers caused by varicosities plus infection, complicate hemorrhoids. Callous ulcers comparable to the ordinary ulcer of the leg do not occur at the anus. Rather, then, than label all leg ulcers as "varicose ulcers," it
seems more logical to seek for some anatomic peculiarity of the legs which might account both for the frequency of varicosities and of ulceration in this part of the body.

Three peculiarities of the legs are striking: The first is that the blood stagnates in the veins of the leg more readily than in other parts of the body; this stasis is helped by our upright posture and by the fact that most people use the muscles of their legs much less actively than they do other muscles, those of the arm or the back, for instance. Most of us stand or sit a great deal more than we walk or run; most of us, for every one step we take, change the position of our arms or our body dozens of times, whether we are sedentary workers or whether we work standing on our feet.

The second peculiarity of the legs and ankles is that nowhere else in the body do we find so large a mass of living substance with so poor an arterial blood-supply and so little need of one. A cross-section of the ankle and the lower third of the leg shows a negligible amount of muscle; it consists almost entirely of skin, tendons, fascia, and bone; all of them poorly nourished passive tissues.

The third peculiarity of the legs is that they are much exposed to infection, both internal and external. Their lymph-vessels and the lymph-vessels of the pelvis and of the anus debouch into the same cess-pool.

It is in a combination of these three factors—blood stasis, arterial anemia, exposure to infection—that the susceptibility of the legs to ulceration must be sought. One or the other of them will explain the commoner kinds of leg ulcers—the arteriosclerotic, the infectious, the varicose.

In 1920 there were listed in the San Francisco Hospital 76 patients with leg ulcers. This number is too low; a good many patients entering hospital for other causes, but suffering from leg ulcers as a minor complaint, do not appear in the indexes. of the 76, 46 were men and 27 women. The incidence is about equally distributed between the sexes, the ratio of male to female patients admitted to the surgical wards being about 2 to 1. Of the 76, 25 may be classified as of arterial origin, 40
varicose, and 37 infectious. Some of these had a mixed etiology. Forty-nine of the patients were over fifty years of age; 27 were under fifty. Of the 25 arteriosclerotic ulcers, however, only 3 occurred in patients under fifty. The 76 patients spent 2831 days in hospital; the arteriosclerotic ulcers averaged 64.2 days per patient; the varicose and infectious ones, 27 days, or less than half the time. Twenty-nine patients were discharged with their ulcers completely healed; 23 with the ulcers improved, but still open, making 52, or about two-thirds of the number cured and improved. Twelve were unimproved, most of them remaining only a few days; 3 died. In 9 the state of the ulcer on discharge is not noted. The blood-pressure readings appear on 12 of the charts of the arteriosclerotic and on 13 of those of the varicose ulcers. Of the 12 arteriosclerotic ulcers, 6 showed systolic pressures of over 170 mm. Of the 13 varicose ones, but 1 had a pressure over 170 mm.

The urine was examined in 67 of the patients; 19, or about one-quarter of the whole, passed albumin. Of 24 arteriosclerotic ulcers, 13, or more than one-half, suffered from albuminuria. The Wassermann test was done in 64 patients; it was positive in 11, about one-sixth of the whole; of 15 Wassermann tests in the arteriosclerotic group, 3, or about one-fifth, were positive. A history of typhoid is noted in 7 patients, milk-leg in 4.

The treatment of leg ulcer resolves itself into three problems— to clean the ulcer, to heal it, and to keep it healed.

Varicose ulcers are easy to clean; so are the superficial infectious ones, those without a deep suppuration, such as an osteomyelitic sinus, to keep up the infection. Arteriosclerotic ulcers; ulcers with an old scarry fibrous bed are very slow to clean. They become reinfeected easily; often the ulceration spreads under the eyes of the surgeon instead of diminishing. Mild lotions—solutions of boric acid, of aluminum acetate, of lead acetate—are more useful than strong antiseptics in covering the floor of the ulcer with healthy pink granulations. Compressing the ulcer with a solution of picric acid for one day or touching it with a silver nitrate stick will sometimes convert a poorly granulating ulcer into a healthy one. Dakin's solution
is risky; the burns of Dakin's solution will cause new ulcers, that may be more difficult to heal than the original ones. Stronger antiseptics, iodin and alcoholic solutions, do harm. Ointments are useful in ambulatory patients, silver nitrate 1 per cent., balsam of Peru 10 per cent. in a vaselin-lanolin base. Scarlet red ointment is distinctly harmful. When it is used the granulations become covered with a dingy grayish fibrinous exudate.

Hospital patients should be put to bed and kept there until their ulcers are closed. If they are well enough to be up they are well enough to be discharged. The ambulatory treatment of ulcer has its advantages, but ulcers certainly heal more rapidly when the patient is kept in bed with his legs elevated.

Once ulcers are clean, the question comes of healing them over. Small ulcers will heal under the old Baynton dressing: small strips of sterile adhesive plaster applied directly over the ulcer and left unchanged for five to seven days. Larger ones must be closed with grafts; Reverdin grafts ("pinch"-grafts) give a thicker, more resistant covering than Thiersch grafts. A small cone of skin is lifted up on the point of a needle and the base of the cone is snipped off with a pair of scissors. A series of these islands of skin placed about \( \frac{1}{4} \) inch apart is laid directly on the granulations and covered with rubber tissue. Reverdin grafts will live when Thiersch grafts will not. They may be placed on fibrous ulcers where Thiersch grafts will not stick.

Large ulcers, when covered by healthy pink granulations, especially recent ulcers, the result of operative wounds or injuries, may be covered by Thiersch grafts.

After the grafts have taken (about a week after operation) they may be painted with a weak solution, 1 or \( \frac{1}{2} \) per cent. of scarlet red in olive oil. This will cause them to thicken. Only the grafted skin and not the granulations should be painted with scarlet red.

Large arteriosclerotic ulcers, when the whole thickness of the leg is hard and fibrous, especially the ulcers that one sees extending circularly around brawny edematous and elephantiasic legs, cannot be healed. By dint of great care and patience, and
after months in bed, one may occasionally succeed in covering them over; but the cure is not worth the effort. The ulcer will break out anew on the slightest injury; often as soon as the patient gets out of bed. Such neglected ulcerous legs should be amputated.

Only after the ulcer is completely healed should the man be allowed out of bed. It is no saving in time to discharge a man with a "practically" healed ulcer. The "practically" healed ulcer usually grows larger after the man leaves hospital; in a few months he is back with a leg worse than ever before.

When the ulcer is completely healed the leg should be kept bandaged. Zinc-gelatin is good if the man can be watched from time to time. If, however, he is careless in reporting, or if he is to travel away from competent medical care, it is better to teach him to wrap his leg firmly from the foot to the knee with a flannel bandage (a soft spiral puttee is good) or a woven cotton elastic bandage. Either is better and cheaper than a rubber elastic stocking.

When zinc-gelatin is used the man should be ordered insistently to report for a change of bandage as soon as the gelatin gets hard, at least every four weeks; or immediately he sees the first signs of ulceration going on under the bandage, a spot of serum or pus coming through. If the men are discharged without proper instructions they will often come back after weeks and months with a hard, foul bandage, chafing the leg into a new ulceration and caked with pus.

The zinc-gelatin is made of: zinc oxid and gelatin, 1 part of each; water and glycerin, 2 parts of each. The gelatin is dissolved in hot water, the zinc oxid added, and then the glycerin. The mixture is kept in a tin or agateware vessel, not in a jar. It is melted by placing the tin in a water-bath. Several loosely rolled coarse mesh crinolin bandages, 5 yards long by 3 inches wide, are dropped into the melted gelatin and allowed to soak thoroughly. The bandage is then applied perfectly smoothly and evenly, without creases and without reverses, beginning with a turn about the foot below the ankle. Each turn is wrapped once around the leg and then cut off. Each succeeding turn
overlaps its predecessor by half its width, so that the finished bandage consists of two layers, no more. The bandage is patted with a handful of absorbent cotton and dusted with talcum so that it may not stick to the underclothing.

Occasionally it may be necessary to put the bandage over an ulcer which is not quite healed. In this case the ulcer should be covered with a little dab of cotton soaked in zinc-gelatin before the bandage is applied; the finished bandage should be opened by a crucial incision over the cotton. The ulcer is dressed through this little window; the flaps of bandage are pasted down with a turn of adhesive plaster after each dressing.

Varicotomy rarely leads to a cure of ulcer. The large tortuosities of the dilated saphenous vein which are curable by operation do not cause ulcer; it is the small purple teleangiec-tatic venules located in the skin itself that thrombose and ulcerate or perforate their very thin covering and bleed, and these venules are irremovable.

"Trophic" ulcers, especially those over the internal malleolus, may be helped, it is said, by resection of the saphenous nerve. The resection should be done at some distance from the ulcer itself.

Occasionally recurrent ulcer may be excised and the resulting defect covered by a plastic of the whole thickness of skin; not, of course, the ulcers of the aged and decrepid, but extensive ulcers following burns and crushing injuries in otherwise healthy young individuals. A long tube flap may be swung down over the ulcer from either the same or the opposite thigh.

The treatment of ulcers is tedious; it needs care and ingenuity and patience to effect a cure.

Review your cases of leg ulcer, gentlemen; you will find among them many examples of interesting disease of the arteries, the veins, and the nerves; there will present themselves to you many unsolved problems concerning the peripheral circulation, its distribution, and its physiology; you will unearth many a quaint history of vagabondage, and you will occasionally help to cure.
ETIOLOGY AND TREATMENT OF PROLAPSE

Much of our knowledge of prolapse is of very recent origin. This is due chiefly to two reasons: First, surgeons almost without exception have reported their series only as cases of prolapse and have made no effort at proper classification, in spite of the fact that all have long since known that there are many different types of prolapse which have varying probabilities of cure. Second, there has never been an agreement as to the time which should elapse before a case could be counted as a cure. It seems perfectly reasonable to assume that the operative result of many advanced cases has never been properly tested from the standpoint of recurrence. The older patients often escape recurrence only because the infirmities of their age restrict their muscular activities and thus inhibit excessive intra-abdominal pressure. Consequently, they may die before the operation has had a fair test. All reported results, therefore, present many chances of error being influenced more profoundly by the percentage of complete prolapse of the entire floor, and the number of extreme cases in young women in the series, than upon the type of operative procedures employed. Until proper classification is universally recognized there is very little to be learned from the case reports of the literature.

It is the object of this paper to call attention to a classification which will be most helpful to the surgeon, and to briefly consider certain fundamental principles that we have developed for the cure of complete procidentia from a follow-up study of 52 cases of complete prolapse that were treated by one method.

The classification to which I would call your attention was developed by Dickinson from study of the plates of the truly
remarkable anatomic preparation of prolapse described by Halban and Tandler. It is, in reality, a study of cleavage lines, since Dickinson finds the following transverse cleavage planes illustrated in the Halben-Tandler series (Fig. 233).

1. Postpubic, close to the bone.
2. In the urethrovaginal septum, close behind the urethra.
3. In the rectovaginal septum, just behind the vagina.
4. Along the anorectal canal.

**Segments That Drop Downwards (Sliding Along Cleavage Lines)**

1. Urethral
2. Vaginal (including bladder base and cervix and fornix)
3. Perineal
4. Retro-anal

There are, in consequence, four segments—urethral, vaginal, perineal, and retro-anal.

The urethral segment includes the whole urethra, the anterior or postpubic bladder, and the postpubic triangle. The triangular and pubovesical ligaments form its supports.

The vaginal segment includes the vagina and most of the urethrovaginal septum and the bladder base, as well as the cervix and the posterior vaginal wall. It is attached laterally to the base of the broad ligaments, and behind to the uterosacral ligaments. It receives no levator fibers.
The perineal segment includes all the perineal pyramid and that part of the rectovaginal septum behind the posterior vaginal wall. It is supported by levator fibers.

The retro-anal segment lies posterior to the middle of the gut and is supported by the levator and pubococcygeus muscles.

There are other cleavage planes, better known, on the sides of the pelvis. They run from the steep slopes of the levator and in the cross span of the triangular ligament. They are well known to all operators.

Dickinson’s remarkable paper has done much to elucidate many of the confusing points of the prolapse problem. He emphasizes many things, among which we will quote:

1. A prolapse may occur in the presence of well-developed levators due to their diastasis.

2. While any combination of the four segments may be displaced downward, prolapse of the second, or vaginovesico-uterine segment, is the most common.

3. Prolapse of the second segment was associated with a cleavage in the postpubic region in 15 of 33 of Halban-Tandler’s series, complicating the problem by removing a firm anterior anchorage so necessary to effect a cure, since the firmest perineal segment will not suffice to support this section of the floor.

4. The perineal segment is displaced more often than any other dislocation of lesser degree, due doubtless to the trauma of labor and the constant straining of the weakened fibers during defecation.

5. The retro-anal segment is least commonly displaced. Even complete extrusion of bladder and uterus may exist without it. Fortunately so, since it can occur only when there is hopeless atrophy of the levators and fascia when cure may not be possible unless the plastic may include the gluteus maximus muscle.

Prolapse of the first or second degree is frequently met with. It constitutes its own problem, chief of which is the fact that it often occurs in young women whose activity makes it difficult to cure. It assumes especial interest when we recall that complete prolapse, which shares with cancer the odium of being the most difficult gynecologic conditions to cure, was at one time a simple
prolapse of the first or second degree. Fortunately, these simpler cases may be cured by one of a number of repair operations which are not destructive in character and which seem trivial when compared with those necessary to cure procidentia. We will not consider them in this paper.

Complete prolapse is a hernia of the pelvic floor. It depends primarily upon injuries in childbirth and especially upon injuries to the upper pelvic floor which permit a sliding of the segments. The supporting structures of the upper pelvic floor center about

![Image of cystocele](image-url)

Fig. 234.—Beginning cystocele. The bladder insertion on the uterus is sliding down. Tandler and Halban prolapse.

the cervix just as the muscles and fascias of the lower plane meet in the central tendon of the perineum. Given lacerations of the fascia about the cervix and prolapse will occur if the intra-abdominal tension is kept at high level by hard work, especially when maintained during the atrophy of the floor during the menopause. Faulty forceps deliveries account for many of the severe injuries. Nothing can traumatize more than attempts at forceps extraction through an incompletely dilated cervix. Prolonged second stages with a head on the perineum for hours, in
effort to deliver without laceration, account for their share. But the common obstetric error is not as apparent. Yet nothing save forceps applied through a half-dilated cervix can exceed the damage caused by straining for a long time against a floor blocked by a full rectum or bladder. Few things are more incompressible than water.

The character of the hernia is determined largely by the site of the chief rupture of the fascia. If it was on the anterior side of the cervix the continued thrust of intra-abdominal pressure gradually carries down that portion of the cervix which hyper-

![Fig. 235.—Anatomy of cystocele. The bladder has loosened from its attachment to the cervix. Tandler and Halban prolapse.](image)

trophies as it goes. With it comes a part of the bladder which may also loose some of its attachments from the cervical wall (Figs. 234, 235). The resulting cystocele may grow occasionally by stretching of the bladder walls. If the chief injury is posterior to the cervix, the resulting condition may well be a hernia of the pouch of Douglas (Fig. 236). Other segments may join in the displacement.

The final result in either case is a complete inversion of the vagina, a process which follows the stretching of the broad ligaments and their continuation in the uterosacrals because of
their weakened base. Yet no example of procidentia is seen in operating rooms which does not have either the cystocele or rectocele as its chief feature. The cervix is markedly hypertrophied in all cases, pulled out by the diverging traction of the fascial supports of the pelvis which center about its sides. The uterine body takes no active part in the process. It merely follows the hernia in company with the other structures above the floor.

Various operative procedures have been developed for the cure of procidentia and nearly all have been tried and found wanting. A most popular operation is described in many texts as a modified ventrofixation, in which it would appear as if the fundamental feature of the procedure is the fixation of the cervical stump to the abdominal wall after a supravaginal hysterectomy. For this reason the operation is nearly always unsuccessful if the patient is active and does physical work unless most careful attention has previously been given to making a firm pelvic floor. Following the fixation and the more usual type of repair, the cervix is left to bear the brunt of the support of the floor. It cannot do so, however, unless the fascial rup-

Fig. 236.—Prolapse with giant rectocele. Tandler and Halban prolapse.
tures have been corrected, in which event the abdominal work is unnecessary and adds to the mortality. The operation usually gives at least temporary relief because the new elevated position of the cervix protects in some measure the vesico-uterine plica from the great downward strain exerted from above. This

![Fig. 237.—Enormous hypertrophy of cervix following ventrofixation of uterus.](image)

point is clear when we recall that cystoceles are usually the predominant features of procidentia. In case the fascial injury was in the region of the pouch of Douglas, the operation gives no fundamental relief. With the return of the prolapse, which is almost certain if the patient endures prolonged muscular strain,
the cervix may hypertrophy to enormous length. In one of our cases the cervix was 5 inches in length (Fig. 237). This specimen was removed from a heavy-set, active woman of seventy-two, who presented a complete prolapse (chiefly second and third segments) eighteen months following a ventrofixation, a cervical amputation, and a cystocele and rectocele repair done by a surgeon well known as a competent technician (Fig. 238).

It follows logically that the operative cure of procidentia depends upon a proper reconstruction of the pelvic floor. To this end in prolapse chiefly of the second and third segments:

1. The upper angle of the vagina is joined firmly to the shortened broad and uterosacral ligaments.
2. The orifice is held close under the pubic arch.
3. The bladder is elevated upon the round and broad ligaments and supported by a remodeled pubicocervical fascial wall; if there is prolapse of the first segment, the upper pubic region of the bladder must be fixed in the abdominal wall.
4. The rectal hernia is closed by shortening and uniting the uterosacrals and continuing the closure by a fascial and muscular union beneath the remodeled posterior vaginal wall.
It is extremely essential that the vagina be narrowed as much as can be done in the individual case as a safeguard against recurrence. While the removal of the uterus is probably not absolutely necessary, we have been led to do vaginal hysterectomy to better shorten the supports and to permit the removal of the redundant tissue and to facilitate exposure. If vaginal hysterectomy is not done, the cervix must be removed, which amounts in old women to practically the same thing.

Complete prolapse hardly ever occurs in young women, and rarely prior to the menopause. For this reason the removal of the uterus occasions little regret. It insures, moreover, freedom from uterine cancer in addition to points enumerated before. The removal of the tubes and ovaries adds to the success of the operation, since it makes available the upper broad ligament to help in elevating the vagina. We remove them, therefore, as a routine except in young women.

Complete prolapse appears common in San Francisco, probably because of the stimulating climate which induces exercise, as well as the many hills, which increases abdominal strain. In the following table is given our experience with procidentia during the years 1917 to 1921. All the cases in this series were treated in my clinic by the same procedure. Figure 239 shows some of the cases. Without exception they were prolapse chiefly of the second and third segments. A few only had weakened support under the pubis and prolapse of the urethra. There were no retro-anal prolapses.

Given a good support of the urethra and posterior rectal wall, our problem is to hold up the center of the pelvic floor. The uterus is removed by vaginal hysterectomy, since this permits a rational choice of supports for holding up the upper vagina. The direction of the intra-abdominal thrusts are also changed by removal of the cleavage planes and the narrowing of the upper vagina. The steps of the hysterectomy are shown in Figs. 240-242. The broad ligaments and their extensions are tied off with ligatures left long to serve as tractors to put the stumps upon the stretch when they later are fixed into the vaginal angles. The uterus, tubes, and ovaries are now re-
moved (Figs. 243, 244) and all raw stumps are brought into the vagina so that they can be made extraperitoneal by fixation sutures. An incision is now made on the anterior vaginal wall parallel to its long axis to permit the exposure of the bladder.

This is better done after the vaginal mucosa and fascia have been separated from the bladder by dissecting scissors, which are introduced closed and then are opened in the proper lines of cleavage. When the bladder has been freed the round ligament
Fig. 240.—An extremely large prolapse with marked cystocele. The cervix is ulcerated from friction in locomotion.

is pulled down and attached to the anterior upper vaginal angle by a heavy chromic suture placed in the base of the broad liga-
ment, and includes the bladder peritoneum, the round ligament and adjacent broad ligament, and returns to the broad ligament base for its support (Fig. 245, A). This is repeated on the opposite side. The broad ligament stumps are now treated in

Fig. 241.—a, The cervix is circumscribed and a flap turned down to cover the ulcer. For artistic reasons this is not depicted; b, the bladder is separated from the uterus.

the same manner and are fixed into the angles of the wound so that they will elevate that portion of the vagina and support the base of the bladder. The two stumps are now united mesially to cut off the upper portion of the peritoneal opening and make a better support for the bladder and give a firm floor. The
uterosacral ligaments, in turn, are brought down and fastened to each side of the vaginal incision immediately below the new attachment of the broad ligaments. They are also united
Fig. 243.—Tying off the right adnexa. The uterus has been freed without inverting it, to lessen the chance of infection from the ulcer. The ulcer has been covered by a flap of mucosa and several layers of gauze, not depicted in the drawing.
Fig. 244.—Showing the flaps left after the hysterectomy. A fixation suture has been laid through the peritoneum and round ligament to support the anterior upper angle of the new vagina. The broad ligament and uterosacral stumps are depicted below. The bladder has been elevated and the fascial flaps are shown.

mesially to close off the peritoneal cavity. The selection of proper points for the fixation of these stumps insures the success of the
operation. The stumps retract in healing and further elevate the vault of the vagina.

Fig. 245.—A, The round, broad, and uterosacral ligaments are united to the pelvic fascia and to each other, thus elevating the bladder. B, The ligaments have been united to form a support for the upper vagina and bladder. The bladder is tucked in and the pubic fascia is united, after which the mucosa is brought together. This redundancy is unusual, but existed in this individual case.

The bladder is now freed from the anterior wall of the vagina. This can be done by the dissecting scissors or by stripping back
the fascia with a gauze sponge. The excess flap is trimmed away to a desirable dimension, and the fascial margins are united by interrupted heavy chromic sutures. The sutures at the upper angle may also be passed into the newly united round and broad ligaments to obtain added support. After the union of the fascia the mucosa should be approximated by a continuous suture (Fig. 245, B).

Time was when the cystocele constituted the problem of procidentia. This no longer holds true, although there are more procidentias which present cystoceles as their major complication than giant rectoceles. The success of a cystocele repair depends upon the preparation of the flaps. The introduction of dissecting scissors has simplified the problem, since they prepare flaps in the simpler and most certain manner. Flaps are essential for success in the operation. When cystocele constituted the problem, the fascia was not incised and the incision ran only through the mucosa, and there were no free flaps to serve as supports. With properly prepared flaps even an indifferent repair may now result successfully, or at least approach 100 per cent. of its possibilities if the bladder is kept empty after operation, either by very frequent catheterization or, better, by the use of a self-retaining catheter. There is never any difficulty in obtaining a firm anterior vaginal wall in the narrower angles of the pubis, but the broad ligament region is not so easy to treat. For this reason the denudation area of the anterior vaginal wall should be triangular and its two lower angles should be firmly united with the two broad ligaments to serve as support for the bladder base. Much has been written concerning the fascia of the anterior wall. It hypertrophies to such an enormous extent in prolapse that it may no longer be considered firm. It suggests large muscles which are seldom strong. Since the firmest margins are near the pubic bones, all excess tissue should be removed.

Complete prolapse with marked rectocele are the very difficult cases to cure. Failures result when the surgeon leaves a capacious vagina. The nearer the pelvic floor is closed, the more certain is the cure in this especial group of cases. The bladder may be kept empty following operation, but there is no way of
so treating the rectum. The closure must be made with the idea that feces are constantly pressing down and impinging upon the sutures, either to break them down or more likely to free them by necrosing their tissue supports. The rectum must be supported in a manner identical to that of the bladder, but with more layers of support. Proper flaps are essential for firm union (Fig. 246).

Fig. 246.—The cystocele has been repaired. Clamps draw down the rectocele.

The uterosacralis must be further united as a bulwark against the thrust through the pouch of Douglas. They should be closed as completely as seems safe and allow only sufficient clearance for a heavily distended rectum. The redundant posterior wall is then removed downward from above until the perineum is en-
countered. This region may present its own problem, so the dissection may be momentarily discontinued. The mucosa should be removed so as to leave a vagina as small as is compatible with the social condition of the patient (Fig. 247). The uterosacral union is the bulwark of the posterior vaginal vault. Proceeding from here downward by typical rectopexy sutures, the rectum is elevated and closed off behind a firm fascial wall (Fig. 248). Our experience suggests a fascial support of at least two layers of interrupted sutures and the union of wide areas of free firm fascial flaps (Fig. 249). The mucosa is now united by a continuous suture (Fig. 250).
The perineum is now repaired after a very extensive dissection. The transverse profundis muscles are united to further displace the rectum and a large perineal body is built up by layers. It is of interest that the rectal sphincters of these cases always seem loose. The perineum must be built up to support them. Occasionally it is necessary to bring even the edges of the gluteal muscles into the wound.

In our series of 52 complete procidentias, all chiefly of the second and third segments, we have had no complete recurrences during an interval of one to five years. There were no
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deaths and no new cystocele. One case was lost from the series. All others have been frequently examined. The patient’s statements have not been used as a basis to determine the anatomic condition.

There has been, however, one return of rectocele which has been successfully reoperated. It was a case early in the series when the cystocele was believed of paramount importance.

This patient had a giant rectocele from which we learned much concerning the value of fully utilizing the uterosacral ligaments. The recurrence developed within the first year following operation.

One cannot fail to be impressed with the number of prolapse cases which apply for treatment after two, three, or even more unsuccessful operations. Every detail to secure success should,
therefore, be carefully considered. Cases should not be operated while bearing infected ulcers, nor while the urinary disturbances are based on infectious changes.

The postoperative care needs little discussion. The care of the bladder demands the greatest attention. Instillations of 1 ounce of 1:500 silver nitrate solution after catheterization keep

down bladder infections. A rectal tube to allow the escape of gases should be left in after operation. The bowels are moved on the fifth day, twelve hours following a large sweet oil injection. The patients are kept ten days in bed in the horizontal position.

We wish to emphasize the part played by the hysterectomy.

Fig. 250.—Closure of the vaginal mucosa, the suture including vaginal fascia.
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Its chief function is to permit a proper exposure and allow for the shortening of the uterine supports for the elevation of the upper end of the vagina. A complete inversion of the vagina will follow a hysterectomy if the pelvic floor is not reconstructed. Upon the proper repair of the floor depends the success of the operation.

PROCIDENTIA RESULTS, AUTHOR'S METHOD

(52 cases)

1916 ................. 4 cases (results good unless otherwise noted).

Period of observation:

- 1 to 1½ years ........ 3 cases
- 3½ years ........ 1 case

1917 ................. 5 cases

- 6 months ........ 1 case
- 1½ years ........ 2 cases
- 3½ years ........ 1 case
- 4 years ........ 1 case (return of rectocele. Reoperation January, 1920. Good result a year later).

1918 ................. 17 cases

- Lost ........ 1 case
- 6 months ........ 1 case
- 1 to 1½ years ........ 8 cases
- 2 to 3 years ........ 5 cases
- 3½ to 4 years ........ 2 cases

1919 ................. 20 cases

- 6 months to 1 year . 9 cases
- 1 to 2 years ........ 4 cases
- 2 to 3 years ........ 7 cases

1920 ................. 1 case

1 year ........ 1 case

1921 ................. 5 cases (of one year's standing).

1 year ........ 5 cases.

AGES IN 52 PROCIDENTIA CASES

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CHORIO-EPITHELIOMA AND ITS TREATMENT

Since Sänger in 1889 described his first case of chorioepithelioma less than 700 cases of this rare tumor have been described. There is no doubt, however, but that the growth is more common than is indicated by these figures. There are 2 unreported recent cases in this city. No cases were reported from Continental Europe during the war, and it is a matter of interest that nearly all the reported cases were observed in Europe.

Yet there is really little known concerning this extremely interesting tumor, and in spite of the very considerable literature that has developed gradually, even many basic facts concerning the growth are still unsolved. For this reason reports even of well-controlled single cases are warranted if they present unusual features.

Chorioepithelioma are composed of two chief types of cells which present the characteristics of the syncytium and Langhans' cells of the chorionic fetal epithelium. They arise nearly always shortly following a pregnancy, usually metastasize through the blood-vessels early, and kill with astonishing rapidity. The primary growth develops almost invariably in the uterine cavity either in the placenta or in the uterine wall, occasionally in the tube following a tubal pregnancy, and very rarely in the ovary.

Students are not yet absolutely agreed that all chorioepithelioma owe their origin to a pregnancy. While there appears no reasonable doubt that the very great majority of cases do so, there is considerable question in the smaller number. The interval between the pregnancy and the appearance of the tumor is usually quite short, yet occasionally there is a latent period which may amount to years. There are, moreover, a few cases in which the disease occurred in women who have
never been pregnant, and in a very few cases the tumor has been found in virgins. Both groups of cases usually presented tumors which apparently were primary in the ovary.

There is always the possibility that chorio-epithelioma which, in any but the virgin cases, were primary in the ovary followed ovarian pregnancy, in spite of the extreme rarity of such an event. It seems more likely, however, that there was no relation to pregnancy in either group of cases. The question of the origin of these tumors in these groups of cases is of the greatest interest. There is strong evidence that they may arise from ovarian teratoma. There is no doubt that areas of teratomata of the sex glands may be indistinguishable from uterine chorio-epithelioma.

Testicular growths resembling chorionic villi have been described in the literature at irregular intervals since Waldeyer first drew attention to this phenomenon in 1868. Some cases, as the one described by Breus in 1878, presented polypoid masses extending to the heart. Many authors of the French school, notably Malassez and Monod, Carnot and Marie, and others, have called attention to the regularity with which these processes develop in the blood-vessels. Yet it remained for Wlassow and Schlagenhauffer to emphasize the resemblance of certain of these testicular tumors to chorio-epithelioma. Their case presented a teratoma of the testicle which had given off generalized metastases which were carried by the blood. It was composed of syncytium and Langhans' cells and contained structures which resembled chorionic villi. The observers traced the origin of the syncytium to the epithelium of the tumor, demonstrated glycogen in Langhans' cells, proved the hemorrhagic character of the metastases, and showed that this chorioma of the testicle, although of teratomatous origin, reproduced almost exactly the essential features of a uterine chorio-epithelioma.

When the excitement following this discovery died down, it developed that similar processes could occur in the ovary, although such cases were few in number in comparison with the testicular chorioma. Pick's case in the ovary reproduced the gross picture and microscopic details of a uterine chorioma. It
CHORIO-EPITHELIOMA AND ITS TREATMENT

contained, however, a sarcomatous framework in addition to the syncytial and Langhans' cell derivatives. The syncytial masses developed from the neuro-epithelial cell group of the teratoma and Langhans' cells contained glycogen. Other cases have been reported in which the other teratomatous features were less marked, and Ries, when presenting his case in 1915, was able to collect from the literature 6 cases of primary chorioma of the ovary which presented no other evidence of teratomatous structures than the chorio-epitheliomatous areas.

A number of theories have been advanced to explain the origin of the syncytial and Langhans' cell elements in the teratomata resembling uterine chorio-epithelioma which have been found in sex glands. The first assumed that fetal membranes had been included in the teratoma and that they proliferated only after remaining dormant for many years. This view failed because no teratoma has yet been described which presented such structures. The theory of Risel, that the tumor may develop from undifferentiated fetal ectoderm contained in the teratomata, has been confirmed by several observers. The fact that most uterine chorio-epithelioma appear to arise from differentiated fetal cells need not controvert this theory. Chorio-epithelioma may follow either early or full-term pregnancy, as is shown by the compilation of Pollasson and Violet, but in either event the tumor appears to develop from highly differentiated epithelium. In 455 collected chorio-epithelioma these authors found that 45 per cent. (203 cases) followed hydatidiform mole; 30 per cent. (135 cases) followed abortion; 2.5 per cent. (12 cases) followed ectopic pregnancy, and 21 per cent. (99 cases) followed labor at term. The character of the previous pregnancy could not be determined in the remaining 1.5 per cent. (6 cases). If the tumor develops from the fetal ectoderm of the chorionic villi, it must arise from highly differentiated epithelium. The case holds true if it arises from cells deported from the villi into maternal tissue, since these early become differentiated, presumably from contact with the blood. If, however, the tumor springs from remnants of trophoblasts on the maternal side of anchoring villi (anchoring nodes), or the
trophoblastic cells on the fetal side of the Nitabuch line, the subject is less clear, since these cells may well be undifferentiated fetal ectoderm. It is more difficult to explain why the chorioma of the ovary, if arising from teratoma, presents no other evidence of teratomatous features.

There is also the slight possibility that certain of the chorioma which appear as primary in the ovary are not what they appear to be, but, in reality, are metastases from sarcoma or carcinoma which have developed an atypic structure. Such cases should not confuse, however, since they can be diagnosed readily by careful study of a number of different sections, because the structures suggesting chorioma which develop in metastases from carcinoma or sarcoma are not uniform in appearance and resemble chorio-epithelioma in comparatively few areas.

We have recently observed the following case which presents several unusual features, on account of which it seems worthy of record:

Case I.—Widowed Mexican, aged fifty-two years, entered the University of California Hospital October 19, 1921 complaining of irregular uterine bleeding of two months' duration. She is acquainted only with the family history of her father, mother, and children. This is negative for tuberculosis, insanity, and cancer. She has never had a serious sickness. Her menstruation began at twelve years, was regular, of twenty-eight-day type, had a duration of four to five days. The menopause came on at the age of forty-nine, nearly four years ago. She was married at fourteen, and has had 15 children and no miscarriages between her fifteenth and thirty-seventh year, or 15 children in twenty-two years. All pregnancies and labors were normal. There were no instrumental deliveries or breech extractions. On careful questioning, she states that she bled a few weeks after the birth of 3 children and was cureteted, but was confined to bed only for a day or two. She had some hemorrhage after her last child which was born fifteen years ago. Save for occasional trouble with hemorrhoids, the rest of her personal history is not of interest.
About one year before the menopause, or a little more than four years ago, she had a uterine hemorrhage which came on without warning, soaked quite a number of cloths, and stopped after medicine and injections. She was in bed only a few days. Menstruation up to that time had been perfectly regular. There was no further bleeding until two months ago, when a blood-tinged stain gradually developed, until on some days there was sufficient blood to heavily stain an entire pad. During the period of bleeding there was no pain. Pain marked the cessation of bleeding. It was present in the lower left abdominal quadrant. Aside from occasional pain on urinating there were no other complaints.

The patient was extremely stout. The physical examination was negative. On vaginal examination, the vagina was relaxed and a small polyp was seen at the external os. The cervix was short and thick. The uterine contour was normal, the organ was upright and moved with slight difficulty and was enlarged to twice normal size. The adnexa were free. There were no masses.

Feeling that the bleeding was probably due to a uterine polyp, the uterine cavity was explored with a curet forceps, and a considerable amount of old blood, together with a small mass, felt to be a necrotic polyp, was removed. At the same time the cervical polyp was cut away with a broad base and the vaginal vault was repaired. There was very little tissue in the scrapings. The mass considered a polyp was necrotic and gave no definite picture. A few areas on the slides strongly suggested chorio-epithelioma, but there was not enough tissue to make the definite diagnosis. The bleeding did not cease following the curetage, but was present daily, at least as a stain. The patient was extremely stout and had a tremendous abdomen. Accordingly, radium treatment was determined upon as a matter of choice, and two tubes of radium emanations containing 55 mc. and 87.5 mc. respectively were introduced tandem into the uterine cavity at another sitting ten days later. They were screened with 0.5 mm. silver, 1.2 mm. brass, 2 mm. rubber, each capsule measuring 3½ cm., and were left
in place for twenty-four and a fraction hours, to give a total dosage of 3420 mc. hours. She left the hospital five days later.

Forty-six days after the radium treatment she returned, stating there had been no more bleeding until three days before, when she had a severe uterine hemorrhage which came on without pain. We, therefore, urged operation, and on January 11, 1922 the uterus, tubes, and ovaries were removed by an ordinary abdominal panhysterectomy without a preliminary cureting.

The operation was difficult on account of the great thickness of the abdominal fat. The uterus felt brawny. Its contour was even. The broad ligaments contained no local indurations, although they were firmer than normal. The parametria and uterosacral ligaments were brawny. This we attributed at least in part to the radium treatment. There was no evidence of pelvic or abdominal metastases. The upper abdomen was negative. Preliminary to the operation the chest was negative. The lungs appeared normal on physical examination. An x-ray plate was not taken, as there was no cough or lung symptoms. There were no external tumors.

The specimen consists of uterus, cervix, tubes, ovaries, and upper broad ligament.

In the laboratory the uterus measured 9.5 cm. long, 8 cm. wide, and 6 cm. thick. The uterine walls were thick, measuring 3 to 4 cm. There is a definite uterine cavity present. Projecting into it in the right upper portion near the opening of the tube is an irregular polypoid mass measuring 1.5 by 1 by 1 cm. This is extremely friable and cellular in appearance (Fig. 251). It is stained with blood. Immediately below this polypoid mass is a small excavation about 5 mm. in depth. This is lined by a smooth yellow membrane, somewhat granular at its base. It suggests a pyogenic membrane in appearance. The remainder of the uterine cavity is lined by what appears to be normal endometrium about 1 mm. in thickness except at a point just opposite the polypoid growth previously described. Here the endometrium juts out as small polypoid projections extending into the uterine cavity.
Extending back from the polypoid mass are outgrowths running back in the uterine wall for at least 2.5 cm. About 5 mm. farther out is a well circumscribed hemorrhagic nodule 7 to 8 mm. in diameter. The outer border of the nodule is less than 5 mm. from the peritoneal surface of the uterus. The whole uterine wall is mottled by patches of rust-colored pigment, apparently changed blood, which appears independent of any gross extensions from the microscopic tumor.

![Image of uterine structure](image)

**Fig. 251.—Chorio-epithelioma.** Uterus with polypoid mass projecting from fundus. Hemorrhagic nodule and invasion of uterine wall well shown.

The walls of the cervix are hypertrophied, but are otherwise normal. The cervical mucosa is normal in appearance and shows no reddening or cyst formation.

The right tube measures 9 cm. in length. It is somewhat convoluted and is very slightly thickened. There are three or four peritoneal inclusions 2 to 3 mm. in diameter near the fimbriated end. The fimbriated extremity is open, but the fimbria are somewhat blunted.

The right ovary is 4.5 by 2 cm. by 5 mm. in size. It appears
as a senile ovary with a fairly smooth surface. A number of small contracted corpora albicanties are seen on cut section, but there is no evidence that the ovarian tissue is functioning.

The upper broad ligament on the right side is somewhat thickened. There are no tumor masses or evidence of local indurations.

![Microphotograph](image)

**Fig. 252.**—Chorio-epithelioma. Microphotograph (low power). Section taken through base of polyp showing masses of Langhans and syncytial cells in contact with blood spaces.

The left tube is somewhat shorter than the right, being only 7 cm. long. Otherwise it resembles it in every way.

The left ovary is even smaller than the right, measuring 3 by 2 by 0.5 cm. It is sclerotic and shows neither functioning ovarian tissue nor cystic formation.

The left broad ligament is likewise negative.
Gross diagnosis: Chorio-epithelioma uteri; senile tubes; senile ovaries.

On microscopic examination, the tissue was found to consist of irregular masses of cells of two distinct types (Fig. 252). The one presented an irregular, darkly staining fusing protoplasm with large granular nuclei scattered throughout the protoplasm. These did not have a definite cell boundary, a characteristic feature of the syncytial cells. The other cell, identified as Langhans' layer, consisted of epithelial cells, with well-marked cell membrane and a faintly staining vesicular nucleus (Fig. 253). Frequent mitotic figures were noted throughout the section and the various cells were in intimate contact with enlarged blood-spaces. The blood-vessel walls were frequently lined by masses of syncytial cells. There were extensive extravasations of blood on all sections of the tumor. There were no villi seen and no evidences of degeneration of these structures (Fig. 254).

The case, therefore, is a chorio-epithelioma in a woman of fifty-two years, who developed symptoms four years after the menopause and fifteen years after her last pregnancy. She
has had fifteen full-term pregnancies and no abortions. She bled in the puerperium of three pregnancies and had one hemorrhage a year before the menopause. Careful questioning could not develop history of abortion. This long latency is very unusual. Yet there is one case in the literature in which the period elapsing between the last pregnancy and the development of the disease is much longer (thirty-one years, case of

Fig. 254.—Chorio-epithelioma. Groups of Langhans' cells in center with syncytial elements on periphery of section.
Palthauf and Pollosson). The interval is often from three to four years; Caturani reported a case with a five-year interval; Polano, one of ten years. While there is always a possibility that an early abortion has been overlooked in the cases with long latent periods, there are several incontrovertible cases in the literature which prove that chorio-epithelioma may not develop until many years after a pregnancy. Krösing's case is the best example of this group. His patient was fifty-two years of age. Five and a half years before the patient had a hydatidiform mole which was removed from the uterus. Both ovaries were removed two and a half years later, at which time the uterus appeared perfectly normal. Following this operation she went into the menopause. Bleeding returned five and a half years after the hydatidiform mole and three and a quarter years after the ovariectomy and was found to be due to a chorio-epithelioma. Her case report is accompanied by a table of 21 examples of a long latent period.

The observation of Ries suggests that a villus may preserve its identity in the uterus for many years. While his study, unfortunately, is based upon a case which is unique in the literature, the observation is well controlled. In a uterus which he removed for fibroids from a woman who had not been pregnant for eighteen years he noted a long thread-like formation extending down several inches from its attachment in the blood sinuses of the left uterine horn. He convinced himself that these filaments were chorionic villi, the epithelial layers of which had not proliferated, and had not, therefore, developed into chorio-epithelioma.

It is a matter of interest that in our case there were no evidences of metastases recognizable at time of operation or now, three months later, in spite of the fact that the case presents as a typical chorio-epithelioma of Marchand and a chorio-carcinoma of Ewing. In discussing its origin it seems most likely that the tumor developed on the basis of a pregnancy since its presence in the uterine cavity excludes a teratoma. The growth is so characteristic of chorio-epithelioma that it could not be the degenerations of an adenocarcinoma.
The prognosis of chorio-epithelioma is of the very greatest interest. While as a group this tumor is the most malignant neoplasm known, and death usually follows in from a few weeks to a year, there are a few cases of spontaneous recovery and a few examples of a semibenign type which have disappeared following irritations, such as cureting or an incomplete removal, procedures which would stimulate an ordinary cancer to its fullest activity. Quite naturally, these exceptional cases have been the subject of much study. These good results cannot be expected with confidence, however, since the tumor often kills by metastases even before the primary growth has given symptoms. Occasionally the primary focus is not apparent even after careful autopsy, as in the case of Williams. This warrants the belief that the primary growth may lie in the placenta and be extruded at labor. Metastases are widely disseminated and may occur in any portion of the body, although they are more frequently noted in the apices and bases of the lungs which are more commonly involved than the middle lobes. Next to the lungs the vagina and vulva are most commonly involved by metastases.

Yet neither cases presenting pulmonary or vaginal metastases are necessarily fatal. Von Fleischmann in 1905 collected cases which Chroback, von Franque, Zagerjunski, Kissel, Ladinski, Neumann, Schauta, and Pestalozzi respectively believed had recovered after metastases in the lungs. All these cases had lung symptoms and signs apparent on physical examination. Recently there are one or two cases in which lung involvement was suspected from the x-ray picture, which also recovered spontaneously. Teacher, Risel, Eden, and Lockyer have noted healed nodules in the lungs surrounded by others which were still growing in cases which terminated fatally. While these observations are authentic, it is not necessary, however, to state that such lucky cases are extremely infrequent, and that the very great majority of cases presenting lung involvement speedily succumb.

There are a larger number of cases in which recovery has occurred after the development of vaginal metastases.
Schmauch early collected 13 examples, Neumann and Kolomenkin later reported 2 cases, and others more recently have presented single cases. The observation of Rockafellow is the most remarkable of them. In some of the cases reported the vaginal nodules were removed immediately after hysterectomy. In others only the uterus was removed, while neither the uterus nor vaginal nodules were completely removed in the cases of von Fleischmann, Hermann, and Kolomenkin. The uterus was removed in Rockafellow's case, shortly following which large metastases, some as large as a kidney, developed in the labia. These, when excised, returned in a few weeks and, in turn, were removed. They returned again. After four operations for recurrences the patient's condition was so bad that it did not seem worth while to again attempt removal. To everyone's surprise the unoperated growth began to shrink, and disappeared spontaneously in a few weeks. The patient soon improved and regained good health, and remained well for more than two years while under observation.

Men have long interested themselves in classifications hoping to determine the malignancy of individual tumors. Teacher arranged his 188 cases to show the relation of the mortality to the type of pregnancy which antedated the tumor: 72 cases following a hydatidiform mole, with a mortality of 53.4 per cent.; 59 cases following abortion, with a mortality of 66.1 per cent.; 49 cases following labor at term had mortality of 89.6 per cent. There were 7 ectopic choriomas in the series in which no tumor could be found in the uterus and in which the primary growth appeared to be in the tube or ovary. Only one of these recovered. Recurrences developed within six months after operation, or not at all, except in 5 cases, one of which (Löhlein) did not develop for one year.

Many observers have attempted to correlate the degree of malignancy with the clinical findings and the histology of the tumor, and determine a treatment based on the malignancy of the individual tumor. Their results have not proved of much value, however, nor have greatly improved upon the work of von Velits and Schmauch, who emphasized the great malig-
nancy of tumors presenting mitoses in Langhans’ cells, and showed that the tumors composed chiefly of syncytium were not so likely to be as virulent. The classification of Ewing is quite elaborate. It also is developed on the histologic basis. Former authors worked out their theories for tumors classed according to Marchand’s grouping of typical and atypical chorio-epithelioma. Ewing, however, divided the typical chorio-epithelioma of Marchand into two classes: (a) benign chorio-adenoma; (b) the very malignant choriocarcinoma. The former growth was previously known as malignant placental polyp. This atypically reproduces the structure of villi and tends to remain for considerable periods within the uterine body. Eventually they infiltrate the sinuses, invade the broad ligament and pelvic veins with villi, and kill but do not appear to uniformly give rise to wide-spread metastases. While malignant, the process is not as rapid as choriocarcinoma. There may be long latent periods between the appearance of symptoms and metastases. The malignant choriocarcinoma, however, presents a very different picture. Its activity depends upon an extensive proliferation and pronounced metaplasia of both Langhans’ cells and syncytium. The primary tumor in the uterus is comparatively small and does not enlarge that organ nearly as much as chorio-adenoma, yet it metastasizes widely at a much earlier period. Ewing divides the atypical chorioepithelioma of Marchand into syncytial endometritis and syncytioma, which differ from each other chiefly in degree, since both remain long localized as a uterine condition. The lesion of the former is more endometritic, while the latter presents as a bulky mass which distends the cavity and enlarges the organ. Ewing argued that cures might readily follow in the syncytioma groups, whereas they might not reasonably be expected in the choriocarcinoma. Ewing’s hope has not been realized, since subsequent investigators have shown there are too many transitional cases between the various groups to permit the study to be of practical value. Even in Schmauch’s compilation many years ago there were many deaths in cases
in which syncytial cells were the predominating feature and in which Langhans' cells were deficient or absent.

The various attempts at classification of the tumors in a manner to standardize treatment developed because of the confusing clinical course of the disease. Many authors refused to perform hysterectomy on the ground that it was unnecessary in the many cases in which there was no uterine tumor and useless in the cases which presented general metastases, statements which we feel we have proved may be fallacious. They called attention to the fact that cases might be cured by curetage, and urged this plan of treatment, aiming to perform hysterectomy only when curetage failed to cure. The basis for this treatment was the belief that the tumor metastasized so early that the removal of the uterus would not improve the situation. Others were guided by false ideas of conservatism. The study of many cases which, although abandoned to their fate, recovered either spontaneously without operation or lived after incomplete operations have proved the fallacy of this type of treatment.

From the standpoint of a surgeon it seems the sheerest folly to temporize with a tumor which belongs to the most malignant type of neoplasms, especially if there is chance of cure through hysterectomy. The problem of cure in chorio-epithelioma is strikingly similar to that of cervical carcinoma in that there is certainty of curing only the very earliest growths. It differs, however, in that late growths are occasionally cured by hysterectomy in chorio-epithelioma, whereas none are cured in cervical cancers. The method of delay, attempting first to treat by curetage and, to remove the uterus in event the symptoms persist, no longer has a proper basis. Until more is known concerning this tumor we believe a surgeon who refuses to perform hysterectomy, if there is a uterine chorio-epithelioma, is accepting a responsibility which no surgeon should assume.

Within the last few years radium has entered the field of treatment, and although an insufficient number of cases have been reported to permit actual conclusions, it has appeared as logical treatment on purely theoretic consideration. Our case
may force a revision of opinion. Clark in 1921 reported 2 cases which were still alive between six and seven years. There are also a few cases noted in German literature. The case of Erck and Outerbridge has been quoted erroneously as a cure. It was treated with radium for a recurrence causing hemorrhage developing six weeks after a supravaginal hysterectomy. The fact that this patient was subjectively well one month later is not of interest, since there is no later report of the case. Theoretically, there may be trauma attending the insertion of the capsule of radium into the uterine cavity. It is of interest, therefore, that our case did not respond to a fairly large dose of radium and that, six weeks later, there was no evidence of destruction of cells. On the contrary, the disease was progressing extremely rapidly in spite of the fact that 142.5 mc. had been left more than twenty-four hours in the cavity, giving a dosage of 3420 mc. hours.
REMOVAL OF RENAL CALCULUS FROM PELVIS OF FLOATING KIDNEY, THE SECOND KIDNEY BEING ABSENT


On June 27, 1919, after eleven days of symptoms, the patient underwent a nephrotomy, and five stones were removed from the left kidney. Twenty-three days later she was discharged as recovered. At this time x-ray plates of the right kidney had showed no stones and there were no signs or symptoms referable to the right kidney. On May 6, 1921 she returned to the hospital complaining of dull aching pains in the left kidney region. These were worse at night, but were never sharp or colicky, and did not radiate, and there was no history of bloody urine. She had noticed cloudy urine and there was nocturia (two or three), otherwise the urinary history was negative. Her general health had not been good for nearly two years—nervousness, insomnia, rapid heart and dyspnea on exertion, occasional sharp pains through the heart, morning headache, and slight dizziness. There was no failing of vision, blood-pressure was 145/95, and, though the patient said her ankles would swell, no edema was
found. The general physical examination was essentially negative save for moderate obesity, a slightly enlarged and otherwise not remarkable heart, a well-healed left nephrotomy scar. At the examination no tenderness was elicited anywhere in the abdomen or back and there were no masses. X-Ray of the left kidney showed two stones (Fig. 255). On May 9th the left kidney was removed and on June 19, 1921 she was discharged as recovered.

Fig. 255.—Tracing from roentgenogram of left kidney in June, 1919, preceding the nephrotomy. Note the location of the five stones.

On October 26, 1921 she returned to the hospital with the following story: On September 1, 1921 she was taken with severe agonizing pain in the right flank, radiating to the right groin. There was bloody urine, and a few days later the patient passed a sharply pointed stone the size of a pea. She remained well until October 22d, fourteen days before last entrance, when similar severe pains set in. Her physician was called, and found
in the right upper quadrant a large rounded mass which he interpreted as kidney, and which on being placed upward and to the right disappeared completely. Soon after this 1 pint of clear urine was passed. There was no history of jaundice and the gastric history is not remarkable.

Fig. 256.—Tracing from roentgenogram of right kidney taken October 28, 1921, showing the presence of a large stone.

After entering the hospital the same pains as felt before on two occasions have continued, and x-ray examination of the right kidney shows a large stone (Fig. 256). There is tenderness over the right costovertebral angle. The general physical examination reveals nothing in addition to that detailed in connection with the previous entrance. The mass in the right upper abdomen is not present.
This patient gives a typical history of intermittent hydropneumostasis with complete anuria, which was relieved by manipulation of the only kidney she has.

Were it not for the fact that the x-ray shows the shadow of a stone the anuria could reasonably be attributed to a kink in the ureter in a case of floating kidney in a patient whose other kidney had previously been removed.

The kidney can be moved from its normal position down to a point opposite the anterior superior spine of the ilium. The x-ray shadow shows a stone too large to pass through the ureter, and even though the stone were much smaller it would scarcely be safe to risk its passing through the ureter, because during its passage it might cause a temporary obstruction of sufficient duration to produce a fatal uremia.

Of course, with all of these facts before us the case would not be hopeless even in event of complete obstruction due to an impaction of a stone in the ureter, because a pyelotomy which could be performed under local anesthesia with ½ per cent. solution of novocain would relieve the retention of urine so that the stone could later be removed when the patient had recovered from the harm done by the temporary obstruction.

Each one of these repeated obstructions must, however, result in a certain degree of injury to the kidney, and consequently the patient can never be in a more favorable condition for operation than at the present time.

In planning this operation it seems important to relieve the kidney as much as possible of any irritation.

This can be accomplished by giving buttermilk and fruit juices for nourishment and by keeping the colon free from decomposing fecal material by giving 1 ounce of mineral oil in cream or in fruit juice morning and evening, and giving 2 ounces of castor oil on the morning of the day before the day of the operation.

Aside from this she should take at least 2 quarts of distilled water each day.

In planning the steps of the operation we must accomplish: (a) the removal of the stone; (b) we must prevent future dis-
REMOVAL OF RENAL CALCULUS FROM KIDNEY 597

placement of the kidney to any position in which kinking of the ureter might result; (c) we must not traumatize the kidney tissue; (d) we must guard against future obstruction of the ureter due to cicatricial contraction; (e) we must not prolong the operation sufficiently to produce a severe degree of exhaustion; (f) we must guard against postoperative infection. This last has been provided against by the administration of 5 grains of urotropin in a glass of distilled water given every three hours for two days preceding the operation.

Operation.—The patient has been given a hypodermic injection of $\frac{1}{4}$ gr. of morphin and $\frac{1}{48}$ gr. of atropin one hour before and $\frac{1}{6}$ gr. of morphin and $\frac{1}{200}$ gr. of atropin fifteen minutes before applying the local anesthesia.

The skin and all the tissues down to the kidney are then thoroughly injected with $\frac{1}{2}$ per cent. solution of novocain, 2 ounces being injected.

After waiting for fifteen minutes the kidney is exposed by making a curved incision extending downward from the twelfth rib, and then curving forward directly above the anterior superior spine (Fig. 257), splitting the latissimus dorsi and quadratus lumborum muscles and remaining behind the ilioinguinal nerve (Fig. 257).

Upon exposing the perinephritic fat capsule the latter is torn, and the finger is passed behind the kidney, then forward until the upper end of the ureter is reached, where it issues from the pelvis of the kidney.

The wound is retracted forward so as to make it possible to hold the kidney forward and expose the upper end of the ureter and the pelvis of the kidney.

An incision is now made 2 cm. long, splitting the ureter longitudinally, and extending one-third of its length into the pelvis of the kidney.

The end of the forefinger is now passed into the pelvis of the kidney and an oblong stone $1\frac{1}{2}$ cm. long, 1 cm. wide, and 8 mm. thick is located freely movable in the lower calix of the kidney.

It is doubtful whether the stone has been in this location for some time or whether it was forced into this position at the time
when the hydronephrosis was relieved by the manipulations necessary to replace the kidney, as mentioned in the history, or

Fig. 257.—Drawing showing technic of operation. The kidney is exposed by a curved incision extending downward from the twelfth rib and then curving forward directly above the anterior superior spine. The latisimus dorsi and quadratus lumborum muscles are split and care is taken not to injure the ilio-inguinal nerve. The method of closure is also shown.

whether this was accomplished during the manipulations incident to the operation.

The stone is removed by means of a blunt spoon, great care
being taken not to traumatize calix, pelvis, or ureter. The edges of the wound in the ureter come together perfectly.

A gauze sponge is placed opposite the incision in the ureter, while the remaining steps of the operation are being carried out. In order to prevent future kinking of the ureter the following method of nephropexy is employed. The capsule of the kidney is split longitudinally from pole to pole and reflected for a distance of 2 cm. on each side of the incision (Fig. 257).

Eight chromicized catgut sutures are then applied, four on each side, the lower three sutures on each side grasping the capsule and the aponeurosis of the muscle, and the upper two sutures being passed through the capsule and then around the twelfth rib. Care is taken in each instance to secure a broad bite in the capsule.

The gauze sponge which has been placed opposite the incision in the ureter and pelvis is now removed and a rubber drain \( \frac{1}{2} \) cm. in diameter, together with two cigarette drains, are introduced down to the ureter and brought out through the lower end of the incision.

The wound is sutured carefully in layers with catgut and with six deep silkworm sutures and a large dressing applied.

**Progress of Case.**—A small amount of urine up to 15 ounces in twenty-four hours passed through the ureter into the bladder each day until the third week, most of the urine passing out through the wound during two weeks.

The cigarette drains were removed on the ninth day and the drain on the eleventh day after the operation. The deep silkworm sutures were removed on the sixteenth day. On the twenty-second day the patient sat up. Until this time she had been normal as to pulse and temperature and free from pain.

On the twenty-third day but 2 ounces of urine were passed from the bladder, and the patient suffered pain in the region of the kidney, where a large mass could be felt. There was practically no drainage from the wound.

On the twenty-fourth day the patient appeared severely ill, there was no increase of urine from the bladder, and none from the wound.
A pair of curved forceps were passed down to the pelvis of the kidney through the wound, resulting in a spurt of urine—about 60 c.c. in quantity. Following this there was no urine passed from the wound for twenty-four hours, when it began to flow freely, and immediately it began to pass through the bladder. From this time on the amount passed through the bladder increased from day to day, while the amount passed through the wound decreased correspondingly.

Within three weeks the wound stopped draining and the urine passed normally through the bladder.

The patient was discharged well eight weeks from the day she was admitted.

In order to prevent the formation of more renal stones she has been advised to drink at least ½ gallon of distilled water each day during the remainder of her life. It has been our experience that none of our patients have ever had a recurrence of renal calculi if they have observed this rule, although they may have had many recurrences before. Other patients have remained free from stones for years while following this rule, only to suffer from recurrence upon returning to the use of ordinary well-water rich in lime.

A few others, again, have remained free from stone so long as they drank ½ gallon of distilled water every day, while they had a recurrence after going for weeks or months without drinking anything except the fluids they got in coffee, tea, or soup, together with only a little distilled water daily.

It has been claimed that some articles of food, such as milk, contain much lime, hence the amount taken in drinking-water cannot be of much importance.

This argument is, of course, of no value, because every cook knows that she can boil milk in the same crock for years without ever accumulating any lime, while a few weeks of boiling hard drinking-water will invariably precipitate lime in the tea-kettle.

With our patient it is, of course, more important than in ordinary cases that these precautions be followed, because the pelvis of the only kidney she has left and her ureter have both
been damaged, and there can be no doubt but what this adds a further element predisposing to the formation of renal calculi.

There is undoubtedly a strong element of predisposition, for many persons may live under the same conditions, eat the same food, and drink the same water, and only a few of them may develop kidney stone. But those who have once developed stones are very likely to develop others unless the above precautions are taken.

Experience shows that in certain regions a considerable proportion of the population suffers from stone, while in other communities stone appears seldom or never.

It has been claimed, for instance, that the wheat eaters in India suffer from stone, while the rice eaters remain free. It must be remembered, however, that wheat will not continue to produce profitable crops in soil which does not contain lime, while rice will grow in alluvial soil so long as it is properly supplied with water.

Consequently, it may not be the wheat they eat, but the lime they drink in the water which produces the stone.

There are, however, many natural waters that are famous for their ability to prevent the recurrence of stone, but in the use of all of these waters, as in the use of distilled water, it is important to drink at least 2 liters each day and to be quite regular in this practice.

In the after-treatment of this patient there can be no doubt but that the drain which led down to the incision in the ureter and pelvis should have been left in place until practically all of the urine had passed out through the bladder, because undoubtedly it was the pressure of urine on the outside of the injured ureter which caused the obstruction in the ureter on the twenty-fourth postoperative day?

Again, after the removal of the left kidney the patient should have been impressed with the danger of neglecting the drinking of at least ½ gallon of distilled water, because this would undoubtedly have prevented the formation of the stone in the right kidney.
CLINIC OF DR. ALLEN B. KANAVEL

WESLEY MEMORIAL HOSPITAL

RETROPHARYNGEAL AND POSTERIOR MEDIASTINAL ABScesses

Cold Abscesses Secondary to Tuberculous Disease of the Cervical and Dorsal Vertebrae May Cause Serious and Widespread Involvement Because of Their Tendency to Gravitate Downward Into the Posterior Mediastinum. According to Their Location, They Should be Drained, as Early as Recognized, in the Neck or Through a Dorsal Approach. Frequently They May Be Evacuated and Closed, with Complete Remission of Symptoms.

It is my purpose to present to you today 2 patients suffering with abscesses—one in the retropharyngeal space and the other in the posterior mediastinum. The first patient we will operate upon by the method which we believe should be used in opening these abscesses. The second patient has been under our observation for two years. Originally she suffered from a tuberculosis of the spinal column and an abscess in the posterior mediastinum, which was drained by operation. I have asked her to return today that I may discuss with you the surgical considerations involved in the treatment of these abscesses, since they are of a similar nature.

The patient to be operated upon today is a child, eleven years of age, who has been suffering for over nine months with tuberculous lesions of different parts of the body. We have already drained a tuberculous abscess of the upper lid, one of the hand, and another of the abdomen. He now comes with a swollen gland on the right side of the neck, lying at the bifurcation of the carotid, and, in addition, a swelling in the retropharyngeal
space, evident by inspection when the mouth is open, and easily
demonstrable by palpation with the finger. This, in all probabil-
ity, is the result of tuberculous disease of the cervical vertebrae,
although the x-ray picture is not conclusive. Retropharyngeal
abscesses not infrequently appear as a result of a tuberculosis of
the cervical vertebrae, though they are more commonly asso-
associated with acute infections of the pharynx in young children.
In the former instance, particularly, a serious error is often made
in that these abscesses are opened through the mouth and, as a
result, we have an open wound connected with a tuberculous cav-
ity, resulting in long-continued suppuration and often in death.
Tuberculous abscesses here, as elsewhere in the body, should be
opened in such a manner as to prevent secondary infection.
Opening them through the mouth is a serious technical error.

We make an incision 2\(\frac{1}{2}\) inches in length along the anterior
border of the sternocleidomastoid muscle. The muscle is re-
tracted and we come upon a large gland, the size of a walnut,
which, fortunately, can be enucleated intact. We now see in the
floor of the field the internal jugular vein and the common caro-
tid artery. These we will retract laterally. Since the superior
thyroid artery is preventing free retraction, I will ligate and di-
vide it between ligatures, since the collateral circulation is so free
that it must be ligated both proximally and distally. We now
see at this point a bulging mass (Fig. 258): I am in some doubt
as to its relation to the pharynx; in fact, it may be the bulging
wall of the pharynx itself. I will, therefore, ask my assistant to
place his finger in the mouth and outline for me the pharyngeal
wall. This permits me to dissect posteriorly to the pharynx.
Here we come at once upon the abscess and open it widely with
forceps. As you see, a considerable amount of thick, green pus
is evacuated. My palpating finger does not demonstrate any
erosion of bone. I shall swab the cavity carefully with sterile
gauze so as to remove all detritus, and close the wound in layers,
so that there may be no possibility of contamination from the
skin.

It is readily seen that this method is similar to that used in
opening psoas abscesses or other tuberculous abscesses where
we wish to prevent secondary infections. The history of these patients shows that not uncommonly the wound heals kindly, and the patient makes an immediate recovery as far as the local abscess and pressure symptoms are concerned. In this partic-

[Image: Method of approach for drainage of retropharyngeal abscess through the neck.]

ular type of case it prevents, first, the rupture of the abscess into the pharyngeal cavity and, second, a serious secondary infection.

**Note.**—Section of the gland showed it to be a caseating tuberculous lymph-gland, with a central cavity filled with greenish-yellow pus. The stitches were removed one week later, at which time the wound was well healed (Fig. 259).
In considering the technic of draining this abscess it is well to draw attention to the fact that any abscess lying in the posterior pharyngeal space, even extending down as far as the third and fourth dorsal vertebrae, can be opened and drained by this approach. It has long been recognized as a proper surgical procedure. Lurmann, as long ago as 1876, operated upon a patient who had a deep abscess in the left side of the neck following a pharyngeal phlegmon. Fortunately, it did not rupture in the pharynx, but fluctuation appeared at the anterior border of the sternocleidomastoid muscle. Incision was made here and a pint of foul-smelling pus evacuated. Through this opening the chest was examined, and it was found that the cavity extended down into the posterior mediastinal space for a considerable distance. The cavity was filled with fluid and was

Fig. 259.—Photograph of patient (Case I) showing appearance of healed wound.
found to hold 2 quarts. A fistula had formed low down in the esophagus, so that for two weeks after operation food appeared in the wound. The patient, however, made a slow, but eventful recovery.

Zieinbrecki in 1895, in the bulletin of the Surgical Society of Paris, reported the case of a patient who developed a sudden pain in the neck, with dysphagia. Esophageal sounds were passed for a few days. It was then noted that the patient had fever, fetid breath, and a peculiar configuration of the neck, as though the increased size were due to a pharyngeal and laryngeal edema. The diagnosis of prevertebral septic phlegmon was made, and operation demonstrated an abscess beneath the deep fascia, as well as a cavity between the esophagus and the vertebra, with pieces of bone in it. The patient was fed with an esophageal tube while in the hospital, and discharged with a small fistula still present. After leaving the hospital he began to take food by mouth, and soon returned with a recurrence of the abscess in the posterior mediastinum. At the autopsy following his death, three months later, a small fistula was found in the posterior wall of the esophagus just below the pharynx. The abscess which resulted had denuded and eroded the vertebral bodies of the cervical and dorsal vertebrae, and extended well into the posterior mediastinum.

Von Hacker in 1901 described practically a similar incision, with the report of 2 cases. Von Hacker recognized that in the presence of an extensive abscess it is wise to do a preliminary gastrostomy because of the esophageal perforation which frequently exists in these cases.

Rasumowski in 1900 reported in Hildebrandt’s Jahresbericht the case of a patient twelve years of age who had an abscess that extended 14 cm. into the posterior mediastinum, and that communicated through a small opening with the trachea. He recommended that these patients should be placed in the Trendelenburg position after operation and fed with a tube—manifestly a very wise procedure if there is either an esophageal or tracheal fistula, since the first measure tends to aid in drainage and the second prevents repeated contamination.
Cavazzini in 1898 also reported a case with esophageal fistula. In this patient a cervical operation was first performed, and later a dorsal incision was made for better drainage. From his experience he recommends both operations as routine—first, incision in the neck and later dorsal mediastinotomy. This is unnecessary unless the abscess is of great size and the convalescence slow, since the Trendelenburg position with tube feeding or gastrostomy will usually result in recovery.

Gaudiani reported the case of a patient with dysphagia and a swollen mass in the left side of the neck, evidently an abscess, which was opened under local anesthesia anterior to the sternocleidomastoid. A drain was inserted which ran down into the posterior mediastinum for 9 inches. The patient was placed in the Trendelenburg position and the wound healed in two months. He reported a second case—a patient who swallowed a fish bone which penetrated the posterior part of the esophagus in its upper portion. A retropharyngeal abscess developed which was drained by the same method. Death occurred two days later, and at autopsy a perforation of the trachea and bronchopneumonia were found. He is of the opinion that a cervical incision may be made to drain abscesses extending as low as the arch of the aorta, but in those patients in whom the abscess lies below the fourth or fifth dorsal vertebra a dorsal incision should be made.

It is evident from this review that if secondary infection develops as the result of a perforation of the abscess into the pharynx or esophagus, we are dealing with a much more serious condition than that in which the abscess has not yet ruptured or has not been opened in the pharynx. Had this abscess been opened through the pharynx or had perforation taken place, as would inevitably occur if the abscess were left to itself, we would probably have had a secondarily infected retropharyngeal abscess which would have required drainage through the neck. It would have been advisable then to have placed this child in the Trendelenburg position to secure dependent drainage, and either to do a gastrostomy or feed the child through a stomach-tube. The increased hazard for the patient under such
conditions, and the added difficulties in carrying out adequate treatment, emphasize the importance of careful diagnosis and early operation in these patients.

Let me now present this patient, Miss S., Wesley Memorial Hospital, No. 79,028, who has returned at my request. She came to us first two years ago with a tuberculosis of the sixth, seventh, and eighth dorsal vertebrae. During the course of the treatment it was necessary to drain an abscess in the posterior mediastinum, and it is because of this complication that I am drawing her case to your attention.

At the time we first saw her two years ago she had evidence of tuberculosis of the vertebrae mentioned, with marked spasticity of the muscles of both lower extremities. The left thigh and leg were rigidly flexed and she was unable voluntarily to extend them. Voluntary abduction and adduction of the thighs were impossible. She had ankle-clonus and exaggerated patellar and ankle-jerks, a bilateral Babinski, Oppenheim, Gordon, and Chaddock. Muscle and joint sense of the toes were absent.

From this summary of the findings at that time it is evident that she was suffering from compression of the spinal cord. It was thought advisable to immobilize the spine, and this was done by a typical Albee operation, followed by prolonged rest in bed. Although the operation was successful in immobilizing the spine and was followed by a temporary remission of her symptoms of spasticity, she returned to us three months afterward in even worse condition than upon her first admission. The spasticity was more marked and there was evidence of a more complete sensory involvement. While at home she had gradually lost the use of both lower limbs and developed severe pains in the calves and thighs. These symptoms abated somewhat, so that at the time of her second admission to the hospital it was found there was some tenderness at the site of the dorsal swelling, and absolute spastic rigidity of the lower extremities. There was a diminution of sensation below the tenth dorsal segment on the left, and the eleventh on the right, with absence of pain in the lower extremities. There was a zone of hyperesthesia at the level of the ninth and tenth dorsal vertebrae. The bowels and
bladder were normal. The upper extremities were normal. An x-ray picture taken at this time disclosed an oval shadow the size of a lemon in front of the body of the seventh dorsal verte-

Fig. 260.—Roentgenogram (Case II), anteroposterior view, showing outline of mediastinal abscess.

bra and contiguous to it, lying apparently somewhat more upon the right side than upon the left (Figs. 260, 261). A diagnosis of tuberculous abscess of the posterior mediastinum at this site was made. At operation an incision was made from the level of
the fourth to the ninth dorsal spines, about 4 cm. to the right of the midline. The tissues were retracted medialward, so as to expose the neck of the seventh and eighth ribs, and the internal intercostal muscles just lateral to the erector spinae group. The periosteum was separated from the seventh rib and a small piece

Fig. 261.—Roentgenogram (Case II), lateral view, showing outline of mediastinal abscess.
of this removed as close to the spine as possible. In passing through the anterior layer of the periosteal covering the forceps passed directly into the abscess cavity, and thick, green, caseous pus began to well into the operative field (Fig. 262). The pus was aspirated and the cavity thoroughly cleansed by passing a rubber tube attached to an aspirating syringe into its most dependent portion. The wound was dried and the tissues closed in layers.

Fig. 262.—Method of draining mediastinal abscess through dorsal approach.

It is evident from these findings that the patient was suffering from the effect of pressure upon the spinal cord produced by a tuberculous abscess. She made an immediate and satisfactory recovery from the operation. The wound healed by primary intention, but the evidences of involvement of the spinal cord disappeared very slowly. The patient was kept in
bed on her back, and left the hospital in a much improved condition.

She returned at the end of six months able to walk, but with a tuberculous empyema of the right pleural cavity. This was drained and treated by repeated irrigations with Dakin's solution, and after some months in the hospital was completely healed. The patient returns to us now, eight months after her discharge, and, as you see, she walks perfectly and has no evidence of involvement of the spinal cord. She has gained 15 pounds in weight, and informs me that she is now married.

The question of drainage of the posterior mediastinum in tuberculous abscesses is of great importance. It is not commonly done, in all probability not nearly so often as it should be. Jacobs, in an excellent contribution on this subject, states that compression paralysis in Pott's disease is not infrequent in adults, and occurred in 24 out of 75 patients at the Cook County Hospital between 1914 and 1916. These patients were between nineteen and sixty-two years of age. He states that the most frequent cause of such paralysis in adults is intraspinal abscess. At first pressure may not make any appreciable alteration in the nerve elements, but sooner or later it is bound to cause severe damage to the cord, with a resulting primary or secondary degeneration. At times actual necrosis and severing of the cord may occur. In such cases, of course, paraplegia will be complete and permanent. As a rule death is anticipated from pulmonary tuberculosis. Recovery may take place occasionally, even after paralysis has existed for a long time.

Compression from tuberculous granulation tissue occurs most commonly in children. There is invasion of the vertebral canal and the production of pressure sufficient to excite functional disturbances without actual mechanical destruction of the nerve elements.

Jacobs states that in none of the 24 patients with abscess was operation performed for drainage of the abscess. Of the 24 cases there was not one recovery; death or permanent paralysis resulted in every case. These results illustrate the grave consequences of permitting a patient with a tuberculous
abscess developing from the dorsal vertebrae to remain untreated, and it is hoped that the presentation of this patient who was subjected to operation, and who has made an apparently complete recovery, may point the way to a saner therapy in this condition.

The method of opening the posterior mediastinum has been discussed by various surgeons. Nassiloid worked out a method of approach upon the cadaver. A flap was made upon one side of the spinal column and a small portion of several ribs resected. The dissected pleura was then pushed aside and the mediastinum exposed.

Quénu and Hartmann did not resect the ribs so near the column as did Nassiloid. The incision was made at the angle of the ribs, and by resecting 2 cm. of the third, fourth, and fifth ribs, the hilus of the lung could be exposed and access gained to the esophagus down to the esophageal opening in the diaphragm. They advised performing the operation on the left side because the pleura on the right forms a culdesac behind the posterior wall of the esophagus. This was suggested in spite of the fact that the thoracic esophagus is on the right side. Potarc advised operating upon the right side because the aorta lies on the left side of the spinal column. Enderlen suggested operating on the left when the incision is made above the bifurcation of the bronchi, and on the right when between the bifurcation and the diaphragm. Heidenhain made his incision near the median line, and resected one or more transverse processes together with a section of the ribs. It was his belief that by blunt dissection of the tissues anterior to the vertebrae the pleura would rarely be wounded.

Fontau-Meniard’s method is similar to that of Heidenhain. He states by following the vertebral bodies after removing two or three laminae and 1 or 2 inches of the adjoining ribs it is easy to dissect away the pleura and have a fairly good view of the structures of the posterior mediastinum.

From the presentation of these 2 patients with abscesses in the posterior mediastinum, one in the upper portion and one in the lower portion, it is evident that if a more careful study be
given to the diagnosis of these conditions and to early operation, many of the complications incident to such abscesses will be avoided, and many lives will be saved that are now lost. That you may make a study of this subject for yourselves I will give you the following references to the literature.

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"DUMPING STOMACH" FOLLOWING GASTROJEJUNOSTOMY

Patient Suffering from Severe Gastric Disturbance Following Gastrojejunostomy. Fluoroscopic Examination Revealed a "Dumping Stomach." Operation Performed to Unhook Gastrojejunostomy.

The patient, Miss O'R., has long been under my care except for a year and a half during the late war. During most of that time she got along reasonably well, but during my absence she got into rather deep water.

She is now forty years of age. In 1913 she was at Mercy Hospital for a long period under the care of the late Dr. J. B. Murphy and myself. At that time she had an ulcer on the gastric side of the pylorus and was treated for several months. She recovered, increased in weight from 103 or 104 to 130 pounds, and was able to act as a housekeeper, doing a good deal of work for a number of years. I saw her from time to time, when she complained of some gastric ailment or temporary disturbance which always yielded readily to a little treatment and suggestion.

During the war she was again taken with distress and vomiting, and saw a surgeon, who, without x-ray examination and basing his conclusion wholly upon physical examination, decided that she needed the operation of gastrojejunostomy, which he accordingly performed. After my return I did not see her until recently, when I was called in consultation.

It now develops that her stomach has been disturbing her very severely for the last year or two. She has been under the care of a physician who was doing the best he could, but that
was little, because her needs were great. I found her lying in bed complaining of a great deal of pain, wishing that she might die, and threatening to commit suicide if she did not get better, vomiting pretty nearly everything that she had eaten. Her weight had fallen to 106 pounds. She was very weak because everything that she ate came up; in fact, her diet had been reduced to milk-toast. Even this was vomited more than half the time, but it was the only thing that would stay down even in part. I found that she had been living a month on milk-toast without any other article of food. I naturally told her that it was absurd to attempt in her home to give her any adequate advice, that it could only be done after finding out what her needs were, and that these could be determined only in a hospital. She finally assented and, accordingly, came to the hospital the next day.

The Rehfuss examination disclosed a surprise. We gave the customary meal and passed the tube, kept it down four hours, and were unable to aspirate a single drop of fluid in any one of the eight aspirations. The stomach was apparently absolutely dry. This did not coincide with her story of vomiting of food, and it was apparent that the Rehfuss test-meal had passed clear through her stomach, and that there were no gastric contents to aspirate. Examination of the feces showed no blood. Examination of the blood showed 70 per cent. hemoglobin, 3,700,000 red cells, and 9000 white cells. She showed on physical examination no tumor mass in the abdomen, no peristaltic unrest, nothing but tenderness in the area midway between the umbilicus and the navel, a little to the left.

After the exertion of the Rehfuss test-meal we allowed her to have a quiet afternoon, and the following morning fluoroscoped her, and found the reason for the negative Rehfuss findings. As soon as the barium was swallowed it passed from the stomach into the bowel. We could see it slipping into the small intestine almost as fast as it went into the stomach. We gave her in very rapid succession 2 glasses of barium and butter-milk, and could hardly get enough lodged in the stomach to make an observation of the pylorus. We could not well fill the
pylorus with manipulation, because as soon as we attempted to squeeze the barium and malted milk toward the pylorus it would shoot into the small intestine. We at once took her into the radiographic room and gave her a third 8-ounce glass of barium and malted milk, and while she was still drinking it took a skiagram (Fig. 263). This disclosed the diagnosis and the whole story.

The interpretation of her story of the complaint is simple.
enough with the present findings. She had had perfect relief from her stomach for about four years, but while I was away she began to have some nausea and vomiting and pain in the epigastrium, coming on mostly at night. She was operated upon in 1918. Since the operation she has had nausea and vomiting followed by pain in the epigastrium and left hypochondrium. The vomitus consists of bile and mucus, or, as she calls it, "slime." These attacks always came on about midnight and lasted one-half hour or so, and then disappeared. Three weeks ago she had influenza. Three days later she was practically recovered from the influenza, when she was seized with severe pain in the left upper abdomen, and she vomited. The pain radiated across from right to left and up into the left shoulder. She said that vomiting relieved her a little and that bicarbonate of soda also did some, but there were times when the bicarbonate of soda induced vomiting. For two and a half weeks she has been having pain and vomiting almost continuously, with remissions only after hypodermic injections, which had unwisely been given to her.

Is it any wonder that the patient has had so much gastric distress when one sees her condition? From the x-ray plate we were unable to determine whether the greater curvature had been fastened to the ileum or not, but we strongly suspected that such might have been the case. She was advised that only one thing could be done—the short circuit would have to be righted. We told her that it would be necessary for the former operation to be undone, that she could not have her stomach pumping its contents into some part of the small intestine, that it was absolutely essential for her to have the anastomosis unhooked. She assented, and the operation was done by Dr. E. Wyllys Andrews.

It was quite difficult at first to find the point at which the stomach had been fastened to the small intestine because of the adhesions which were present, but it was ultimately discovered, the necessary clamps were applied, and the two organs separated without a great deal of mechanical difficulty. Taking advantage of the opening into the stomach, the pylorus was
"DUMPING STOMACH" AFTER GASTROJEJUNOSTOMY

explored by Dr. Andrews, who reported that he could easily get his finger through it, so it was thought wise merely to unhook the stomach and permit the pylorus to carry on the work which it should carry on. No other lesions were found in the stomach. The stomach was then closed.

Following the operation and preceding it the patient showed acetone and diacetic acid in the urine, the acetone and diacetic acid being due to the preliminary starvation, the etherization, and to the subsequent starvation after the unhooking operation. The patient has had a very good convalescence. She was put on the usual treatment of 2000 c.c. daily by proctoclysis, given in four doses of 500 c.c. each. The proctoclytic fluid consisted of 5 per cent. glucose and ½ per cent. sodium bicarbonate. The third day she was permitted sips of water and the fourth day she was given fruit juices, strained honey and water by mouth and a little broth, and on the fifth day she was taking broth and gruels freely. It is now five days after the operation and her present condition is excellent.

Nature never intended to have the stomach connected up with the small intestine just any place. There is only one place where an anastomosis can be made without harm to the patient, and that is in the very first portion of the jejunum before the first loop, and the anastomosis should not be with the greater curvature of the stomach, but should be with the posterior wall. When a posterior gastro-enterostomy is properly performed at this point there is usually no trouble. A vicious circle rarely occurs and the patient's subsequent history is usually excellent. If, however, the operation is done as it was here the patient is deprived of gastric digestion, and of that digestion which takes place in the duodenum and in the beginning of the jejunum. Beyond doubt the jejunum is physiologically important and should not be shut off by the careless operator, and, furthermore, when the stoma is made it should never be much larger than the ordinary pyloric opening. When it is too large the stomach does not retain its contents sufficiently long. Nature evidently wishes the stomach to keep its contents an hour or an hour and a half after an ordinary meal.
If the stomach contents pass out within a short time it is perfectly obvious that something is lost to the patient. This patient is very much in the state that she would have been had the operation of gastrectomy been done. Virtually her stomach was useless to her, and in order to put her in perfect physical condition it was necessary to give her stomach back to her. This could only be done by undoing the short circuit which had been made.

We are not necessarily finding fault with the doing of an operation in her case. Her condition indicated that she had an ulcer at the pylorus at some time. That being the case it probably would have been right and proper for the operation of gastrojejunostomy to be performed if dietetic treatment had failed. We believe there are only four reasons why a gastrojejunostomy should be done. These are: first, a threatening perforation; second, persistent hemorrhage; third, a narrowed pylorus; fourth, failure to bring about recovery by proper and persistent dietetic treatment. In her case proper and persistent dietetic treatment had not been followed out, and there was no indication for operation. At the present time the pylorus is sufficiently patent to function, and, therefore, the operation of gastrojejunostomy was wholly unnecessary. We expect her to recover and to have a good stomach ultimately.

Postscript.—These hopes have been fulfilled. April 27, 1922 she is still in hospital, but is up and about, partaking freely of light diet with no distress. Her pylorus is functioning perfectly well.¹

¹At the date of proof-reading, May 27, 1922, the patient had been out of the hospital almost a month, in very good health, with no vomiting or gastric distress.—C. L. M.
FREE FASCIAL TRANSPLANTS IN DURAPLASTIES

(Reported by Dr. Frederick Christopher)

Use of Free Fascial Transplants to Replace Defects in the Dura. Report of 3 Cases in which this Method was Successfully Used.

CASE I

This case is one of traumatic meningeal cyst, or hygroma of dura mater (Virchow), or meningitis serosa circumscripta cystica. Five years previous to admission patient had had a decompression. A swelling started six months after this operation. There was approaching blindness, deafness, and hernia cerebri. The latter came off of the upper occipital region of the head in a tumor the size of an ordinary toy balloon half inflated. Mass soft and fluctuating, 16 inches in circumference, was painful to pressure. Patient blind. Optic atrophy, probably secondary to optic neuritis, both eyes.

Operation.—An incision was made through the skin over the large tumor and the bleeding controlled by forceps. The dura was then opened and a clear fluid allowed to flow out in small amounts at short intervals. After the fluid was all out the incision in the dura was made larger and the flaps turned over the head. A large opening in the right occipitoparietal region of the skull was found. This was 2 inches wide and about 6 inches deep. This cyst cavity occupied a position between the temporosphenoidal lobe and the parietal bone. The inner (median) wall was formed by the pia covering the temporosphenoidal lobe. The outer wall was formed by the arachnoid and dura. The lining of the cyst presented a glistening white mother-of-pearl appearance. The content was a clear limpid fluid. The
quantity obtained was 7 ounces; about one-third of the contents of the cysts was lost. After removing by excision the extra-
cranial portion of the cyst wall, the thin lining membrane was
removed from the greater part of the intracranial cyst cavity. This cavity was then filled by a transplant of fat, to which was
attached a piece of fascia lata the size of the dural defect (2½
by 3 inches). The fascial transplant was united by interrupted
sutures to the edges of the dura surrounding the opening into
the cyst. The redundant parts of the scalp were excised. The
scalp wound was closed by catgut and silkworm-gut sutures.

CASE II

Patient, H. A., age twenty-two, was admitted to the surgical
service of Dr. Albert E. Halstead, St. Luke's Hospital, Chicago,
on September 9, 1914. Ten years previous to admission the
patient's parents noticed a small hard lump the size of a pea in
the right upper temporal region. No known injury to this area.
The mass continued to grow, was always tender. Eighteen
months previous to admission an operation was performed, at
which, the mother said, "small piece of loose bone was removed." It was learned that at this time a section of the skull was cureted
on the supposition that there was an osteomyelitis present. The
mother says that she has noticed no cerebral symptoms, but the
patient had always been subject to headaches. Physical ex-
amination, aside from the tumor, negative. Operation, Septem-
ber 22, 1914, Dr. Albert E. Halstead. The head was prepared
with iodin and a constrictor applied to the scalp. A horseshoe-
shaped incision was made over the protruding portion of the
skull. The flap of scalp was turned back, exposing the bony
tumor. A circular incision was made through the pericranium
widely surrounding the tumor. The pericranium was stripped
back, exposing the bone. A circle of small holes was made with
the Hudson set and these connected with a Gigli saw (Fig. 264, 1).
This portion of the skull which included the bony new growth
was now loosened and lifted up. It was found to be adherent to
the dura because of processes which had grown out through the
diploë, and it was necessary to remove the underlying section
Fig. 264.—1, Method of removing area of skull affected by osteosarcoma. 2, Cross-sectional view of osteosarcoma of the skull, showing the dura to be intimately adherent to the osteosarcoma. 3, Cross-sectional view showing fascia lata fastened in place with the fat side down, to take the place of the dura removed in resection of tumor. 4, Fascial transplant in place.
of the dura with the bone tumor (Fig. 264, 2). Accordingly, a
wide circular incision was made in the dura and the whole
affected portion removed. There was a marked depression in
the brain beneath the tumor. A semicircular incision was
made in the thigh and a portion of the fascia lata with adherent
fat was dissected off. This was transferred to the defect in the
dura so that the fat side was down and sutured there by inter-
rupted sutures of fine chromic catgut (Figs. 364, 3, 4). The
scalp flap was sutured with interrupted silkworm-gut. The
wound was covered with compound tincture of benzoin, silver
leaf, and a dry dressing.

The histologic diagnosis of the specimen removed at opera-
tion was osteosarcoma of the skull (Dr. E. R. LeCount).

The patient made an uneventful convalescence and was dis-
charged thirteen days after the operation.

On January 25, 1915 the patient was readmitted to the service
of Dr. Halstead.

Operation, January 26, 1915, Dr. Halstead. The defect of
the skull incurred in the preceding operation was exposed, and
the fascia lata which had been transplanted in the
previous operation was readily identified and found to be in
good condition. No hernia cerebri. A piece of bone about 3.75
by 5 cm. was removed from the body of the scapula (Fig. 265,
5) and trimmed to fit the defect in the skull, and a number of
small holes were drilled through it at the borders. Chromic
sutures were passed through these holes and attached to the ad-
jacent periosteum of the skull (Figs. 265, 6, 7). Temporal muscle
was sutured over the transplant, and the wound closed and
dressed in the usual manner.

The patient made an uneventful convalescence and was dis-
charged twenty days after the operation.

On September 2, 1915 the patient was readmitted, com-
plaining of pain in the old scar. Under local anesthesia a nerve
which had been caught in the scar of the old incision was re-
moved and the patient was discharged the same day. On Sep-
tember 23, 1915 further scar tissue was removed. On January
20, 1916 the patient was again admitted to the hospital because
Fig. 265.—5, Diagram showing method of removing the hexagonal bone transplant after reflection of the periosteum. 6, Hexagonal bone transplant fastened into the defect in the skull. 7, Cross-sectional view showing the method of attaching bone transplant. The transplant rests on a base formed by the inner table of the skull.

of several nodules in the scalp at the site of the previous operation and also because of pain in the old scar. On January 22,
1916 the scar tissue was excised together with a piece of bone for histologic examination. There was no recurrence. The wound was closed in the usual manner and there has been no recurrence.

The patient was an officer in the army during the war and was present in some of the most severe actions. At present he holds the rank of captain in the regular army.

CASE III

On June 11, 1916 the patient, Mrs. F. G. (St. Luke's Hospital, Chicago, Illinois, No. 153,654), was in an old-fashioned swing fastened with large logging chains to the limb of an oak, the limb being about 30 feet from the ground. The chain broke and struck her on the right side of the head about 4 inches above the eye. After the injury the patient walked into the house and up the steps, but gradually lapsed into unconsciousness. She was brought to the nearby city of New Orleans four hours later in profound unconsciousness and breathing from six to eight times a minute.

The surgeon here lifted the scalp and found a comminuted fracture of the skull. The dura was torn and at least a teaspoonful of brain tissue escaped. There was a marked depression and a piece of bone larger than a dollar was removed. She had an uneventful recovery and was perfectly well for five years.

In April, 1921, or seven months previous to her admission to St. Luke's Hospital, the patient had a severe convolution. She has had three other convulsions since that time, the last one two weeks prior to admission.

The attacks or convulsions were usually preceded by a feeling of depression. The eyes would begin to twitch and turn upward. Her mouth was drawn to one side. Her hands would become claw-like and her legs be flexed. The entire body would become rigid; she would froth at the mouth and vomit profusely, and bite her tongue and lips. She would not fall during the attacks, which lasted about fifteen minutes, but would sit up straight and rigid. She is confused for several hours after each attack.

On examination there was noted a healed depression of the upper medial angle of the right frontal bone, in the sagitto-
coronal angle near the coronal suture, and depressed about 1 cm. is a triangular area nearer the midline and less in the wing, extending to the right. The entire defect is 8.5 cm. side to side and the triangular depression is 3.5 cm. wide. The brain

Fig. 266.—Roentgenogram (Case III) taken at time of operation. There is a large area of increased radiability involving the right parietal and frontal bones of the skull. This area measures about 3 inches in its longest diameter and the posterior border is somewhat depressed.

pulsates in one portion of this defect. Triceps, abdominal, and patellar reflexes present. Pupil reactions, tension, ocular muscle excursions, and fundi are all normal. Refraction shows a high degree of hyperopia. Physical examination otherwise negative.
The Roentgen findings (Fig. 266) (Dr. E. L. Jenkinson) were as follows: There is a large area involving the right parietal and frontal bones of the skull of an increased radiability. This area is due to the absence of bone. The area measures about 3 inches in its longest diameter. The posterior border of this area is somewhat depressed. There is no evidence of loose bone. The base of the skull seems normal. The clinoid processes are normal in outline. The floor of the sella is regular in outline. There is no evidence of increased intracranial pressure.

White count (December 27, 1921), 8800. Urine negative.

**Operation** (Dr. Albert E. Halstead, December 16, 1921).—Nitrous oxid and oxygen anesthesia. The scalp had previously been shaved and washed with neutral soap, Dakin’s solution, alcohol, and powdered with dry boric acid. At time of operation the dry boric acid was washed away with ether and painted with iodin. Loose-meshed gauze and rubber constrictors were then applied to the scalp. A curved scalp incision 12 cm. long was made, and the scalp flap was carefully dissected from the periosteum and turned outward. The fibrous adhesions between the leptomeninges and the scalp and the parietal and visceral arachnoid and the margin of the defect were dissected free. A sponge saturated with hot salt solution was used to control bleeding.

The right thigh was then prepared and a piece of fascia lata and fat 1 cm. thick and about 6 cm. in diameter was removed. It was immediately placed in warm salt solution and carried to the head, where it was transferred to the defect in the skull so that the fat pad was in contact with the cerebrum. The fascia was sewed to the edge of the dura and periosteum, the edges of the skull defect having been freshened with a chisel, and the thick ridge of bone which was posterior having been chiseled away.

Small pieces of bone with periosteum intact were then chiseled loose in front of the defect, and they and other small pieces cut away from the edge of the defect were laid over the fascia. The periosteum was sewed with catgut, and the scalp stitched with silkworm tension sutures. Silver foil and gauze saturated with compound tincture of benzoin were applied to the wound.
During the operation the systolic blood-pressure rose to 141, and at the end was 131. The general condition was good. After a very easy convalescence the patient was discharged on January 8, 1922, twenty-three days after the operation. There has been no return of the former symptoms save a few slight dizzy spells which the patient had while she was still in the hospital.

**Discussion.**—Ablation of a section of the dura may be occasioned by trauma or it may have become necessary in the operative procedures incident to the removal of tumors of the skull or the brain. Absence of a portion of dura, particularly if there be no effort to make an overlying bone-graft, is almost invariably followed by hernia cerebri because of intercranial tension which is pulsating in nature.

The subject of replacing these defects in the dura has been given a great deal of study. The ideal transplant material must be made from: (1) a tough tendinous tissue and (2) a tissue which is clothed in an endothelial layer. Only by this means can a large defect of the skull be covered water-tight, the strong mechanical resistance be overcome, and transplant not grow to the brain surface. Fascia and periosteum are materials possessing the first attribute, and skin and periosteum the second. The periosteum almost invariably becomes adherent to the pia mater, and hence has been found unsuitable. The skin must be rejected because of the difficulty or impossibility of rendering it sterile, and because of its too great elasticity. Peritoneum has not been found to be practicable because the endothelial layer is damaged or changed in the process of transplantation.

Free transplants of fat have been tried in the hope that after the fat has contracted a suitable layer will remain, but the inability to secure a firm water-tight union virtually excludes the use of fat alone.

By far the best material to be used in duraplasty is the fascia lata of the same individual (Fig. 267). This was first employed in 1910 by Körte. The advantages of fascia are: (1) firmness; (2) resemblance to the histologic structure of the dura; (3) accessibility; (4) possibility of obtaining aseptically;
(5) its nutrition is readily maintained under unfavorable circumstances. The small amount of endothelial coating of fascia has been cited as a disadvantage. To overcome this defect recent workers (Lukes, Wendel, Payr) have left a portion of the subcutaneous fat attached to the fascia lata and have so inserted the fascial transplant that the fat side is toward the brain.

Lawrow collected 73 cases in which fascia was used in duraplasties, and in all but 2 cases a water-tight union was secured. There was a large number of cures not only in fresh injuries to the dura but also in covering operative defects, and in individual cases the results were astonishing.

The fascia lata transplants with their attached fat must be larger than the defects which they are to cover. Where possible they must be inserted by pushing their edges under the bone edges, and be closely approximated to the good circumjacent dura with fine sutures. Silk has been recommended for this purpose.

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RECENT GUNSHOT WOUNDS OF THE KIDNEY: WITH REPORT OF 4 CASES


Case II. Through-and-through Gunshot Wound of Left Side of Abdomen, with Bullet Lodged Just Beneath the Skin Just to the Left of the Spine at About the Level of the First Lumbar Vertebra. Nephrectomy and Recovery.

Case III. Three Through-and-through Gunshot Wounds All from Behind Forward; One Entered Just Beneath the Left Eleventh Rib, Passed Through the Abdomen, Diaphragm, and Lower Left Chest, with the Wound of Exit in the Eighth Intercostal Space in the Nipple Line. A Second Entered Just to the Left of the Vertebral Column, Nicked the Fourth Lumbar Vertebra, Passed Through the Abdomen, and Lodged Beneath the Skin of the Anterior Abdominal Wall Just Below the Level of the Umbilicus and Just Outside the Nipple Line. A Third Entered the Left Buttock and Escaped Just Below the Middle of Poupart’s Ligament on the Left Side.

Case IV. Through-and-through Gunshot Wound of Abdomen with Bullet Wound of Entrance the Size of a .38-caliber Bullet, Located About 1 cm. to the Left of the Midline at the Level of the Tip of the Xiphoid Cartilage, and a Similar Bullet Wound of Exit Located About Two Fingerbreadths Below the Right Twelfth Rib and at a Point About 3 Inches to the Right of the Spine, with Perforation of the Liver and the Right Kidney. Uneventful Recovery Without Operation.

Discussion of the Symptoms, Surgical Indications, and Operative Technic of Recent Gunshot Wounds of the Kidney.

1 These cases were presented before the Clinical Meeting of the Chicago Surgical Society held Friday, April 7, 1922.
Since the close of the war gunshot wounds have been very frequent, probably due to the unsettled social conditions. Since my return to civil practice I have handled a considerable number of gunshot wounds at the Cook County and Michael Reese Hospitals, and among these I have had 4 cases where the bullet penetrated the kidney. I wish to present these 4 cases and to discuss the symptoms, surgical indications, and operative technique of handling recent gunshot wounds of the kidney.

Case I

H. F., Cook County Hospital, No. 746,448, a teamster, thirty-four years of age, attempted to commit suicide while in bed at 7.15 A. M., December 20, 1920, by discharging a revolver into the region of the heart. He was brought to the Cook County Hospital by the police at 8.05 A. M.

When admitted he was conscious, and in reply to questioning stated that bleeding had not been profuse, that no blood had been expectorated, and that he had not vomited. He complained of some pain on deep inspiration in the lower left side of the chest. His greatest complaint was pain and tenderness in the upper left quadrant of the abdomen. The history is otherwise of no particular significance.

Physical examination, recorded by the intern soon after the patient was admitted, showed the following findings: The patient was a well-nourished white male, thirty-four years of age, who was apparently suffering with considerable abdominal pain. Temperature was 97.6° F., pulse 68, and respirations 20. Examination of the head showed no abnormal findings. The lips were of good color.

Neck.—There was a slight cervical adenopathy. No subcutaneous emphysema was present.

Chest.—There was a .32-caliber bullet wound of entrance in the seventh left intercostal space just within the left midclavicular line (Fig. 268). The skin showed powder burns and a zone of subcutaneous emphysema about the wound. A slit-like wound of exit was located in the left scapular line just below the twelfth rib (Fig. 269).
Lungs.—The right lung showed no changes in fremitus, resonance, or breath sounds. The left lung showed no changes in the upper part, but there was hyperresonance from the fifth to the seventh intercostal space and dulness below the seventh.

Breath sounds below the seventh interspace were distant and tactile and vocal fremitus decreased.

Heart.—The borders were within normal limits. No murmurs were heard. The pulse was 68, regular, but weak.
Abdomen.—There was marked tenderness in the epigastrium and beneath the left costal margin. The whole abdomen was rigid, but the rigidity was most marked in the left upper quadrant. Percussion showed that the lower margin of the liver extended about 1½ inches below the right costal arch. The liver could not be palpated owing to the rigidity of the abdomen.

Extremities were normal. Pupillary, patellar, triceps, Achilles’, abdominal, and cremasteric reflexes were normal.

Fig. 269.—Photograph of patient (Case I) taken at the same time as Fig. 268, showing slit-like bullet wound of exit located in the left scapular line just below the twelfth rib.

The blood-pressure was 118 systolic and 82 diastolic. Pulse-pressure was 36.

A specimen of urine was collected and examined, and showed specific gravity 1030, albumin present in large amount (2 mm. ring), sugar absent. Microscopic examination showed the presence of many red blood-corpuscles, but no casts.

When I first saw the patient at 11 a.m. I dictated the fol-
lowing findings: "The patient lies quietly and does not appear to be in shock. His color is good. He complains of pain located just above the umbilicus. He has no pain in the chest except on deep inspiration, which causes pain in the lower portion of the left side of the chest. Otherwise respirations seem normal—20 per minute.

"Head shows nothing of particular interest. The lips are of good color. The tongue is clean.

"Neck.—There is some slight bilateral cervical adenopathy. Pulsation of the jugular is visible and palpable. There is no subcutaneous emphysema.

"Chest.—Lungs: Right lung is entirely normal on palpation, percussion, and auscultation. Percussion of the upper anterior part of the left chest gives a normal note until the anterior axillary border is reached, where the note becomes more tympanic than normal—pneumothorax. In the axilla this tympanic note extends as low as the seventh rib, below which the percussion note is dull. Auscultation over the hyperresonant area in the axilla shows distant breath sounds. Below the seventh rib the breath sounds are very distant or absent—fluid, probably blood.

"Chest Wall.—In the seventh interspace, just within the nipple line, there is a bullet wound of entrance. About this wound is some slight subcutaneous emphysema. Examination of the chest posteriorly shows nothing abnormal on the right side. On the left side hyperresonance is present as low as the eighth rib, below which there is dulness. There is a bullet wound of exit just within the scapular line at about the level of the twelfth rib. Auscultation over the right side of the chest shows normal findings. Over the left side breath sounds are somewhat decreased as low as the eighth rib, below which they are nearly absent. Tactile fremitus is markedly decreased in this latter area.

"Abdomen.—The abdomen is somewhat scaphoid and there is general rigidity, especially in the upper half. Palpation shows a tender area just above the umbilicus. The liver dulness is not obliterated. Percussion shows that the liver extends about one
and a half fingerbreadths below the right costal arch, but, due to
rigidity, palpation is difficult and, therefore, unreliable."

Blood examination made at this time showed hemoglobin 80
per cent. and leukocyte count 19,800.

**Diagnosis.**—From these findings I made a diagnosis of gun-
shot wound of the left chest and abdomen, with probable per-
foration of the left lower lobe of the lung, with moderate pneu-
mothorax and moderate hemothorax; perforation of the dia-
aphragm, perforation of the stomach, left kidney, and possible
perforation of the spleen and some portion of the intestine.

As soon as I completed my examination the patient was given
a hypodermic injection of morphin, gr. ¼, with atropin, gr. ½ₐ₀,
and arrangements were made for immediate operation.

**Operation.**—As the chest condition seemed of much less
seriousness than that of the abdomen, there merely being a
moderate pneumothorax in the left chest and a moderate hemo-
thorax, with no displacement of the heart to the right and no
dyspnea, I deemed it wisest to not do any intrathoracic opera-
tion to repair the damage in the left chest and close the per-
foration in the diaphragm from above or do a transthoracic lap-
arotomy, but, instead, to first open the abdomen.

Under ether anesthesia an S-shaped incision was made on
the left side beginning above just beneath the ensiform cartilage,
and curving the incision downward and laterally until the middle
of the left rectus muscle was reached, and then continuing it
vertically downward almost to the umbilicus, when it again was
curved downward and outward to the left to slightly below the
level of the umbilicus (Fig. 268). The skin and anterior sheath of
the rectus were divided, the internal half of the left rectus muscle
was completely divided, and the two cut ends grasped and held
by a heavy double chromic catgut stitch, so as to later close the
ends and to prevent the cut ends from retracting within the
sheath. Then the rectus muscle was divided the length of the
incision by blunt dissection, care being taken not to divide the
nerves supplying it. These were exposed, but not injured. The
outer half of the left rectus muscle was retracted laterally, and
then the posterior sheath of the rectus and the peritoneum were
divided the entire length of the incision by means of scissors. Before the peritoneum was divided blood free in the peritoneal cavity was plainly seen through the parietal peritoneum. On opening the peritoneal cavity a fair amount of free blood escaped. The transverse colon presented and blood could be seen through the transverse mesocolon in the lesser peritoneal cavity. The transverse colon was inspected, but no perforation found in it. The anterior wall of the stomach was examined systematically, beginning at the cardia and proceeding toward the pylorus. A .32-caliber bullet size perforation was almost at once found on the anterior wall of the stomach at about the junction of the cardiac with the middle third, and about 3 cm. from the lesser curvature. No escaped gastric contents was seen and only a slight amount of leakage occurred during the examination. The stomach was quite distended and contained brownish fluid in considerable amount—partly blood. There was no bleeding to speak of from this perforation. It was at once closed by means of four through-and-through sutures of black waxed silk, placed at right angles to the long axis of the stomach to prevent narrowing, and then by a second row of continuous Lembert stitches of the same material, the second row extending well beyond the first at both ends. Next the duodenum was examined and found intact. Before examining the posterior wall of the stomach the descending colon and spleen were examined. Both were entirely normal. The spleen when drawn forward was seen to be of normal size, with a normal surface. There was no bleeding. The left kidney pouch was then exposed, but no retroperitoneal collection of blood could be made out. Finally, the left half of the diaphragm was examined and a perforation through it was well exposed. This was located at about the middle portion of the anterior half, and rather near the anterior margin. It was sutured with chronic catgut without much difficulty, and a satisfactory closure accomplished. Now, the few neighboring coils of small gut in the field were examined, but all were normal. After sponging away the remaining blood in the general peritoneal cavity, the lesser peritoneal cavity was seen to be full of blood. An opening was made into the lesser sac by incising the gastro-
colic omentum transversely, after first doubly ligating the vessels it was necessary to cut. An opening of at least 5 inches was made, and then the blood in the lesser peritoneal cavity was sponged away. The posterior wall of the stomach was examined, and a perforation, similar to the one that had been closed in the anterior wall, was seen at about the middle of the posterior wall, at a point about midway between the greater and lesser curvatures. This perforation was leaking a moderate amount of air and blood. It was closed in the same manner as the one in the anterior wall, great care being taken to assure a water-tight closure. Next the pancreas was examined. It looked and felt normal except for a point at about its middle, where it evidently had been perforated. Here there was some escaped blood in the form of a small hematoma, but as there was no active bleeding no interference was done. There was no fat necrosis anywhere. As there was no active bleeding in the lesser peritoneal cavity and no soiling with stomach contents, the opening made on the gastrocolic omentum was closed without drainage, using a running plain catgut suture.

The liver was next examined. It was considerably enlarged. There was a through-and-through bullet wound in the left portion of the left lobe at a point about 3 cm. from the lower margin and at about the same distance from the left tip. Both the wound of entrance on the anterior surface and the one of exit on the inferior surface were stellate and irregular, but there was no active bleeding, and so no suturing was done.

Finally, a cigarette drain was placed between the inferior surface of the liver and the anterior wall of the stomach, and then the abdomen was closed in layers above and below the drain. The posterior rectus sheath was closed, together with the peritoneum, using a continuous chromic catgut suture. Next the divided inner portion of the rectus muscle was sutured together by tying the two mattress sutures which were inserted before the muscle was cut, reinforcing this by a row of continuous chromic catgut sutures. The two nerves to the rectus which had been exposed were still intact. Next the anterior rectus sheath was closed in the same manner as the posterior sheath.
A few stitches were put in to hold the divided portion of the external and internal oblique where they had been divided. Next, a number of interrupted tension sutures of silk were inserted, but not tied until after the skin had been closed by a running black waxed silk suture. The patient left the table in good condition.

Postoperative Course.—Patient's condition following operation was very satisfactory. The drain was removed December 23d—the fourth day after the operation. All stitches were removed on December 27th. Drainage was very slight following operation, not enough to make a satisfactory bile test, which was attempted. Urine was examined for bile, but none found. Recovery was uneventful. The temperature never went above 100.2° F., and this only a few times, usually remaining under 100° F. The pulse likewise remained low, after the second day ranging between 72 and 90. Respiration were 18 to 22. The patient was discharged cured January 3, 1921, fourteen days after the accident.

CASE II

E. S., Cook County Hospital, No. 760,763, a laborer, forty-seven years of age, was brought into the hospital by the police at 2.05 p. m. May 16, 1921.

Upon questioning, the patient stated that he was drunk at the time he was shot and did not know anything about the circumstances of the shooting. From the police it was learned that the patient had been shot at 4 o'clock in the morning and was brought to the University Hospital in an intoxicated condition. Here his wounds were dressed and the patient advised to undergo an exploratory operation, which both he and his brother refused. The physician who cared for the patient informed us that at this time his temperature was 98° F., pulse 108, and respirations 20. At 1.30 p. m. they had catheterized the patient, removing 22 ounces of very bloody urine, the first ounce appearing to be almost pure blood.

Physical examination upon entrance showed the patient to be a thoroughly well-nourished, white male about forty-seven years of age, who was brought into the hospital because of a
gunshot wound in the left side of the abdomen. His pulse was 130, but of good volume; temperature 99.6° F., and respirations 24. Examination of the head, neck, and chest showed no findings of interest. The essential pathology was limited to the abdo-

Fig. 270.—Photograph of patient (Case II) taken after the stitches had been removed and the patient was up and about. Note how the kidney incision was carried forward to just below the bullet wound of entrance so as to expose the peritoneal cavity from in front, so that the descending colon and its mesentery could be examined. In order to gain adequate exposure of the other abdominal viscera a second incision was made, beginning near the anterior extremity of the oblique incision, extending upward and medially just to the medial side of the bullet wound of entrance (A), carrying the incision upward parallel to the costal arch to the medial side of the left rectus muscle, which was completely divided. Note the area in the kidney incision where drainage had been introduced (D).

men. There was a gunshot wound of entrance, the size of a .38-caliber bullet, in the left side of the abdomen, about a handbreadth below the costal arch and just outside the nipple line (Fig. 270, A). There was some slight subcutaneous emphysema
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Fig. 271.—Photograph of patient (Case II) taken after the stitches had been removed and when the patient was up and about. Note the small vertical incision just to the left of the spine at about the level of the first lumbar vertebra, through which the bullet which lodged just beneath the skin was removed. The mark left by the single suture used to close this incision is seen crossing this at about its middle. Note also the lateral incision used to expose the kidney. You will see that this does not begin as near the median line or as high up as the usual oblique incision used to expose the kidney. This is an adequate incision for muscle-splitting exposure of the kidney.
about it. The bullet could be palpated beneath the skin just to the left of the spine at about the level of the junction of the first and second lumbar vertebrae. The course, therefore, was from before backward and slightly medialward.

The abdomen was not rigid, but there was tenderness over the wound of entrance and also over the point of lodgment. There was definite dulness in the left flank which shifted but slightly on change of position. There was almost complete obliteration of the liver dulness anteriorly. The liver, spleen, and kidneys were not palpable. Examination was otherwise negative. Blood examination showed 4,500,000 red cells and leukocyte count 10,200.

**Diagnosis.**—As the bullet had entered through the left side of the abdominal wall about a handbreadth below the costal arch and just lateral to the nipple line, and as the bullet could be felt posteriorly just to the left of the spine, at about the level of the junction of the first and second lumbar vertebrae, and as the urine contained an enormous amount of blood, it was clear that the left kidney had been perforated. From the course the bullet had taken it seemed likely that there might be perforation of the stomach, descending colon, and small intestine, but as fourteen hours had elapsed since the accident and as there was dulness in the left flank, with no evidence of peritonitis (no abdominal rigidity or pain and a leukocyte count of only 10,200), I believed the free fluid was blood rather than escaped gastric or intestinal contents.

Immediate operation was arranged for and the patient was given morphin, gr. $\frac{1}{6}$, with atropin, gr. $\frac{1}{10}$, hypodermically.

**Operation.**—In deciding whether to primarily expose the kidney through a posterior incision or first do a primary exploratory laparotomy, the following points were taken into consideration. From the progressive rapidity of the patient’s pulse, which had risen to 130 just before the operation, and from the fact that the urine contained so large an amount of blood, it seemed probable that the patient was suffering from severe hemorrhage from the kidney. The amount of blood in the abdomen, so far as one could estimate it from the amount of dulness
in the left flank, even if one believed it was entirely or largely blood, seemed insufficient to explain the rapidity of the pulse. Furthermore, as it seemed almost certain that I would have to expose the kidney, and as it seemed probable that there might be a perforation of some hollow viscus in the abdomen, I deemed it safest to expose the kidney primarily so as to avoid the risk of carrying any infection from the abdomen into the retroperitoneal space. Accordingly, arrangements were made for a kidney operation and the patient was placed in the usual position on his right side. Before exposing the kidney the bullet was removed through a separate small incision. After removing the bullet this wound was swabbed out with tincture of iodin and closed with a single silkworm-gut suture (Fig. 271).

The kidney was now exposed by a transverse, essentially muscle-splitting incision (Fig. 271). This was not begun nearly as far posteriorly or as high up as the usual kidney incision, for I planned to carry the incision forward after completing the kidney operation in order to do an exploratory laparotomy. The original incision ended anteriorly in the region of the posterior axillary line. After dividing the skin and subcutaneous tissues the muscles were separated, much as one does in a muscle-splitting appendectomy operation, in an endeavor to expose the kidney in a purely muscle-splitting manner. It was soon apparent that there was a great deal of hemorrhage about the kidney. Consequently, in order to expose the kidney as quickly as possible, the operation was not carried out further as a muscle-splitting one. On incising the perirenal tissues an enormous amount of blood escaped and severe active bleeding continued. The capsule of the kidney was stripped off by the blood. The renal pedicle was quickly exposed and a large curved clamp placed about it. This controlled the hemorrhage. The kidney was now examined to determine the extent of the injury to it and whether or not it was necessary to perform a nephrectomy. There was a large, irregular defect in the kidney at the pelvis near its lower portion posteriorly (Fig. 272) and this infringed upon the pelvis (Fig. 273). Because of the size of the defect and the extent of the damage to the pelvis nephrectomy seemed im-
operative. This defect was the wound of exit of the bullet after having traversed the lower pole of the kidney. There was a large amount of hemorrhage in the kidney tissue about this defect (Fig. 272). The wound of entrance was seen at the

anterior lateral portion of the lower pole of the kidney and was of the size of a .38-caliber bullet (Fig. 274).

Nephrectomy was now quickly performed. The ureter was doubly clamped and divided. (The value of first dividing the ureter before attacking the renal vessels in case of nephrectomy was emphasized in a recent clinic in which the technic of

Fig. 272.—Photograph of kidney removed at operation (Case II). Note that the kidney is devoid of its true capsule, i.e., that a subcapsular nephrectomy was performed. On exposing the kidney the capsule of the kidney was found stripped off and there was a large amount of blood between the cortex of the kidney and the capsule. Note the large defect in the posterior surface of the kidney near the lower pole and the extensive damage about it with hemorrhage into the adjacent renal tissue. Note that the defect extends into the pelvis. This can be better seen in Fig. 273. The kidney presented an irregular surface due to old pathologic change—a secondarily contracted kidney.
subcapsular nephrectomy was described and illustrated in detail.¹

Having done this, the renal artery and vein were doubly ligated distal to the clamp with No. 2 chromic catgut and then the kidney was cut away subcapsularly. The clamp was now re-

moved and all bleeding was seen to be controlled. After ligating the ureter a small rubber drainage-tube was inserted and the incision was closed in layers up to the drain (Fig. 270, D), using No. 2 chromic catgut for the muscles and black waxed silk for the skin.

Then the incision was carried forward and downward to just below the bullet wound of entrance (Fig. 270). On opening the peritoneal cavity a considerable amount of blood escaped. The mesentery of the descending colon was seen to contain a considerable amount of blood between its two layers. In order to gain adequate exposure, a second incision was made from near the anterior extremity of the oblique incision, upward and medially, just to the medial side of the bullet wound of entrance, carrying the incision upward parallel to the costal arch to the medial side of the rectus muscle, which was completely divided (Fig. 270). A mattress suture of chromic catgut was passed through each of the two cut ends of the rectus muscle together with its anterior and posterior sheath, so as to prevent the ends retracting within the sheath. Now the abdomen was carefully and systematically explored—first, the descending and transverse-

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**Fig. 274.**—Photograph of kidney (Case II) removed at operation, viewed from its anterior surface. Note the bullet wound of entrance at the anterolateral portion of the lower pole. The dark area surrounding it shows the extent of the hemorrhage about the wound of entrance. The .38 caliber bullet is seen lying just lateral to the lower pole of the kidney.
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colon with its mesentery, then the stomach, the liver, and finally, the entire small intestine, beginning at the ileocecal valve, and progressing upward until the ligament of Trietz was reached. No perforation of any viscus was found. After swabbing away the free blood the mesenteries were examined, but no active bleeding was found. There was a perforation through the mesentery of the descending colon, but as no active bleeding was noted, it was left untreated. The spleen was palpated, but not seen, no perforation could be made out, although there were some clots in its vicinity. The abdomen was closed without drainage, using No. 2 chromic catgut for the peritoneum and muscle layers and black waxed silk for the skin. Several interrupted tension sutures of heavy black waxed silk were inserted.

During the operation the patient was given 1000 c.c. of normal saline solution beneath the breasts.

The patient’s pulse immediately before the operation was begun was 130 and only of fair quality. After the operation the patient’s condition was very fair and his pulse had fallen to 120 and was of good quality.

Postoperative Course.—The patient’s pulse progressively improved until by midnight it had come down to 108. By the second day it came down from 100 in the morning to 84 in the afternoon. The patient made an uneventful recovery and was discharged from the hospital June 10, 1921 cured, twenty-five days after the accident.

CASE III

L. F., Michael Reese Hospital, No. 18,840, a negro, twenty-two years of age, was brought into the hospital by the police at 4 A. M. June 23, 1921. The patient was robbing a pool room; the police entered and the patient in attempting to get away jumped through a glass door. A policeman shot at the patient as he was running away, shooting him twice through the abdomen and once in the left buttock. This was at about 2 A. M.

Physical Examination.—The patient lay quietly in bed, but was slightly restless, seemed very uncomfortable, and was moaning. He was conscious and clear mentally. He was not in
shock. He had not vomited. The pulse was of good quality—60. The respirations were quiet. Temperature was 99° F. rectally.

There were two through-and-through gunshot wounds of the abdomen, both from behind forward and both through the left side of the abdomen. One entered the eleventh intercostal space

Fig. 275.—Photograph of patient (Case III) taken after all stitches had been removed and the patient was up and about. The three bullet wounds of entrance can clearly be made out. The upper one (1) perforated the twelfth rib, as can be plainly seen in the roentgenogram (Fig. 277). The middle one (2) is seen immediately adjacent to the vertebral column, about 1 inch below a line joining the iliac crests, that is, at a point corresponding to the transverse process of the fourth lumbar vertebra. The lower one (3) is seen in the left buttock.

about 5 cm. to the left of the median line (Fig. 275, 1). A corresponding wound of exit (Fig. 276, 1) was located just above the costal arch anteriorly, at a point midway between the left nipple line and the midsternal line, just lateral to a line joining the umbilicus and the left nipple. This, also, was about the size of a .38-caliber bullet.
There was a second bullet wound of entrance (Fig. 275, 2) immediately adjacent to the vertebral column, about 1 inch below a line joining the iliac crests, that is, at a point corresponding to the transverse process of the fourth lumbar vertebra. This bullet was easily palpable, lodged beneath the skin of the anterior abdominal wall, just above the level of the umbilicus and just outside the nipple line (Fig. 276, 2).

Fig. 276.—Photograph of patient (Case III) taken after all stitches had been removed and the patient was up and about. The upper wound of exit (1) is seen just above the costal arch anteriorly at a point midway between the left nipple line and the midsternal line, just lateral to a line joining the umbilicus and left nipple. The site at which the second bullet lodged beneath the skin and was removed by a small incision is seen just above the level of the umbilicus and just outside the left nipple line (2). The lower wound of exit (3) is seen at a point just above the pubis, about 3 cm. to the left of the median line. The first incision is seen just below and parallel to the left costal arch, beginning above, just below the xiphoid, and extending downward and laterally across the left rectus muscle, which was completely divided. The second incision is seen along the lateral margin of the left rectus muscle, beginning above, a short distance below the umbilicus, and ending below, a short distance above the lower wound of exit.
A third bullet wound of entrance (Fig. 275, 3), also the size of a .38-caliber bullet, was seen in the left buttock, and a corresponding wound of exit (Fig. 276, 3) of about the same size was seen low down on the abdominal wall, at a point just above the pubis about 3 cm. to the left of the median line.

Head and Neck.—Examination of the head and neck was negative except for a lacerated scalp wound in the midfrontal region, about 1 cm. below the hair line and slightly to the left of the midline—a linear cut about 3 cm. in length, evidently sustained by jumping through the glass door.

Chest.—Examination of the chest showed no abnormal findings except on the left side, where there was slight pneumothorax and a very slight hemothorax. There was no displacement of the heart to the right.

Abdomen.—Examination of the abdomen showed dulness in the right flank extending to within three fingerbreadths of the umbilicus when the patient was turned on his right side. This dulness did not shift with change of position. There was no dullness demonstrable in the left lower quadrant of the abdomen. Liver dulness was normal.

Extremities were negative except for a ragged, lacerated wound of the left thenar eminence, about 3 cm. in length, and a similar tear on the dorsum of the left hand, between the index and middle fingers. These cuts had undoubtedly been sustained when he broke through the glass door.

The patient was able to urinate. Examination showed that the urine contained much blood. It showed specific gravity 1029, reaction acid, a trace of albumin (due to blood), no sugar, no acetone. Microscopic examination showed no casts, but many red blood-cells. The blood examination showed hemoglobin 80 per cent., red blood count 4,440,000, and leukocyte count 15,000.

Diagnosis.—From the course taken by the bullet with the point of entrance in the eleventh intercostal space about 5 cm. from the median line posteriorly and the wound of exit in the eighth intercostal space anteriorly, it seemed probable that the bullet had perforated the left kidney, possibly the pancreas, the
stomach, the left lobe of the liver, the diaphragm, the pleura, and the left lower lobe of the lung. The fact that the urine passed by the patient contained blood in large amount substantiated the belief that the kidney had been perforated. The second bullet, with its point of entrance immediately adjacent to the fourth lumbar vertebra and lodged just beneath the skin of the anterior abdominal wall below the level of the umbilicus and just outside the nipple line, had probably perforated the intestines. One had to remember, also, that in case the patient had an unusually long sigmoid colon, this also might have been perforated. The third bullet with its wound of entrance in the buttock and its wound of exit low down on the abdominal wall, at a point just above the pubis and about 3 cm. to the left of the median line, might have perforated the peritoneal cavity low down, with injury to the small intestine, sigmoid or bladder, or might have passed entirely extraperitoneally, with possible extraperitoneal injury to the bladder.

Operation.—Although it was clear from the site of the bullet wound in the left eighth intercostal space that the bullet had traversed the left pleural cavity, but as there was practically no pneumothorax or hemothorax, I decided not to explore the chest, but to at once open the abdomen. As the one bullet had passed from just above the left twelfth rib at about the scapular line and had come out in the eighth intercostal space, it seemed reasonable to assume that the bullet probably had perforated the left kidney, pancreas, stomach, transverse colon, left lobe of the liver, and left diaphragm. (Urine passed just before the patient was taken to the operating room contained much blood.) Accordingly, as the pulse-rate was slow, and it seemed reasonable to believe that the kidney was not bleeding severely, I decided not to first explore the kidney, but to first explore the abdomen, and then after repairing all damage done there, inspect the left kidney pouch from in front to see whether there was much blood in the perirenal space, and depending on the amount of this, decide whether or not to expose the kidney. Accordingly, my first incision (Fig. 276) was just below and parallel to the left costal arch, dividing all muscles, including the rectus. As soon
as the rectus muscle was divided, a mattress suture of No. 2 chromic catgut was inserted into each of the two cut ends, including its anterior and posterior sheath, so as to prevent the cut ends from retracting within the sheath.

On opening the peritoneum and reflecting upward the upper margin of the wound the perforation in the diaphragm was seen and sewed up with a running silk suture, going through the entire thickness of the diaphragm. Next, the left lobe of the liver was inspected and a tear about 3 cm. long at its left border was seen, and although it was not bleeding, it was closed with two interrupted heavy plain catgut stitches, using a large fully curved non-cutting needle. This apposed the gaping edges of the wound. Next, the anterior wall of the stomach was examined and a .38-caliber perforation found at about its middle, rather nearer the lesser than the greater curvature. This was at once closed for some stomach contents was escaping. The closure was made by means of interrupted through-and-through black waxed silk sutures, and then a row of continuous Lembert stitches of the same material to bury the first row. Both were placed at right angles to the long axis of the stomach to prevent narrowing. Next an opening was made in the gastrocolic omentum to permit examination of the posterior wall of the stomach, and there a similar perforation was seen in the stomach immediately behind the perforation through the anterior walls. It was repaired in the same manner. Next the pancreas was examined and a perforation seen. A small rubber drainage-tube was inserted into the lesser peritoneal cavity to drain any pancreatic secretion and any soiling from the gastric perforation. Then the opening in the gastrocolic omentum was sutured on each side up to the drainage-tube, using plain catgut sutures. Next the transverse colon was examined and a perforation found in it slightly to the left of the midline and located near the mesentery. The perforation was closed by four through-and-through black waxed silk sutures placed at right angles to its long axis, and then buried by a purse-string suture of the same material. Next the duodenojejunal angle was located, and then the entire small intestine was examined systematically from its beginning to the
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Recent gunshot wounds of the kidney... No perforations were found. The appendix was seen and appeared normal.

The abdominal incision was now closed in layers, using No. 2 chromic catgut for the peritoneum and posterior rectus sheath together. Then the two mattress sutures of the same material, which had been inserted into each of the two cut ends of the rectus muscle to prevent the ends from retracting within its sheath, were tied together, bringing the two cut edges in apposition. The muscles and anterior rectus sheath were now closed by a second chromic catgut suture. Several tension sutures of No. 12 black waxed silk were inserted and the skin closed with black waxed silk up to the drain.

The wound of exit (Fig. 276, 3) just below the left ramus of the pubis was explored with the right index-finger, and the track did not seem to enter the peritoneal cavity, but to make certain an incision was made along the outer margin of the left rectus (Fig. 276). There was a considerable amount of free blood in the left iliac fossa. The lower portion of the large intestine, including the sigmoid, was examined for a possible perforation, but none was found. The possibility of an intraperitoneal perforation of the bladder was considered, but the examination was negative. As the entire small intestine had been examined through the upper incision, it was not necessary to repeat the examination of the small intestine. The free blood was now swabbed away and the incision closed in layers without drainage.

There was some active bleeding externally from the bullet wound of exit. In order to drain any possible extraperitoneal perforation of the bladder a rubber drainage-tube was inserted and a piece of iodoform gauze was inserted beside the rubber drainage-tube to control the hemorrhage.

The bullet palpated beneath the skin of the abdominal wall on the left side was removed by a small incision. It was a .38-caliber lead bullet. The wound was swabbed with tincture of iodin and closed with a silk suture. The bullet wounds in the back were swabbed with tincture of iodin and dry dressings applied.

The scalp wound was cleaned and sutured, as were also the two lacerated wounds of the left hand.
While still on the table the patient was given 1500 units of antitetanic serum.

He left the operating room in fair condition.

Postoperative Course.—When returned to bed his pulse was 96 and his condition was fairly good. When I saw him at 6 o'clock that evening his pulse was 110 and of good quality. He had only vomited once since the operation and that was immediately after his return from the operating room. Temperature was 102° F. rectally. The second day after operation, June 25th, the upper drainage-tube was shortened about 5 inches and all tension sutures were removed. The lower drainage-tube and the iodoform gauze packing were entirely removed. His temperature gradually rose until on June 26th it reached 104° F. rectally, with pulse 128, and respirations 22. Examination at this time showed no findings of interest, except that there was a foul odor from the upper wound. Two stitches were removed and a new rubber drainage-tube introduced. A considerable amount of very foul discharge escaped. The wound continued to discharge a large amount of this foul material the following day. Accordingly, the wound was irrigated with Dakin's solution every two hours. Blood examination on the 28th showed a leukocyte count of 14,200. On June 29th all stitches were removed from both incisions. Following this the patient's condition progressively improved, though he still continued to run a septic temperature, reaching as high as 102.4° F. in the evening of June 30th. On July 1st the upper wound was opened for its entire length.

In order to determine whether the patient's continued temperature might not be due to a perinephritic abscess, in addition to the infection of the upper wound, an attempt was made to pass a probe into the upper posterior bullet wound, but this was unsuccessful. For this reason aspiration was next performed under local anesthesia. A long needle was inserted deeply into the perinephritic area, but repeated aspirations failed to reveal the presence of any pus. In order to rule out the possibility of a subphrenic abscess the needle was then inserted between the eighth and ninth ribs in the left anterior axillary line, but no
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Fig. 277.—Roentgenogram (Case III) taken July 1st. This shows a definite rounded defect in the left twelfth rib caused by the passage through it of the upper bullet, marked (1) in Fig. 275. A small splinter of the lower surface of the rib is seen to be torn away at this site and a fragment of the bullet is seen attached to this loose fragment. Several very small but very dense shadows immediately about the defect in the twelfth rib show where very small fragments of the bullet remained adherent to the rib during its passage through it. There is an area of increased density more or less oval in contour in relation to the twelfth rib, with its center at the site where the bullet had perforated the rib.

pus was encountered. In order to corroborate these negative findings the patient was brought down to the x-ray department. Fluoroscopic examination showed no evidence of subphrenic abscess. Roentgenograms were taken. The plates showed
dense elongated shadows, one in the region of the pelvis of the right kidney, and the second superimposed upon the right transverse process of the fourth lumbar vertebra, extending downward to the superior surface of the fifth lumbar vertebra. There was a definite rounded defect in the left twelfth rib caused by the passage through it of the upper bullet (Fig. 277). A small splinter of the lower surface of the rib was torn away at this site and a fragment of the bullet was attached to this loose fragment. Several very small but very dense shadows immediately about the defect in the twelfth rib showed where very small fragments of the bullet remained adherent to the rib during its passage through it. There was an area of increased density more or less oval in contour in relation to the twelfth rib, with its center at the site where the bullet had perforated the rib.

By the following morning, July 2d, the temperature had dropped to 101.2° F. and the patient seemed very comfortable. On August 2d there was tenderness over the left loin quite severe on rather gentle pressure. The leukocyte count was 15,640. In view of the increased leukocyte count a perinephritic abscess was considered. On August 4th I had Dr. Koll cystoscope the bladder and catheterize the ureters. The bladder was found to be normal in every respect. The urine obtained from each kidney was entirely normal. From this time on the patient continued to improve and was discharged on August 12th cured, fifty days after the accident.

CASE IV

M. F., a laborer, nineteen years of age, Cook County Hospital, No. 793,293, was brought into my service at 11.55 p. m. March 30, 1922 by the police. According to the police report he was shot in a hold-up in which he was the victim. This occurred at 11.20 p. m.

On admission the patient was conscious and answered questions intelligently. He said he had been held up and the man shot him without any apparent cause. He did not remember anything else that happened until he came to himself about one block from the site of the shooting and was lying on the sidewalk.
Examination on admission showed that the patient was in moderate shock, his skin was rather cold, extremities cold, and mucous membranes pale. Pulse was 70 and of fairly good volume. Respirations were shallow, regular, and slow.

The examination of the head, neck, and chest showed no findings of interest, except that he was bleeding from his nose, which had been injured.

The essential pathology was limited to the abdomen. There was a bullet wound of entrance (Fig. 278) the size of a .38-caliber bullet located about 1 cm. to the left of the midline at the level of the tip of the xiphoid cartilage. There was a similar bullet wound of exit located about two fingerbreadths below the right twelfth rib and at a point about 3 inches to the right of the spine (Fig. 279). The abdomen showed no tenderness or rigidity. There were no palpable masses. Percussion note showed some abnormal tympany, but no abnormal area of dulness. The patient was not nauseated and did not vomit. A specimen of urine passed contained a large amount of blood, but no clots. Examination of the urine showed color red, specific gravity 1030, reaction acid, albumin ++++, no sugar, red blood-corpuscles ++. A diagnosis of gunshot perforation of the liver and kidney was made. He was put to bed and external heat applied; 1500 units of antitetanic serum were administered. My intern asked another surgeon to see the case in consultation with him. This surgeon believed that on account of the fact that the patient did not vomit and there was no tenderness in the abdomen that no hollow viscera had been perforated, and as the patient did not present the picture of internal hemorrhage he advised merely treatment for the shock and no operative interference.

When I saw the patient the next morning his temperature was 99.4° F., pulse 100, respiration 24. Auscultatory percussion showed the outline of the stomach as indicated in the photograph (Fig. 278, S). Liver dulness was as seen on the same photograph (Fig. 278, L. His abdomen was soft and there was no evidence of peritonitis or internal hemorrhage. For this reason operation was certainly not indicated at this time.
That morning he vomited for the first time. The vomitus contained undigested food and a few small blood-clots. This blood was believed to be blood swallowed due to the hemorrhage from the injury to the nose. That afternoon the temperature was 99.6° F., pulse 86, and respiration 22. He vomited twice
that afternoon. The vomitus was dark green fluid and one specimen contained a few small blood-clots. The following day the temperature was normal. He vomited twice a fair amount of greenish fluid, once in the morning and once in the afternoon, and did not vomit after this. The next day, April 1st,

Fig. 279.—Photograph of patient (Case IV) taken two days before his discharge from the hospital. Note the bullet wound of exit (B) located about two fingerbreadths below the right twelfth rib and at a point about 3 inches to the right of the spine.

the temperature remained between 99° and 100° F. the entire day and the pulse varied between 80 and 90. On April 2d, 3d, 4th, 5th, and 6th the temperature remained slightly above normal, but never over 100° F. On April 7th the noon temperature was 101.2° F., pulse was 100, and respiration 22. The patient did not complain of any pain and seemed comfortable. Because
of this rise in temperature the possibility of subphrenic abscess was considered. Blood examination and roentgenologic examination were ordered. The blood-picture showed hemoglobin 80 per cent., leukocytes 12,200. Differential count showed small mononuclear lymphocytes 15 per cent., large mononuclear lymphocytes 6 per cent., polymorphonuclear neutrophils 78 per cent., eosinophils 1 per cent. The roentgenologic examination showed that the left diaphragm was almost as high as the right. The right half of the diaphragm moved more freely than the left although the latter was not immobile. No subphrenic pathology could be determined. No pathology could be made out in the chest.

The next day the patient’s temperature fell and the highest reading was 99.4° F. A leukocyte count showed that this also had fallen, and was only 8500. The temperature reached normal by April 15th and remained normal. The patient was discharged cured on April 17th, eighteen days after the accident.

Had I seen the patient at the time he was admitted to the hospital I believe I should have made an exploratory incision to determine whether or not the stomach was injured, irrespective of the fact that the patient had not vomited. While the course pursued showed that the judgment of the surgeon who saw him in consultation with the intern was good in this case, in general I believe that every gunshot wound of the abdomen seen soon after the injury should have the benefit of an exploratory incision for diagnosis. This will be discussed later.

**DISCUSSION**

These 4 cases bring out many of the clinical problems presented by recent gunshot wounds of the kidney. In determining the course of treatment to be pursued in any particular case it is essential to be familiar with the surgical pathology and the symptoms as well as the objective findings.

**Pathologic Anatomy.**—Gunshot wounds of the kidney occur in two forms—those in which the peritoneal cavity with its contents has also been injured (*intrapерitoneal gunshot wounds of the kidney*) and those in which the injury is entirely extraperi-
Recent Gunshot Wounds of the Kidney

Recent gunshot wounds of the kidney (extraperitoneal gunshot wounds of the kidney). The latter are far less common. As a rule, either the abdomen or the abdomen and chest is perforated. In Laewen's¹ report of 42 gunshot wounds of the kidney in the recent war there were 37 cases in which the abdomen was penetrated and only 5 extraperitoneal cases. On the other hand, he found that in 149 gunshot wounds of the abdomen there were only 28 cases in which a simultaneous injury to the kidney was found, that is, in only 18.8 per cent. British statistics show that in 2121 gunshot wounds of the abdomen, the kidney was wounded in only 155, or only 7.3 per cent. (See Table of British Statistics on p. 675 under Prognosis.)

Rouvillois,² in his 232 cases of gunshot wounds of the abdominal viscera, found 15 extraperitoneal visceral wounds, of which 8 involved the kidney; 48 wounds involving both the thorax and the abdomen, of which 4 involved the kidney, and 169 intraperitoneal wounds, of which 6 involved the kidney.

The clinical picture presented by a case of gunshot wound of the kidney varies greatly depending upon the associated injuries present. The nature of the associated injuries depends upon the course taken by the bullet. The bullet may pass through the kidney and the entire abdomen, and any of the intra-abdominal organs may be injured. On the other hand, the bullet may pass through the chest, diaphragm, and abdomen and the essential associated injury may be intrathoracic.

A. Intraperitoneal Gunshot Wounds of the Kidney.—In a general way intraperitoneal gunshot wounds of the kidney may be classified into four groups, as suggested by Laewen:

1. Intraperitoneal Injury of a Kidney with Hemorrhage in the Abdominal Cavity, but Without Injury of Any of the Intra-abdominal Organs.—These are very rare. Case II is an example of this type. Laewen had but a single case of this type in his 42 cases. His case is almost identical with mine. An infantry bullet had perforated the right kidney from behind. Laparotomy

showed much blood in the peritoneal cavity, and the bullet was found below the liver. Transperitoneal extirpation of the severely damaged kidney was performed and the patient recovered. Faisst\(^1\) also reports a single case. The bullet entered the abdomen beneath the left costal arch and passed through the entire peritoneal cavity without injurying any of the intestines, passing out in the neighborhood of the splenic flexure and lodging in the left kidney. Thelen\(^2\) reports a case where a bullet entered beneath the right costal arch, penetrated the entire peritoneal cavity without any injury to the intestine, and, passing out of the peritoneal cavity, injured the right kidney. Burckhardt and Landois\(^3\) also report a single case. A fragment of hand-grenade perforated the left kidney from behind and remained embedded close to the spleen. An abscess the size of the fist developed between the spleen, splenic flexure, stomach, and kidney, resulting in a fatal peritonitis.

The blood found in the abdomen in these cases comes in part from the damaged kidney and enters the peritoneal cavity through the small perforation in the posterior parietal peritoneum caused by the bullet in its passage. In my Case II the blood found in the peritoneal cavity probably came in part from a retroperitoneal hematoma, but also in part from the perforation of the mesentery of the descending colon.

2. **Right Intraperitoneal Gunshot Wounds of the Kidney with Injury to the Liver.**—These occur most commonly in gunshot wounds of the right upper quadrant of the abdomen. The hepatic flexure of the colon or the adjacent ascending colon or transverse colon are often simultaneously injured. In other cases the bullet penetrates the right lower portion of the chest wall, also the pleura and lung and, perforating the diaphragm, passes through the liver and kidney. These cases of simulta-

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neous injury of the right kidney and the liver are common, as my Case IV. While the above-mentioned combinations are the most frequent, almost any combination of associated injury to intraperitoneal organs may occur.

3. Intraperitoneal Gunshot Wounds of the Kidney with Damage to the Spleen.—These occur most commonly in gunshot wounds of the left upper quadrant of the abdomen. The splenic flexure or the adjacent portion of the transverse colon or the descending colon may be injured, also the diaphragm, pleura, lung, and chest wall.

4. Intraperitoneal Gunshot Wounds of the Kidney with Perforation of the Stomach or Small Intestine.—Here also there may be perforation of the diaphragm, pleura, lung, and chest wall, as in Cases I and III. The pancreas and left lobe of the liver may be injured in these cases, as in Case I.

B. Extraperitoneal gunshot wounds of the kidney comprise those cases in which the peritoneal cavity has not been entered. These may occur when the bullet passes tangentially through the lumbar region. They may also occur in tangential perforations through the thorax and then are associated with local pneumothorax.

In general, extraperitoneal gunshot wounds of the kidney are not so serious as the intraperitoneal type. However, the aorta and inferior vena cava may be perforated in this type of case. Also there may be injury to the spinal column and cord. In extremely rare cases both kidneys may be simultaneously perforated. Finally, the damage to the kidney may be entirely an indirect injury to the kidney in the form of a concussion or even rupture. The former has been seen in tangential wounds through the lumbar region, and the latter in case of tangential gunshot wounds through the thorax. In these cases of indirect injury to the kidney it is believed that the ribs immediately behind the kidney transmit the blow to the kidney which is broken in the form of deep tears. Burkhartd and Landois report a case in which a horizontal gunshot wound at the level of the first lumbar vertebra had splintered the eleventh and twelfth ribs near their vertebral attachment, and completely
destroyed the kidney. They explained the kidney damage in this manner:

On account of the small size of the kidney it is rare to find the bullet retained in the kidney.

The damage to the kidney may be no more than a tract the size of the caliber of the bullet, though this is rare. Ordinarily there is considerable destruction of the parenchyma, as the result of hydrodynamic action. This is particularly true in the case of high-powered rifle wounds. When the injury is near one pole the entire pole may be more or less torn away. There is usually hemorrhage into the parenchyma beyond the area that is damaged. This is well shown in the kidney removed from Case II (Figs. 272, 274). The kidney may even be divided into two halves. In all cases in which there is much destruction of the kidney proper, due to the direct action of the bullet, there is always considerable tearing of the fibrous and fatty capsule. It is not uncommon that in cases in which the damage to the kidney parenchyma is not very extensive the entire fibrous fatty capsule may be torn away so that the entire kidney hangs on its pedicle completely decapsulated, as in Case II. In the case of rifle bullet wounds this is due to the bursting action caused by the bullet. In Case II I believe the capsule was stripped by hemorrhage.

When the kidney parenchyma has been damaged the bleeding is usually considerable and may in certain cases lead to death very rapidly. In rare cases, even when the damage to the kidney is severe, the bleeding may be slight. The blood ordinarily flows down into the pelvis and the urine passed by the patient or that obtained by catheterization soon after the injury almost always contains blood. Not uncommonly the amount of blood present in the urine is so great that the urine has the appearance of being almost pure blood, as in Case II. The absence of blood in the urine is extremely rare. The blood that escapes about the kidney is found in the perirenal space, where it may form a localized hematoma, but more often it spreads out in the retroperitoneal tissues and may extend medially as far as the vertebral column and downward along the
iliopsoas muscle or even between its muscle-fibers. It may also spread forward between the two layers of peritoneum, forming the mesentery of the transverse colon, descending colon, and of the sigmoid flexure, until the bowel is reached. On exploratory laparotomy one may, therefore, see this blood as a blue-black hematoma in the transverse and descending mesocolon and just behind the posterior parietal peritoneum. This was noted in Case II, but in this case it was not possible to be certain whether the blood seen between the two layers of the mesentery of the descending colon was due to extension forward of the blood from the retroperitoneal hematoma or was due to bleeding from the site at which the mesentery was perforated, because at this time there was no active bleeding from the perforation in the mesentery. As was mentioned before, the blood may extend forward through the bullet hole in the posterior parietal peritoneum and enter the peritoneal cavity. When the bullet has perforated the diaphragm the blood from the kidney may similarly extend into the pleural cavity. In cases in which the gunshot wound of the soft tissues is large the blood may escape externally, and this at once. It is rare that the gunshot wound of the kidney is limited to the pelvis. It is not quite so rare to find the injury limited to the renal artery and vein. Enderlen and Sauerbruch\textsuperscript{1} report a case of injury to the right renal vein in which the patient was saved by an immediate nephrectomy.

\textbf{Symptoms and Diagnosis.---Shock.---}If a patient is seen soon after receiving a gunshot wound of the kidney, be it an extra-peritoneal or an intraperitoneal injury with perforation of any combination of the viscera, shock is often, though by no means always, present. In the first 3 cases here presented shock was absent, while in the fourth case moderate shock was present. When the patient does present symptoms of shock it is often extremely difficult to determine the cause. In most cases it is probably the result of severe hemorrhage. Contributing factors may include the irritation of the peritoneum by escaped blood or escaped gastric or intestinal contents.

Vomiting, nausea, and hiccup are inconstant symptoms, and their evaluation in the matter of diagnosis is difficult. Their absence during the first five hours following an injury does not at all rule out the presence of perforation of the liver, stomach, intestines, or any other viscer.a. However, statistics seem to show that in gunshot wounds through the intestine approximately two-thirds of the cases vomit within the first five hours. When it does occur during this time it usually occurs but once, rarely repeated. If the early vomitus contains blood it is very suggestive of a perforation of the stomach or the intestines. In some patients the vomiting may be repeated or there may be long-continued nausea. If this is present, it is suggestive of a severe intra-abdominal injury. Vomiting may be present in the absence of any injury to the intestine, and cases have been reported in which in addition to the vomiting the abdomen showed marked rigidity, and at operation the only findings were hemorrhage from the liver, mesentery, etc., without any injury to the intestine. This is probably explained by stimulation of the vagus endings caused by the escaped blood. Even in the presence of severe injury to the intestinal tract vomiting may be entirely absent, as in Cases I and III. These cases, however, are the exception. In gunshot wounds through the retroperitoneal tissue without any intra-abdominal injury vomiting may be present. If vomiting has been absent during the first few hours following the injury, but appears later and in increasing frequency, it is very suggestive of injury to the gastro-intestinal tract. In case the liver has been perforated without any associated injury to the intestine, vomiting occurs less often than when the intestine has been perforated. It has been observed that when vomiting occurred during the first five hours and operation was performed during this period, the mortality was slightly higher than in the patients in whom no vomiting occurred.

Abdominal Rigidity and Tenderness on Pressure.—Generalized abdominal rigidity is the most frequent and most important early symptom of gunshot wound of the abdomen. It usually is associated with tenderness on pressure of the abdominal wall. However, as is well known, this abdominal
rigidity may occur in gunshot wounds through the thorax which do not perforate the abdomen. In these cases the rigidity is due to irritation of the intercostal nerves or to the presence of blood, irritating the diaphragm. It may also occur in extraperitoneal gunshot wounds of the kidney due to irritation of the intercostal nerves outside the peritoneal cavity or due to a collection of blood in the retroperitoneal tissues. While it is true that extreme rigidity of the abdominal wall combined with tenderness on pressure is suggestive of severe intra-abdominal injury, especially when associated with the other symptoms of peritoneal irritation, it must be remembered that this rigidity may be present due to intra-abdominal hemorrhage alone without any injury to the intestine. It is not at all unusual to find cases in which the intestine has been perforated without any rigidity of the abdomen being present. The tenderness on pressure may be diffuse over the entire abdomen far removed from the tract of the missile. In other cases the rigidity is localized. In these cases it usually corresponds to the location of the intestinal injury. One must remember that rigidity of the abdominal wall may be present in gunshot wounds limited to the abdominal wall, and may even be very marked in these cases and may last for two days or more. Similarly, in gunshot wounds through the chest without any intra-abdominal injury the rigidity has been seen to last for as long as four days. In all tangential gunshot wounds along the lower costal margin the rigidity of the abdomen on the corresponding side is particularly well marked and may last two days or more. It is apt to be associated with severe long-continued pain in the corresponding lower half of the abdomen. In the case of retained projectile in the retroperitoneal tissue it is the rule to find a marked abdominal rigidity. This is often associated with tenderness on pressure in the corresponding area. It is clear, therefore, that marked abdominal rigidity does not at all indicate that the intestines have been perforated. When the abdominal rigidity is caused by the presence of blood in the peritoneal cavity without any injury to the intestinal tract, or when it is due to blood in the retroperitoneal space or to intrathoracic
hemorrhage with blood above the diaphragm, the generalized abdominal rigidity is ordinarily not so marked as in case it is due to perforation of the gastro-intestinal tract. In the latter case the tenderness on pressure is similarly apt to be more marked. In case of hemorrhage the tenderness on pressure of the anterior abdominal wall is apt to be unilateral and limited to the side of injury. In intraperitoneal gunshot wounds of the kidney abdominal respiration is likely to be absent and respiration is entirely costal. Abdominal rigidity with generalized tenderness on pressure is present in more than half of the cases of gunshot wounds of the intestine and in cases of hemorrhage into the peritoneal cavity, such as occurs in gunshot wounds of the liver and spleen.

**Pulse.**—The pulse may remain essentially normal both as to rate and volume, no matter what viscus has been perforated. In case the patient is in shock he may be pulseless or the pulse may be fluttering, but this is the exception. In about one-third of the cases with associated gastro-intestinal perforation the pulse remains approximately normal, though frequently the tension may be somewhat lower than normal. In about two-thirds of these cases even a few hours after the injury the pulse is small and more rapid than normal, and may show irregularity both as to rate and volume. In case of gunshot wounds of the liver without marked hemorrhage into the abdominal cavity the pulse is usually practically normal, as in Case IV, at times even somewhat slowed. This was noted in Case I. Finsterer\(^1\) first called attention to the occurrence of bradycardia (slow pulse) in injuries of the liver, and considers that this is typical of rupture of the liver. His attention was first attracted to *bradycardia* in liver injuries in a case of gunshot wound of the liver. While it is true that bradycardia is frequently seen in case the hemorrhage from the liver is slight or even moderate, whenever the hemorrhage is severe, tachycardia eventually develops. For this reason a slow or normal pulse does not rule out hemorrhage from the liver, and should

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not delay one from an exploratory operation. If one waits until the pulse becomes rapid he will often lose the best chance for the patient in the cases of hemorrhage from the liver. In case the spleen is perforated the pulse-rate may remain approximately normal if the bleeding is only slight, but when the hemorrhage is more marked the pulse-rate is always increased. One must be guarded, therefore, by other signs of hemorrhage, as the patient's general appearance, pallor of the lips, etc. In case the pulse in the first hours after the injury rises above 120, the prognosis is correspondingly more grave.

_Shifting Dulness in the Flanks._—The presence of dulness in the flanks, which may or may not show shifting on change of position, is a very uncertain symptom, for its demonstration on physical examination is possible only when the free fluid is of rather large amount. In these cases one cannot be certain whether the fluid is blood or escaped gastric or intestinal contents, but in either event the indication for immediate exploratory operation is the same. One must not forget that in case of slow bleeding from the liver the blood may coagulate soon after it has escaped from the liver, and in these cases the dulness may not be present in the flanks, but as an area of abnormal dulness near the liver. In other cases of slow bleeding from the liver the blood may remain diffused between the intestinal loops, and may be in large amount without being demonstrable at all by physical examination. Finally, one must be careful not to mistake the shifting dulness in the flanks, which not rarely is due to fluid in the large bowel, for free fluid in the abdominal cavity.

_Obliteration of the Liver Dulness._—In case the stomach or intestines are perforated the escaped air may cause obliteration of the liver dulness, but one cannot rely upon this finding in arriving at a diagnosis of perforation of the gastro-intestinal tract. It cannot be demonstrated in more than about one-third of these cases. When it is present the finding is striking and is of great value. Its absence does not in the least speak against the presence of a perforation of the stomach or the intestines, as in Cases I and III. In case one suspects such a per-
foration, and this finding is not demonstrable, fluoroscopic examination or roentgenograms with the patient in an upright position may show definitely the presence of free air in the peritoneal cavity in the form of a small, light zone between the upper border of the liver shadow and the diaphragm.

Other signs of intraperitoneal damage are of much less importance. Elevation of the testicle due to a reflex cramp of the cremasteric muscle is occasionally seen. It has been recorded in perforation of the stomach, large and small intestine, liver and gall-bladder, and urinary bladder. Rare cases are reported of bilateral elevation of the testicle where one of these organs and one kidney were perforated. It may occur in extraperitoneal gunshot wounds of the kidney where there is no intra-abdominal injury.

In rare cases bile or gastric or intestinal contents may escape through either the wound of entrance or exit.

Where the bullet has passed through the liver the pain may be referred to one or both shoulders, more usually the right. This is, however, a rare finding.

Irrespective of what other symptoms are present in a patient who has sustained a gunshot injury in the region of the kidney, the presence of a hematoma in the loin or of blood in the urine makes the diagnosis of a gunshot injury to the kidney highly probable.

All patients who have sustained a gunshot wound through the abdomen should be catheterized at once unless they can urinate, and the urine obtained should be examined for blood. Retention of urine is common when the kidney has been injured. The presence of blood in the urine is the most important evidence that the kidney has been injured. In case the urine does not contain blood, but the course of the bullet makes one suspect that the kidney has been injured, cystoscopic examination and ureteral catheterization should be carried out.

In the absence of hematuria the diagnosis should always be considered in cases which present a hematoma in the loin.

Prognosis.—The prognosis of gunshot wounds of the kidney depends upon the severity of the damage done to the kidney,
and in the average case even more upon the gravity of the associated injuries.

When the injury done to the kidney is slight, and no serious associated injury is present, the outlook is good. Small perforations of the kidney heal spontaneously, as in Cases I, III, and IV.

**Table Showing Incidence and Operative Mortality of Renal Wounds Operated Upon at the Front (Exclusive of Thoracic Wounds)**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Total number of abdominal wounds operated</th>
<th>Total mortality</th>
<th>Total kidney wounds</th>
<th>Total kidney mortality</th>
<th>Per cent.</th>
<th>Uncomplicated kidney wounds</th>
<th>Mortality</th>
<th>Per cent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colonel Cuthbert Wallace²</td>
<td>965</td>
<td>53.9</td>
<td>73</td>
<td>7.5</td>
<td>22</td>
<td>30.1</td>
<td>34</td>
<td>6</td>
</tr>
<tr>
<td>Captain A. L. Lockwood³</td>
<td>356</td>
<td>52.0</td>
<td>33</td>
<td>9.3</td>
<td>15</td>
<td>45.5</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Captain J. Frazer⁴</td>
<td>300</td>
<td>51.0</td>
<td>20</td>
<td>4.0</td>
<td>8</td>
<td>40.0</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Captain C. F. Walters⁵</td>
<td>500</td>
<td>51.0</td>
<td>20</td>
<td>4.0</td>
<td>8</td>
<td>40.0</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2121</td>
<td>52 (?)</td>
<td>155</td>
<td>7.3</td>
<td>57</td>
<td>36.8</td>
<td>69</td>
<td>14</td>
</tr>
</tbody>
</table>


Laewen, in a collective review of the German statistics in the recent war, together with a report of his own series, states: “The prognosis of gunshot wounds of the kidney is good in light cases, extraperitoneal and intraperitoneal, without injury to the intestine, very doubtful where the organs have been torn, practically hopeless in gunshot wounds through the intestine and kidney.” He points out that in his own series of 34 gunshot wounds through the abdomen and kidney, only 3 were cured; that Most¹ reported 7 intraperitoneal gunshot wounds of the

¹ Most: Zur Prognose und Behandlung de Bauchscüsse im Kriege, 1916, Br. 100, Vieter kriegschirurgischer Band, Heft 16.
kidney with associated liver or intestinal injury, and that all of these 7 died; and that Burkhardt and Landois reported 16 intraperitoneal gunshot wounds of the kidney, only 2 of which they saved. All their cases in which the intestine was injured died. This makes a total of 57 cases, with only 5 cures, or a mortality of 87.7 per cent. And only 2 of these cases saved out of the 57 had injury to the intestine.

In marked contrast to this extremely high mortality the table of British statistics (page 675) is of interest.

In civil practice the mortality should be even still lower, for the general condition of the wounded soldier is quite different from that of a normally healthy individual who has not undergone the exposure and hardships of war.

Treatment.—In a general way one may state that where the indications are that the injury done to the kidney is probably slight, as far as the kidney injury is concerned one should proceed in a conservative manner.

The injury to the kidney is characterized chiefly by hematuria and internal hemorrhage. Even if the urine passed or obtained by catheterization appears to be almost pure blood, this does not of itself indicate operative interference. It is only when the hematuria persists in spite of rest that operation is essential. In general, it is not the amount of the hematuria that demands operation, but its persistence; that is, usually after several days. Immediate intervention is indicated only in case of severe internal hemorrhage. In these cases if the hemorrhage is from the kidney nephrectomy is usually indicated, as in Case II.

If the course of the bullet indicates that the abdomen has been perforated I believe an exploratory laparotomy to determine the nature and extent of the intra-abdominal injury is indicated as soon as the general condition of the patient will permit. If the patient is in shock, the usual treatment for shock should be carried out before any operative interference is undertaken, unless there is reason to believe that the shock is due to hemorrhage. Except for this, immediate exploration of the abdomen is indicated.

In cases in which the chest as well as the abdomen has been
perforated, if the chest findings and symptoms lead one to believe that grave injury to the lung is present, as marked signs of hemothorax and pneumothorax, with marked dyspnea and cyanosis, very rapid pulse, and marked displacement of the heart, it may be necessary to perform an open operation on the chest to repair the lung and check the bleeding. In such cases transthoracic laparotomy is of great value. The transthoracic approach affords especial advantage for exploration and treatment of the damage done within the chest and for suturing the diaphragm, which should always be done. It permits also the treatment of the intra-abdominal organs, especially well those just beneath the diaphragm, whether there is a diaphragmatic hernia or not, and is of especial value in high perforations of the liver if these require local care. A separate laparotomy may sometimes be needed in addition, though rarely, for the opening of the thorax and abdomen by a single incision permits adequate treatment of both intrathoracic and intra-abdominal lesions.

In case the symptoms and objective findings indicate that only slight damage has been done to the chest, that is, when respiration is not much affected, and there is no special cyanosis or dyspnea, and when the signs of hemothorax and pneumothorax are only slight or moderate, it is best not to interfere in the thorax. The usual aspiration of the hemothorax can be done later according to generally accepted principles. The chest condition should be left undisturbed during the primary operation, as in Cases I and III. The later care of the intrathoracic pathology presents nothing of special interest. The usual indications are followed.

On general principles, all recent wounds of the abdomen should be operated upon except when the lesion is without doubt limited to the liver and there is no symptom of serious hemorrhage. In this connection I wish to again call attention to the fact that a slow pulse of itself does not rule out serious hemorrhage from the liver, especially early. This was discussed in considering the pathology and so will not be further explained. The operation should be performed as early as possible except when the patient is suffering from shock, as was mentioned
previously. When there is doubt as to the relative seriousness of the shock, and that of the hemorrhage, it is better to operate, particularly as it is possible that the hemorrhage is the chief cause of the shock. The intra-abdominal injuries require the customary surgical care.

When the course of the bullet has been through the abdomen and the kidney, the question often arises whether it is better to open the abdomen first, or to expose the kidney first, if the kidney will probably need to be exposed.

If the patient is suffering from severe internal hemorrhage, and if, as in Case II, the findings lead one to believe that the bleeding is chiefly from the kidney, the kidney should be exposed first. If the bullet has traversed the abdomen as well as the kidney, it is probable that the intestinal tract has been perforated, and it is better to avoid the danger of carrying infection into the retroperitoneal space by first exposing and treating the kidney before opening the abdomen.

In any case of doubt as to whether to expose the kidney first or the abdomen first, always expose the kidney first.

When it is probable that one will not have to attack the kidney at all, one may do an exploratory laparotomy first, and after caring for the damage done within the abdomen, one may inspect the posterior parietal peritoneum about the kidney, and be guided by his findings.

As far as transperitoneal approach to the kidney is concerned, experience, and especially that learned during the war, has shown that the transperitoneal route can only be recommended in cases in which at laparotomy one has made certain that the gastro-intestinal tract has not been perforated. The danger of infecting the retroperitoneal tissues is too great. In such cases the lumbar exposure is the method of choice. If after exposing and treating the kidney it is desired to inspect the abdomen, this can be done as in Case II by continuing the incision forward. If, as in Case II, a large incision in the abdomen is needed, the forward portion of the incision can be carried upward or downward as indicated. In any case, no matter by which route the kidney has been exposed, it is essential, part-
particularly if the kidney has not been removed, to drain from behind.

The technic of the nephrectomy, if indicated, is the usual. However, in case the fibrous and fatty capsule have been stripped entirely away, as in Case II, subcapsular nephrectomy is performed as described in considering Case II.

Slight hemorrhage from the kidney may be treated by tamponade. Küttner\(^1\) recommends that in case one pole is shattered and is bleeding, the pole be freely exposed and ligated as a whole, using a very heavy ligature placed proximalward from the pole. Nephrectomy is, however, usually preferable.

Late operations or secondary operations are usually indicated because of secondary hemorrhage, infection, urinary infiltration, and urinary fistulae that show no tendency to spontaneous closure.

In case secondary operation is necessary, great care must be given to not injure the peritoneum, which is almost always firmly attached by numerous inflammatory adhesions and is easily torn into, with great danger of secondary peritonitis. In these cases the peritoneum is often drawn backward toward the kidney.

As none of the cases here presented required secondary operation, these late operations will not be discussed.

In closing, it may be of interest to recall the information prepared in the office of the Surgeon-General and published by the United States Army Medical Department in Review of War Surgery and Medicine, September, 1918, Vol. I, No. 7, pp. 47-49. The following treatment was advised:

1. Inspect urine for blood (catheterize if necessary).
2. Treat shock in the usual manner—by warmth and transfusion.
3. If in doubt whether or not to operate, the most prudent decision is usually the wisest.
4. If in doubt whether to open the belly or loin first, open the loin.

5. The loin incision should be transverse and should extend approximately to the edge of the rectus. It may be enlarged by a vertical transrectus incision or by vertical incision along the outer border of the erector spinae muscle long enough to permit division of all muscular and ligamentous attachments to the last rib. The twelfth dorsal nerve and artery may be avoided by placing the transverse incision a fingerbreadth below the rib. Thus also one avoids the danger of inadvertently entering the pleura through mistaking the eleventh for the twelfth rib.

6. If there is a wound of the loin and hematuria, or if the wound plainly leads to the kidney, enlarge it transversely, deliver the kidney, and examine the hilum for lesions of the renal vessels.

(a) If the main artery or vein, or the upper main branch of the artery, is wounded, perform nephrectomy.

(b) If smaller arteries, or the lower branch of the renal artery, are wounded, excise a cone-shaped portion of the kidney, corresponding to the area supplied by this vessel.

(c) Excise contused parenchyma in neighborhood of wound.

(d) Explore renal pelvis for foreign bodies with finger or probe.

(e) Suture a torn pelvis with interrupted plain catgut. Use no silk or other permanent sutures for fear of secondary stone formation or persistent fistula. There is no need to suture the pelvis with great nicety. The wound will heal if the ureter drains properly.

(f) In order to insure ureteral drainage and to prevent blood-clot from blocking its orifice, lead a split tube, or a few strands of silk-worm gut, into the upper end of the ureter. (To be removed in forty-eight hours.)

(g) Suture parenchyma with heavy, plain catgut deep sutures about 2 cm. apart, and, if necessary, interposing more superficial sutures to stop bleeding. All deep sutures should be placed at right angles to the long axis of the kidney in order not to obstruct the arteries.

A small tube should be left in the pelvis of the kidney two days, if this has been opened, in order to evacuate blood-clots
and to hasten the return of kidney function by removing intra-pelvic pressure.

(h) Always open peritoneum in front of the colon in order to examine the adjacent viscera.

(i) Drain and suture the wound in the usual manner.

7. If more than one-third of the kidney is contused, perform complete nephrectomy; if less, resection may be considered.

8. If hematuria suggests a renal injury, but the wound is remote from the loin, the decision in favor of or against immediate operation should be based on the following data:

(a) If the patient is going to die of primary renal hemorrhage he is likely to do so before reaching the dressing station.

(b) Though exploration of renal wounds usually starts a fresh parenchymatous hemorrhage, it discloses the fact that the primary bleeding has already stopped.

(c) Therefore, unless an external wound leads directly to the kidney region, the presence of hematuria or of retroperitoneal hematoma is no indication for immediate operation.

9. A retroperitoneal hemorrhage discovered in the course of a laparotomy may be disregarded (it often does not arise from the renal vessels at all) unless it is of enormous size, in which event it should be evacuated extraperitoneally before the intestines are much handled, for it has been found that immediate grave shock results from turning the patient over and operating upon his loin after laparotomy.

10. Transperitoneal nephrectomy is generally condemned.
ECTOPIC PREGNANCY


The case for demonstration on this occasion brings up the topic of ectopic pregnancy, since the symptoms and findings point very strongly to such a diagnosis.

The patient is thirty-two years of age, married, and a domestic by occupation. She entered the hospital two days ago complaining of pain in the lower abdomen and back. This pain has been present on and off for four years, the onset being gradual and bothering her only at intervals, and generally in the left side. Recently it has been a constant, dull, heavy pain. There is no history of a severe acute onset at any time, such as would necessitate her going to bed. There is no history of any attacks characterized by chills and fever or nausea and vomiting. Since the pain has been more or less constant, that is, during the past five or six months she has noticed a rectal tenesmus or at least pressure low down in the pelvis. A more striking symptom in her case is that of recent amenorrhea followed by metrorrhagia.

Her menses began when she was thirteen years of age. They have come every twenty-eight days, of five days' duration, moderate in amount, and always associated with cramping pain. Her last regular period occurred January 13th. In February the period did not appear, and eight days after it was due, fearing that she was pregnant, she went to a doctor and had
an instrument passed into the uterus. Three days later she began to bleed, and for one week this hemorrhage was associated with severe cramping pain in the pelvis. She bled rather freely with some clots for one week, and since that time has continued to bleed more or less every day; though there has been severe hemorrhage at no time. Associated with this has been increasing pain in the left lower abdomen and in the back; in other words, it is now approximately nine weeks since the uterine bleeding was noticed, and during this time she has been suffering pain and distress.

The patient has had 2 children, 1 of whom is living and well. Both were born spontaneously. Her last pregnancy was five years ago.

Examination reveals a patient who is fairly well developed and nourished and not acutely ill. Her temperature is normal, leukocytes 6400, hemoglobin 85 per cent. The urine is normal and the Wassermann test is negative.

On examination the abdominal wall is thin, diastatic, and flabby, and there are no tender points, but in the lower left quadrant a small swelling is palpable. This is low down and is firm and fixed. Vaginally there is a moderate relaxation. The vagina is short and distensible. The cervix is up behind the symphysis, fixed, and split to the left so that it gapes. The corpus and fundus are indefinite, but the body of the uterus is apparently involved or included in the mass that is palpable in the left iliac region. The entire pelvis is occupied by a firm, brawny mass filling it from side to side and bulging down posteriorly and laterally, and continuous with the mass palpable in the left iliac region. There are no tender areas on palpation.

In considering the diagnosis in this case we must take into consideration, first, the history of long-continued pain in the left side which strongly suggests some chronic illness, most probably of an inflammatory nature; second, the period of five years which has intervened since her last pregnancy also is suggestive of an inflammatory involvement, most probably of the tubes, and hence responsible for the secondary sterility. The menstrual disturbance, which is altogether recent, strongly suggests preg-
nancy, either a uterine pregnancy that was disturbed and aborted or pregnancy in the left tube which has been disturbed and hence led to hemorrhage. If we had seen this patient prior to last February we should probably have found some mass formation on the left side with fixation of the uterus, representing a salpingitis if, indeed, not a general pelvic peritonitis chronic in type. At this time, however, we have a very definite mass formation with considerable pain, but no tenderness, and such a mass being present after a history of menstrual disturbance and an attempt at induction of abortion, leads us to suspect that the pregnancy if it had occurred was most probably in the left tube. It is true, of course, that there may have been no pregnancy at all, since menstrual disturbance is present in a relatively large proportion of cases of chronic pelvic peritonitis, but this disturbance is more often an increased menstrual frequency without periods of amenorrhea. It is possible, too, that there was a uterine pregnancy and that the attempt to induce abortion perforated the uterus, and so gave rise to either hemorrhage from the uterine wound which has filled the pelvis or to a general pelvic peritonitis, which has extended to all parts of the pelvis and possibly become suppurative, or, again, it is possible that the patient was not pregnant at all, but that the attempt at inducing abortion has stirred up an old chronic inflammatory process which has developed likewise into a general suppurative peritonitis. In extensive mass formations filling the entire pelvis we are constantly confronted with a differentiation between abscess, that is, pus as contents of the mass, or hematocoele, that is, a pelvis filled with blood the result of traumatism, or, more frequently, an ectopic pregnancy which has either ruptured or aborted. In the absence, however, of a definite leukocytosis, of a history of fever and chills, of an illness sufficiently severe to send this patient to bed, the chances are that this mass is not due to suppuration. On the other hand, it is equally true that pelvic hematocoele gives rise to some increase in leukocytosis and that it is not infrequently associated in what might be termed its "chronic stage" with a low-grade fever. Many of these cases of hematocoele due to tubal pregnancy, especially
where the process has been present for some time, show a degree of leukocytosis and a temperature as high as 99.5° or 100° F. Where the hemorrhage has taken place some time prior to examination, and particularly where there is a history suggestive of previous infection, we must also consider the possibility of both processes being present, that is to say, the mass in the pelvis may be a simple hematocele or it may be an infected one, infected either from a preceding pus-tube or an ovarian abscess, or infected from the intestinal tract or through the uterus.

In the last three months I have seen 4 cases of ectopic pregnancy associated with suppuration. In one the patient’s blood showed 16,400 leukocytes and a temperature as high as 99.5° or 100° F. The pelvis was filled with old but fluid blood which bore a strong colon bacillus odor, evidently due to infection after the spilling of blood from the right tubal pregnancy. It was uncertain whether this represented a ruptured or an aborted pregnancy. In addition, this patient had a small uterine fibroid and a chronic nephritis. Culture was negative.

In the second case the patient’s blood showed a leukocyte count of 33,400 and she had been running a septic temperature since admission to the hospital, a temperature which, however, never rose above 101.8° F. The patient had been taken acutely ill three weeks prior to operation with nausea and vomiting, chills, fever, and pain in the right lower abdomen. There had been no preceding menstrual disturbance. Here again the pelvis was occupied by a large amount of free and dark, clotted blood which escaped freely under pressure and which had a strong colon bacillus odor. The pregnancy was in the isthmus of the right tube and represented a so-called rupture. Here culture was positive for the Bacillus coli.

In the third case the leukocytes varied from 12,600 to 16,000 and the temperature did not rise above 100.4° F. Upon operation the pelvis was filled with thin and clotted blood, with thick fibrin layers, the pregnancy being in the outer portion of the right tube and representing a so-called tubal abortion. Both tubes represented subacute pyosalpingitis.

The fourth patient was admitted to my service only this
present month and was in an extremely serious condition, suffering from general suppurative peritonitis, with a leukocyte count of 21,200 and temperature varying from 97° to 100.4° F. The pulse was constantly high, thin, and irregular at times. Her last period had occurred in January, with amenorrhea in February and March. She had been sick apparently for about one week. Owing to the gravity of her condition no operation was attempted, but from the findings on examination and her history a diagnosis was made of probable ectopic pregnancy on the right side together with a general suppurative peritonitis. This patient died three days after admission to the hospital. Autopsy revealed a fetid peritonitis and right ectopic pregnancy which was infected and which had ruptured into the right broad ligament, with perforation of the peritoneum. The uterus showed decidual thickening of the endometrium. There was a chronic fibrous endocarditis; dilated mitral and tricuspid valves with incompetency and marked stenosis and hypertrophy of all the chambers of the heart; chronic passive congestion of the liver, with central cyanosis and cyanotic induration of the spleen and kidneys; edema in the right upper pulmonary lobe; healed tuberculous scars in the left upper pulmonary lobe; acute swelling of the retroperitoneal lymph-glands; cholelithiasis; subcutaneous dermoid cyst in the midline of the neck anteriorly; Meckel’s diverticulum; fibrous adhesions between the omentum and a left hydrosalpinx; in addition, there was a moderate stenosis of the aorta which was probably luetic in origin, since the patient’s blood gave a strongly positive Wassermann reaction.

To return to the case immediately under discussion, a diagnosis as to the exact nature of the contents of these pelvic masses can always be made in a very simple way. For a long time when there has been any doubt in my mind as to the nature of such masses, particularly where it is important to avoid abdominal operation, it has been my custom to do an exploratory colpotomy. In many cases this is not necessary, as in this instance, since this patient is afebrile, and even if we had opened into pus there would be no particular contraindication to the latter operation. But were this patient febrile, and hence not in the
best condition for abdominal section, I would make an incision through the posterior vaginal wall and drain the pelvis first from below. Two of the cases just cited were treated in this manner, in one the colpotomy being performed immediately prior to the abdominal section and in the other three days prior. If pus escapes, drainage is effected and the laparotomy may be undertaken as soon as it appears wise. If blood escapes, laparotomy may be carried on at once or subsequently, according to the patient’s condition, the only danger being that in promoting an evacuation of clotted blood from the pelvis there is a possibility that renewed hemorrhage might take place. This, however, I do not regard as a considerable danger. Inasmuch then as this patient has been afebrile during her time in the hospital, we will proceed to a laparotomy.

Upon opening the abdomen the uterus is seen to be elevated with the bladder into the false pelvis and adherent posteriorly to the mass filling the pelvis. The right tube is free and slightly injected, thickened and kinked, but patent. The right ovary is normal and free. The mass filling the pelvis on the left side consists, first of all, of an upper portion representing the left tube and enlarged to 8 cm. in diameter and containing a hematoma. It is densely adherent between the pelvic wall and the uterus, while the sigmoid flexure is adherent over it posteriorly and above. Below this there is another mass of quite the same size. This is densely adherent to the pelvic wall, and upon being freed it proves to be the left ovary. Owing to the density of the adhesions and difficulty in freeing this second mass it has ruptured and pus escapes from it. The rectum has walled this lower mass off fairly well from the right side of the pelvis. The anterior culdesac is free and two small subserous fibroids are found presenting in the uterine fundus.

The question of dealing with these structures now presents itself. It is obvious that the entire left appendage must be extirpated. The question of the extent to which operation may be carried in cases of tubal pregnancy must be determined, as in everything else in surgery, by the condition of the patient. In tubal pregnancy where there has been a recent rupture or
abortion with a considerable escape of blood, so that the patient is in a state of acute anemia, and particularly if she shows any degree of shock, operative procedure must be limited to the sheerest necessity, and it must not be forgotten that the fundamental surgical procedure in hemorrhage is to reach the bleeding point and stop the escape of blood. This is particularly applicable to an ectopic pregnancy where the patient is plainly in grave condition. In a case such as this present one, however, where the hemorrhage has taken place some time prior, often weeks, and where the patient’s condition is not worse than were she suffering simply from an old, chronic left salpingo-ovaritis, or from simple uterine fibroids, the operation may be as extensive as the pathology of all the tissues taken together warrants. Hence, inasmuch as we have here a uterus that contains fibroids, it would be better to treat this case not only by extirpation of the pregnant tube and of the abscessed ovary, but of the uterus as well. With the left tube and ovary freed, ligated off and cut, the next ligature takes in the uterine artery on the left side. This is cut away. On the right side we will remove the tube only and leave the ovary, since that is quite normal and the patient’s age warrants ovarian conservation. The technic in detail of hysterectomy has been described in a previous clinic.¹ By this time we have arrived at the anterior culdesac, and the question now comes up whether the hysterectomy should be a subtotal or a total one. There are those who argue that in performing a hysterectomy the cervix should always be removed, owing to the fact that subsequent disease has been known to take place in the cervical stump. Just at this time I am somewhat strongly inclined to this view because I have in my ward down stairs a patient who was operated upon in 1900, twenty-two years ago, in this hospital, for a fibroid of the uterus by subtotal hysterectomy. She is now dying of extensive inoperable carcinoma involving the vagina and bladder and probably arising in this cervical stump. On the other hand, there are occasions where it is plainly not necessary to remove the cervix. It has been my custom in performing

¹ Surgical Clinics of Chicago, Vol. 4, No. 4, p. 682.
hysterectomy to remove the cervix where the cervix itself shows any pathology, either that due to infiltration, hypertrophy, or erosion, and particularly where it has been traumatized by labor. That is the circumstance in this case. The cervix was described as having been split to the left and gaping into the vagina, a cervix that should not under any circumstances be left in its present state. Therefore this uterus will be removed in its entirety. Where, however, the cervix does not show disease and where it has not been damaged by labor, it may be safely left. This is particularly advisable where the hysterectomy is more than ordinarily difficult, as in operating upon very obese patients, or where the patient's condition is such as to require more than ordinary haste. The objection to total hysterectomy that is at times made, that the vagina is shortened, need not give concern provided in closing the vaginal vault the round ligaments are securely stitched into it. Formerly I closed the vaginal vault first and then secured the round ligaments over this line of suture. For the last three or four years I have been stitching the round ligaments directly into the vaginal vault in closing the wound, as is done in this case. This is somewhat simpler, saves a little time, and has not been followed by any evidence of postoperative ascending infection. Where drainage is desired, where each ligament is stitched into its respective vaginal angle, the intervening space is left open so that gauze or rubber tissue drainage can be placed, leading down through the vagina. In this case drainage will not be established inasmuch as the pus in the ovarian abscess is undoubtedly sterile and the patient is afebrile, there being no leukocytosis and no evidence of acute reaction in the pelvis. Another advantage in stitching the round ligaments into the vaginal vault is that the lateral peritoneal surfaces are brought well down into the true pelvis and thus peritonization of the raw surfaces is begun. There is now left the raw pouch of Douglas posteriorly, with a clean anterior culdesac, the vesical peritoneum being still loose. In order to close over this raw pelvis I will now cover it by a sigmoid-rectal closure, using the sigmoid flexure and rectum with running catgut stitch to entirely
block off the lower pelvis from the upper clean structures. This method has been described previously in one of these clinics.\(^1\)

While the abdominal wall is being closed I will examine the gross specimen. The uterus is seen to be slightly thickened throughout its wall, soft, and doughy. The mucosa is thin, showing that a decidua has already been cast off. The decidua is rarely present in a uterus after bleeding has gone on for any length of time in ectopic gestation. In the anterior fundal wall we find two fibrous growths, each approximately 1 cm. in diameter, and in the posterior fundal wall one subserous growth about the same size. The cavity is approximately 2\(\frac{1}{4}\) inches deep and the cervix shows the lacerations described with several small cystic developments, the so-called Nabothian follicles. The right tube is slightly injected and slightly kinked, but is patent at the fimbriated end. The left tube contains in its isthmus a swelling approximately 6 cm. in diameter, the upper margin of which is seen to be eroded. Upon splitting this open the mass is revealed as a hematoma with a cyst-like center, 1 cm. in diameter, in which we find a macerated embryo, proving grossly that the case is one of pregnancy. Adherent below this mass is a left ovarian abscess of about the same size.

From the appearance of this specimen the case would ordinarily be classed as a ruptured tubal pregnancy. Insofar as the tube wall has been destroyed, and hence there has been an accumulation of free blood in the pelvis, this is a pregnancy of that type. We should regard this accident to tubal pregnancy as due rather to the erosion of the structure of the tube wall by the active infiltration on the part of the trophoblastic cells rather than as a splitting or rupture due to distention. The chances are that the tubal wall seldom gives way as a result of distention. Otherwise such a thing as tubal pregnancy going on to the later months of pregnancy or to term could not happen. What actually happens in tubal pregnancy is this: There being a relatively poor decidual reaction in the tube there is no well-developed decidual membrane, such as occurs in normal uterine pregnancy, to receive the infiltrating tropho-

blast as the ovum embeds, and to protect the maternal tissues from this infiltration. In uterine pregnancy the decidua is so thick that the trophoblastic cells are unable to penetrate into the uterine wall and permit chorionic villæ to develop there. In tubal pregnancy, there being no such protection to the maternal tissues, the wall of the tube is penetrated, and not only the trophoblast but the chorionic villæ are able to go entirely through it. Again, in uterine pregnancy the decidua membrane contains only capillaries. These are opened up by the trophoblastic cells and occupied by them, only sufficient blood escaping to form the intervillous circulation. It is probable that trophoblastic cell should never reach an artery or vein. In tubal pregnancy this, again, is not the case. The trophoblast is able to attack the arterioles and veins and in opening them up releases more blood than the chorionic layer itself can control. This blood coagulates about the ectopic gestation sac, which then undergoes necrosis. Now if this hemorrhage occurs coincidently with the erosion of the tube wall, blood escapes into the peritoneal cavity, and this is called ruptured ectopic pregnancy. If it is a hemorrhage without erosion of the tube wall the hematoma which forms is retained within the tubal lumen, or if not retained the fluid portion of it runs out through the fimbriated end, again forming a pelvic hematomele, and in either circumstance it is called tubal abortion. As a matter of fact, the word “abortion” here is also poorly employed, since this process is not in any way comparable to what we ordinarily mean by abortion with reference to uterine pregnancy. The idea that the gestation sac may be aborted from the tube by being carried through its lumen and expelled either through the uterine or abdominal end is, in all probability, incorrect. We have all seen specimens of tubal pregnancy where the hematoma including, of course, the gestation sac has been found projecting from the abdominal end. This is as nearly a tubal abortion in the proper sense of that term as ever happens, and yet it represents most probably an implantation of the gestation sac into the infundibular tissue. It can be readily understood, of course, that if the ovum should implant in the infun-
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dibulum, where the lumen of the tube is so much wider, any ensuing hemorrhage would at once flow out through the tube into the pelvis. During this past year I have had 2 cases of tubal pregnancy, in both of which there was considerable clotted blood in the pelvis, one forming a mass the size of a grapefruit and the other not larger than a lemon. In each of these the tube was absolutely undamaged through its entire length, the fimbriated end being merely embedded in the blood-clot. In neither case was there any gross material proving pregnancy, but in both cases the small portion of tissue removed from the fimbriated extremity showed chorionic villæ on microscopic section.

Here we have another end-result of tubal pregnancy that is ordinarily not thought of, the development of a hematoma without anatomic destruction or extensive damage to the tube itself, where the hemorrhage spontaneously ceases, and where if left alone the hematoma would become resorbed and the patient be spontaneously cured. In operation it is sufficient in cases such as this to remove the clotted blood alone.

The case here presented, together with those cited, illustrates another important point in the clinical aspect of ectopic gestation, that is, that relatively few of these patients develop the crises so dramatically described in the text-books as characteristic of this condition. In my own series not more than 1 in 15 of these patients showed shock or in any way a dangerous condition at the time of their admission to the hospital. Not more than one in fifteen, in other words, are emergencies. It is true that we do see the woman who is brought in with the abdomen and pelvis full of free blood, who is in shock and collapse, in a condition of grave emergency—and there is no graver emergency than that of an actively bleeding ectopic pregnancy when it does occur. But in the great majority of ectopic pregnancies, at least in my experience, this is not seen. The history as exhibited by the patient here presented is rather characteristic of nearly all of them. It is in these cases rather than in the emergencies that the diagnosis is most often missed. Too often the physician thinks unless his patient is in shock and collapse he
should not consider an ectopic pregnancy. On the contrary, wherever he has a pelvic mass he should consider ectopic pregnancy whether the patient has a preceding history of amenorrhea or not or, indeed, whether she has given a history of excessive or too frequent bleeding or not. We have, then, ectopic pregnancy without preceding amenorrhea, and I have had one case of tubal pregnancy with extensive pelvic hematocele where the patient had had no menstrual irregularity whatever, and had had no extensive bleeding subsequent to the probable time of tubal rupture. Even in the absence of extensive mass formation in the pelvis tubal pregnancy must be considered, because the diagnosis may be made even prior to the so-called rupture or abortion. Here it would be based rather upon the appearance of a small swelling on one side or the other, with probably a short period of amenorrhea and without metrorrhagia. The character of the pain, too, is often misleading. After the hematocele has been developed to any extent it is apt to be one of pressure fulness in the pelvis with more or less short, cutting, stabbing pains low down in the abdomen, but many of these patients speak of the pain as if it were indefinite in origin, sharp, cramp-like, and cutting, and if associated with nausea and vomiting, as it not infrequently is, they are apt to regard it as an attack of indigestion. Particularly if the cramps are lateral instead of median and if the patient presents symptoms indicating threatened, imminent, or incomplete abortion, should ectopic pregnancy be held in mind. Finally, the passing of a decidual cast from the uterus is emphasized as an important sign by all writers. This cannot be controverted, but, as a matter of fact, this cast is rarely seen either by the physician or the patient. In nearly every case it is lost by the time the patient appears for treatment.
CLINIC OF DR. ARTHUR DEAN BEVAN AND JAMES C. GILL

Presbyterian Hospital

ENDOTHELIOMA OF THE SPINAL CORD


A Third Patient on Whom an Operation for Tumor of the Spinal Cord Had Been Performed Some Ten Years Previous.

Dr. Bevan: This morning I am going to give a joint clinic with my colleague of the Neurological Department, Dr. Gill.

The patient is a young woman upon whom Dr. Gill has made a diagnosis of tumor of the spinal cord. Dr. Gill will first present to you quite fully the history of the patient, the general clinical picture, the evidence upon which he has made the diagnosis of spinal cord tumor, and will attempt to locate as accurately as possible the position of the tumor. I shall then do a laminectomy and expose the section of the cord in which Dr. Gill believes the tumor lies, and attempt to find and, if possible, remove the growth.

Dr. Gill: Tumors involving the spinal cord occur with sufficient frequency to warrant careful consideration as to the possibility of a surgical procedure for the removal of the tumor and the relief of the symptoms.

The following case is of interest: Miss S., age thirty-one, entered the Presbyterian Hospital on the service of Dr. Sippy December 27, 1921. Because of symptoms indicating some involvement of the nervous system I was asked to see the case.
Patient complained of pain in left side of abdomen and difficulty in walking. The pain began about eight months ago. At first it was not very severe and did not cause much anxiety. Gradually it has increased in severity until the patient consulted a physician because she thought it was due to some abdominal condition. The pain is always located in the left side, extending from the middle of the left part of the back in the lumbar region, around the side, and on to the abdomen as far forward as the midline and in a zone about 4 inches wide. It is constant, but more pronounced at times, seemingly worse at night. Movements involving the bending of the back increase the pain. The pain is usually of a dull, aching nature, but sometimes becomes cramp-like.

Difficulty in walking was not noticed until about two months ago, but patient says it may have been present longer, since she thought at first that it was rheumatism or stiffness from overwork, etc. During last few weeks it has become greatly aggravated, until at the present time she walks with great difficulty.

Family history negative.

Past Illnesses.—Nothing of importance except the fact that the patient was confined to the Elgin State Hospital for the Insane for a period of about six months during 1919 suffering from an attack of manic-depressive type of insanity which had no bearing upon her present condition.

Examination.—Shows a well-developed female, both sides of the body symmetric. There is no apparent atrophy of the muscles of the body.

Reflexes.—Lower Extremities.—Both knee-jerks exaggerated, ankle-clonus present on both sides. Positive Babinski both sides. All reflexes are more pronounced on the left than on the right side.

Upper Extremities.—Tendon reflexes present and equal on the two sides.

Abdominal reflexes present on right side, absent on left.

Eyes.—Pupils react to light and accommodation normally. No nystagmus. All movements of eyes normal. All cranial nerves apparently normal.
**Sensations.**—Pain and temperature sense diminished equally on both legs, most below knees. Tactile sensation present on both lower extremities, but diminished below knees. Muscle sense markedly diminished on left lower extremity, normal on right side. Pressure over the first and second lumbar vertebrae produces pain, to which I attach no importance. Romberg present to a considerable degree. Upper extremities and trunk above the tenth dorsal segment normal. A narrow zone of hyperesthesia exists in region of tenth dorsal segment.

**Bladder.**—Not disturbed except for some slight inability to empty readily at all times.

**Bowels.**—Normal except for constipation.

**Motor Power.**—Flexors of knees stronger on right side than on left. Flexors and extensors of toes stronger on right side than on left.

**Gait.**—Patient walks with a shuffling, spastic gait, more pronounced in the left leg than in the right.

**Spine.**—x-Ray of spine negative. Laboratory examination of spinal fluid negative except Nonne shows 1+.

**Diagnosis.**—A clinical diagnosis was made of an intradural tumor on the left side of the cord located at the level of the tenth dorsal vertebra. Nature of the tumor problematic. The diagnosis is based upon the history of a persistent pain localized along the distribution of the twelfth dorsal segment on the left side, worse at times, but never disappearing entirely; the disturbance of pain and temperature sense on both lower extremities, spasticity, exaggerated reflexes, positive Babinski, ankle-clonus on both sides, but more marked on the right. A combination of such symptoms would indicate that there was interference with the functions of the ascending Gower tracts in both hemispheres of the cord; pressure on the cross pyramidal tract in both hemispheres, but more pronounced on the left side; interference with the direct cerebellar tracts, carrying impulses of muscle and joint sense on the left side.

Differentiation must be made from other disorders which might present many of the symptoms shown in this case.

Involvement of the vertebrae from caries, syphilitic exostoses,
carcinoma, and osteomyelitis must be considered. Caries, which is usually tuberculous and invariably secondary to some tuberculous process in other parts of the body, might present many of the symptoms as given in the case under consideration, differing in this respect, that following the bone involvement there is an accumulation of a purulent, cheesy material between the bone and the dura, with compression of the cord and the an-

![Chart of Dr. Gill's case of spinal cord tumor.](image)

Differential points would be age of patient, caries, as a rule coming on earlier in life, accompanied by stiffness of the back, pain upon pressure over the vertebrae, pain from jarring of the spine; and the fact that early symptoms of cord pressure from the products of tuberculous involvement manifest themselves
usually by pressure upon the anterior motor roots, producing atrophy of some of the muscles prior to sensory disturbances.

X-Ray pictures of the vertebrae sometimes aid in the early diagnosis of caries.

We have examined the patient carefully and fail to find any evidence of a primary tuberculosis or any symptoms that would indicate caries. Syphilitic exostoses may be excluded by the absence of any syphilitic history and the negative results of the examination of the cerebrospinal fluid. Carcinoma of the vertebrae is usually secondary to a primary carcinoma in some other part of the body, but when present may produce symptoms somewhat similar to tuberculous caries, and the differential points would be practically the same. Osteomyelitis of the vertebrae is rare, but may produce symptoms such as described in this case.

Involvement of the cord itself and its coverings in conditions

Fig. 281.—Chart II of Dr. Gill's case of spinal cord tumor.
other than tumors must be considered. The various types of subacute and chronic myelitis, such as lateral sclerosis, ataxic paraplegia, or combined sclerosis, may present a combination of symptoms suggestive of tumor. The etiologic factors in the development of such conditions, such as acute infectious diseases, focal infections, syphilis, spinal cord changes of pernicious anemia, arteriosclerosis, can all be excluded in the present case. Multiple sclerosis, with its symptoms irregularly distributed throughout the central nervous system, frequently accompanied by nystagmus and optic nerve changes, speech disturbances, and occasional intention tremor, certainly would not be confused with the symptoms of cord tumor. Pachymeningitis cervicalis hypertrophica presents a group of symptoms that may give some difficulty in differentiation.

Remembering that the above disorder is located usually in the cervical region of the cord, which rarely is the seat of tumors, that pachymeningitis often progresses more rapidly and is frequently preceded by syphilis, the differentiation usually will be made without difficulty.

Syringomyelia in its early manifestations may present symptoms as given in the present case, but the characteristic symptoms of this disorder, namely, the dissociation of sensation, often makes its appearance quite early and would be an important factor in the diagnosis.

Intradural tumors may be differentiated frequently from intramedullary by noting the fact that the symptoms, as in the present case, indicative of an intradural tumor first produced pain which was continuous in character and confined to one segment of the cord. The intramedullary tumors, on the other hand, show a tendency to extend to other segments of the cord sooner or later, and the symptoms would be shifting in character. In intramedullary tumors the pain is not as pronounced a symptom as in intradural tumors.

Location of the Tumor.—The tumor may be located with a fair degree of accuracy by remembering the skin areas supplied by the various cord segments. Complete anesthesia in skin area supplied by certain segments not looked for, as the cutaneous
sensory fibers in any given area may extend to two or three segments. Tenderness over the vertebrae is not a reliable guide in locating the tumor. The position of the spontaneous, persistent pain along the distribution of the twelfth dorsal segment seemed to warrant locating the tumor opposite the body of the ninth dorsal vertebra.

**Treatment.**—Excluding the gummas, we cannot hope to benefit the patient materially by medicinal treatment and surgery is the only hope for relief in this case. In the hands of an experienced, skilful operator many cases have been materially improved and frequently complete cures established. I have asked Dr. Bevan to operate this case, and feel sure that in his hands the case will be given every possibility of relief from her distressing symptoms.

**Dr. Bevan:** Dr. Gill has located for us the tumor opposite the eleventh dorsal vertebra, more on the left side than upon the right. After hearing his very clear discussion of the case I quite agree with him that the chances are distinctly in favor of the symptoms in this girl's case being due to the pressure of the spinal cord tumor, and that it is clearly our duty to make a laminectomy and expose that area of the cord.

The patient is now anesthetized. Dr. Herb has used ether in this case, and the patient, as you see, is lying upon the abdomen so that we can readily expose the lower dorsal vertebrae. I now make an incision from the twelfth dorsal spine upward for a distance of about 6 inches (Fig. 282). I cut down to the tips of the spinous processes from about the eighth to the twelfth dorsal vertebrae. I now take a rather broad, moderately sharp chisel, and with this instrument separate the soft tissues, muscles, and small tendons from the posterior surfaces of the arches. There is, as you will notice, considerable hemorrhage in doing this. I pack the groove thus exposed very tightly with gauze so as to control the bleeding. I then have the two assistants hold the edges of the incision well apart. I might use here a self-retaining retractor, but, on the whole, I rather prefer retractors in the hands of the assistants. I use a very strong pair of rongeur for-
Fig. 282.—Case I.  A, Midline incision.  B and C, Musculature separated from lamina.

ceps and bite off first the spinous processes of the twelfth, eleventh, tenth, and ninth dorsal vertebrae. You will notice that I continue packing the wound tightly with gauze so as to
control the bleeding wherever I can. I do not attempt to control it by ligating any vessels. I now begin with the strong rongeur forceps and bite off the arches of the vertebrae. In doing this in several places you will notice that we have very free bleeding from the bone, and I control this with a piece of Horsley's wax, the same wax that you have seen me use so frequently in operations on the skull. The process of removing these arches with the rongeur forceps is rather tedious, and yet I think it is safer than removing them with the chisel, and I prefer it on account of its greater safety. I have now exposed the cord from the twelfth to the eighth dorsal vertebrae. You will notice that after removing the arches the cord is surrounded with a thin layer of fat and veins, called the meningoarachidian plexus of veins, which is outside the dura.

As I look at the cord covered by the dura I see nothing abnormal, and as I very gently run my fingers over it I am not sure that I feel anything abnormal. I now split the dura and allow a very considerable amount of cerebrospinal fluid to escape. This comes out, when I first made the puncture in the dura, in a little stream with enough pressure to spurt out 3 or 4 inches above the opening. This, however, is simply momentary, and when the pressure is relieved the cerebrospinal fluid simply gently flows out, wetting the field. As I expose the cord outside of the eleventh dorsal vertebra I see no tumor, but as I split the dura up over the tenth I see very distinctly the lower margin of a well-outlined neoplasm occupying the left side of the spinal cord (Fig. 283). This is about the size of an ordinary cranberry and compromises very materially the cord because of its pressure. The tumor has the appearance of an endothelioma. It seems to spring from the pia. Several of the posterior roots of the spinal nerves cross the tumor. It is not extremely vascular. It is rather brownish-red in color and is so distinctly separated from the cord itself that we can find a line of cleavage and can separate it from the cord and two of the posterior roots without apparently doing any serious injury to the structures. In doing this part of the operation you will notice that I take some small pledgets of cotton wet in normal salt solution which are grasped with
some small mosquito forceps, and the process is rather that of very gently wiping off the tumor from the cord than anything in the way of a definite dissection. As I have separated almost
all of the tumor, possibly nine-tenths of the circumference in this way, I now pick up the tumor mass with some fine dissecting forceps without teeth, and am able to lift it out and gently tease it away from the cord without producing any hemorrhage and without apparently producing any injury of the cord. The bleed-

Fig. 284.—Case I. A, Closure of dura. B, Button sutures in place; skin closed. C, Cross-section of B. D, Button suture and needle.

ing from the laminectomy incision has not entirely been controlled, so I shall pack the edges with some sterile absorbent cotton pretty firmly and at one place use a little more Horsley’s wax, stopping some bleeding from the bone, as I am very desirous of having a perfectly dry field when I complete my closure.
With very fine catgut I now sew up the incision in the dura mater. By this time the hemorrhage is entirely controlled and I close the incision in the soft parts. I am using, as you see, a method which I believe is quite efficient. I am using tension button sutures, passing through the skin and superficial fascia and the muscles, so that when these two sets of tension sutures are tied the dead space produced by the removal of the arches is practically entirely obliterated, so much so that I do not intend to use any drainage in this case (Fig. 284). Frequently in these cases I have left in a little piece of rubber tissue for forty-eight hours to provide for the escape of cerebrospinal fluid, blood, and primary wound secretion. The field here is so dry that I shall treat it as a clean hernia or appendix incision and dispense with drainage entirely.

The patient is in very good condition at the close of the operation, and I am very much in the hope that it will be one of a group of successful cases both from the standpoint of the operative recovery and that the character of the growth will be such that there will be no recurrence, in other words, that it will prove histologically to be benign and not malignant.

After-history.—The patient made a very good recovery. She complained rather bitterly of headaches for several days after the operation. I have had this same experience in a number of laminectomies where we have opened the dura and allowed the cerebrospinal fluid to escape. The same thing is experienced sometimes in using spinal anesthesia. Just what causes these headaches is difficult to explain. They are associated in some way evidently with interference with the cerebrospinal fluid and with brain and cord tension. Most of them are transitory. Some of them, however, are very persistent and are followed by a train of symptoms which might be classified as aseptic meningitis, from which the patient usually recovers completely. In this patient's case the headaches lasted for several days and then disappeared. She was then surprised and delighted to find that the pain in the left side from which she had complained before operation had almost entirely disappeared, and within a few days this had gone completely. Immediately after the opera-
tion the patient had little or no use of the left limb and but slight use of the right. Within a few days, however, the function of the right returned, and within a week it had practically completely returned, and within two weeks the patient had very fair motion in the left leg. I kept her in bed for a couple of weeks and then got her up in a wheel chair, and as the function of the left leg returned, gradually got her about on crutches, until now, three months after operation, she is walking fairly well, improving gradually but surely, and I hope will go on to complete recovery.

The microscopic examination of the specimen shows that it was an endothelium of a benign type, and from that we can hope that there will be no recurrence in this case.

Dr. Gill: Patient was operated on January 12th. Left the hospital markedly improved on February 28th, since which time I have seen her on several different occasions, each time noting continued improvement.

I saw her last on April 24th. At that time she was able to walk without assistance, the area of pain on the left side had disappeared entirely, and the only reminder she had of the original trouble is an exaggerated knee-jerk on the left side, with some slight limp as she walks.

The improvement has been so rapid and pronounced that I feel we are justified in saying that the patient will be restored to normal.

Dr. Bevan: I am fortunate in being able to show you this morning another spinal cord tumor, a case which was operated upon some weeks ago. This patient, a man of forty, came first under the observation of my colleague, Dr. Robert H. Herbst, of our Urological Department, with bladder symptoms, difficulty in urination, and the case was at first looked upon as being one of a possible prostatic obstruction. In going over the case, however, it was noticed that he had, in addition to difficulty in emptying the bladder, a paresis of both extremities. He walked with great difficulty, and these symptoms became worse, so that within a short time he could not walk at all. Dr. Bassoe, our neuro-
logic colleague, was called into consultation, and going over the case the conclusion was arrived at that he had a tumor of the spinal cord. The consultants, Dr. Bassoe, Dr. Herbst, and myself, agreed that the wisest procedure would be to first do a laminectomy and explore the cord with the hope of finding the tumor, and remove this if it were possible to do so. I shall ask Dr. Herbst to give you the urologic aspects of the case.

Dr. Herbst: This patient, who is fifty-two years of age, entered the hospital complaining of inability to urinate and paralysis of the left leg.

Past History.—He states that he was in good health until one year ago, when he noticed disturbance in sensation on the right side, especially the right leg, which he describes as a loss of feeling or numbness. One month after the onset of these symptoms he noticed that the left foot began to drag along the ground when walking. About four months ago he began to have difficulty in voiding urine. This was accompanied by frequency, both diurnal and nocturnal. He states that he has been compelled to urinate every half-hour. During the last two weeks he has not been able to void successfully until he could feel his bladder as a mass above the pubis. For the last eighteen hours he has not been able to pass any urine.

Physical Examination.—A poorly nourished man who appears acutely ill, with a marked distention of the bladder evidenced by a symmetric suprapubic tumor which extends to the umbilicus. The prostate gland is slightly enlarged, smooth, soft, and symmetric. The seminal vesicles are palpable. A No. 20 Wishard catheter passes into the bladder without difficulty, obtaining 880 c.c. of urine.

Laboratory Findings.—The urine contains many pus-cells (2500 to the field), a few red cells, a trace of albumin, but is otherwise negative. Both blood and spinal fluid Wassermanns are negative. Nonne negative.

Cystoscopic Examination.—The bladder is greatly dilated. There is a marked degree of trabeculation and the wall is covered
by a fringe-like necrotic membrane. There is a slight projection of prostate into the bladder, the left lateral and middle lobes being the larger.

**Discussion.**—It is evident from these findings that the retention of urine in this case is not due to obstruction. Although the prostate gland is slightly enlarged, it is not sufficient to produce the marked retention found in this patient. A disturbance of urinary function, either partial or complete, is frequently an early sign found in spinal cord lesions, such as tabes, cord tumors, etc. In some instances, even before the patient shows any other signs or symptoms, one may see changes in the bladder wall which are diagnostic of nerve injury or disease.

Etiologically there are two types of retention of urine:
1. Obstructive.
2. Retention due to paresis or inco-ordination of the bladder muscles.

Our patient’s retention belongs to the latter type, and is probably caused by a lesion of the spinal cord. Therefore we will refer him to Dr. Bassoe for neurologic study.

**Later History.**—During convalescence following the removal of the cord tumor the bladder has been drained by an indwelling catheter and cleansed with boric acid solution morning and night. The indwelling catheter was not well tolerated, and repeated catheterization with argyrol instillation was substituted.

It is now four weeks since the cord tumor was removed. The patient complains of pain in the lower abdomen and has developed an afternoon temperature ranging from 101° to 102° F. You will note a suprapubic swelling which is extremely tender and does not disappear on emptying the bladder. This is evidently a pericystitis due to infection which has spread from the bladder into the prevesical space.

Cystotomy with drainage of the bladder and prevesical space is indicated.

**Operation.**—I will infiltrate the abdominal wall with $\frac{3}{4}$ per cent. novocain solution, beginning in the midline at the pubis and extending to within 4 cm. of the umbilicus.

I will now make a 3-inch incision, dividing the fascia and
separating the recti. You will note that the prevesical space is infiltrated and you can see a seropurulent fluid oozing from it. The peritoneum is adherent rather low down on the anterior wall of the bladder; using care and gentle blunt dissection, I have succeeded in pushing the peritoneum up and exposing the anterior bladder wall. I will now infiltrate with novocain solution and make a 3 cm. opening into the bladder. The bladder wall is greatly thickened; this is due to infiltration and hypertrophy of the muscular wall. I will insert a No. 40 drainage-tube into the bladder and a small cigarette drain into the prevesical space.

By means of a through-and-through silkworm-gut suture, which includes the upper angle of the bladder incision, I will suspend the anterior wall of the bladder. This suture prevents leakage of urine around the tube.

I will close the wound in the usual manner, fixing the tube to the skin with one silkworm-gut suture.

Subsequent Course.—After five days the tube was removed and a No. 20 dePezzer catheter substituted. This was changed and the bladder irrigated every three days for six weeks, when it was removed and the fistula allowed to close.

Postscript.—Eight months after the operation the patient has gained in weight. The urine is quite clear. The bladder function has not been entirely restored, as he still carries a small quantity of residual urine.

**Dr. Bevan:** Dr. Bassoe will give you the neurologic diagnosis.

**Neurologic Examination by Dr. Peter Bassoe on May 7, 1921.—**The pupils are normal and there is no cranial nerve affection. The reflexes in the arms are normal. No abdominal reflex is obtained except in the left upper quadrant, where it is weak. The cremasteric reflexes are weak, more so on the left side. The knee and ankle reflexes are exaggerated, particularly on the left side, where clonus is present. A Babinski sign is not obtained. (The Babinski sign had been positive on the left side a few days previously and was again obtained three days later.)
Beevor’s umbilicus sign is present: When the patient attempts to raise his body with the arms folded on the chest the umbilicus moves upward about an inch, and the upper abdominal muscles can be seen to contract while the lower ones are ballooned outward. The strength in the right leg is good. The extensors of the left foot and knee are very weak and the flexors of the foot are considerably weakened, while those of the knee are good. All left hip movements are decidedly weak. Tactile sensation is impaired below the level of the umbilicus, especially in the distribution of the three lower thoracic and two upper lumbar segments, while the hypesthesia is less marked in the distribution of the lower lumbar and sacral segments. The temperature sense is lost in practically the entire right lower extremity and on the left side only along the outside of the hip. The rest of the left leg is rather hypersensitive to heat and cold. The pain sense is also more impaired in the right leg than in the left.

Diagnosis.—Compression of the cord more marked on the left side at about the tenth thoracic segment (i.e., at the level of the eighth thoracic vertebra). In view of the negative spinal fluid tests and the absence of roentgenologic evidence of a bone lesion as the cause of compression it is most likely that a tumor within the spinal canal is causing the compression. Exploratory laminectomy is advised, with removal of the arches of the sixth to the tenth thoracic vertebrae.

Dr. Bevan: Under ether we did a laminectomy in the way we did this morning, using the same technic that we employed this morning. We found a tumor situated opposite the vertebra. This was also not found until after we had opened the dura, and was an endothelioma. The tumor was removed in the same way. The patient made a very excellent operative recovery. The paralysis of the bladder, however, required frequent catheterization and the use of 5-grain doses of urotropin every four hours. In spite of this, however, the bladder became pretty badly infected, so that Dr. Herbst and I agreed that the best plan would be to do a suprapubic under local and drain the bladder to get rid of the infection. This proved to be an excellent thing. The high tem-
perature, which was from the cystitis, disappeared very promptly, and he was much more comfortable after the suprapubic drainage. For a number of weeks we kept him on a water-bed so as to avoid the development of pressure necrosis and bed-sores. Gradually the paralysis of the lower extremities and the bladder cleared up, so that we got him up first on an ordinary mattress and then up in a wheelchair. Slowly the power of the bladder returned so that he could urinate. We then took the suprapubic tube out and allowed the bladder incision to close. He then began to walk, and he has gone on to a very satisfactory recovery in the sense that he is able to get about with the aid of a cane, and if the improvement continues he will go on to a pretty complete recovery.

Within the last few weeks there came into my consulting room a woman of about twenty-five upon whom I had operated ten or twelve years ago for a tumor of the spinal cord, and I will refer to the case because it will give you a picture of the result in some of these cases, and also it will make clear to you another class of tumors producing cord pressure. This young woman came first to the service of Dr. Harold Moyer, one of our best known neurologists. Dr. Moyer studied the case very carefully and came to the conclusion that the cord pressure symptoms from which she suffered were due to a tumor pressing on the spinal cord opposite the fourth dorsal vertebra. Briefly, the young woman gave symptoms of gradually developing paresis of both extremities, a little more on the left side than on the right. She had at first difficulty in walking, some pain, not very marked. This difficulty increased until finally she was unable to walk at all and barely able to move the lower limbs when in bed. x-Ray picture of the vertebral region showed nothing definite, but on a general physical examination it was found that the child had a number of exostoses at different points of the skeleton, on the humerus and femur, and on the tibia. These were bilateral and in the x-ray they showed definitely that they were bony outgrowths from the normal bone with more or less complete ossification. Because of these multiple exostoses Dr. Moyer’s conclusion was that a similar exostosis
was growing within the vertebral canal and pressing on the spinal cord, producing the pressure symptoms which existed. I therefore made a laminectomy, and on removal of the arches of the third, fourth, and fifth dorsal vertebrae I came down to a bony tumor about \( \frac{1}{4} \) inch long and about \( \frac{1}{2} \) inch in diameter. This sprang from a pedicle on the left side of the fourth dorsal vertebra and compromises very materially the cord, because at that portion of the spine the vertebral canal is small.

Fig. 285.—Case II. Bony outgrowth from lamina of fourth thoracic vertebra which was chiseled away.

I remember one little incident very distinctly in connection with the case. After exposing the tumor I picked up a chisel and mallet and rather jubilantly said that we were very fortunate in finding conditions which we could so definitely remove and which were clearly benign. I said, looking down at the tumor, "Dr. Moyer, we shall be able to chisel this off without any difficulty," and then I looked up, and found that Dr. Moyer had left the operating room. I thought it was rather singular, but went on with the operation and removed the tumor with the chisel, which was readily done. Within a few moments Dr. Moyer stepped back into the room, and I said, "Why, Dr. Moyer,
I wanted to show you how completely we could remove this tumor." He said, "Well, Bevan, when I saw you pick up that chisel and mallet the thought came to my mind, 'what a terrible thing it would be if the chisel slipped and you cut off the spinal cord,' and I simply could not stay in the room while you were doing that part of the operation."

The girl made a very satisfactory operative recovery, but was rather slow in regaining the use of her limbs. This, however, she eventually did, so that she can now walk a half-mile or more with, however, a rather slow, hesitating gait. When she came to see me recently she had developed into a rather large, stout woman, was married, and able to do her housework, but had gotten rather stout because of lack of exercise, and although she can with some difficulty walk a half-mile she had gotten out of the habit of walking and did as little as she could get along with. She has had one child. She is in a condition now where she can get about fairly well, can do almost everything that an ordinary individual can do, and yet even at the end of ten or twelve years she still shows the evidences of the cord pressure. I cite the case to you because of that fact.

The results obtained from operative treatment in tumors of the spinal cord are distinctly more satisfactory than the results obtained from the operative treatment for brain tumors. On the other hand, we find in cord tumors a number of the same difficulties. A certain proportion of the cases are malignant; a certain proportion of the cases are of an infiltrating character, so that they cannot be removed without great injury to the cord, and in a certain proportion of cases where even by expert neurologists a diagnosis of cord tumor is made, exploration fails to disclose a neoplasm, and shows in many cases degenerative lesions of the cord for which nothing can be done by surgical operation. On the whole, however, these tumors of the cord furnish us one of the brilliant chapters in modern surgical diagnosis and technic. Many of these patients who are paralyzed and bedridden because of the cord tumor can be cured by removal of the growth. Many of these operations are begun necessarily as exploratory operations. Some of them are unsatis-
factory, but a certain number of them are among the most satisfactory cases in the whole range of surgery. With such a conception of the possibilities we should be willing to give many of these doubtful and uncertain cases of paralysis from pressure the benefit of an exploratory laminectomy, knowing that there may be only one chance in three or possibly more of finding conditions which can be removed and the patient cured.
Carcinoma of the Stomach: Resection by the Second Billroth Method


The patient upon whom I shall operate this morning is a man of sixty-three who has been under the observation of Dr. Ortmeyer. The clinical history is briefly summarized as follows:

He has complained of abdominal distress rather vague in character, he has lost about 20 pounds in weight, lost a good deal of strength, he has no symptoms pointing definitely to his stomach, and the picture has been rather that of distress from the large intestine. In going over the case carefully, however, the examination of the stomach contents showed no free hydrochloric acid. Some occult blood was found in several stools. X-Ray examination of the stomach with the fluoroscope and plates showed a definite filling defect at the pyloric end of the stomach. The motor meal also showed definitely a retention, although there had been at no time any vomiting. No tumor could be felt in the abdominal wall. On the basis, however, of the general abdominal distress, occult blood, absence of free hydrochloric acid, and the definite filling defect Dr. Ortmeyer and I both agreed that it would be much wiser to make an exploratory to determine the condition and to do whatever seemed advisable at that time.

We shall employ here a general anesthetic as there are no contraindications, and I prefer to do these exploratories of the
stomach under drop ether wherever the patient is a good surgical risk. Dr. Herb has the patient now under ether. I make an incision from the endiform to the umbilicus, going a little to the left of the umbilicus as we come down to it. As I open the peritoneal cavity I come at once upon the tumor which is irregular in outline, but, on the whole, about as large as an egg, just to the stomach side of the pylorus. This tumor feels hard and firm and I can invaginate the stomach wall with my finger into what seems like a crater ulcer close to the pylorus. The duodenum is quite definitely larger than normal and, fortunately, quite free. There are some small glands about the size of beans along the greater curvature and along the lesser curvature. I cannot tell from the examination, even with the mass in my hand, whether it is a callous ulcer or a carcinoma. It is one of those cases, however, in which, whether it is a callous ulcer or a carcinoma, I feel that we should do a radical operation and resect the lesion. A new chapter is being written at the present time in the treatment of ulcer of the stomach, and one of the most interesting parts of the chapter is the conclusion which I have arrived at and which many other surgeons have arrived at, notably Moy-nihan, von Eiselberg, and his former assistant, Haberer, Clare-mont and Schmieden in Frankfort, is that where we have a large callous ulcer to deal with the best treatment is resection by the second Billroth method. Haberer has been doing a number of these by the first Billroth method, making a direct anastomosis between the duodenum and stomach. I personally think that the second Billroth method has a much larger field of usefulness and is the operation of choice. In this patient I shall at once proceed to do the second Billroth resection.

I first tear an opening in the thin peritoneum between the greater curvature and the transverse colon, then doubly ligate the vessels in the omentum along the lower border of the stomach and the lower border of the duodenum for a distance of about 6 or 7 inches. In doing this I must be very careful not to ligate the main arterial supply of the transverse colon. If one does ligate the artery supplying the transverse colon he is in great danger of having a necrosis of this portion of the bowel as a
result and, of course, a fatal termination (Fig. 286). I now ligate the gastrohepatic omentum for a distance of 4 or 5 inches, in this way freeing the stomach, pylorus and duodenum, and mobilizing the mass so that we can proceed with its excision. I now clamp the stomach about 1$\frac{1}{2}$ inches behind the lesion, putting on a clamp the blades of which are protected with rubber, on the proximal side of the stomach, and putting on a large clamp without rubber protection about $\frac{3}{8}$ inch distal to this. I then divide the stomach at this point, using a knife. We might use a cautery, and I fre-

![Diagram showing arterial supply of stomach and transverse colon.](image)

quently use an electric cautery for this purpose. I am not, how-

ever, at all convinced that the division of the stomach or duo-
denum with the cautery in preference to the knife has any special advantage. I now close the stomach with three rows of sutures, one through the mucosa, one through the peritoneum and muscularis, and the third a Lembert suture. You will notice that before putting in the last Lembert suture I remove the clamps so as to see whether there is any bleeding. I find a little spurting vessel along the greater curvature which I ligate with
catgut. I now lift up the mass and dissect very carefully the duodenum free for a distance of fully 1 inch or \(1\frac{1}{4}\) inches from the pylorus, separating it very gently from the pancreas and from the gastrohepatic omentum above and the greater omentum below. I then crush the duodenum just beyond the pylorus with a heavy pair of forceps, and at this line of crushed tissue I ligate the duodenum off with a very strong piece of silk and then cut the bowel between this ligation and the pylorus. I now put a purse-string suture about \(\frac{3}{2}\) inch from this point of ligation around the duodenum and invaginate this ligated stump. I then tie the purse-string suture tightly and place a second purse-string suture over the first, but the second one is about \(\frac{1}{2}\) inch behind the first. In this way we have now removed the mobilized mass containing a small portion of the duodenum, pylorus, and about 4 or 5 inches of the pyloric end of the stomach.

Our next problem is to make an anastomosis between the stomach and jejunum. In these cases I have learned that much the most satisfactory technic is to cut open the transverse mesocolon and draw a loop of jejunum through this opening, and make an anastomosis between the stomach and jejunum above the transverse mesocolon (Fig. 287). You see how I do this, using clamps on both the stomach and jejunum and employing three rows of suture. I am still using the Pagenstecher linen and have more confidence in it than I have in catgut. I think, on the whole, it is the best suture to employ in gastro-intestinal work. I am inclined to believe that the argument advanced against the linen and silk sutures, that they are the cause of jejunal ulcer, is not very well founded. They may possibly do that in a few cases, but I am inclined to believe our future work will show that these jejunal ulcers occur about as frequently where we use catgut as where we use the non-absorbable sutures, that the essential factor in the production of jejunal ulcer is a transformation of the jejunum into what is essentially the first part of the duodenum, exposing the jejunum in this way to the corrosive action of the gastric juices, which are, beyond question, the most essential factors in the production of peptic ulcer. Now after the gastro-enterostomy is completed I draw the loop of
jejunum down through the opening in the transverse mesocolon and stitch the line of the gastro-enterostomy to this slit in the mesocolon with three or four catgut sutures. I usually in placing these sutures pass them through both the jejunum and stomach wall and then into the mesocolon. Great care, of course, should be taken in doing this in order to prevent a possible hernia of the jejunum occurring at this opening in the mesocolon. I shall not use any drainage in this case. You will notice that I am clos-
ing the abdominal wall by first closing the peritoneum and then using three sets of button tension sutures, which we are so partial to in this clinic, and then closing the rest of the abdominal wall in the usual way with catgut through the anterior sheath of the rectus and silk through the integument.

I now want to show you the gross specimen which we have removed. Splitting this open I find, rather to my surprise, that there is no raw surface of the mucous membrane, that there is a crater-like lesion with rather indurated callous margins, but there is no real open ulcer. On making an incision into this callous ulcer as I divide the submucosa with the knife I can feel that the tissue is very much like a carcinoma, and I feel pretty sure that this is a carcinoma of the stomach. (Note: Careful examination of the specimen from the sections taken at five points of the periphery of the lesion and from enlarged glands all showed typical carcinoma.)

There is one question that occurs to me as I look at this specimen, that is the question of whether this is an old healed ulcer in which a carcinoma has developed, or whether this lesion is a carcinoma which has developed independent of the preceding ulcer. I want to give you my impressions of this problem from observations which I have made in my own clinic. They are these: I do not believe that any large percentage of stomach carcinomas develop from the preceding stomach ulcers. Of course, there is no doubt the development of a carcinoma in an old callous ulcer is a definite possibility, and I have no question but it occurs, and taking the enormous number of these cases that exist, that it occurs, of course, quite frequently. But when we ask ourselves the question, In what percentage of cases are carcinomas of the stomach primary lesions independent of preceding ulcers and in what proportion are they secondary to the pre-existing ulcer? the evidence which I have been able to obtain would lead me to conclude that in much more than 90 per cent. of the cases of carcinoma of the stomach have the carcinomas occurred independent of the preceding ulcer, and that in much less than 10 per cent. of the cases which have carcinomas have they developed in the old callous ulcer or in the scar of the
ulcer. In this connection I want to call your attention to a somewhat parallel condition which we have the opportunity of observing more frequently because the lesion is always in sight, that is, the question of the occurrence of carcinoma in ulcers of the leg. Ulcers of the leg are exceedingly common conditions. We know that occasionally a carcinoma does develop in an old leg ulcer or in the scar of an old healed leg ulcer, but when we ask ourselves the particular question, How often does a carcinoma develop in these old ulcers? without being able to answer it absolutely from statistics one could without any hesitation say that of the enormous number of leg ulcers that occur in the community very few develop cancer; without any question much less than 5 per cent. and probably even less than 1 per cent. I believe the parallel between the leg ulcer and the gastric ulcer which I make is sound. We might admit, of course, that more gastric ulcers will change into carcinomas than leg ulcers, but at the same time I believe that this change is the exception and that it occurs comparatively infrequently, and from my own individual experience I would say without hesitation that I believe I see at least twenty carcinomas of the stomach which have developed independent of any preceding ulcer today where I see one where there is a fair probability that the cancer developed at the site of the old peptic ulcer. Certainly the conception that 20, 30, 40, or 50 per cent. of the cancers of the stomach develop on the site of old ulcers is based upon a misconception and a misinterpretation of facts.

I want to dwell upon this case and tell you that although I believe from the gross evidence this morning that this case is a cancer, I would like to make it clear to you that if I had believed that this was a callous ulcer I should have resorted to exactly the same operative technic. I have long been converted to the opinion that peptic ulcers should be treated medically, and that the great majority of these cases can be cured in this way. There are, however, a number of cases which resist treatment and which present complications which either demand surgical treatment or make surgical treatment preferable in that particular case. In ordinary ulcers of the duodenum gastro-enterostomy offers,
I believe, in about 90 per cent. of the cases a cure, and in ordinary ulcers of the stomach gastro-enterostomy offers about 50 per cent. prospect of a cure. In the large callous ulcers, however, the prognosis from gastro-enterostomy is not favorable, and I believe here the second Billroth resection offers the patient much the best prospect of cure, just such an operation as I have shown you this morning. Fortunately, in ulcer cases the operative mortality is very small, a number of skilled operators having done the operation with no more than 2 or 3 per cent. mortality. The advantages of the operation with resection in callous ulcer are: first, that it removes the ulcer; second, it removes the pylorus and the element of pyloric spasm is thus eliminated from the case; in the third place, by removing a considerable portion of the stomach it diminishes the sum total of the gastric secretion, and, as has been shown clinically, reduces the free hydrochloric acid content of the stomach very definitely, and, above all, this operation has this tremendous advantage, that if the operator has made a mistake and his case is not an ulcer, but a carcinoma, or in the exceptional case, an ulcer which is undergoing carcinomatous change, this technic gives the patient the benefit of the same radical operation that we employ for carcinoma of the stomach.
TWO CASES OF COMMON DUCT OBSTRUCTION

Two Patients with Common Duct Obstruction. History and Operative Findings in Each Case. Difficulty in Diagnosis in Obstruction of the Common Duct.

I have the opportunity of showing you this morning 2 cases of common duct obstruction. The first patient is a woman of fifty-five who comes to us with a history of having had repeated attacks of what seems from the description of her attending physician to be gall-stone attacks. In the early history of the attacks she was not jaundiced, but during the last seven or eight months the attacks have been followed by jaundice which, when first present, would develop shortly after an attack, last for some days, and then disappear. During the last eight weeks the jaundice has been persistent, and although it has varied somewhat in intensity it has been, on the whole, deepening. You will notice that she is a large woman, weighing about 150 pounds even in her present emaciated condition. She did weigh a year ago, when she was in good health, about 190 pounds. These attacks have been associated with chills and fever, the attack appearing very much from the patient's description like the Charcot fever that is so suggestive of common duct stone with infection in the bile tracts.

We have tested out the coagulation time of her blood a number of times, and it is about five and a half minutes. She has 80 per cent. hemoglobin and the Wassermann test is negative. For some weeks she has had clay-colored stools with occasionally some evidence of bile.

On physical examination one can find what appears like a very markedly distended gall-bladder in the right upper quadrant, but apparently 2 or 3 inches farther outward than the ordinary position of the gall-bladder. I am inclined in this case to make a clinical diagnosis of gall-stones and an obstruction of the common duct. The fact that she has a very greatly distended
gall-bladder would speak, however, according to Courvoisier's law, in favor of not an obstruction of the common duct by stone, but an obstruction from carcinoma of the pancreas. You know Courvoisier's law, which we have found to be of great service in analyzing these cases, is that in 80 per cent. of the cases of obstruction of the common duct from stone the gall-bladder is contracted and not palpable, but, on the other hand, in 80 per cent. of the cases of obstruction of the common duct from carcinoma the gall-bladder is distended as it is in this case.

The patient is now anesthetized and I shall make a large S-shaped incision, exposing the bile tracts. I want to say a word in regard to the S-shaped incision (Fig. 288). I have shown you this incision and have emphasized its importance and valve so frequently that it would seem unnecessary to take it up in detail at this time. On the other hand, it is so often badly employed that I want to give you the essentials of it here this morning, and tell you that we have in the last few months not modified it in principle in any way, but modified it slightly in a way to emphasize what we regard as the correct method of making the incision. We start the incision in the angle between the ensiform and the costal cartilage, carry it downward and outward about a fingerbreathth from the costal cartilage until we come to the center of the rectus muscle. We then pass down the center of the rectus muscle to a point just below the umbilicus to a straight line, and then shoot outward and downward for a distance of about 3 inches. This divides the skin, superficial fascia, and the anterior sheath of the rectus. We then pick up that portion of the anterior sheath of the rectus which covers the inner half of the muscle and dissect it up from the muscle until we reach the inner border of the muscle or almost to the inner border. We then split the rectus muscle, leaving at least four-fifths of the muscle to the outer side. Then we retract the rectus muscle well outward with a pair of retractors and expose the transversalis and the peritoneum which are beneath. We then divide the transversalis muscle and peritoneum not at the point where we split the rectus muscle, but about 2 inches external to this, so that it brings us very much nearer the ordinary
position of the gall-bladder. If you have followed me carefully you will see that in this way we have conserved the nerve supply of at least four-fifths of the rectus muscle and at the same time we have obtained a very wide exposure of the liver and bile.

Fig. 288.—Modification of S incision in approach to gall-bladder region: A, Anatomic relations of incision through skin and sheath of rectus. B, Rectus muscle incised, leaving four-fifths of muscle lateral to incision. C, Rectus retracted and transversalis exposed. D, Exposure completed and viscera brought into view.
tracts, and we have obtained this exposure where it is most needed, well out toward the gall-bladder. This form of incision enables us to open up the abdominal wall very high or in the angle between the ensiform and the costal arch, and this portion of the incision is of particular value in difficult bile tract work. This portion of the exposure cannot be obtained by the ordinary incision over the middle of the rectus which is still practised by a number of surgeons in spite of the fact that a much better exposure of the field can be obtained by this method of incision.

Retracting the edges of the incision I now expose the peritoneal cavity and bring into view this greatly distended gall-bladder. I pack it off with abdominal pads and with a large aspirating syringe draw off, as you see, a considerable amount of pus and mucus from the gall-bladder. The gall-bladder wall is very much thickened and edematous, but I can readily feel through the wall that the gall-bladder is filled with a number of large stones. I now introduce my hand into the abdominal cavity and I find a hugely distended common duct. It feels as though it were 1 inch or 1 1/2 inches in diameter and filled with great masses of gall-stones. I separate the fundus of the gall-bladder from the liver, free the gall-bladder completely, and I find as I do this that there is apparently no cystic duct, that the gall-bladder and the common duct seem to run into each other without any intervening narrowing as we would expect where there is still present a cystic duct (Fig. 289). I have had this problem to deal with a number of times, and in order to make sure of the situation and prevent any injury of the common duct I shall now split the gall-bladder open and remove the stones. I split the gall-bladder open all the way down to the common duct, and I find as I remove the stones that the condition is as I expected. The cystic duct has disappeared, and in place of the cystic duct the neck of the gall-bladder seems to run into the common duct, and at that point the caliber must be at least an inch in diameter. I now cut off the gall-bladder from the common duct, and as I do this you see this large gaping opening into the common duct, and in this opening you can see projecting a large gall-stone. With a scoop I now take out this enormous collection of gall-
stones, enough to fill an ordinary teacup. I now come down to a very large concretion which fills the lower portion of the common duct. With my thumb and finger I carefully push this concretion upward. You see I now deliver it. It is about 2½ inches long and more than an inch in diameter. It is rather pyramidal in form, the apex of the pyramid projecting down-

Fig. 289.—Diagram of common duct and obliterated cystic duct filled with gall-stones.

ward toward the ampulla, and the upper portion or base of this huge gall-stone is smooth and facetted and was in contact with the large facetted stone immediately above it. I introduce now a probe through this greatly dilated common duct readily into the duodenum. I now introduce a scoop upward into the hepatic duct and remove a number of concretions from the hepatic duct. The hepatic duct is so dilated that I can readily introduce my finger, and I find we have cleaned the hepatic duct out com-
pletely. I introduce a probe first into the right hepatic and then into the left hepatic duct. Examination of the pancreas shows there is a slight induration of the pancreas. There is no evidence of carcinoma, however, and I am inclined to believe that we can exclude any probability of carcinoma from the case. I shall drain the hepatic duct in this case. Because of the large size of the duct I use a good size drainage-tube, about as large as my index-finger. I introduce also a split-rubber tube containing iodoform gauze down to the opening in the common duct. Because of the fact that both the gall-bladder and common duct contained pus and mucus I shall carry a strip of iodoform gauze in either side down to this opening. I dislike very much to do this because it will be rather painful to remove this gauze, yet I feel that iodoform gauze in this case is the lesser of the evils and will give us a certain amount of protection against infection. We now close the wound as we do in these cases, closing the posterior sheath of the rectus with catgut, and then passing through-and-through sutures of silkworm-gut through the abdominal layers, and then catgut through the anterior sheath and silk in the skin. In addition, I shall employ three sets of button sutures, which we are now employing in all of these cases. I want to again emphasize the importance of these button sutures. They certainly add a great deal of safety to one of these badly infected bile tract cases.

After-history.—This patient had a rather stormy convalescence. For three or four days she had a great deal of nausea and vomiting and could retain nothing on her stomach. Fluids were given subcutaneously and the stomach was washed out. At the end of four or five days she was able to retain liquids and cereals and her condition improved then quite rapidly. For the first two days the discharge from the tube was pus, mucus, and bile, then the bile became clear. There was a very large amount of bile discharged by the tube. The jaundice very rapidly disappeared and she went on to a very satisfactory and complete recovery. The tube was allowed to remain in the hepatic duct for about two weeks and the bile discharged through the fistula after removal of the tube for about two weeks longer.
Case II.—The second case this morning is a somewhat similar one. This lady had very much the same picture as the first patient, and was operated upon two years ago for common duct obstruction. The common duct also was very greatly distended, about 1 inch in diameter, and packed full of stones. She had marked enlargement and induration of the pancreas and we thought that it was probably inflammatory and not carcinomatous. She had at that time a very stormy convalescence, but finally went on to a complete recovery and was entirely well for a number of months. Then the old attacks recurred and she comes back to the hospital intensely jaundiced, one of those greenish-yellow colored skins which is found only after a very long-standing and continuous obstruction of the common duct. Her general condition in spite of the attacks which have been associated with chills and fever is fairly good. Her time coagulation is about five minutes. At the previous operation her time coagulation was between seven and eight minutes and she had a direct transfusion from her husband before the operation. She had a very sharp reaction, however, after this transfusion, and I have omitted repeating it at this time because her time coagulation is fair and her general condition is better, and because I was rather inclined to think that the transfusion done before the last operation did her more harm than good. I know that we shall have a good deal of trouble in operating upon this patient at this time. I have operated on a great many of these old common duct cases where second and third operations were necessary, and have found them among the most difficult surgical procedures that I have ever undertaken.

I make in this case as in the former case the same S-shaped incision, and come down to the peritoneal cavity, which is entirely obliterated by adhesions. I find it necessary to divide the round ligament of the liver in the attempt to expose the common duct. I do this and doubly ligate it. I find that the duodenum is plastered to the under surface of the liver and with great difficulty I separate the duodenum from the liver. I now feel the enlarged pancreas. I do not believe, however, that it is carcinomatous. Continuing the dissection, I have at last come
down to the common duct containing a stone. You see that it has taken forty minutes to separate these adhesions and expose the common duct. In other words, we have to fight our way through these adhesions, and with the greatest possible care to avoid any serious injury before we can expose the common duct sufficiently to palpate it and to incise it. Lifting the common duct on the index-finger of my left hand and holding this mass of stones between the index-finger and thumb, I make an incision down through the common duct on to the underlying stone. Doing this I divide a vessel of fair size which I clamp and ligate. I now open the common duct and out of it comes some pus and mucus, but no bile. With a scoop I remove these gall-stones which, as you see, are partly formed gall-stones with facets and partly débris of cholesterol and pus. With great care and with great gentleness I scoop out all of this débris and pass a probe through the common duct into the duodenum, which I find I can do without any difficulty. I also pass a probe up through the hepatic duct. I believe we have now removed all the gall-stones from the common duct. From our previous experience with this case I am going to provide drainage for a long time—for a number of weeks—and in order to do this I am going to introduce a T-tube. I take, therefore, a good size T-tube and cut it off so that the short arm will go into the hepatic duct for a distance of 1\(\frac{1}{2}\) inches and the long arm down in the common duct for a distance of 1\(\frac{1}{2}\) inches. I then set the T-tube in position and, as in the previous case, I carry a split-rubber drain with iodoform gauze in it down to the closed incision. I close the external incision just as we did in the last patient.

**After-history.**—This patient, considering her condition, made a very satisfactory recovery. For the first forty-eight hours nothing but pus came out through the tubes; evidently little or no bile was secreted by the liver during this period. Then the bile began to flow out of the tube, and this gradually increased and for a number of days was very copious. The first few stools were clay colored, but within four or five days the bile passed readily through the T-tube into the intestine and the stools were deeply bile stained. The jaundice faded and gradually
finally disappeared, and the patient went on to a good recovery, the T-tube being left in position for four weeks, and then removed without great distress, though I thought it wise to give the patient a whiff of gas in order to make this procedure more bearable.

I want to take the opportunity of referring to 2 other cases which we have recently had which illustrate the difficulties in diagnosis and the uncertainties of diagnosis in cases of obstruction of the common duct. We have recently operated upon a case very much like the patients we operated upon this morning in which the findings at operation and the after-history demonstrated a different pathologic condition. I operated upon a woman of fifty some weeks ago who presented clinically very much the same picture that existed in the first patient operated on this morning—repeated attacks which were consistent with being gall-stone attacks followed by jaundice, which gradually deepened, and when the patient was brought to our service she had a definite enlargement of the gall-bladder. Under local anesthesia, because the patient’s condition was so bad, I simply drained the gall-bladder. I made a rather superficial examination of the abdominal contents, sufficient, however, to satisfy myself that she had a carcinoma producing obstruction of the common duct, presumably the primary site of the carcinoma being the pancreas. There was no difficulty about introducing under local anesthesia a drainage-tube in the gall-bladder. It contained at that time simply bile-stained mucus. At no time did any considerable amount of bile escape. The patient continued to be jaundiced and finally left the hospital slightly improved and still having the tube in the gall-bladder. I referred her to one of my colleagues who took care of her at home. He reported to me that within a few weeks she commenced to pass gall-stones through the fistula alongside of the tube, and that she improved somewhat. Because of the uncertainties in her case I had her brought back to the hospital and under general anesthesia opened up the incision, exposed the gall-bladder, and found that it was full of gall-stones, but, in addition, there was a great mass, which certainly must have been carcinoma of the
pancreas, surrounding the common duct. I simply removed the stones from the gall-bladder, introduced a tube, and she made a good operative recovery. The jaundice persisted and she is apparently now dying of general carcinomatosis.

I want also to refer to a case which will illustrate another phase of this condition of common duct obstruction. Recently a patient upon whom I had operated in 1918 came in to see me apparently in the best of health. I looked up my records and found these interesting facts: The patient in 1918 was a man of forty. He had had a number of attacks consistent with being gall-stone colics. In the early history there was no jaundice, but in the last two months before I saw him jaundice developed and became persistent, varying somewhat in intensity. During his gall-bladder attacks he had slight temperature and increased leukocyte count and tenderness over the gall-bladder region. Dr. B. W. Sippy and myself saw him in consultation and made a clinical diagnosis of common duct obstruction. I operated on him in January, 1918. I exposed through a large S-shaped incision the liver and bile-ducts and found no evidence of stone in the gall-bladder. With my finger in the foramen of Winslow I could feel a large mass which was consistent with being either a chronic interstitial pancreatitis or a carcinoma of the pancreas. I incised the gall-bladder and thought from its gross appearance that the tumor was probably carcinomatous. No stones were to be felt after the gall-bladder was opened. I then opened either the upper part of the common duct or the hepatic duct, I could not be sure which, and introduced a tube into the gall-bladder and drained in this way both the hepatic duct and the gall-bladder. After we had made the exploratory operation we came to the conclusion that we were dealing with a primary carcinoma involving the bile tracts and pancreas, and the tubes were maintained in position for a number of months. The patient made a rather slow recovery, gradually the jaundice disappeared, and his general condition improved. He finally went on to a complete recovery and is now in apparently perfect health without any evidence of his old trouble.

We have had a number of similar cases. We evidently had
COMMON DUCT OBSTRUCTION

to deal in this case with a chronic inflammation of the gall-bladder and bile tracts, a chronic cholecystitis and cholangitis without any gall-stones, but with a very marked chronic interstitial pancreatitis which led us even at the exploratory to believe that we had a carcinoma to deal with. Of course the result and the fact that it is more than four years after operation and the patient is entirely well settles the diagnosis and eliminates entirely the possibility of carcinoma and makes certain the diagnosis of infected bile tracts with secondary chronic interstitial pancreatitis. Cases of this kind are now well known and a large number of them can be found in the literature. We owe, I think, to Mayo-Robson more than to anyone else our knowledge of these cases. I can remember quite well that about twenty years ago Robson reported a number of these cases which he had believed at the time of the exploratory to be carcinomas of the pancreas, and where he drained either the common duct or the gall-bladder, and found later that instead of being a carcinoma the patients went on to complete recovery, demonstrating the fact that the swelling was inflammatory and not malignant. This possibility we should always keep in mind. It is the one hopeful side of these cases which appear like carcinomas of the pancreas, and these experiences teach us the importance of draining the bile tracts in these cases and the importance of maintaining this drainage for a long period of time with the hope that the condition may not be malignant, but may be inflammatory, and one which may go on to a recovery under proper drainage of the bile tracts.

I want to say one further word in regard to this group, that from our own experience we rely more upon the external drains than we do upon cholecystenterostomy. I am quite aware that this is a disputed point, but my own clinical results and the experiments of my assistants in doing cholecystenterostomies on dogs have led us to believe that cholecystenterostomies carry with them a good deal of risk of ascending infection of the liver, which, of course, is one of the things we should especially avoid in these cases.
INFRACTION OF THE HEAD OF A METATARSAL BONE

Infraction of the Head of the Third Metatarsal Bone in a Girl of Fourteen. Incidence, Cause, Pathology, Symptoms, and Treatment of this Condition.

A FOURTEEN-YEAR-OLD school girl was seen in December, 1920, complaining of pain of six months' duration on the dorsum of the foot and at the base of the toes. So far as she could recall there had been no trauma to this foot. She had been fitted with and worn a metal arch support with some relief, but for the immediately preceding six weeks the pain had grown so severe that she could scarcely walk. There was no loss of weight, no night-sweats, no cough. Her appetite was poor; her tonsils had been removed five years previously.

Physical examination at the Presbyterian Hospital revealed a scoliotic spine, a general tendency to lax joints, but was otherwise negative. The left foot showed some swelling over the head of the third metatarsal bone, where there was tenderness on pressure and weight bearing, or when the middle toe was strongly manipulated. Roentgenologic examination of the chest failed to discover any active tuberculous process. There were shadows of possible mediastinal glands. Roentgenogram of the foot (Figs. 290, 291) showed a flattening of the head of the third metatarsal bone, evidenced in both anteroposterior and lateral views. Infraction of the head of the bone was diagnosed, and on account of the long-standing history of pain, together with the joint swelling and possible presence of a loose piece of bone, arthrotomy with removal of any loose bone
fragment was suggested. This was refused and the foot was put at rest. After one month the pain had disappeared and did not return following use. At this time, over a year having passed, the young woman can walk and run without pain in the affected region.

Information about this delicate type of fracture of the metatarsal head has developed recently. The first report

![Image 290](image)

Fig. 290.—Roentgenogram showing the head of the third metatarsal bone plainly flattened and distorted. This change in contour is characteristic of infraction and is remote from the epiphyseal line.

was made by Freiberg\(^1\) in 1914, mentioning 6 patients. In all I find 14 instances of infraction of the metatarsal head reported, one by P. G. Skillern, Jr.,\(^2\) 4 by Campbell,\(^3\) and 3 by Painter,\(^4\) to which is added my patient, making 15.

\(^1\) Freiberg: Surg., Gyn., and Obst., August, 1914.
**Incidence.**—A majority of the instances reported occur in girls under eighteen years of age. In these young women the epiphysis of the metatarsal bones have not yet closed, and yet the condition is not one of epiphyseal separation. Women and boys, probably very seldom men, are subject to this fracture. During the war many observers recorded disability among young soldiers arising from metacarpal derangements. These were called everything from overstrain to fracture, but no infractions of the metatarsal head were reported.

**Cause.**—Some patients, as my own, fail to recall any specific date on which the trouble began. Others have distinct remembrance of stumbling or tripping, which was the onset of their disability. Jumping, stumbling while playing tennis, tripping, and stubbing the toe, as in a basket ball game when the toes were dorsiflexed, was the usual contributory cause given
by the athletically inclined young women or boys who suffered with this condition.

Pathology.—It must be remembered that there is diversity of projection as well as strength of the metatarsal bones. The fifth projects the least, the fourth the next, but the projections of the heads of the inner three bones vary. The third bone may reach as far as the second, never beyond, yet both of them may be longer or shorter than the first bone. The third metatarsal is the most delicate and is a weak bone; the second may be the strongest next to the first, or the weakest of all five; in fact, it is the most variable.

In the anterior part of the long arch of the foot the second and third bones occupy the highest plane in a cross-section. While all metatarsals articulate with the tarsus, the first has most freedom of motion; the fifth next, and fourth, third, or second very little if any independence of movement, on account of the interlocking character of their apposition one to another. The second and third bones lying parallel and straight antero-posteriorly form a narrow angle with the other bones which diverge slightly, so that most of the body weight is transmitted through the head of the second metatarsal bone to the tarsus. To stand, to bear weight on both normal feet necessitates chief points of support in the calcaneus, shaft, and head of the fifth metatarsal and the head of the first metatarsal. To walk, however, the main points of contact with the floor are constantly changing. The heel strikes first, the sole next, and the body weight is then carried forward on to the heads of the metatarsal bones, so that during the termination of the step the four inner metatarsal bones and their toes are the main points of support, while the second and third metatarsal heads form the most direct support of the anterior and of the longitudinal arch of the foot. In this final act of stepping the second and third metatarsals therefore subject themselves to direct pressure of all the body weight. So the soles of the shoes wear out over the head of the second bone, calluses on the sole are frequently found there. In the act of stumbling or stubbing during weight bearing this point of foot support is subjected to suddenly in-
creased pressure when its weight bearing is at a maximum and when the toe is dorsally flexed, but this pressure is applied largely at the end of the bone in an anteroposterior axis, and expends itself on the broadened head of the bone to force it on to the shaft, possibly in a slightly posterior direction. The thin cortex of the head of the bone is driven in on to the underlying cancellous tissue, infraction results, sometimes called egg-shell fracture, and the skiagram reveals a flattening of the head with some broadening and foreshortening where the cancellous trabeculae have been crushed together. In some instances the cartilage of the joint surface, together with the shell of cortical bone, may be entirely separated from the head, to come to lie freely within the joint, acting as a foreign body on account of deprivation of its blood-supply. The outer layers of cells are probably nourished by the surrounding synovial fluid as in injuries of the intra-articular carpal bones.

Hemarthrosis in this joint may follow; serous effusion always does; and there results distention of the joint, rarely I believe any tearing of the joint ligaments. This joint swelling usually persists because the condition is not recognized and use (walking) is continued. Bone formation may be stimulated so that small osteophytic projections develop. If there has been true infraction and compression of cancellous bone trabeculae, a greater density of the bone in that area may be shown in the skiagram. If a layer has been partially separated off from the head of the bone, losing its blood-supply, it may preserve its original density, as would a sequestrum. Later it would appear as a deeper shadow in the skiagram, and, in contrast to some atrophy of disuse developing in the remainder of the bone or neighboring metatarsals, lead to a mistaken roentgenologic interpretation. Possibly this condition is the one described by Köhler as a diseased condition of the metatarsophalangeal articulation. He showed 2 cases at the Deutsche Roentgengesellschaft in 1920, claiming that the condition attacks the second metatarsal, so that the distal third of the bone becomes involved with nearly complete disappearance of the head or neck, or else the head is pressed in or flattened, or the joint surface alone may be flattened
down. He opened the joint of one patient to find gray granulations. Five patients had been seen by him; the condition was always unilateral, but he had been sent the skiagrams of the feet of a sixteen-year-old girl in whom the condition was bilateral. My patient suffered the injury solely on the third metatarsal head. This is the only one so reported, although the roentgenogram of one patient of Campbell’s suggests injury of the third bone in addition to the second. A position of slight adduction of the foot might lead to injury of the third bone instead of the second, especially if the second bone were quite short.

**Symptoms.**—With an understanding of the cause and pathology it is not difficult to believe that the patient may not complain of great disability at first. The stub of the toe, although causing momentary sharp pain, might easily be forgotten. Pain and soreness in the toe joints gradually assert themselves, especially after exertion. There may be no ecchymoses or abrasions. If the bone head has been flattened an exostosis and thickening of the capsular structures about the joint may follow; the head of the bone involved feels thick on examination. There is swelling, exquisite tenderness, and pain on pressure of this head. The disability may be such that the patient walks with a decided limp and may show some atrophy of the calf muscles in that leg. The skiagram shows the flattening or thickening of the bone head, regional bone atrophy, possibly osteophytic outgrowths, and corpora libra of detached bone in the joint. When the second toe is manipulated there may be pain or stiffness in its joint or in some instances exaggerated joint crepitus in the metatarsophalangeal joint. The symptoms tend to persist.

A differential diagnosis must consider metatarsal pain from flattening of the anterior arch. The skiagram is very helpful, and because the patient is a large adult differentiation is not difficult. Morton’s disease is paroxysmal and involves mostly the fourth metatarsal; fracture of the fibular sesamoid (very rare) occurs in adults and is differentiated by skiagram; tuberculosis or even acute low-grade osteomyelitis of the metatarsal
may lead to difficulty in diagnosis. A careful study of the two-way plate will reveal the flattening or indentation of the metatarsal head in infraction; the presence of loose bodies makes a differentiation difficult. General physical findings will settle the difference. Osteo-arthritis seldom occurs in these young people, nor is it monarticular.

**Treatment.**—The indications for treatment are to remove the irritating bone, which may have come to act as a foreign body, and to remove the irritation of weight bearing. If there is no roentgenologic evidence of loose bone fragment, complete cessation from weight bearing for one month will probably effect a cure. A small pad or plate arranged for transverse arch support just posterior to the metatarsal head may prevent a recurrence of symptoms. If loose bone is present arthrotomy with removal of fragments, resuture of the joint, and subsequent rest from weight bearing promises cure.

One of Painter's patients subjected to operation yielded a thin film of granulation tissue between the cartilage and shell of the head of the metatarsal bone. The cartilage was lifted out of the joint, the end of the bone was curretted, and the wound closed, with a complete recovery following.
MYXOMA OF JAW


In 1907 this young woman experienced trouble on the right side of her lower jaw on account of the incrowding of a small tooth. Within a year this tooth was extracted, and in 1909 a lump appeared on the jaw at the site of removal. A surgeon, working inside the mouth, chiseled off this lump, but before the middle of 1911 the tumor reappeared on the jaw. A second surgeon then cut through the neck externally below the jaw level, after removing another tooth, and cut away some of the hard tumor mass. Within the subsequent year (1911-12) two additional operations were performed to reduce this enlargement.

The patient first consulted me on May 3, 1919, nearly twelve years after the onset of the disturbance. At that time four teeth were wanting on the right mandible and their space was occupied by a hard rounded painless tumor the size of a small egg. There was some interference with chewing and articulation, but no ulceration existed through the mucous membrane covering the tumor. On the skin surface of the neck and jaw were two scars, one quite thick, indicating healing by secondary intention, but there was very little external evidence of tumor mass to be seen. The patient was apparently in good health, no enlarged lymph-nodes were palpable in her neck, and a physical and roentgenologic examination of the chest revealed no suspicious dulness, breathing sounds, or shadows which would indicate metastases. Her weight was 130 pounds.

The roentgenogram of the jaw (Fig. 292) showed a diffusely invading tumor of the mandible, evidently confined by the periosteum, with large clear spaces showing no bone shadow,
partition walls of bone trabeculae crossing through the mass. The main portion of the tumor was rounded and extended along the mandible by prolongations into the medullary cavity, the cortical bone being the last to give way before the advancing growth. No new subperiosteal bone seemed to be laid down. The roots of neighboring teeth were surrounded by this invasion and yet they were not loose in the alveolar process. The findings were not definitely those of osteitis fibrosa either in the roentgenogram or in the clinical examination and history.

Fig. 292.—Roentgenogram of myxoma of jaw taken May 12, 1919. The fine bony trabeculae, the enlargement of the mandible, and the loss of teeth are evident in the roentgenogram. There is no deposition of new subperiosteal bone.

The tumor had been operated upon with at least partial removal several times; it had recurred as a steadily growing hard tumor, not cystic to palpation, not yet ulcerating through its mucous covering, not giving gross evidence of glandular metastases, but insidiously invading the jaw substance, particularly via the medullary cavity. These facts, coupled with the evidence that the tumor mass seemed still to be contained within the periosteum, led to a belief that we were dealing with a bone tumor relatively and originally benign, but which was gradually assuming a malignant aspect. Consequently radical removal
was advised, especially since half-hearted previous attempts at excision had proved valueless and had possibly led to recurrence.

From the surgical standpoint we were confronted with the problem of complete removal, no matter what the extent of the tumor invasion. This meant the sacrifice of perfectly normal appearing teeth and considerable extent of jaw, which would lead to mechanical problems immediately following operation, and later replacement of bone to furnish a basis for a masticating surface. There were, moreover, two scars from previous operations; from a cosmetic standpoint we wished to avoid adding any facial disfigurement.

On May 20, 1919 a preliminary ligation of the right external carotid artery was performed through a small incision, and then through her stretched and retracted mouth a complete removal of the right mandible was performed, taking its covering of mucous membrane along with it, from just in front of the last molar to and beyond the canine of the left side, passing beyond the line of the symphysis in front. By doing this work through the open mouth an external wound and scar were avoided. We were surprised to find that the tumor had grown nearly 2 inches along the medullary cavity, beyond any apparent involvement of the bone, passing the symphysis and invading the left side. The first area of resection of the mandible at about the middle line showed this invasion and necessitated a removal of an additional inch of bone on the left side. A close inspection of both removed and remaining surface showed what seemed to be normal bone section.

To avoid collapse of the remaining portion of the mandible the teeth on the left side were wired snugly to the upper jaw, holding the remainder of the mandible in its proper relation. On the stub end at the right side only one tooth remained in front of the ramus, and it was impractical to attempt to wire it to the jaw above.

Mouth-washes were used after operation, and ten days later the patient left the hospital, the ligation wound cleanly healed. The mucous membrane within the mouth rapidly closed down over the defect created by operation.
On July 5, 1919 the patient entered the hospital for a transplantation of bone to fill the existing jaw defect. A plaster-of-Paris mold was made of the mouth, the wires on the teeth being temporarily removed, and the exact size and shape of the defect were estimated. To fit the transplant to the curve of the jaw was one difficult point to arrange. After some study we found that the curve of the eighth rib in its extreme posterior portion near the spine, entering into the angle, almost exactly fitted. A measured section of the eighth rib was therefore removed with its periosteum intact, and was split in half. An incision into the cheek was made just below the jaw level and the two ends of the mandible were exposed and freshened, while the gutter in the cheek tissues was prepared for reception of the transplant without opening into the mouth. At the proximal end of the mandible, near the ramus, the rib was inserted snugly into the reamed-out medullary jaw cavity, while at the distal end the attachment was made by catgut tied through drill holes in both bone segments. The soft parts and skin were closed over

Fig. 293.—Roentgenogram taken soon after resection and transplantation of bone. Jaws are wired together. Note the curve of the transplant.
the transplanted rib, the teeth remaining wired together as before (Fig. 293).

On August 22, 1919 the wires in the teeth were released and use of the jaw encouraged. There seemed to be a firm bony union at each end of the transplant and the fair jaw alinement on the left side held in position. By September 25, 1919 it appeared that the proximal end of the transplant was loosening slightly and a roentgenogram confirmed the lack of union at this point. The teeth were rewired, but on January 3, 1920 the non-union seemed established beyond doubt, and consequently, eight days later, under local and gas anesthesia, a small sliver of tibial crest was removed and inserted into the jaw to bridge this defect. Contact with transplant and jaw stump was maintained by absorbable sutures. At this operation the end of the rib transplant did not appear especially healthful. When scraped
to freshen its surface there was but slight bleeding and it looked whiter than normal, with some osteoporosis. This fibrous union of rib to jaw was sparingly yet completely cut away. The teeth wiring broke the day after operation, but was reapplied within a few hours.

During the next three months the jaw was kept wired. On April 10, 1920 the wires were removed and bony union was

found. The condition of the transplant at this time—nearly two years after—is shown in Fig. 294. The jaw functionates very well, is strong, and bears artificial teeth. There has been no infection or sinus development (Fig. 295).

The gross specimen was cut into six sections to permit ex-

amination of the extent of the tumor and its general character-
istics. It was grayish white, softly gelatinous or mucilaginous in character, and was not surrounded by any thickened wall of bone. Its progression into the mandible apparently was via the medullary cavity. In some parts of the main tumor there were areas of old bone remaining, completely surrounded by the soft tumor mass.

A microscopic section was made of this tumor and its surrounding bone. At no place was there demonstrated a malignant type of invasion of the bone substance. The tumor seemed to be limited not by a definite capsule, but by a layer of fibrous cells quite like those in the body of the tumor mass. There was no effort at new bone formation beneath the periosteum, and the surrounding soft parts did not appear invaded. The main body of the tumor mass was composed of connective-tissue cells with short fibrillae filled in with homogeneous mucoid substance. No giant-cells, osteoclasts, or round-celled infiltration were seen. There were no mitotic figures. The included islands of bone surrounded by the tumor were dead. A diagnosis of myxoma of the jaw was made, primary, to the best of our knowledge, as no other tumor has appeared, and as a radical resection had led to no recurrence after three years it seems probable that this tumor was a true primary myxoma of the mandible.

Myxoma is defined as a tumor composed of mucous-like tissue, and consequently a primary myxoma which possibly takes origin in embryonal mucous tissue is not frequently found. We often see, however, other tumors of mesoblastic type, such as fibroma, chondroma, or even lipoma which show areas of myxomatous degeneration. Where the tumor is of rapid growth the possibility of myxosarcoma is great; in the slower growing mass we may expect a true myxoma. But in dealing with any such mucoid-like tumor which is apparently benign there is the greatest necessity for radical excision. They do recur; they invade insidiously and slowly and have enough aspect of malignancy to warrant treatment as if malignant. Bloodgood\(^1\) states that the only cures of central myxoma of bone of which he is aware were those in which the involved bone had been removed.

\(^1\) Journal of Radiology, March, 1920.
by resection or amputation, without exposure of the tumor tissue. This corresponds to our technic adopted on this patient. Ewing agrees with these ideas, and after describing the tendency of the mucous material to infiltrate the surrounding tissue, with a clinical course of a slowly growing tumor producing few other symptoms than local swelling and pressure, states that there is no recurrence after complete extirpation.

Virchow mentions that primary myxoma of bone is derived from the mucous tissue of the bone-marrow, that it infiltrates the periosteum, and causes absorption of bone. Secondary myxomas may be present in bone, but represent rather a mucous degeneration of fibroma, chondroma, or osteoma, and are usually surrounded by a bony shell of new bone laid down by the periosteum. Portions of the original bone may be included in the substance of the tumor.

In Perthes' article on the Jaw\textsuperscript{1} he mentions the fact that myxoma occurs with about equal frequency in the upper and lower jaw, and mentions 2 cases which involved the antrum of Highmore.

Our report of this instance confirms these previous statements. Primary myxoma of bone should be treated as a malignant tumor and should be subjected to radical resection as soon as diagnosed. Its main features are those of a slowly growing tumor causing no pain, progressing via the medullary cavity of the bone, leading to no regional metastases and affording roentgenologic findings which simulate cystic bone disease, without periosteal thickening covering the tumor.

Our patient shows all the hoped-for phenomena of growth in the implanted bone which is responding to the work demanded of it and promises to assume nearly full-sized jaw proportions.

\textsuperscript{1} Deut. Chir., 33a, 119.
Stricture of Small Intestine (Intestinal Obstruction—Meckel's Diverticulum)

Patient with history of abdominal distress dating back eighteen months. Relief not obtained by removal of appendix. Diagnosis finally made by inflation of the peritoneal cavity with oxygen gas. Operation. Examination of specimen.

William S. enters the Radiologic Department of the North Chicago Hospital on the service of Dr. B. H. Orndoff.

The history of the young man's sickness dates back to July, 1920, about a year and a half ago, when the patient came down with symptoms of an acute distress in his abdomen, which gradually seemed to point to an acute appendicitis so severe that the doctor decided upon an immediate operation. His report on the case is as follows:

"In August, 1920 this boy was sent to me from a neighboring town in an acute attack of a recurrent appendicitis. He was in the second day of the attack when admitted to the hospital here. On operating, the appendix was found necrotic, and a very moderate exudate on its walls involving the adjacent terminal ileum. The appendix was removed and drainage established. Forty-eight hours following the drain was removed and an uninterrupted recovery ensued."

Although the very acute symptoms immediately disappeared, the patient was not well; he kept on suffering from abdominal pain, and particularly from such symptoms as would indicate a partial intestinal obstruction. When these symptoms did not improve in due time, another surgeon was consulted in a neighboring town. He was of the opinion that adhesions from the first operation were the cause of the complex of symptoms. He therefore recommended reopening of the abdomen and

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separation of the adhesions. The patient consented and the operation was done immediately; but even this second operation and the trial of straightening out the course of the cecum and adjoining intestines did not cure the young man, for he had several attacks of very bad obstruction symptoms, with vomiting, collapse, and a great deal of pain. In one of these attacks he nearly went under. In the course of a year he recovered between the attacks sufficiently to consult some of the most competent surgeons and physicians, who, however, could not find the cause of these repeated attacks because most likely at the time of consultation he was just in one of his quiet periods. This probably accounts for the failure to determine the seat of trouble. Though he was very carefully fluoroscoped with the ordinary barium and bismuth method and his intestinal canal was well gone over by one of the best roentgenologists of our country, no evidence of a palpable pathologic lesion could be pointed out. He was told that his symptoms were of nervous origin and he was dismissed with the advice to return when more serious symptoms set in.

He was referred to Dr. B. H. Orndoff's clinic after his last attack, and arrived January 20, 1922.

Examination with the ordinary clinical methods did not reveal any more than had been brought out before, but with the pneumoperitoneum method advocated by Dr. Orndoff the findings were as follows:

X-Ray observation after barium meal showed much distortion of outline in the region of the terminal ileum, cecum, and ascending colon, as well as in other loops of small intestine. There was considerable delay or partial obstruction at one point.

After inflation of the peritoneum with oxygen-gas (pneumoperitoneum) there was positive evidence of visceral fixation of small intestine—near umbilicus—to the anterior abdominal wall, as well as to the lateral and posterior abdominal wall, which accounted for the delay and partial obstruction at this point.

Diagnosis, therefore, Stricture of small intestine with occasional total obstruction.

He was, therefore, turned over to us for an operation, and on
January 21, 1922, under general anesthesia, a median incision was made. As soon as the peritoneum was exposed it was clear that there was some very unusual pathologic condition present.

A very distended loop of small bowel presented itself below the midline (Fig. 296). The distention leaned somewhat to the right side, and it was with great difficulty that we could follow the largest pouch to a point of fixation and stricture.
Beyond this stricture the small bowel was very much reduced in size; in fact, very much like an atrophied bowel of a child. At that fixed point the stricture corresponded in its location to the middle abdomen, and the very much shortened mesentery was infiltrated and contained something like a nodule of the shape of a large gland. This small tumor mass seemed to be locked in the mesentery or adherent to the side of the same by adhesion.

I feared that in trying to bring this stricture portion with the short mesentery into better view I would rupture the bowel, and therefore walled off the exposed intestine toward both sides with sponges. As I was apprehensive, the bowel really ruptured by a very slight traction, and the contents of the distended pouch of the bowel emptied themselves and were sucked up by sponges. As soon as the distended bowel came down in size we could make that tumor mass to the side of the mesentery more visible, and we found that it was only adherent to the outside of the mesentery and not enclosed in the same; it also had a connective-tissue process toward the umbilicus.

We now proceeded to make a resection of as much of the small intestine as was necessary to establish a lateral anastomosis (Fig. 297). We clamped the proximal and distal portions of the bowels and resected about 10 inches on either side. We closed the ends and ligated all of the vessels of the very constricted mesentery after resection of that portion of it which was coherent with the tumor mass on the side of it. We then proceeded to make a lateral anastomosis of quite a good size between the two ends of the resected bowel. This portion of the small intestine containing the lateral anastomosis and two short pouches beyond the anastomosis were sutured to the abdominal wound as a matter of precaution and safety in such a manner that the two pouch ends were in the level of the abdominal wall, while the anastomosis was inside of the abdomen. We used this procedure for two reasons: In the first place to insure against the possibility of danger from peritonitis in this case in which the abdominal peritoneum was soiled, and second, in case of obstruction on account of ileus to have the possibility
of reopening the upper branch of the anastomosis and allow the contents of the intestines to flow out well (a very important procedure in a case of ileus). The rest of the peritoneum was closed and the abdominal wall sutured in the usual manner.
The patient made a very good recovery. After twenty-four hours the projecting part of the intestine had already sunk into the level of the peritoneum so that nothing of it was visible, but during the next eight days there developed a slight intestinal discharge, showing that there was a very slight leak in the bowel, and proving to us that we were correct in our technic; but this slight leak closed very rapidly, and at the end of three weeks the patient left the hospital in good condition. He was repeatedly fluoroscoped and the report of Dr. Orndoff reads as follows:

"Several observations following barium meal have been conducted since the operation, and very little delay has been noted, no more than could be accounted for by the spastic irritation so soon after the operation."
"I would suggest that at intervals of from three to six months observation should be repeated with a view of ascertaining the degree and character of delay or obstruction following barium meal, and if necessary further pneumoperitoneum in order to assist in the direction of releasing fixed viscera."

The specimen (Fig. 298) still shows a considerable dilatation of the proximal part of the intestine and a rather narrow lower bowel. It shows, furthermore, the ulcer on the site of the stricture. The tumor which seemed to be adherent to the side when opened up showed a structure of intestine with a distinct mucosa and muscularis. It was filled with purulent intestinal contents, showing that it was in its structure really a bowel in a blind little corner leading toward the ulcerated portion in the bowel, and the whole pouch could be separated from the rest of the intestine and mesentery. What was this separated pouch of bowel?

I could not find any explanation except that it was a Meckel diverticulum, and that it was slightly coherent with the bowel and very loosely coherent to the abdominal wall, this cohesion running in toward the umbilicus. This is an unusual condition of Meckel's diverticulum leading to a stricture and ulceration of the bowel at its junctions.

What makes this case most interesting is the fact that a diagnosis of this condition could be made with the aid of the inflation of the peritoneal cavity with oxygen-gas, and the fluoroscopic proof of an abnormality outside of the region of suspected pathologic conditions.

Clinically it is hardly possible to diagnose such conditions, and even the ordinary method of bismuth and barium fluoroscopy and filling the intestinal canal is not sufficient, because the distended bowel above the stricture filled with bismuth would mislead the observer and make him see a structure very similar to the cecum, or else the bismuth would pass through the stricture at the time when the bowel was not totally obstructed, and would escape the observer as it has escaped the observation of the very best radiologists who had a chance to examine the case; but making the intra-abdominal structures visible by the use of oxygen makes such a diagnosis possible.
CLINIC OF DR. LEIGH F. WATSON
Rush Medical College

PARTIAL ENTEROCELE


I wish to discuss with you this morning the subject of partial enterocèle and to present a patient on whom I operated a few days ago.

A partial enterocèle is a strangulated hernia in which only a part of the circumference of the intestine is caught in the constriction ring. There are various names applied to this condition, such as Richter's hernia, nipped hernia, masked hernia, lateral pinching of the intestines, and Lavater's hernia.

This patient is thirty-five years old. She had had symptoms of partial obstruction for twelve hours. On account of the absence of vomiting and absolute constipation she thought the condition would improve after taking a laxative. This illustrates a point I will emphasize later. The delayed diagnosis often results in a late operation, consequently, the mortality is much higher than it should be.

When I first saw the patient a small tender mass in the right femoral region was found on examination. She said she had had a small swelling in this region for several years, but it had never caused any trouble.

Frequently small strangulated partial enteroceles are mistaken for a lymphatic adenitis and incised, with disastrous results. The operation was done under local anesthesia. Small femoral hernias lend themselves readily to the local method. A series of wheals along the line of the proposed incision was all
that was needed in this case, as the sac was just beneath the skin. As you know, intestinal serosa is insensitive to heat, cold, pain, and pressure.

After carefully exposing Gimbernat's ligament, it was cautiously nicked, and then stretched with a hemostat, as suggested by Doyen. Only one-third of the caliber of the gut was caught in the constriction, and this accounted for the mildness of the symptoms. If you will look at the diagrams you can readily understand why the symptoms vary, and depend on the amount of the gut circumference constricted (Fig. 299). When almost the entire caliber is nipped, the symptoms are similar to those of complete obstruction, and on account of this severity operation is seldom delayed. There is considerable difference of

![Fig. 299.—Diagrammatic sketch showing different degrees of partial enterocele.](image)

opinion as to the results of the different operations. I believe the simplest operation is always the best.

As soon as the constricting ring was divided hot moist compresses were applied to the congested gut, and in a few minutes its color returned, and as it had preserved its "polish," it was returned to the abdomen.

Before the knuckle was replaced I pulled down the distal and proximal loops a short distance and inspected them. Proximal perforation above the constriction is sometimes the cause of peritonitis and death following an otherwise successful operation for strangulated hernia.

The usual operation for femoral hernia with suture of the femoral ring was performed. Her convalescence has been un-
eventful and she will be discharged from the hospital in a few days.

Partial enterocele was first observed by Fabricus Hildanus in 1598, and was clearly described by Lavater in 1672. Various authors have described this condition, but the most important of the early papers was published by Richter in 1799, from whom this hernia takes the name most often applied to it. Later important papers were contributed by Meckel, Riecke, Wagner, Kocher, Defant, Treves, De Baumis, Adam, and Vires. Sawyer in 1921 reported a case and reviewed the literature on the subject.

In partial enterocele the constricted portion of gut becomes distended, swollen, and may retain its deformity some time after the constriction is relieved, presenting the appearance of a diverticulum. This false diverticulum of partial enterocele gave rise to considerable confusion among the early writers; even Littre mistook his 2 cases of hernia of Meckel’s diverticulum for hernias of the intestinal wall.

The changes that take place in the constricted intestine are due to the cutting off of its blood-supply and to the distention of the gut, as the result of the imprisoned intestinal contents. The dilatation of the constricted gut is always secondary to the onset of the strangulation.

Gangrene occurs earlier in partial enterocele than in ordinary strangulation. This fact is undoubtedly due to the direct pressure exerted on the gut by the constricting ring, in the absence of mesentery or omentum, which by their elasticity act as a cushion or buffer, consequently delaying the onset of strangulation.

In partial enterocele the portion of the gut that is strangulated is the convex surface of the loop, the free border opposite the mesentery.

The mesentery does not enter the hernial sac, and for this reason Roser in 1886 denied the existence of partial strangulation of the gut.

When intestine is adherent to the sac wall a sudden increase in intra-abdominal pressure may force the sac with its attached intestine through the constricting ring.
A partial enterocele is most frequent in femoral, obturator, and inguinal hernias; rarely is it found in the umbilical and ventral varieties. Sawyer in 1921 and Baldwin in 1922 reported cases in which strangulation occurred in postoperative ventral hernias. Arnold in 1907 reported a case of fracture of the pelvis in a woman aged seventy-six years, in which a portion of the intestine was nipped by the bony fragments of the horizontal ramus of the pubis. Considerable force was required to liberate the lacerated intestine.

The symptoms of partial enterocele are similar to those found in strangulation of the entire intestine, with the exception that in partial enterocele constipation is not complete, as some fecal matter and gas can pass the constriction in nearly all cases. Vomiting is sometimes absent, and when present it seldom becomes fecal in character.

Local signs are often absent. If a swelling can be detected in the femoral or inguinal region, a diagnosis is easy. According to Treves, the tumor is absent in 50 per cent. of the cases. In the majority of cases, however, no tumor can be detected, and the pain and tenderness over the strangulated hernia may be so slight as to pass unnoticed, even by the patient himself, as in the cases reported by Berard and Lejars.

A partial enterocele in the femoral or inguinal region is often mistaken for an inflamed lymphatic gland, especially when the condition is accompanied by tenderness, a degree or two of fever, and the typical symptoms of strangulation are lacking. Perforation into the sac may take place without serious symptoms developing.

The prognosis for strangulated partial enterocele is usually grave, because gangrene develops early and operation is usually undertaken late on account of the mildness of the symptoms. The mortality rate is higher than in ordinary strangulated hernia.

The treatment for strangulated partial enterocele is the same as for other forms of strangulated hernia. Early operation is imperative. A small, tender, painful mass at one of the hernial openings, if accompanied by only moderate gastro-intestinal
symptoms, should be regarded with suspicion and treated by prompt operation without preliminary attempts at taxis.

If the intestine is viable, as was the case in our patient, and no constricting furrow is seen, the gut can be returned to the abdominal cavity. If there is gangrene, perforation, or signs of doubtful viability, the gut should always be resected unless the gangrenous area is very small, when it may be turned in and buried under a few Lembert sutures. Large patches of gangrene should never be inverted because of the danger of postoperative stenosis.

When the patient's condition is grave, it is often best to do a two-stage operation. At the first operation the intestine is brought into the wound and a fecal fistula formed. At the second stage the fistula is closed and the hernia repaired.

Operation by the abdominal route is often advised as a time saver in strangulated partial enterocele in the femoral, obturator, or sciatic regions (Fig. 300).
EMBOLISM AND THROMBOSIS COMPLICATING HERNIA OPERATIONS

Frequency of Embolism and Thrombosis Following Hernia Operations. Treatment.

The second condition I wish to discuss with you because it has a bearing on the operation just performed is that of embolism and thrombosis complicating hernia operations. Under this heading we shall consider particularly pulmonary thrombosis and mesenteric thrombosis.

Pulmonary thrombosis seldom occurs before the first week after operation, usually between the tenth and fourteenth day. Mauclair collected in the literature 50 cases of pulmonary thrombosis following inguinal hernia operations, and of this number 12, or 24 per cent., were fatal. Lenormant collected 233 cases, with a mortality of 45.5 per cent. The symptoms come on without warning and death may be almost instantaneous. The patient complains of a severe pain over the heart and suffocation, and usually dies before medical assistance can be summoned. If the obstruction to the blood flow is not complete, he may live several hours, with rapid breathing and marked dyspnea and cyanosis.

Several years ago I operated on a man, fifty years old, for right inguinal hernia. There were extensive omental adhesions in the sac, but no omentum was excised. Recovery was uneventful until the sixth day, when he suddenly developed symptoms of pulmonary thrombosis and died within five minutes.

The treatment may be divided into preventive and operative. The principal preventive measures may be summed up as follows: The tissues should be handled very gently during the operation; rough retraction should always be avoided; the veins in the field of operation should be ligated carefully and injury to their intima painstakingly avoided; hemastasis should be complete before the wound is closed. The patient’s knees should

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not be bent while on the operating table, because the slowing of the blood-stream is an important etiologic factor, and for this same reason patient's with severe anemia should receive a blood transfusion before operation. Local infection is, unquestionably, an important cause, and for this reason absorption areas should not be opened up any more than is necessary during the operation.

Meyer in an article published in 1921 advocated active exercise for hernia patients, to be carried out while they are still in bed, to speed up the circulation.

Because of the fact that death follows so quickly after the onset of the symptoms, little is to be offered in the way of operative treatment. There are only a few instances recorded in the literature in which an attempt has been made to remove a pulmonary embolus by operation. Capelle in 1920 reported 2 cases in which the operation was unsuccessful. The results from the removal of an embolus from other arteries have been more favorable. Sundberg in 1920 collected in the literature 6 cases in which this had been successfully accomplished, and reported one case of his own in which the embolus was removed from the femoral artery and the patient survived.

*Mesenteric thrombosis* is often associated with arteriosclerosis, and the most important causative factors are probably disturbance in the blood-supply, trauma, and local infection.

Mesenteric thrombosis may be venous or arterial. Venous thrombosis gives more indefinite symptoms and its progress is slower than arterial thrombosis, in which the symptoms often resemble those of acute intestinal obstruction. This variety has a greater tendency to spontaneous cure than arterial thrombosis.

Immediate operation is indicated when mesenteric thrombosis is suspected. If the mesentery is gangrenous, resection of the gut is necessary. If the patient's condition is critical, the intestine can be left in the wound, a glass drainage-tube inserted, and the intestinal contents allowed to drain.
IMPACTED CALCULUS IN THE JUXTAVESICAL PORTION OF THE URETER; TECHNIC OF URETEROLITHOTOMY UNDER LOCAL ANESTHESIA


The passage of a stone through the ureter is a common condition. Probably a large number of people have at some time passed one or more renal calculi. A number of these have a temporary or permanent lodging of calculi in the uterer, and at times with none or only indefinite symptoms. This has been possible of demonstration since the use of the Roentgen ray. The majority of ureteral stones produce pains, but they may be of varying grades of intensity and referred to various parts of the abdomen, so that they are often confused with other abdominal disorders. In the operative removal of a stone impacted in the lower ureter I wish particularly to demonstrate the technic of local anesthesia, and the surgical anatomy of the lower portion of the ureter.

The patient on whom we shall operate this morning gives the following history:

Onset and Course.—First attack of soreness and pain over the left kidney region, non-radiating in character, occurred three years and four months ago, lasting several days. During the second attack, one year ago, there were sharp cutting pains in the kidney region, lasting for one day. A third attack of pain
came six months ago. This was not a severe pain. It lasted one
day, and was more of a soreness than a colicky pain. Four
months ago a fourth attack came on, lasting two days. This was
a severe soreness, with excruciating pain over the region of the
left kidney. There was no cutting pain or radiation. He
stayed in bed one day, but the pain persisted for several days,
gradually getting better. No other symptoms accompanied these
attacks. There was no blood, gravel, frequency, polyuria, dy-
suria, or anuria. The patient was Roentgen-rayed four months
ago, and has been under treatment since then for a stone which
was found at that time to be in the ureter, just above the bladder.

**Past History.**—Patient had most of the childhood diseases,
including scarlet fever, from which he has a discharging left ear.
Ten years ago the patient was operated on for a tuberculous right
knee-joint. The knee-joint was resected and the leg is now stiff.
Previously he had had trouble with the knee for three years.

**Venereal History.**—Patient had a neisserian infection three
years ago followed by epididymitis, and also lues at the same
time.

**Family History.**—Mother is living and well; father died of
pneumonia, aged fifty; 4 brothers and a sister living and well;
one sister died in infancy.

**Physical Examination.**—Patient is a rather poorly nourished
and developed white male.

*Head* and *neck* are negative.

*Chest.*—Heart borders are normal and there are no murmurs.
Lung borders are normal and respiratory excursion is good.
There are no abnormal areas of dulness and no râles.

*Abdomen.*—There are no scars, tender areas, or rigidity.
The liver and kidneys are not palpable.

*Rectal examination* shows slight thickening and irregularity
of the prostate.

*Lymphatic System.*—No superficial groups can be palpated
except the inguinal, which are about as large as buckshot.

*Reflexes.*—Eyes react to light and accommodation. Left
eknee-jerk is normal and there is no Babinski.

About four months ago, several days after his attack of
pain, examination of the urine showed numerous pus-cells, but no blood. Cystoscopic examination was made to determine the source of the pain and pus. The bladder and the region of both ureteral meati were negative. The orifices of both meati were quite small. Apparently normal urine spurted from both sides. The right ureter was catheterized easily. There was an obstruction in the left ureter about 4 cm. above the meatus. With considerable difficulty and trauma a No. 4 catheter was finally passed by this point of obstruction. A grating sensation could be felt. Bloody urine passed from the catheter. Specimens of urine from the bladder and both kidneys were examined. The cultures from the bladder were positive for colon bacillus, but were negative from both kidneys. There was no pus or blood found in the urine from the right side; pus was absent from the left side, but there were many red cells. A wax-tipped catheter was passed in contact with the obstruction in the left ureter and showed a definite scratch mark. Roentgenograms were then taken which showed a definite shadow in the region of the lower ureter.

This confirmed the diagnosis of ureteral stone determined by the use of the wax tip, the grating sensation, and the presence of obstruction. The patient was told that he might pass the stone following this manipulation and to strain all urine through gauze. He was instructed to drink large quantities of water and given hexamethylamin and benzoic acid alternating with alkalies every ten days. Since then manipulation through the cystoscope in an endeavor to loosen the stone by the injection of oil was done five times. It was impossible on most occasions to pass anything by the obstruction, but at times a No. 4 catheter was passed with considerable trauma. On two occasions the rather small ureteral meatus was dilated up to a No. 11 French size. This dilatation was only obtained with difficulty on account of the great resistance of the tissues about the ureter where it passes through the bladder wall. On two occasions 5 c.c. of a 5 per cent. procain solution was injected into the ureter, followed by the injection of oil. Owing to the difficulty of catheterizing the left ureter, the absence of infec-
tion and the normal secretion of urine, a functional test was not made.

The patient had symptoms of a calculus for almost three and a half years. All of the pains were over the region of the kidney posteriorly, so that it was impossible to tell how long the stone had been in the ureter. We know that ureteral stones
may cause pain which is entirely limited to the kidney region. The reason for this variation is not clear, but it may be due to the distention of the pelvis by some obstruction. The stone has been impacted for at least four months and possibly much longer. While the stone is of a size that might ordinarily be passed, the ureteral meatus is quite small and the tissues about it are very resistant, so that the disproportion is great. Smears from the prostate have shown numerous pus-cells and a few bacteria. With a positive culture of colon bacillus from the bladder urine the possibility of introducing infection is considerable, especially following repeated trauma from the continued use of non-operative methods.

Operation, therefore, is indicated. The patient being rather frail and having a history of tuberculosis of the knee, local anesthesia is preferable. The urine has been negative except for numerous pus-cells in a passed specimen. The hemoglobin is 90 per cent., white blood-cells 8200; blood-pressure 120/78. An hour ago the patient was cystoscoped, and a shadowgraph catheter was introduced up to the point of obstruction and a roentgenogram taken, showing the stone still in position (Fig. 301). The localizing of the stone immediately preceding operation is an important point; not a few patients have been operated after migration of the stone up or down the ureter, or after it has been passed.

Operation.—I will use regional or block anesthesia, employing $\frac{1}{2}$ of 1 per cent. procain with adrenalin. The first injection is made at a point two fingers medial and slightly above the anterior superior spine of the ilium similar to the technic for a hernia operation. The needle is now passing into the deep layers of the muscles in order to catch the lumbar nerves. The point of the needle is changed to pass down almost to the ilium into the deep muscles through which the nerves pass. The needle is inserted in a fan-shaped manner for several injections, so that this region at right angles to the course of the nerves is thoroughly infiltrated. The needle is now turned upward toward the umbilicus, infiltrating the various muscle layers first and then superficially. This regional injection is now
carried beyond the umbilicus to the outer border of the right rectus muscle and then down to the pubes. This line of injection is now carried back along Poupart's ligament to join the original injection (Fig. 302). The patient is placed in a Trendelenburg position.

A suprapubic midline incision is made in the paramedial fibers of the left rectus muscle similar to an ordinary cystotomy incision. The bladder has not been distended with fluid, since that is not necessary or desirable. It is found by following the peritoneal reflection down close to the pubic bone. It is readily recognizable by its muscle-fibers, and the peritoneum is reflected away from above the bladder, which is not to be opened. The left outer side is now followed down to its base.

The first landmark seen is usually the obliterated hypogastric artery. This is associated with the peritoneum and leads us
down to the branches of the superior vesical artery. As the base of the bladder is approached we see what resembles the ureter. This is traced to the bladder, but it passes along it posteriorly toward the midline, and we identify it as the ductus deferens. It is lifted up carefully and retracted in order to avoid injury to the branches of the superior vesical artery, which pass laterally. Kidd states that occasionally it may be necessary to cut the hypogastric ligament or even the superior vesical artery and strongly retract the ductus deferens upward and outward. The bladder is now followed farther down by retracting the peritoneum upward. Just beneath the region of the ductus deferens, near its point of approach to the bladder, a blunt forceps is used to dissect along the loose fat over the peritoneum in a line with the direction of the ureter. The ureter is normally carried up with the peritoneum. This immediately discloses a structure which undoubtedly is the ureter, we having already identified the ductus deferens above. We easily dissect it down toward the base of the bladder.

Just before it enters the bladder wall we see a decided enlargement and discover a hard mass which proves to be a calculus. A soft clamp is now placed higher up in order to prevent the calculus from slipping up when we attempt to remove it. On palpation, the calculus is found firmly impacted and resists any attempt to move it up or down in the ureter. It is lying just above the entrance of the ureter into the bladder. The ureter is well exposed in the field and available for any operative procedure. There is no hemorrhage, due to our care in the deep dissection. A small cut is now made into the ureter over the upper part of the oval-shaped distended portion (Fig. 303). The stone is removed by delivering it end first through the incision. A few fine catgut sutures are placed in the sides of the ureter in order to close the incision, catching only the outer layers of the ureteral wall. The clamp is removed from the ureter and a folded piece of rubber-dam is placed down to the region of the ureter. A cigarette drain is placed in the space of Retzius and the fascia closed with catgut. A few interrupted silkworm-gut sutures are put through the skin and fascia to-
Fig. 303.—The various structures in the suprapubic extraperitoneal approach to the lower ureter are shown. The peritoneum is reflected up, exposing the bladder, which is followed down laterally to its base. The hypogastric ligament and the ductus deferens are usually the first landmarks seen. The ureter may be well exposed in this manner. The soft-jawed clamp applied to the ureter above the stone, to prevent it slipping up, is not shown. A small incision is made in the ureter over the upper end of the stone, which is removed in its long axis.
gether and the skin is closed with silk. The calculus is somewhat pear shaped and has a very rough surface studded with minute projections. It measures 1.2 cm. long by 0.9 cm. wide.

**Postoperative History.**—There was some urine discharge for a few days, until at the end of a week there was apparently no urine in the small amount of discharge coming from the wound where the drainage-tubes had been removed. The tubes were shortened several times before removal. The remainder of the wound healed by first intention. The skin stitches were removed at the end of a week and the silkworm-gut at the end of twelve days.

A postoperative cystoscopic observation was made six months later. The patient had no complaint and had put on weight since the operation. The bladder was negative. A No. 6 catheter was passed into the left ureter without any difficulty; there was no evidence of a stricture or a narrowing of the ureter; urine secretion was normal. Phenolsulphonephthalein appeared in the urine from the left kidney three minutes after intravenous injection. In the first fifteen minutes there was an output of 10 per cent. from the left kidney. Urine examination from the bladder showed a cell count of 211 cells to 1 c.mm. and cultures were negative. There was a cell count of 280 cells to 1 c.mm. from the left kidney and the cultures were negative. The right ureter was not catheterized, since secretion appeared normal.

In the discussion of operations on the ureter we shall limit ourselves to a consideration of calculi located in the ureter. As to the frequency of operations as compared to the number of ureteral stones treated by non-surgical methods, the statistics reported by Judd and others include cases over a number of years before the development of non-operative methods. Judd reports 400 patients operated for ureteral stone as compared to 126 patients treated by non-operative methods. In 198 of those operated the stones were in the lower third of the ureter. Braasch states that it is inadvisable to operate on stones in the ureter for at least three months unless there is a definite indication for operation. In cases of low renal function with bilateral
kidney and ureteral stones operation is usually contraindicated. He states that operation is indicated in ureteral stones larger than 2 cm., acute impaction with continuous obstruction, acute renal infection, intolerance to cystoscope, and anatomic deformity. Bevan says that stones no larger than a coffee berry usually pass.

It is reported by Bugbee that only 15 out of 107 cases of ureteral calculi were operated. Kidd gives a series of 20 consecutive cases where 15 ureteral stones passed naturally and 5 were operated. He found experimentally that a stone can lie in the ureter not longer than six months to a year before damaging the kidney irreparably. Clinically he puts no definite time limit, but advises waiting six months, using non-operative methods during that period. He states that the wall of the ureter at site of impaction undergoes fibrosis and stenosis. The ureter above becomes dilated and sooner or later bacteria filtering through the kidney from the blood produce infection. Later abscess may form around the ureter. Infection of the kidney and anuria may develop with destruction of the kidney. In several cases operated by Judd the stone was lying in an abscess outside the ureter. At operation he states the ureter in many cases appeared normal in size and appearance and yet the stone seemed to fill the lumen. Spontaneous perforation of the ureter by a calculus may result in death, as in a case reported by Berry where sepsis and death followed a perforation by a calculus. There was a calculus also in the opposite ureter and a double pyelonephrosis.

In this case the stone is seen to be rough and resembles a mulberry. This rough, irregular surface was probably what permitted the urine to filter around it among the projections, while the stone was held tightly by the wall of the ureter.

The accurate diagnosis of ureteral calculi by the Roentgen ray alone, Braasch and Moore state, is possible in only 60 per cent. of cases, on account of extra-ureteral shadows and stones which for some reason do not show on the films. In 8 cases of calculi in the ureter reported by Braasch and Thomas where the roentgenograms and the cystoscopic evidence were doubtful,
positive diminution in comparative secretion was found in 2 cases. They state that marked reduction in the renal function test is not usually found in the absence of dilatation of the pelvis or infection. Geraghty and Hinman state that in a series of 67 cases radiography missed the calculus in 22.4 per cent. They state that the wax-tipped catheter excels in accuracy any known method. They report a diagnosis of 6 cases where the Roentgen ray was negative and only 1 case where the wax tip failed. Kretschmer has found the double exposure on the same roentgenogram to be of value for differentiating extrinsic ureteral shadows.

In cases where there is no immediate indication to operate, and where the stone may pass through the ureter, non-operative methods are indicated. With the development of the operating cystoscope there has occurred a rapid increase in intravesical maneuvers to remove calculi impacted in the ureter. This has led to the instillation of drugs, papaverin, novocain, oil, and the injection of fluids in large quantities above the stone. Good results are reported from many methods and various drugs (Fowler, Merritt). However, manipulation against the calculus is involved in all these procedures, and usually distention of the ureter. Braasch states that the manipulation is the important factor. This may be aided, I think, by the mechanical action of the fluids and oil injected at the same time. Braasch states that approximately one-half of the stones in the lower ureter that will not pass spontaneously can be removed successfully by non-operative measures.

Bugbee states that 50 per cent. of ureteral stones pass by themselves and 75 per cent. pass after manipulation. Dilatation of the ureter at its outlet is often of great value, and cutting the mucous membrane where the stone is intramural may be all that is necessary. Young advocates enlarging the meatus by means of the high-frequency current for intravesical and intramural calculi. Where the stone is above the bladder wall there is danger in cutting through into the paravesical structures. Bugbee describes a trick of coiling a ureteral catheter around a stone and pulling it out. He states that in one case he was un-
able to get the catheter out after this procedure, so that it is not without danger.

There are comparatively few reports of late results from operative treatment of ureteral stones. Fowler lists 24 operative cases of stone impacted in the lower end of the ureter in the male up to 1904, which include 2 of his own. The mortality given by Judd in 400 operated cases of ureteral stone was one death due to operation. Bugbee states that 1 case of 15 operated died six weeks after operation. McNeil describes 2 cases of inflammatory stricture of the right ureter due to a pelvic abscess following ureterotomy of the left ureter. In one case this led to a kidney stone and nephrotomy. Kretschmer lists the complications as stricture, infection, destruction of kidney, and death. Of the 400 operated cases reported by Judd there was a recurrence of ureteral stone with operation in 3 cases, and in 4 cases a later nephrectomy was done on the operated side. There was complete relief reported in 90 per cent. of the cases; 26 of these operated cases have passed stones since. Kidd reports 1 out of 28 operated cases where stricture followed operation and a nephrectomy was necessary.

The bad results from operation, we see, are rather few in spite of the fact that cases operated are the more serious ones. Certainly serious results may follow prolonged impaction with obstruction of the ureter. While non-operative procedures are of great value in many cases as outlined above, Judd states that they may be carried too far, since there is danger of trauma of the ureter and bladder and infection of a normal kidney.

**BIBLIOGRAPHY**

THREE CASES OF LABYRINTHITIS SECONDARY TO CHRONIC SUPPURATIVE OTITIS MEDIA

Presentation of 3 Patients Suffering from Labyrinthitis Secondary to Chronic Suppurative Otitis Media. History, Diagnosis, and Treatment.

CASE I

The first case is that of a man thirty-seven years old who consulted me first in 1915 because of a discharge from both ears which had persisted since an attack of scarlet fever in childhood. During these years the discharge had been continuous except for short intervals when there was an apparent cessation. For the past eight months the discharge had been continuous and much more profuse, brought on as the result of swimming in cold water.

The examination disclosed a central perforation in the right drum membrane and a discharge more mucousy than purulent. In the left ear the perforation extended to and eroded the bony margin in the upper posterior quadrant. In this ear the discharge had the offensive odor characteristic of a bone-invading process.

The hearing in both ears was depressed—the whispered voice being heard in the right ear at a distance of 1 meter and in the left ear at 2 meters. The defect had all the characteristic reactions of an obstructive middle-ear lesion. There was a marked elevation of the lower tone limit, with a relatively slight defect for the higher tones and, of course, a Rinne negative.

It was clear that the process in the two ears was quite different. In the right ear there was every reason to believe that
the disease was involving only the mucous membrane of the middle-ear chambers, while in the left ear it was equally clear that we had to do with a bone-invading process. The question of treatment was very easily settled as regards the right side. Here, where the disease was restricted to the mucous lining of the middle ear, the question of an operation did not have to be considered, for the simple reason that there was little or no probability of any of those serious complications developing which endanger the patient's life. In conditions of this sort one is justified in limiting the treatment to local, non-operative measures indefinitely. One is not warranted in advising the radical mastoid operation merely to check the persistence of discharge when it can be definitely ascertained that the disease causing the discharge is not a serious menace to the life of the patient. There are very good reasons for restricting the radical mastoid operation to only those cases where the middle-ear disease is a distinct menace, as distinguished from the annoyance of the discharge. These reasons are that the operation itself even in the hands of an experienced operator is not without more or less serious risks. One of these is the risk to the hearing. There is always the possibility of the margin of hearing being seriously reduced as the result of scar formation in the region of the labyrinth window. Then there is always to be considered the danger to the facial nerve in performing the radical operation. A patient who permits the radical operation for the purpose of checking a discharge when the middle-ear disease has no more serious outlook would hardly relish having in exchange for the annoyance of the discharge to put up with the disfiguring facial paralysis for the remainder of his life. One must also consider the ordinary risk incurred from any major operation requiring a more or less prolonged anesthesia.

The problem of treatment in the case of the left ear in this patient was quite a difficult matter. It was apparent from the examination that the infection causing the discharge was not restricted to the mucous lining of the middle-ear chambers. From the marginal character of the perforation as well as the character of the discharge it was apparent that we had in this
ear a bone-invading process, probably a cholesteatoma. This type of chronic, suppurative otitis media is not without risk of more serious complications which may sooner or later invade the labyrinth, resulting in a complete destruction of the hearing function. More than this, it is this form of chronic suppurative ear disease from which develops so frequently the more serious intracranial lesions which often cost the life of the patient, such as sinus thrombosis, meningitis, or brain abscess. It is only in this type of chronic middle-ear suppuration existing in the left ear that one is called upon to consider the question of advising a radical mastoid operation. The decision to operate is, however, not so easily reached as might be inferred from the above statement of the proper indications. For example, in a case like the one which we are here discussing, where there is a more serious impairment of hearing in the opposite ear, that is, where the patient relies chiefly on the ear for which we are considering the advisability of operating, one proceeds quite differently than when the opposite ear is the better hearing ear. The reason for this is quite plain. If we are planning to operate on the one ear on which the patient has to depend for hearing, the indication for the operation naturally should be much more urgent than when the reverse is true. The proper indication for operating on the one ear on which the patient relies for hearing is when a serious complication is really imminent. To decide this question requires a more careful study of the situation. For example, when the discharge is profuse, it is evident that the disease is progressing more rapidly than when it is slight and, of course, the danger of a complication is more imminent in a rapidly progressing disease. When there is a persisting one-sided headache restricted to the side of the ear under consideration this should be regarded as an indication of an impending intracranial complication where the delay in carrying out the radical operation may cost the life of the patient. It is apparent that under circumstances of this sort the question of a possible increase of the deafness as the result of the operation must not cause delay.

In this particular patient after cleaning out the ear and directing him how to keep the ear clean, I gave him a solution
of alcohol 95 per cent. saturated with boric acid with directions to instill at least $\frac{1}{4}$ teaspoonful of the solution (warm) in the ear each day for two weeks, and at the end of that time to return for final advice as to whether we should continue local treatment or whether the operation should be undertaken. As happens so frequently in these cases the patient did not return.

I did not see him again until January 12, 1922, when he came complaining of vertigo of two weeks' duration associated with an appreciable depression of the hearing in the left ear which had been his better hearing ear. He was not annoyed with tinnitus or earache, but attributed the deafness and the vertigo to a temporary cessation of the discharge. He had accustomed himself to the use of an artificial ear drum which he used in each ear, finding that this device increased the hearing very much in both ears, but particularly in the left.

The examination disclosed about the same situation in the right ear as when first examined seven years ago. In the left ear a mass of granulation was seen protruding from the perforation in the upper posterior quadrant. The slightest pressure on these granulations brought on a violent nystagmus with some sensation of vertigo. Compression of air in the external meatus or suction caused no response. The nystagmus was exactly in the horizontal plane with the slow component to the right and the quick movement toward the same side, that is, to the left. On applying continuous pressure the nystagmus gradually diminished and invariably disappeared completely before one minute. The release of pressure was not noticed to produce the reversed eye movements.

The diagnosis was clearly one of fistula in the horizontal semicircular canal where this canal forms a prominence in the floor of the aditus. The reason one is able to fix so definitely on the location of the fistula is because of the well-known laws governing the movements of endolymph in the several canals. One of these is the law governing the eye movements occasioned by endolymph currents. Experiments first carried out on pigeons by Ewald have shown that movement of endolymph in a semicircular canal produces eye movements restricted to the
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plane of the canal being stimulated. In this case the horizontal character of the nystagmus showed that the endolymph movement resulting from pressure on the polyp mass in the tympanum took place in the horizontal canal. Another law governing the eye movements is that the slow component of the nystagmus is always in the direction of the endolymph current. In this patient pressure on the polyp mass located in the left ear drew the eye slowly on to the right side, with the quick component of the nystagmus directed to the left. Now in order to get this movement of the eye it is necessary for the endolymph movement in the left horizontal canal to be from the left toward the right, that is, from the small end of the canal toward the ampulla.

Further functional examination disclosed no evidence of a spontaneous nystagmus. There was, however, a marked depression in the hearing for the left ear. In the first place the lateralization of the tuning-fork placed on the median line of the head was always to the left. This was very significant, as the tests for air conduction in the left ear showed practically a complete suppression of function for the several parts of the scale. There was no perception for the voice detected in this ear.

It was evident that in addition to the fistula in the horizontal canal we had to do with a diffuse labyrinthitis which had resulted in a very marked depression of the function. The situation was, indeed, critical. There was present in this case a type of chronic suppurative middle-ear disease in which the radical mastoid operation is clearly indicated. In addition, this man had a serious labyrinth complication that had to be considered. The labyrinth disease had resulted in a profound depression of function, but not in the complete suppression, as evidenced by the lateralization of the Weber test to the affected ear and the presence of a positive fistula response that is the nystagmus produced by pressure on the granulation in the tympanum. Before proceeding with the radical operation on the mastoid it seemed best to allow the more or less acute labyrinth involvement the opportunity of subsiding.

Everything went along without any further disturbance until the first of February, when on waking the patient observed
a severe, pulsating, hissing sound in the left ear, and on getting up noticed more or less vertigo with some nausea. Actual vomiting took place during the early morning. Toward noon, with the assistance of his brother, he came to my office. I noticed at once the presence of a spontaneous, rotary nystagmus toward the opposite side which did not disappear even with the eyes turned strongly toward the left. There was also a positive Romberg, the patient falling toward the left. The nystagmus brought out previously by pressure on the granulations had entirely disappeared, and finally the tuning-forks in making the Weber test were lateralized strongly to the right side. Further testing of the vestibular mechanism had to be restricted to the turning tests, for from the beginning the probability of eliciting a caloric response was excluded because of the mass of granulation filling the fundus of the canal. The turning test at this time brought out the same response as it had on January 12th. On turning the patient ten times to the right, the after-nystagmus to the left lasted but five seconds and was extremely weak. On rotating him to the left the after-nystagmus lasted seventeen seconds and was quite vigorous. This is the response invariably obtained in the early stages after a complete suppression of function in one ear.

When the patient was seen on February 1st quite a different situation had developed. It was apparent that the diffuse labyrinthitis that had caused a depression of function in the end organs of the labyrinth had now produced a complete suppression of this function. What did this change signify? The answer to this question was of great importance, as will soon appear. There were two possible conditions: one was that of a severe diffuse serous labyrinthitis, and the other was a diffuse suppuration of the labyrinth. These two conditions might result in the complete suppression of function, but in other respects the two processes are dissimilar. In the first place in a serous labyrinthitis there is the possibility of at least a partial return of function, whereas in the case of suppurative labyrinthitis the suppression of function is not only complete, but the loss is permanent. There is another even more important differ-
ence between these two processes. The condition of serous labyrinthitis rarely, perhaps never, leads to a serious intracranial complication, whereas in diffuse suppuration of the labyrinth there is always grave danger of an extension intracranially with fatal termination either from a meningitis or a brain abscess. There are three channels along which such an extension may take place. One is along the internal meatus; the second, along the aquæductus vestibuli, and the third, along the aquæductus cochleæ. The decision as to which of these two processes was at work in this case was of great importance for the reason that if we decided that a diffuse suppuration had invaded the cavities of the labyrinth, the proper advice would be to urge upon the patient an immediate operation which would combine with the radical mastoid the proper opening and drainage of the labyrinth itself. On the other hand, if we decided that the process was one of diffuse serous labyrinthitis with complete suppression of function, it would be better to defer operation on the mastoid until a subsidence of the acute labyrinthitis. If after a month or two there should be evidence of even a partial return of labyrinth function, one should restrict the operation to the radical mastoid. Should, on the other hand, the tests show a persistence of complete loss of function, the radical mastoid operation could with entire justification include the opening of the labyrinth.

The danger of an intracranial extension in cases of acute suppuration of the labyrinth is greatest during the first week of the labyrinthitis. If nothing develops during that period the infection is likely to remain limited to the cavities of the labyrinth for the reason that the several channels through which an intracranial extension takes place become walled off. This is the explanation of the clinical observation that to open the labyrinth which is the seat of a chronic suppuration in the course of a mastoid operation is much less dangerous than the accidental opening of a normal labyrinth when operating on the mastoid. In the latter circumstances the resulting acute labyrinthitis is very prone to lead quickly to a fatal intracranial disease.
In the patient we are here discussing we concluded that we were dealing with a diffuse serous labyrinthitis which had proceeded to the stages of complete suppression of the labyrinth function. Our reason for this conclusion was that when the patient first consulted us on January 12th there was present a diffuse labyrinthitis which was causing only a partial suppression of function. This was clearly not a suppurative form of labyrinth inflammation, else there would have developed quite promptly a complete destruction of all function. This serous labyrinthitis persisted for at least four weeks before it terminated in the total suppression of function. Now a serous labyrinthitis is no more prone to change into the suppurative type than is a serous otitis media likely to change into the suppurative form of otitis media. One cannot state that such a change never takes place, but when it does occur it does so as the result of new infection. On the basis of our conclusion that this was a case of serous labyrinth disease we have deferred the radical operation on the mastoid until the acute labyrinthitis has had ample time to subside.

CASE II

The second case of labyrinth suppuration presents another series of clinical problems which we have to face in handling this serious complication.

The case is that of a man thirty-nine years old who came to the Central Free Dispensary last month complaining of vertigo of a few weeks' duration. He gave a history of a chronic discharge from the left ear of many years' duration; original cause of the suppuration not known.

The examination disclosed a normal condition on the right side. From the left ear there was a purulent discharge with the offensive odor so characteristic of cholesteatoma. The perforation in the drum membrane was located in the upper posterior quadrant and was associated with a distinct erosion of the bony margin. A mass of granulation occupied the opening in the membrane. Compression of air in the external meatus brought out the characteristic symptom of a fistula in the
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labyrinth. The nystagmus produced by compression was of quite a different character from that observed in the first case. In the first place it was rotatory instead of horizontal, and in the second place the direction of the quick component was toward the opposite side. On applying suction a slight reverse nystagmus was elicited. There was no spontaneous nystagmus.

The functional tests showed normal hearing in the right, with a profound depression in the left. The Weber, however, was lateralized to the left in spite of the fact that the profound depression throughout the upper tone range clearly indicated alteration in the labyrinth in addition to the defect resulting from the obstruction in sound conduction caused by the long-standing middle-ear discharge. The rotatory character of the nystagmus produced by compression and suction in the external meatus resulted from endolymph movements in the superior semicircular canal, rather than in the horizontal canal, as in the previous case. Now there are two possible explanations for the occurrence of endolymph movements in the superior canal when applying this so-called fistula test. One explanation is that there exists an actual fistula in the superior canal where this lies exposed in the inner wall of the aditus, as is occasionally found. The other explanation is that the fistula into the labyrinth is the result of an opening in the region of the oval window, that is, an erosion through the foot plate of the stapes. With a fistula in the superior canal the direction of the flow of endolymph occasioned by compression would be toward the ampulla. This is the direction of endolymph current occasioned by irrigation of the ear with cold water with the head upright. The resulting nystagmus would, therefore, be the same for both tests, that is, the quick component will be toward the opposite side. This was the type of nystagmus observed in this case. Supposing the fistula had been located in the region of the oval window—compression of air in the external meatus would probably result in a flow of endolymph in the superior canal from the vestibule toward the ampulla. This direction of endolymph current in the superior canal would be upward, that is, the direction of flow occasioned by irrigating the ear with warm water.
The resulting nystagmus would, therefore, have the quick component directed toward the same side. It seemed to us, therefore, that the location of the fistula in this case was in the superior canal and not at the oval window.

Two weeks later this patient returned to the dispensary apparently quite ill. His temperature at that time was 101° F. He looked pale and complained of a severe headache. He made the statement that his illness came on three days ago and was associated with an attack of vertigo, nausea, and severe pulsating tinnitus. The examination disclosed a slight rotatory nystagmus toward the opposite side. The Weber was now lateralized to the sound ear, and our tests failed to disclose any evidence of hearing function in the left ear. The fistula symptom had completely disappeared. On applying the rotation tests we got the following responses: On turning the patient toward the right the nystagmus was toward the left, on stopping rotation was very weak and lasted barely five seconds. On turning him to the left the after-nystagmus was much more vigorous and lasted ten seconds. The difference is accounted for as follows: Both responses, that is, after rotation to the right as well as to the left, resulted from endolymph movements in the horizontal canal of the sound ear, that is, the right labyrinth. Now, on turning the patient toward the right, the endolymph current on stopping rotation strikes the side of the crista toward the utricle, which is the less sensitive side of this crista, and the stimulation of the hair-cells in this side of the crista produce the nystagmus with the quick component toward the left, but the nystagmus is very weak for the reason just given. After rotation toward the left the endolymph current in the left horizontal canal is from the canal toward the crista, thus stimulating the hair-cells on the more sensitive side of this crista which produces a nystagmus with the quick component directed toward the same side.

I have gone into these reactions rather minutely for the purpose of illustrating how complex the problem becomes of interpreting correctly the phenomena of labyrinth disease. Upon the correct interpretation of this phenomena hinges the all-important.
question of what action shall be taken in the treatment of the condition.

It was apparent in this case that there had developed a diffuse labyrinthitis with complete suppression of function. From the symptom of headache and elevation of temperature it seemed probable that we had to do with a suppurative form of labyrinth disease rather than with a serous labyrinthitis. Furthermore, the headache and elevation of temperature for which we could discern no other cause than the suppurative ear disease suggested the probability of a beginning intracranial extension, the complication most to be feared in cases of acute suppuration of the labyrinth. The patient was, therefore, placed in the hospital. The spinal puncture made that evening found a turbid fluid caused by a great increase in the cellular count. There did not appear to be any great increase in pressure, nor did we discover any of the characteristic reactions of a diffuse meningitis. It was apparent the patient was in a most critical situation, the result of an intracranial extension of the suppuration in the labyrinth, that this condition, if not immediately checked, would result in either a cerebellar abscess or a diffuse suppurative meningitis, was an imperative indication for surgical interference, consisting of a radical operation for the exenteration of the disease in the antrum and tympanum followed by the free opening of the labyrinth in order to establish satisfactory drainage in the hope of checking a further intracranial extension.

The operation was undertaken the following day. A cholesteatoma was found lodged in the antrum attic and aditus. Careful search was made for a fistula in the superior canal, but this was not detected, but this might be expected, as this canal is not placed as exposed and, therefore, not so easy of observation as is the horizontal canal. The labyrinth was opened, but no effort was made at an exenteration of this structure. The opening back of the ear was not closed as in the ordinary radical mastoid operation. On the following day we detected a perceptible inequality in the action of the facial nerve. There was a distinct though partial loss of function. This condition persisted about the same during most of the first week, which we
attributed to some bruising of the nerve where it passes through the tympanum, especially likely to occur immediately above the oval window. Before the first week had passed this paresis developed into a complete paralysis, and so it has remained. One week after the operation a spinal puncture was again made and the fluid was found to be quite normal. The headache and the elevation of temperature disappeared a few days after the operation. He has made a complete recovery except for the persistence of the facial paralysis and the total loss of function of the internal ear. He is not annoyed with vertigo and is not conscious of any disturbance of equilibrium.

It will be appropriate here to discuss briefly the cause of the vertigo in these cases and the reason why this symptom is transitory in spite of the fact that the loss of function in the labyrinth is permanent, whereas the deafness persists. The symptom of vertigo is but the expression of unbalance resulting from the unilateral suppression of labyrinth tonus. The normal preservation of equilibrium is due to tonus impulses to the skeletal muscle. These tonus impulses are in part extralabyrinthian, but normally the more important source of tonus is from the end organs in the semicircular canals. There are some very definite facts regarding the tonus impulses from the labyrinth. These facts are found in the following laws regarding endolymph currents: First, an endolymph current in a semicircular canal stimulates the skeletal muscle producing movements in the plane of that canal. Second, the motion produced by an endolymph current is not only in the plane of the canal stimulated, but is in the direction of the endolymph current. Third, the greater response is from those endolymph currents which stimulate muscles causing movements toward the opposite side. In order to understand these results of endolymph currents it is necessary to visualize the position of the several semicircular canals in the head. The endolymph currents in one direction stimulate the hair-cells on one side of the crista, while an endolymph current in the opposite direction stimulates the hair-cells on the opposite side of the crista. This fact, taken in connection with the law expressed above, means that the hair-
cells on one side of each crista are more sensitive than are those on the opposite side. This fact, considered in connection with the laws expressed above, means that those hair-cells, the stimulation of which results in movements toward the opposite side, gives a more vigorous response than the opposite group. If we have these facts clearly in mind, and remember that a constant stream of tonus impulses are continually emanating from the end organs in the several cristæ to the skeletal muscles, it becomes apparent, first, that these impulses from a single canal stimulate muscles causing movements in the two directions, and second, that the stronger impulses are those which produce movements toward the opposite side. The result, therefore, of the combined tonus impulses from the right labyrinth causes movements toward the left and the combined impulses from the left labyrinth movements toward the right. Normally the impulses from the two labyrinths are equal and the result is an established state of equilibrium. Suppose now that something suppresses the tonus impulses from the one labyrinth, as in these 2 cases of diffuse suppuration of the labyrinth, an unbalance is at once set up causing the symptom of vertigo with the tendency for the patient to fall toward the diseased side. This is exactly the phenomena observed in these 2 cases.

There still remains to explain why it is that after but a few weeks this disturbance of equilibrium largely disappears, although the loss of function causing the disturbance of equilibrium persists. The explanation of this phenomena is that there is in the first instance a rapid development of the extralabyrinth tonus to re-establish equal tonus from the two sides. In the second place, there takes place sooner or later a tendency for an equalization of the responses from the hair-cells on the two sides of the cristæ in the remaining normal labyrinth. This is shown by the fact that in time the responses aroused from the endolymph currents in the two directions in the canals of the normal labyrinth are equal. This fact is shown more readily when applying the turning tests. For example, in a case where the left labyrinth is destroyed, turning the patient to the right results in an after-nystagmus exactly as vigorous and lasting as
many seconds as when turning him to the left. The whole process is somewhat complex, yet one the exact working of which we have very accurate knowledge.

**CASE III**

The third case of labyrinthitis secondary to chronic suppurative otitis media occurred in a child seven years old. She was brought to me on December 10, 1921, complaining of persisting nausea and vomiting associated with severe headache of over one week’s duration. There was a history of an attack of scarlet fever eleven months previous which was complicated by a bilateral acute otitis media. That there had been any discharge from the ear previous to the attack of scarlet fever could not be ascertained. Eight weeks after the onset of the scarlet fever she developed an acute mastoid abscess on the left side for which a simple exenteration of the mastoid process had been undertaken. There had persisted during the eleven weeks following the scarlet fever a continuous though not profuse discharge from both ears.

On examining the patient December 10th there was found to be an extremely offensive discharge from both ears such as is only found in cases of extensive cholesteatoma formations. In both ears there was a total loss of the drum membrane and in both there was the characteristic erosion of the margin of the bony meatus in the upper posterior segment characteristic of a bone-invading process. There were no granulations in the fundus of either meatus, but there was no difficulty in discovering the characteristic masses of cholesteatoma. The functional tests of hearing disclosed no hearing for the whispered voice in the right and a hearing distance of about 1 meter in the left. The Weber, however, was lateralized distinctly to the right. In testing the tone scale in the right ear, was not able to discover that any of the forks were heard up to and including the c⁴ (2048 d.v.). There was present a rotatory nystagmus on looking toward either side. This seemed to be as pronounced on looking to the left as toward the right. Pressure with a pledget of cotton applied to the upper posterior segment in the right ear produced
a prompt though not violent horizontal nystagmus in which the quick component was directed to the opposite side. On applying the usual fistula test, that is, the compression and suction of air in the external meatus, we got the positive response for a fistula. The response, however, was not typical of a fistula in the horizontal canal, for with pressure there developed a rather weak horizontal nystagmus with the quick component directed toward the opposite side, and with suction there was a much more violent horizontal nystagmus in which the quick component was directed toward the same side. This is exactly the reverse response to the one usually elicited from compression and suction. The production of this nystagmus increased the nausea and the desire to vomit from which the child had been suffering continuously for one whole week. There are two possible explanations for this reverse type of nystagmus on applying the fistula test. One is that the fistula symptom is the result of a relaxation of the attachment of the stapes in the oval window or of the development of an actual fistula in the region of the oval window. The other is that a fistula is located in the typical situation, that is, where the horizontal canal forms a prominence in the floor of the aditus, and that on account of a valve-like action of the granulations about this fistula the currents set up in the endolymph on compression and on suction were the reverse for that ordinarily produced in a fistula in this location. Caloric responses elicited by the blowing of compressed air into the external meatus on the right side brought out quite promptly the typical rotatory nystagmus directed toward the opposite side.

In view of the apparent complete suppression of the function of hearing in the right ear we had at first feared that there had developed in this ear a diffuse suppuration of the labyrinth and that the persisting vomiting might be the result of a cerebellar lesion so much dreaded in cases of acute suppuration of the labyrinth. The discovery of a functioning vestibular mechanism was, therefore, a great relief, since this excluded the existence of a diffuse suppuration of the labyrinth, the one type of labyrinthitis from which an intracranial complication is at all probable. The child was exhausted as the result of the
constant nausea with vomiting which had prevented her from retaining food for more than a week. The cause of the persisting nausea we attributed not so much to the existence of the fistula into the labyrinth, as to a condition usually termed "perilabyrinthisis," in which an irritation of the labyrinth is kept up as the result of the extensive cholesteatoma. The radical mastoid operation was immediately carried out. The cholesteatoma was very extensive, invading the bone in all directions up into the squamous bone, and in the root of the zygoma upward and forward over the external meatus. This type of cholesteatoma is met with only occasionally where the diploëtic bone is extensively invaded.

From the day of the operation the nausea and vomiting stopped. In spite of the extensive bone cavity resulting from the operation, the process of epidermizing proceeded rapidly. Six weeks after operation the radical cavity was quite dry. No evidence of the fistula could be obtained by compression and suction of air, but there developed quite promptly the typical caloric response from blowing compressed air into the external meatus, that is, a rotatory nystagmus with the quick movement toward the opposite side. The functional tests of hearing two months after the operation demonstrated a marked improvement, a rather unusual result after the radical operation. The whispered voice was easily heard at a distance of 3 feet, better now than for the opposite ear. The explanation for the marked improvement was the subsidence of the condition of serous labyrinthitis which has been responsible for the profound depression previous to the operation.

The return of the hearing in this ear was especially gratifying, for this made it possible to recommend the radical operation on the opposite side where an active cholesteatoma was present. Had the hearing not returned in the operated ear one should hesitate long before advising the radical mastoid on the ear on which the patient had to rely for her hearing. This is a principle too often overlooked by otologists, as is seen especially where the simultaneous radical operation on the two ears is recommended. Such a procedure is, in our judgment, never
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called for. Where the indication for the radical mastoid operation exists for both ears, only one should be subjected to the operation, and that should be the one where the hearing is the poorer. Later the opposite ear may be operated, depending largely on whether the hearing in the operated ear has become good enough to warrant subjecting the second ear to the jeopardy of the radical operation.

These 3 cases of chronic suppurative otitis media each complicated by a cholesteatoma and each with an erosion into the labyrinth, the so-called fistula, differ widely in their clinical problems for the otologist. In one an immediate operation, including drainage of the labyrinth, had to be carried out. In another no operation at all has as yet been done, and in the third the radical mastoid has resulted in an elimination of the chronic disease involving the bone and has resulted in a marked improvement in the hearing. I have reported the cases because they illustrate very well how complicated are the problems in these cases of chronic middle-ear discharge, and how differently cases that resemble each other rather closely have to be handled. The clinical problems which confront the otologist are more complex and require more careful analysis than do the problems in any other special field.
This morning I wish to discuss with you the subject of traumatism to the kidney. Our conception of injuries to the kidney has always been an injury that was severe in nature, as the result of which the kidney was very severely damaged.

As illustrative of this type of injury might be mentioned gunshot wounds, severe fractures, and injuries of a similar nature. In recent years there has come under my observation a series of cases that represent a different type of kidney injury. The injuries were all sustained by the patients during the pursuit of their usual occupations. Since the increase of manufacturing interests in this country there have been employed larger and larger bodies of men, and the work of some of these men has been of a more or less hazardous nature, with the result that a large number of men employed are injured each year. For the protection of the workmen the various states have passed Workmen’s Compensation Acts, and as a result thereof there has necessarily arisen a desire on the part of the employing corporation through its industrial surgeons to more carefully study their cases of injury to the kidney. The importance of this phase of the subject is apparent to those of you who are engaged in the practice of industrial medicine and surgery. At times it may be difficult to fix the liability and at other times there is no liability at all.

For the purposes of discussion let us consider, first, the cases that one sees remotely after the injury was received, and second,
the cases of injury of the kidney that one sees immediately at the time of injury.

Trauma of the kidney, aside from the history of injury, generally has as one of its cardinal symptoms the presence of blood in the urine. A history of injury, no matter how slight, and the presence of blood in the urine would seem to be *prima facia* evidence of direct kidney damage, and if this is the result of a trauma incurred during the occupation of the patient, it would upon this rather superficial data place the liability for damages directly upon the employers or employing corporation. Especially important is this as bearing upon the Workmen's Compensation Act. You who engage in this special field of practice are more familiar than I am with its workings.

The two fundamentals to be worked out in each case are:
1. Was there blood in the urine following injury?
2. Was the hematuria due to the injury or are there other pathologic lesions present that may account for the hematuria.

In industrial work, the same as in private practice, the statement is often made that the patient had hematuria. One may be obliged to accept this as a fact because one cannot dispute this statement, and sometimes it becomes necessary to accept the statement of the doctor who saw the patient after the injury or alleged injury was received.

It becomes necessary, therefore, in each and every case in which there is a history of trauma, either of severe degree or mild in its nature, to consider the possible rôle of the trauma in the production of the symptoms as well as to consider the possibility of the existence of previous disease of the kidney which has been fanned into activity by the trauma. Or one must consider the possible previous existence of a pathologic condition in the kidney and that the patient's attention to his urinary tract has been called into existence by the trauma.

Before entering into a more detailed discussion of the subject it may be advisable to illustrate some of these remarks with case reports which I will present very briefly. For purposes of discussion I will attempt to group the cases.

1. **Extrarenal Source of Bleeding.**—It is self-evident that
there may be cases in which the bleeding does not come from the kidneys at all, although there is a very definite history of kidney injury, which might even be quite severe. As an example of this type and also illustrating the great care necessary in "guessing," permit me to cite the following case:

Male, aged thirty, referred by Dr. L. P. Kuhn. While engaged in the performance of his usual occupation patient received a severe injury to the back. Following the injury patient immediately noticed blood in the urine, and it was stated that the urine was port wine colored. A physician was called who made a diagnosis of hematuria and fracture of the last rib. This case came before the industrial board, and the physician stated that the hematuria was renal in origin and that the kidney was injured by penetration of the end of the fractured rib, which injury the patient sustained in carrying out his usual occupation. So convincing was his testimony that the patient was awarded a verdict of $2800 as well as his hospital bill. I was asked to see the patient. Cystoscopic examination revealed the presence of a papillary tumor near the right ureteral orifice. The broken rib and injured kidney were supposed to be on the left side.

Comment is hardly necessary.

2. Cases in Which Kidney Disease was Present Prior to the Injury as Evidenced by the Pathology.—There can be no doubt I think that injury, even mild in degree, may be a very important factor in some cases of "so-called" traumatic kidney. If great care is taken in eliciting the history it will be found that the patient is quite sure the symptoms began shortly after he received his injury, and I believe the patient is perfectly honest in his statement. Many cases of this type have come under observation in which the urinary symptoms were either very much aggravated by an injury or cases in which the patient's attention was first called to the presence of urinary tract disease by an aggravation of symptoms, symptoms that may have been so mild that they were not noticed. And yet there is no doubt in my mind that the pathology as found was such as to lead one to believe that the pathology in the case was not the result of trauma. As examples I would like to briefly mention 2 cases:
A. L., aged forty-four, postal collector. Fifteen years ago patient while driving a mail wagon received a severe jolt and felt a sudden tear in left loin, with swelling soon after. Two operations for perinephritic abscess were performed. After second operation he tore open the incision while running, and this sinus has remained open ever since. Patient entered Hospital because of a sinus in left side. Left nephrectomy was performed and stone found in kidney.

L. R., aged twenty-seven, electrician, was referred by Dr. J. B. Moore, Benton, Ill. One month before coming under observation patient strained his back while lifting an armature. At that time he noticed a sharp pain in the back. Blood was first noticed in the urine two days later and persisted up to time of entrance to hospital. No blood was ever noticed prior to injury. Examination of abdomen was negative. No tumors or masses. X-Rays were negative with the exception of a small wheat-sized dense shadow in region of left kidney. Cystoscopy showed a few areas of ulceration in bladder wall. Ureteral orifices were normal and ureters catheterized without difficulty. Urine from the left side was turbid; from right side, clear. Cell count and cultures were as follows:

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<th>Cells</th>
<th>Cultures</th>
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<tr>
<td>Bladder</td>
<td>3880</td>
<td>Sterile</td>
</tr>
<tr>
<td>Right kidney</td>
<td>6080</td>
<td>Bacillus coli</td>
</tr>
<tr>
<td>Left kidney</td>
<td>380</td>
<td>Sterile</td>
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A second cystoscopic examination was made one month later. There was no flow of urine from the right side; very turbid urine from the left side, which showed 3200 pus-cells and sterile cultures. Urine from the left kidney was stained for tubercle bacilli and found positive, ,+++. Guinea-pigs were injected and were negative for tubercle bacilli.

These are cases that might very easily be classified as injuries due to muscular violence, and yet this in the face of the findings is impossible.

One is impressed with the off-hand way in which the older men reported cases of this kind purely on the history and without any careful urologic study. It has often occurred to me that
many of the cases that were reported in the older literature as cases of traumatic kidney due to muscular strain were, in reality, cases that had some organic lesion as a basis for the hematuria.

3. Cases in Which Kidney Lesions are Found that May Not Be the Direct Results of the Injury.—The problem of fixing the degree to which the trauma is a factor in producing the disability of the patient is quite difficult in cases in which lesions of an infectious nature are found, such as a mild chronic pyelitis. In a given case in which the patient states that he was absolutely free of urinary symptoms prior to the injury and that subsequent thereto he has had persistent pain in the back, and in which careful urologic study shows a mild chronic pyelitis, the determination of liability becomes a difficult problem. Especially so if immediately after a mild trauma there occurs an alledged hematuria of a few days’ duration. We are then confronted with the question of whether the trauma really produced the hematuria or whether the hematuria is the result of the pyelitis, and to what extent, if any, did the trauma serve to the extent of being a factor in the production of the pyelitis. As an example of this type let me read you the following history:

J. C. B., Benton, Ill., referred by Dr. Geo. G. Davis.

In July, 1920 patient slipped while pushing a cart and felt a pain across the left side of chest. Since then he has felt a pain when lifting. January 10, 1921 a truck fell on him. Did not stop work, but injury caused considerable discomfort. Nine days later, while lifting and pushing a car off the slide rail, he felt a stinging sensation under the margin of the ribs. Following this he noticed a lump to the right of the right rectus muscle, which he pushed back.

Patient was admitted to the hospital complaining of pain on right side of abdomen and back, frequency and pain on urination, loss of weight and strength, and shortness of breath.

Pain on right side of abdomen and back began after injury in July. Was unable to work for three weeks because of pain in right abdomen. No hematuria was noticed. Soreness has persisted up to present time, but has been able to work. On January 21st was hit in abdomen by a piece of timber, but was
able to work. On January 29th he was pushing a car, and again tore something loose, which was followed by severe pain which radiated down into the scrotum and was dull and aching in character. This pain has never let up except for short intervals. Has not worked since that time. Keeps him awake at night. Frequency and pain on urination started immediately after the last injury. The pain lasted only a few days, but he is obliged still to void frequently in the daytime and occasionally once at night. Lost about 30 pounds after last injury.

Examination of the abdomen showed tenderness under the costal margin on right side. No tumors or rigidity. No definite tenderness to fist percussion in costovertebral angles. Left kidney not palpable. Right kidney questionably palpable.

Cystoscopy June 30, 1921 showed bladder and ureteral orifices normal. Left ureter catheterized easily. Three catheters were used in the attempt to enter the right kidney pelvis. Finally a small catheter passed. Ureteral catherization showed the following:

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<tr>
<td>Bladder.................. 0 Sterile</td>
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<tr>
<td>Right kidney............... 180 Sterile</td>
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<tr>
<td>Left kidney................. 90 Sterile</td>
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Pyelogram of both kidneys was made. Kidney outlines were apparently normal.

Phenolsulphonephthalein test showed an output of 22 per cent. in one hour.

A second examination of the bladder urine showed 30 pus-cells and a culture of Bacillus coli.

4. Cases in Which a Question of Liability Arises Due to the Wrong Interpretation of Roentgenograms.—Since the routine use of x-rays in cases of injury to the back many roentgenograms have been taken and the plates have not been read or interpreted correctly. In other words, the physician has been led astray by the Roentgen ray or, rather, by his faulty interpretation of what was found in the plate.

For example, patients are examined with x-rays and shadows are found in the plate which are interpreted as stones, and the
physician tells his patient that as the result of his injury he has developed stone. This error is generally due to the wrong interpretation of shadows that are now universally recognized as being of extra-ureteral origin. In this group of cases our problem is simple. All that is necessary is to prove that the shadow or shadows are of extra-ureteral origin by passing a shadowgraph catheter. Several cases of this nature could be cited, but I hardly feel that this is necessary.

This group of cases has been cited to illustrate some of the problems and some of the difficulties of diagnosis and in the fixing of liability in cases that have come under my observation within the past few years.

Injuries of the kidney are usually divided into two groups depending on the presence or absence of an external wound. Injuries without any external wound are usually designated by the term "subparietal." The extent of damage to a kidney is in part directly due to the severity of the trauma, and in very severe injuries the kidney may be only a part of the general damage done, the other organs may be injured at the same time, liver, spleen, genito-urinary tract, etc., including peritoneal tears. This has led to the use of such terms as "complicated" and "uncomplicated" kidney injuries, the term "uncomplicated" being reserved for cases in which only the kidney, its blood-supply, and the pelvis and ureter are injured.

Depending also upon the extent of the injury, further division into incomplete and complete rupture is possible. Cases in which the laceration does not extend beyond the fibrous capsule and in which the entire thickness of the kidney is not involved have been designated as incomplete. Complete rupture includes cases in which the fibrous capsule has been torn and in which the entire thickness of the kidney has been lacerated.

Pathology.—In mild cases there may be tears of the fatty capsule without injury to the kidney parenchyma. This generally results in the collection of blood in the perirenal tissue. The end-result generally is absorption of the blood, or it may become encysted. Rarely does infection of the blood occur, and
if it does, suppuration with the formation of a perinephritic abscess results.

Contusions of the renal parenchyma without laceration of the capsule are generally associated with slight hemorrhage, which may be subcapsular or which may occur as hemorrhage into the parenchyma of the kidney, and extend from the cortex to the pelvis. These irregular areas of hemorrhage when absorbed result in the formation of scars.

When the capsule is torn and the laceration extends into the calyces of pelvis, a true rupture of the kidney exists. The laceration or fissure is supposed to occur most frequently on the anterior surface and is generally transverse in direction, although the tear may radiate from the hilus. As a result of the laceration there occurs leakage of blood or blood and urine into the surrounding tissue, depending upon whether the pelvis or ureter are torn or not. In severe lacerations the kidney may be divided into two halves which may be held together by the pedicle, or the entire kidney may be divided into many small fragments.

The extravasation of blood and urine usually collects in the retroperitoneal cellular tissue, sometimes forming a rapidly growing, fluctuating tumor. This perirenal extravasation may burrow downward toward the iliac fossae. Occasionally the fluid may pass through the inguinal or femoral canals and collect in the scrotum or thigh. Occasionally the fluid may burrow along the ureter or collect in the pelvis. The extravasation fluid may go on to absorption. It usually becomes infected and must be evacuated and drained. Complete detachment of the kidney is rare and practically always fatal.

**Rupture of the Peritoneum.**—This occurs rarely in cases in which the kidney only is injured and, as previously mentioned, belongs to the group usually spoken of as complicated injuries.

The peritoneal tear permits the extravasated blood and urine to find their way into the peritoneal cavity, with the result that peritonitis arises.

**Symptoms.**—The history of a recent injury, the evidence of injury to the kidney as seen upon inspection coupled with the
presence of blood in the urine, render the diagnosis relatively easy, the diagnosis of trauma to the kidney being less difficult than it is to establish the degree of injury. To these may be added shock. Later, anuria and uremia may be added to the clinical picture.

**Absence of Hematuria.**—Suppuration of the perirenal exudate may occur, and this generally begins about the third day. This picture, too, may be clouded by the onset of some intercurrent disease; for example, typhoid.

To you who are engaged in industrial medicine and surgery this end of the problem is simple. The difficulty encountered is with the patient who has passed through this stage and then comes up for compensation. To illustrate these problems it was my object to present the case reports mentioned earlier in the hour.

**Treatment.**—The treatment of kidney injury is based upon the severity of the injury and falls into one of two groups—operative and non-operative.

**Non-operative Treatment.**—Since the milder forms of kidney injuries tend to recover spontaneously, the patient should be given the benefit of expectant treatment. This should include rest in bed for at least five or six days. Especially should the patient be kept in bed when gross blood is present in the urine. At the end of this time the danger of complications are well over.

Shock should be treated in the usual way, with morphin, external heat, and plenty of fluid, either intravenous, subcutaneous, or per rectum. Blood transfusion or the use of gum glucose may be indicated.

The value of ice-bags applied to the back is probably doubtful. Immobilization by adhesive tape may aid in making the patient more comfortable.

Cases in which one believes that both kidneys are the seat of injury had best be treated expectantly.

I cannot subscribe to the view held by many that each injured kidney must be operated on at once. I have always felt conservative about the management of these cases, and I have
never yet had occasion to regret my conservative stand in handling these cases.

The presence of retention of urine due to clots calls for appropriate treatment. When there has been enough bleeding to cause clots and retention I believe the patient should be kept in bed for at least two weeks.

**Operative Treatment.**—*Uncomplicated Cases.*—The surgical interference is either immediate or remote. The indication for immediate intervention is hemorrhage. This may be so severe at the start as to justify or demand immediate operation, and one is guided in his decision by the increasing pallor of the patient, the thready, running pulse, sighing respiration, and a gradual progressive increase in size in the tumor in the kidney area. On the other hand, the bleeding may not be very great at the start, but it may continue for a long time, or there may be recurring attacks of hematuria which demand surgical intervention for their control.

The indication for late operation besides late secondary hemorrhage are suppurition in the perirenal space, infection of the kidney, and hydronephrosis.

**Complicated Cases.**—In the complicated cases with intraperitoneal injury exploratory laparotomy is indicated. At times it may be difficult to determine just the amount of intraperitoneal injury.

The kidney operation at the onset is usually exploratory in nature. Often it is only necessary to remove the clots and establish drainage. Hemorrhage may be controlled by tamponade. The tears in the kidney as well as injuries of the pelvis can be repaired by suture.

Where the damage to the kidney is severe nothing short of nephrectomy is indicated.

This rather slender girl whom you see before you is fourteen years old. She was brought to me a few days ago by a very good general practitioner who had made the probable diagnosis of tuberculosis of the spine. The following history was obtained from the girl and her mother:

The patient has always been more or less ill since she was four years old, having had frequent infections of the nose, pharynx, and more recently the ear. Aside from the usual childhood diseases, such as measles and chicken-pox, she has had no serious illnesses until she developed otitis media three years ago. Following this her tonsils and adenoids were removed and she has been somewhat better. She has done very well in her school work, and in spite of her illness is as far advanced as the average girl of her age.

The present trouble began about a year ago, when she first noticed occasional pain in the left side of her back. This pain would at times radiate downward into the lumbar region, though it frequently was little more than a dull ache. For the last month she has complained of a sharp, shooting pain under the costal margin. This was not associated with respiration or aggravated by deep breaths. About this time her mother dis-
covered a curvature of the spine. She also found that there was some swelling in the region of the left costovertebral angle, which was quite tender. There has been some loss of weight, the patient weighing 87 pounds a year ago and only 82 pounds at present. The mother thinks the loss of weight has occurred within the last three months. Except for a poor appetite there is little else of note in the history. She has no cough or shortness of breath.

On physical examination one finds, as you may see, a some-

Fig. 304.—Note lateral curvature and swelling in costovertebral region suggesting a cold abscess.
what undernourished, pale girl, rather tall for her age. She has a deflection of the septum which makes nose breathing somewhat difficult. There is a perforation of the right ear drum. The chest is asymmetric, there being some bulging in the left costovertebral angle and a slight curvature of the spine with the convexity to the right. The spine is not very rigid, although not as mobile as one would expect in a girl of this type. There is very marked tenderness in the region of the swelling. This swelling seems to be firm, although careful palpation is difficult on account of the tenderness. Examination of the chest reveals no evidence of tuberculosis.

Leukocyte count is 9800 and hemoglobin 65 per cent. (Dare). There are a number of things to be considered in making the diagnosis. In the first place, probably the most common condition is what her home physician has suspected, that is, tuberculosis of the spine in the dorsal region with a cold abscess. The location, the loss of weight, the anemic condition of the patient, the pain in the back, and the deformity all suggest this condition. However, on going over her spine carefully I am unable to find any localized point of tenderness over the vertebrae. Furthermore, there is not the rigidity one would expect for a tuberculosis of the spine with an abscess at this point.

The next most likely condition probably would be a tuberculous process in the rib. This condition is much more common than an acute osteomyelitis. Tuberculosis of the rib may be primary, but it is usually secondary to tuberculous pleurisy or pulmonary tuberculosis, but our x-ray findings will effectually rule this out.

In regard to acute osteomyelitis one must be a little cautious in excluding it. It is of very rare occurrence. Fantozzi1 in 1920 was able to collect 51 cases from all the literature, excluding naturally the secondary infections following empyema and drainage. In many of the cases which he reported there was a swelling very similar to the condition present here. The presence of osteomyelitic foci elsewhere will, of course, help one greatly in making a diagnosis. She has had a great deal of trouble with

1 Fantozzi: Policlinico, 27, 1920, p. 408.
her tonsils and a suppurating ear, either of which might act as a focus, but there is no evidence of other secondary involvement. In four-fifths of Fantozzi's cases but one rib was involved, the seventh being most frequently affected. None of his cases perforated into the pleural cavity. While he includes empyema (necessitatus) and pararenal abscess in his differential diagnosis, they can be readily excluded here, even without the aid of the x-ray.

The third condition which one must consider is a neoplasm. Neoplasms of the rib are also rather uncommon. Hedbloom1 was able to collect 213 cases of tumor of the bony chest wall. These included tumors of the sternum and clavicle as well as those of the ribs. Of this number, 131 were sarcomas, 40 chondromas, and 24 metastatic carcinomas. The others were fibromas, exostoses, and gummas. By far the greatest number were sarcomas.

We will now see what we can make out of our x-ray pictures. First we note there is no evidence of pathology in the vertebrae. Here we find a tumor of the twelfth rib which is a fusiform swelling apparently not breaking through the periosteum at any point. It is consistent with being a cyst. It might possibly be an inflammatory condition, although this is quite unlikely, as there is neither evidence of sequestrum nor involucrum formation. It may be a chondroma or sarcoma. The fact that it has not broken through the periosteum speaks against sarcoma and in favor of one of the more benign tumors, although a central sarcoma may persist for a considerable time before breaking through. It is not multilocular, as one would expect to find in a bone-cyst. Under the circumstances I feel that the most likely diagnosis is a chondroma, especially since it developed so near the end of the rib.

Under ether anesthesia I am making an incision about 15 cm. long parallel to the course of the twelfth rib. Upon exposing the rib there is no evidence of involvement of the soft tissues about it. Most of the tumor mass which one felt from the outside is due to the asymmetry of the chest wall and

1 Hedbloom: Archives of Surgery, 3, 1921, p. 56.
little to the tumor itself. I am being particularly careful in my dissection not to open the pleura. This accident probably

Fig. 305.—Osteosarcoma of the twelfth rib developing in the medullary cavity. Notice the tendency to multilocular arrangement which led to the possible diagnosis of bone cyst. Note the lateral curvature of the spine which had been mistaken for evidence of tuberculosis. (This picture is reversed.)

would not be very serious, although it has been pretty definitely shown that shock occurs more frequently in cases in which the
pleura has been opened than in those in which the tumor is removed extrapleurally. On the other hand, a great many cases of shock and some cases of death have been reported following removal of tumors of the chest wall even though the pleura was not opened at any time. In case we should accidentally tear through the pleura, I shall attempt to make an immediate closure. As you see, I have had our anesthetist, Dr. Herb, have the intrapharyngeal insufflation outfit in readiness, as this is a rather important aid in the event the pleura is opened. It is very difficult to free the rib at the vertebral angle, and as I now have it entirely free elsewhere, I am going to twist it out. This is accomplished without opening the pleura, though we can see the lung move directly beneath it almost as clearly as though you were looking through a pane of isinglass. I have some radium in readiness to insert here in the event the tumor appears to be malignant. Under the circumstances I feel that immediate complete closure is justifiable and am making the same. The patient shows no shock and has stood the operation very well.

Upon section of this tumor I am rather surprised to find that it is not a chondroma, but has the appearance of a sarcoma, but I shall depend upon microscopic section before reopening the wound. The tumor is granular. There is not the homogeneous opalescence of cartilage anywhere in the cut section (Fig. 306, A).

Of the other tumors of the chest wall which were not to be considered in this present case carcinomas are by far the most frequent. I have here a section of a rib removed postmortem from a patient on whom I operated some months ago and removed a gland for diagnosis. This patient, from some unknown cause, had been losing weight rather rapidly. Finally some small glands were found in the right inguinal region, and I removed one of these for diagnosis. Rather to my surprise, sections showed definite adenocarcinoma, and I hazarded the guess that the tumor was primary in the prostate, although the patient had absolutely no prostatic symptoms. Shortly afterward he developed pain in his chest and a collapse of the lung.
The x-ray showed what you can see here, that is, definite metastases. One other tumor might be considered even in this particular case, that is, a metastatic hypernephroma. Hyper-

nephromas occur in young people and are very prone to bone metastases. While the ribs are not frequently involved, still a number of cases have been reported.

I want to show you along with this case a specimen which

![Fig. 306.—A, Photograph of longitudinal section of osteosarcoma removed at operation from case herewith reported. B, Osteochondroma removed by Dr. Phemister from a girl twenty-two years old. Contrast the homogeneous cartilaginous areas with the granular surface of A.](image)
was removed by Dr. Phemister a little while ago from the chest of a girl about twenty. This tumor is unquestionably an osteochondroma and you can see a very evident difference between the two tumors. It is homogeneous in structure, somewhat opalescent, and has attained this large size without any general symptoms (Fig. 306, B).

Tumors of the chest wall occur in the majority of instances in the anterior portion, only 15 per cent. being found posteriorly. The treatment is usually extirpation, and where the tumor is primary some few radical cures have been obtained. Of course, metastatic carcinomas are not suitable for extensive operation,

![Fig. 307. — Osteoplastic carcinoma of the ribs showing multiple metastases from a small primary carcinoma of the prostate.](image)

and frequently sarcomas have invaded the soft parts to such a degree that radical removal is out of the question.

I might cite, however, a case of recurrent carcinoma of the breast operated upon originally September 17, 1917. In August, 1920 the patient returned with a nodule in her old scar about 3.5 cm. in diameter and firmly fixed to the sixth rib. As there was no evidence of mediastinal involvement and there seemed to be good skin enough to cover an operative defect, I undertook to remove it. By a wide dissection I took out about 4 cm. of the rib with a block of the overlying tissue and obtained primary closure. This was followed by x-ray, and over a year later she had no evidence of recurrence, demonstrating to me
that occasionally operative interference is worth while in apparently hopeless recurrences of the chest wall.

Chondromas frequently recur and they seem to be predisposed to malignant degeneration, so that some of these tumors—and perhaps the one we have removed this morning belongs to this class—are chondrosarcomas. Hedbloom reports a case which was operated upon at the age of six, again at twenty-seven, at thirty-six, and finally at thirty-seven. The last time he had a definite sarcoma and died at thirty-eight of metastases.

Postoperative Course.—The microscopic sections showed that this was definitely a sarcoma with a great many spindle-cells and some giant-cells in it. It is not ordinarily a benign tumor, and therefore the prognosis is not very good. Since the sections were out I have reopened the wound under gas and inserted 50 mg. of radium for twenty-four hours. This delayed healing only a few days and primary union was obtained. The patient has gained considerable weight and her general health is very much improved.
HYPERTROPHY AND CARCINOMA OF THE PROSTATE GLAND

A Case of Middle Lobe Hypertrophy with Beginning Carcinoma in Posterior Segment. Two-stage Prostatectomy. Radium and x-Ray Treatment. Pathologic Report. Future Plan of Treatment.

History.—Present.—The patient, a man seventy-seven years old, consulted us because of his increasing urinary disturbance. He complained of difficulty in starting urination with slowness of the stream, pain and frequency, and pain in the right leg following the course of the sciatic nerve.

His urinary symptoms began about ten years ago, but caused him no marked discomfort until about two years ago. Since then his symptoms have been progressive until at the time he consulted us he had marked dysuria and his frequency was so severe that he was obliged to urinate every hour day and night. The pain in his right leg had also become very troublesome.

Past.—His past history is rather uneventful. He has had no operations, and all his illnesses have been of minor importance. His parents, brothers, and sisters all lived to advanced ages.

Physical Examination.—The patient is a well-developed man weighing about 190 pounds and very well preserved. The physical findings are negative except for a perforation of the drum membrane of the left ear, and a systolic heart murmur at the apex. The reflexes are normal.

Rectal Examination.—The prostate is enlarged one plus. There are small palpable nodules in both lobes. These nodules are felt more distinctly by palpating the gland with an instrument in the urethra. The consistency is firmer than normal, but not of unusual hardness. The prostate is not very tender.
Cystoscopic Examination.—It was not possible to pass a cystoscope into the bladder on account of the obstruction at the bladder neck. The residual urine measured 8 ounces.

Laboratory Findings.—The urine was quite cloudy from pus, negative for albumin and sugar, and contained a few hyaline casts.

Blood.—Hemoglobin, 90 per cent.; white blood-cells, 8500. Blood-pressure, systolic 182, diastolic 84.

Blood Chemistry.—Blood sugar, 125; blood urea, 31; blood uric acid, 5.6; blood creatinin, 1.7; blood non-protein nitrogen, 35.

x-Ray report showed no abnormalities in urinary tract and films made of the osseous system did not show any bone changes indicative of metastases.

The character of the prostatic enlargement while not revealing the marked board-like hardness and fixity of a well-developed carcinoma, still gave the impression of being malignant on account of the rather firm consistency, the nodules, and lack of symmetry. Owing to the rather large amount of residual urine and infected character of same, it was thought advisable to do a two-stage operation.

Preliminary Cystotomy.—Seventeen days ago we performed a suprapubic cystotomy and found the bladder side of the prostate rather smooth and soft with a papillary process projecting from the lower part of the internal urethral orifice, partially obstructing the urinary outlet. This was a typical middle-lobe hypertrophy. Bearing in mind the rectal findings, it seemed likely that we had a malignancy involving the lower posterior segment of the prostate with an associated benign hypertrophy of the middle lobe (Fig. 308). In the vertex of the bladder a diverticulum was found, the opening of which admitted the index-finger.

A large rubber drainage-tube was placed in the bladder and the wound sutured. After three days this tube was removed and replaced by a dePezzer catheter. Following the cystotomy there was no shock or disturbance of pulse and temperature, but incessant complaining of sleeplessness made it necessary to administer hypnotics for over a week following the operation.
After draining the bladder for over two weeks the patient is now in good condition for the second stage.

Second-stage Operation.—We will enlarge the fistulous opening into the bladder, and with the aid of an assistant's finger in the rectum I will enucleate the enlarged middle lobe. Laterally this is easily accomplished, but posteriorly it is more adherent, however I have succeeded in separating it from the posterior segment of the gland, leaving a rather rough surface at this point.

Fig. 308.—Cross-section showing location of carcinoma in the lower posterior segment of the prostate gland, associated with benign hypertrophy of the middle lobe.

I am quite convinced now that we have to deal with a malignancy in the lower posterior segment of the gland, so I will insert this capsule which contains 50 mg. of radium. It fits snugly in the space left by the removal of the middle lobe (Fig. 309). I will insert two needles each containing 12½ mg. of radium into the posterior part of the gland so that they are about 1 cm. apart and about the same distance from the radium capsule, giving an opportunity for cross-firing. I will pack some iodoform
gauze against the capsule and needles, insert a rubber drainage-tube, and close the wound in the usual manner. The capsule

and needles have attached to them strong silk threads which are carried out through the cystotomy wound and are fixed to the skin by means of a suture to prevent losing them.
Traction on these cords furnishes the means for removing the radium from the bladder. The capsule of radium is screened with 1.4 mm. of gold and covered with a rubber sheath. The needles are screened with 0.3 mm. of platinum and have no other cover.

The capsule and needles containing radium were not removed for twenty-four hours, as there had been no unfavorable reaction necessitating their removal earlier. This exposure gives us a total dosage of 1800 mg. hours.

Pathologic Report.—Microscopic examination of the removed gland showed in the upper part a normal arrangement of alveoli and stroma. At the lower edge there were a few areas showing an abnormal proliferation of atypical epithelial cells, and another area in which the alveolar cells had broken through the basement membrane. There was also some perivascular round-cell infiltration and an increase in fibrous tissue.

The specimen definitely shows the carcinomatous process beginning in the lower segment of the gland and encroaching on the upper or adenomatous portion, thus verifying our preoperative diagnosis.

Subsequent History.—The postoperative course was uneventful. Four weeks after the prostatectomy 30 mg. of radium at the end of a urethral staff was placed in the prostatic urethra and was kept in place for eight and a half hours, making 425 mg. hours. This radium was screened with 1.4 mm. of gold covered by a rubber sheath.

The patient will be subjected to a course of deep “cross-firing” x-ray treatments.

Postscript.—The prostate gland is richly supplied with lymphatics which carry the cancer cells to the lymph-nodes in the regions of the iliac vessels and subsequently into the prevertebral glands.

Bone metastases are very common and secondary tumors of the spinal cord are sometimes found. Therefore all cases of cancer of the prostate should be subjected to a careful roentgenologic and neurologic study before any form of treatment is instituted. In a large percentage of cases the tumor begins in the posterior lobe of the gland and spreads upward behind the neck of the
bladder and trigone, invading the intervesicular area and the regions of the seminal vesicles. For this reason it should be our object to imbed the radium into this area first if we may hope to prevent the spread of the disease. This is best accomplished through the opened bladder.

Benign hypertrophy of the middle or superior segment of the gland is commonly associated with cancer of the posterior lobe.

![Image](image.png)

Fig. 310.—Cross-section showing long needles passed through perineum and embedded in malignant posterior lobe.

When this is found, enucleation of the adenomatous lobe gives excellent opportunity for the application and imbedding of radium in the malignant part of the tumor as practised in this patient. Further irradiation of the lower part of the gland may be necessary, but can be carried on by introducing long needles (Fig. 310) containing radium through the perineum.
TUMOR OF KIDNEY


History.—This patient, a male forty-three years of age, has had very few symptoms.

Eight months ago he had what he described as a “cold.” At that time he had a slight pain in the back and for four days had a painless hematuria. After this so-called “cold” subsided he felt quite well and returned to his work.

He has had no further symptoms and considers himself in good health. In applying for a new position as a paint chemist his prospective employers elicited the history of the hematuria and sent him to us for examination.

On being questioned he admits a slight feeling of pressure in his back and a slight loss of weight.

Three months ago he expelled a large tapeworm and has regained a little weight since then.

His past history is negative. He has been unusually free from disease all his life.

Physical Examination.—The patient is well developed and well nourished and appears to be in good health. The general examination is negative.

In the right side of his abdomen about 3 inches below the costal margin and 4 inches to the right of the median line there is a palpable tumor, firm in consistency, which extends to the margin of the lumbar muscles, and which moves with respiration. This corresponds in character and location to an enlarged right kidney.

Cystoscopic Examination.—Bladder showed no changes. Ureteral orifices were normal in appearance and were catheterized without difficulty. No urine could be obtained from the right kidney. A pyelogram of the right side was made.
Fig. 311.—Roentgenogram of patient with tumor of kidney. The kidney outlines are rather large, especially on the right side, on which the kidney extends from the twelfth dorsal to the fourth lumbar vertebra. Right pyelogram shows a marked deformity of the kidney pelvis, with dilatation of the ureter, especially above the level of the fourth lumbar vertebra. This dilatation is due to pressure at this point by the enlarged kidney. The findings are compatible with kidney tumor. There are no stone shadows seen in any part of the urinary tract.

x-Ray Report.—The kidney outlines are rather large, especially on the right side, on which the kidney extends from the twelfth dorsal to the fourth lumbar vertebra (Fig. 311).
Right pyelogram shows a marked deformity of the kidney pelvis with dilatation of the ureter, especially above the level of the fourth lumbar vertebra. The findings are compatible with kidney tumor.

There are no stone shadows seen in any part of the urinary tract.

**Laboratory Findings.**—*Urinalysis.*—The urine is clear, free from albumin and sugar, and has few hyaline and granular casts, and few white blood-cells in the centrifuged sediment. The urine was negative on culture, also negative for Bacillus tuberculosis in direct smears and guinea-pig inoculation.

**Phthalein:** First fifteen minutes. Second fifteen minutes. Second half hour.
Left kidney, 25-30 per cent. 15 per cent. 5-10 per cent.
Right kidney, No urine after one and a half hours.

**Blood.**—The hemoglobin is 85 per cent. Leukocytes 8800 per cm. Blood chemistry is within normal limits. Blood-pressure is 138 systolic, and 84 diastolic.

A diagnosis of neoplasm of the right kidney was made and operation decided upon.

**Operation.**—The incision is made beginning at the costo-vertebral angle, running obliquely forward and downward two fingerbreadths below the twelfth rib.

We expose the kidney and deliver it into the flank. The kidney is very large and shows a large tumor involving the lower pole; the upper pole apparently is not involved. The ureter is freed for a distance of about 8 cm., clamped, tied, and cut. The pedicle is very short and is clamped with difficulty, after which we remove the kidney. The stump of the pedicle is ligated and the wound closed in the usual way. I noticed while palpating within the wound cavity that there were some enlarged prevertebral lymph-nodes near the pedicle of the kidney.

**Pathologic Report.**—*Gross.*—The kidney is 14 x 8 x 7 cm. and weighs 425 gm. The external surface is glistening throughout, and beneath the capsule there are several firm nodules ranging from 7 mm. to 3 cm. in diameter. At the junction of the lower and middle third there is a depression running trans-
versely. At the junction of the kidney and pelvis there is a distinct line of cleavage that can readily be separated except at a few adherent points. On opening the kidney the cortex cuts with increased resistance, but the substance resembles soft butter. There are places that coincide with the nodules mentioned on the external surface which are filled with a sanguineous cheesy substance.

Microscopic.—The kidney cortex is markedly fibrotic, there is considerable round-cell infiltration. The tumor mass itself is made up of many large polyhedral cells, many of which have undergone degeneration. The cells are irregular in size, some areas are definitely necrotic. Some of the cells resemble ganglion cells. The tumor is neither a carcinoma nor a hypernephroma.

The differential staining studies have not as yet been completed, so up to date it has not been possible to diagnose the tumor definitely.

Postoperative History.—The convalescence was uneventful and the patient has gained weight, color, and strength in the three months following the nephrectomy. He has been able to attend to his work without any difficulty.

On account of the malignant character of the tumor and the possibility of recurrence and metastases, we are giving him deep "cross-fire" x-ray treatments.

Remarks.—Three common symptoms of neoplasm of the kidney are pain, hematuria, and tumor. It is striking to note that this patient never had any pain and but one short attack of hematuria. Nevertheless, this tumor was far advanced, having involved nearly the entire kidney and in many parts having undergone necrosis. This case illustrates the value of pyelography in the diagnosis of kidney lesions. This pyelogram not only demonstrated conclusively that the kidney was the organ involved but also that we had to deal with a neoplasm. The dilatation at the upper end of the ureter was caused by pressure of the enlarged kidney on the ureter at the level of the fourth lumbar vertebra.

This patient is fifty-seven years of age and comes to the hospital because of a carbuncle of the neck. Before going into the history it might not be amiss to run over some of the causes of carbuncle.

Carbuncle must be regarded as a localized area of gangrene. Gangrene may be divided into symptomatic, traumatic, infective, thermal, and electric. Symptomatic gangrene may be seen in thromboses, embolism, Raynaud’s disease, ergot-poisoning, diabetes, senile arteriosclerosis, and occasionally in syphilitic endarteritis.

Diabetic gangrene most commonly manifests itself in the region of the toes, in which the terminal phalanges are deprived of their blood-supply, or in the form of carbuncle usually situated upon the back of the neck. It is probable that this location is favored by the paucity of its blood-supply and by the further fact that low-grade infections frequently gain entrance into the skin by abrasion from the irritation of a linen collar. In this location the blood-supply being naturally poor, and the further fact that what blood does reach the area is impoverished in its nutritive qualities by the presence of sugar, produces all the conditions necessary for the rapid growth of pathogenic organisms. Under these conditions there is a thrombosis of the vessels, exactly as is observed in acute, infective gangrene. In that condition the gangrene is not caused by the trauma to the vessels.
incident to the inoculation of the infective organisms, but to the rapid thrombosis of the blood caused by the quickly multiplying micro-organisms.

Infected wounds in diabetic patients always do poorly. Furthermore, pulmonary tuberculosis is frequently observed in diabetic subjects as the result of poor nutrition of the apices of the lungs. These subjects often are robust, even obese, in appearance, and at first glance present the appearance of well-nourished individuals. However, upon closer examination it is seen that they are overweight and that they are unable to do any great amount of physical work.

Among certain individuals diabetes is observed as a racial disease; in others as a familial disease. In the present patient there is no familial or racial predisposition. On the other hand, he is a well-nourished man, following an out-of-doors, healthy occupation.

Onset and Course.—He states that his trouble first began with a small pimple above one ear, which has gradually spread around to the back of his neck. It has been very painful and has kept him awake a great deal.

Past History.—He had typhoid in childhood. There is no surgical history. The toes of the right foot were mashed three years ago. Venereal disease is denied.

Family History.—His father died at about seventy; his mother at ninety-two years. Two brothers are living and well; two sisters are dead, cause unknown.

He is married and his wife is living and well. There are 10 children living and well; 5 children died in infancy. He states that he has twin girls twenty years old who have six fingers and toes.

Habits.—He uses no alcohol or drugs; chews tobacco moderately. He sleeps well.

He has lost over 100 pounds in the last three years, yet he still seems well nourished.

Cardiorespiratory.—He coughs occasionally; has no dyspnea, edema, or chest pains.

Gastro-intestinal.—His appetite is good; he says he can eat
everything put before him. He complains of excessive thirst. The bowels are constipated, but he has had no nausea, vomiting, or gastric pains.

Genito-urinary.—There is frequency of urination—about every thirty minutes—and he passes a large quantity each time.

Physical examination reveals a well-developed adult white male, lying in bed and apparently in some discomfort.

Essential Pathology.—The essential pathology consists of a dark red swelling on the back of the neck about 3\(\frac{1}{2}\) by 2\(\frac{1}{2}\) inches, which is punctured with numerous holes which exude pus, and also many small white spots which are due to pus just beneath the skin.

Head: Scalp as described. The skull, ears, and nose are negative.

Eyes: The pupils are round, regular, equal, and react to light and accommodation.

Mouth: The teeth are very dirty and there is much pyorrhea. The tongue and tonsils are reddened.

Neck: The neck is negative except for the lesion described.

Chest: The chest is well developed and symmetric, with fairly good and equal expansion. The lung resonance and breath sounds are good; no râles are heard.

Heart: The heart rate is somewhat rapid and all the tones are exceptionally loud and distinct. There are no abnormal sounds or murmurs.

Abdomen: The abdominal walls are very soft and lax, showing many white lines from excessive stretching. There are no palpable tumors, no areas of tenderness or rigidity. The skin over the abdomen is very loose.

The genitalia are negative.

Extremities: The skin is rather dry over the lower part of the legs and shows a tendency to scale. There is analgesia to pin pricks over the lower extremities below the knees. The knee-jerks are very weak, but are equal on both sides. The Achilles' reflex is not obtainable.

Diagnosis.—A diagnosis of diabetes and carbuncle of the neck was made.
Operation.—A crucial incision was made and flaps dissected back. Necrotic material and skin were excised. Purulent material was curetted out. Iodin was swabbed over the entire wound. The wound was packed with iodoform gauze and hot dressings applied.

Fig. 312.—Drawing showing incisions employed in operation for carbuncle.

Postoperative Course.—The patient did not do well following operation. On the fifth day he sank into a comatose condition, accompanied by rapid respiration and pulse. Examination of
the chest, though difficult because of the noisy respiration, showed the presence of râles and soft tubular breathing could be heard. Moist râles appeared very prominent. A diagnosis of bronchopneumonia was made. He was given 1200 c.c. of 3 per cent. sodium bicarbonate in normal saline solution by hypodermoclysis, and also 35 grams of sodium bicarbonate in 6 per cent. solution intravenously. His condition did not improve and he died later in the day.

In this patient the carbuncle was the result of the diabetes. The first requisite in the treatment of carbuncle due to diabetes is the reduction in blood-sugar. The amount of glucose which the urine may contain in diabetes is enormous. According to Wood, it may rise over 10 per cent. and the total excretion may approach 1500 grams in twenty-four hours. "The amount of sugar varies with the time of day and the time that food is ingested. The minimum amount is found during the night hours; during the day there are, as a rule, two maxima, one about noon and the other toward 6 o'clock. These variations are dependent on the time of meals. In severe cases the sugar may be excreted continuously and even more abundantly at night. It is in the light cases that the greatest variations occur; during the night the sugar may entirely disappear. The sugar sometimes alternates with the albumin which is often present in the urine of diabetes. One of the most powerful influences in producing fluctuations in the sugar content of the urine in diabetes is the condition of the nervous system. A sudden nervous shock will sometimes cause sugar to appear in the urine of a diabetic from which it has long been absent owing to careful regulation of the diet."

The treatment of diabetes is essentially medical. The treatment of carbuncle is both medical and surgical. While it is true that carbuncle is occasionally found in non-diabetic patients, diabetes should always be suspected until repeated examinations of the blood and urine have shown the absence of sugar.

Iron should always be given in liberal doses to increase the general resistance of the patient.
It is useless to try to treat a carbuncle surgically without making incisions which extend out into healthy tissue permitting exposure of the whole carbuncle. This should then be cureted and all dead tissue removed. The raw surface is then swabbed with carbolic acid followed by alcohol and a large wet antiseptic dressing applied.

Healing occurs by granulation. In extensive cases skin-grafting is necessary.
HEMORRHOIDECTOMY BY THE "OPEN" METHOD

Technic of "Open" Method of Hemorrhoidectomy. Advantages of this Method.

JOHN D., aged twenty-two, admitted March 16th to be operated on for hemorrhoids. Soon after admission he was given a laxative colonic flushing at 10 p. m. and an enema this morning.

As the patient lies in the lithotomy position, the first thing to which I wish to call your attention is the scrotal bandage (Fig. 313). This is a strip of gauze, 6 or 8 inches wide, and 36 inches long, split from both ends to within about 2 inches of the center. You will notice it is tied about the thigh on each side, holding the scrotum away from the field of operation. (I have this same bandage applied in the other sex as well; while there is nothing to be kept out of the way, it affords some concealment, which the patients appreciate.)

You will notice this patient is taking a general anesthetic because he preferred it. Practically all hemorrhoidal patients can be operated on under local anesthesia. If there are no contraindications I usually let the patient decide whether the anesthetic shall be general or local. The operative technic is exactly the same in either case.

After introducing the bivalve speculum the rectum is mopped out with soap and water, then dried. I shall now stretch the rectum slightly. In such cases there is frequently more or less hypertrophy and constriction of the sphincter zone. This favors constipation and unrequited bowel movements. Judg- matic divulsion of the sphincter is advisable in these cases, as it aids in restoring the normal tone. Moreover, I believe the
Fig. 313.—Illustrates the application of the scrotal bandage and the author's method of everting the terminal rectum, bringing the internal hemorrhoids into full view for operation. At the left is seen the result after removing the ellipse, as shown in Fig. 314.

Fig. 314.—Shows one of the author's triangular forceps grasped by the left hand, the index-finger making pressure on the skin side of the pile, and the ellipse being removed from it with scissors curved on the flat.
patient has less pain after the operation by this plan, and that
the final result is better.

I next apply a pair of my triangular forceps to each quadrant. Holding them in proper position (as you will notice) everts the field, and brings the pile tumors well into view (Fig. 313). Notice that by grasping one of the forceps with the full hand, and making pressure on the skin side, that I force the mass more prominently into the field, and with these scissors curved

Fig. 315.—Illustrates author's method of ligating the bleeding point or points. Note that the artery forceps are held flat against the patient.

on the flat, I remove an ellipse from the covering of each pile (Fig. 314).

What do I do about the bleeding? The same that you do, Doctor, when you amputate a limb. In this case I pick up the bleeding point with a pair of forceps. Yes! I notice there is bleeding at that point, so we apply forceps there as well; and here is another spot it might be well to include in the tie. You will notice I now take the three pairs of forceps in my hand and
place a ligature around all of them. The forceps after being divaricated are held by the assistants, and as I tie the ligature you see it slips behind the forceps (Fig. 315), and we have a small knot of tissue ligated. In the course of two or three days this ligature will pass away. There! the ligation is done, you see no evidence whatever of bleeding, do you?

Fig. 316.—An ellipse of skin is being removed from an external hemorrhoid. Observe that in the external pile traction is made on the skin covering it, while in internal hemorrhoids (Fig. 314) the pile is pushed into the field. A shows the method of traction and forceps dissection of the hemorrhoidal mass after the skin ellipse has been removed; also incisions left after removal of the other masses.

The other hemorrhoids will now be removed in the same manner. Now that all of the internal hemorrhoids have been removed, my triangular forceps are taken off, and the field cleaned up preparatory to operating on the external hemorrhoids. Here practically the same technic is followed. You see we now remove a small ellipse over this hemorrhoidal mass, and then dissect out the pile tumor (Fig. 316). Observe that now we have dis-
sected out the pile tumors the edges of the wound come together, and you can scarcely notice the incision through which the removal has been effected. (Each external hemorrhoid treated in same manner.) The operation is now completed, and were it not for the slight oozing through the incisions for removal of the external hemorrhoids, you could scarcely see where I had operated on this man.

Fig. 317.—Introduction of the author's rubber-covered tampon through the bivalve speculum after the operation is completed.

After a final cleansing of the field I introduce my rubber-covered tampon,¹ which holds the field of operation in a normal position, and will be removed at the end of eighteen to twenty-four hours (Figs. 317, 318). Hot wet dressings or Dakin dressings are applied after removal of the tampon, and continued for the next two or three days, being renewed every three or four hours. Hot tub-baths or hot sitz-baths are beneficial also. After two or

¹ For method of making tampon, see Surg., Gyn., and Obst., October, 1921, p. 430.
three days or so of this after-treatment patient will be allowed to return home.

After-history.—March 18th: It is now twenty-four hours since operation. 'Man is up, wants to go home, says he "feels fine," and has no pain whatsoever. There is neither redness, swelling, edema, nor inflammation.

![Fig. 318.—The tampon and a cross-section. Approximate dimensions are: Length, 4½ to 5 inches; diameter, ¼ to 1 inch; length from bulbous enlargement to proximal end, 3 inches.](image)

March 19th: Patient's bowels moved; went to lavatory, no pain.

March 20th: Patient left hospital.

Remarks.—I have operated on over 5000 patients by my "open" method, and have not had more than half a dozen recurrences. I have seen postoperative contractures or strictures, no matter what method was used. Pain, too, follows all types of hemorrhoidal operations, but any surgeon of unbiased judgment knows there is more pain when tissues are constricted with a
ligature, burned, or sewed together, than when none of these is done. Also that it is more difficult to find a bleeding point where hidden in a mass of tissue than when in an open field; and that painful skin-tabs are more likely when the tissues are constrained than when not.

Some statistics from St. Mark's Hospital (London) are of interest in this connection: Anderson¹ during his service there as house surgeon made some observations on 300 operations—one-half by the ligature method; 100 by the Whitehead plan; the balance by clamp and cautery. As regards pain, while pointing out a classification is difficult on account of the personal element, he makes a triple division: *Severe*, needing over \( \frac{1}{4} \) grain of morphin for relief; *moderate*, \( \frac{1}{4} \) grain sufficient; *slight*, little or no opiate required.

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<thead>
<tr>
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<tbody>
<tr>
<td>Clamp and cautery</td>
<td>0 per cent.</td>
<td>30 per cent.</td>
<td>70 per cent.</td>
</tr>
<tr>
<td>Ligation</td>
<td>10 &quot;</td>
<td>57 &quot;</td>
<td>33 &quot;</td>
</tr>
<tr>
<td>Whitehead</td>
<td>16 &quot;</td>
<td>56 &quot;</td>
<td>28 &quot;</td>
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There were 8 instances of postoperative hemorrhage: (a) Clamp and cautery, 1; (b) Whitehead, 2 of secondary hemorrhage; (c) patient interfering with dressing, 1; recurrent hemorrhage, 2; and secondary, 2.

Since the paper by Anderson another series from the same hospital (but larger) has been analyzed by Gabriel² with especial reference to severe secondary hemorrhage. The findings were as follows:

<table>
<thead>
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<th>Type and number</th>
<th>Number and days postoperative.</th>
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<tr>
<td>Ligation</td>
<td>Intermediate, 2</td>
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<td></td>
<td>Secondary severe, 5 (7, 7, 7, 7, 8)</td>
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<tr>
<td>Clamp and cautery</td>
<td>Secondary slight, 6 (4, 5, 6, 7, 7, 8)</td>
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<tr>
<td>Whitehead</td>
<td>Secondary slight, 1, (7)</td>
</tr>
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<td></td>
<td>Intermediate, 1</td>
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Intermediate hemorrhage (within twenty-four hours), according to Gabriel, is caused by slipping of a ligature or persistent bleeding from some small vessel not tied at the time, or in which

the thrombus has become loosened from coughing, vomiting, or straining at micturition. In each instance there was considerable oozing during the first night, calling for change of outer dressings one or more times, then active measures in morning. To avoid this the technic is most important: In the ligature operation especially, care should be taken to keep the scissors accurately in the submucous plane to avoid dividing vessels unnecessarily. The distal portion of the ligated hemorrhoids may be left or, if part is cut away, an ample portion must be left to be sure no slipping of the ligature can occur.

Postoperative hemorrhage after twenty-four hours (i. e., secondary), he states, is uncommon, and unless its possibility is kept in mind a large concealed hemorrhage may take place before being recognized. It is brought about by premature separation of the sloughing pile. After the ligature operation the ligatures come away, as a rule, between eight and twelve days. In this series the average date of bleeding was seven days postoperative. The chief factors are: (1) Infection; (2) trauma; (3) anemia and general debility; to which may be added (4) rarely, blood diseases, e. g., hemophilia.

All of which is further evidence, if any were needed, in favor of my "open" method of operation.

Anderson states the average stay in hospital was ten days for clamp and cautery; twenty-one for ligature, and twenty-six for the Whitehead operation. Contrast this with the three or four days by my "open" method.

It has been my experience that recurrences are rather frequent following the closed methods (ligature, clamp and cautery; Whitehead) of operation, and very rare following the "open" method. I should judge about 10 per cent. of the cases of hemorrhoids referred to me have been previously operated on (frequently two or three times) by one or other of the closed methods.

However, in hemorrhoids as in other conditions, there is no short cut to relief, untoward results are possible after any or all methods. What the profession should know is the one having the fewest objections and the greatest number of worthy points.
THE SURGICAL TREATMENT OF CARCINOMA OF THE COLON WITH A NEW METHOD OF MAKING THE OPERATIVE FIELD EXTRAPERITONEAL BY MEANS OF THE OMENTUM

Two Patients Suffering with Carcinoma of the Colon; in One the Tumor is Located in the Lower Sigmoid and Upper Rectum, and in the Other in the Lower Descending Colon and Upper Sigmoid. Operation: Use of the Omentum to Make the Field Extraperitoneal. Presentation of a Third Patient Operated On Eight Years Previous Showing the Result Obtained by this Method.

This morning we have for operation 2 very interesting patients with carcinoma of the colon. In one the tumor is located in the lower sigmoid and upper rectum, and in the other in the lower descending colon and upper sigmoid. Before going into detail about these patients I would like to say a word in general regarding the surgical treatment and some of the principles involved in carcinoma of the colon.

Carcinoma of the colon is in many ways one of the most favorable conditions as compared with carcinoma elsewhere as far as being able to establish a radical cure or giving the patient a fairly large number of years to live before fatal metastases occur. This is due to two important clinical facts: first, with our newer method of x-ray and fluoroscopic examinations and the more complete routine x-ray examinations. They are discovered quite early and many times accidentally before many symptoms or very pronounced symptoms are present. For instance, many times a patient complains of certain gastric symptoms that
simulate duodenal or gastric ulcer, only to find on complete fluoroscopic examination of the gastro-intestinal tract a beginning carcinoma of the colon or rectum. Second, the growth, as a rule, is comparatively slow. The majority of cancers of the colon are of the scirrhous type, and therefore show metastases and involvement of the lymphatics comparatively late. From a standpoint of cancer in general, that of the colon is one of the most favorable types of cancer amenable to surgery, and yet I do not hesitate to state that the surgery of the colon up to the present time is far from having been perfected to the satisfaction of the surgeon as far as end-results and operative procedures are concerned. There are many things wanting with regard to the technical difficulties and perfection of the surgery of the colon to make it safe as compared to the surgery of the small intestine. I believe this can be largely attributed to the fact that we have to deal with the colon bacilli in the large intestine and the stools contaminated with the colon bacilli as well as other organisms. The second important factor is the resulting or accompanying inflammatory process of the colon that seems to go along with carcinoma of the colon. For instance, if one would examine a resected colon for carcinoma grossly and microscopically one would find marked infiltration in the interstitial tissue between the muscle layers and the mucosa and a peculiar edematous swelling of the bowel in general. This infiltrated bowel plus the presence of the colon bacilli within its lumen is the great obstacle that we have to contend with in order to make the surgery of the colon just what we would like to have it, and for this very reason so many various technics and methods have been devised, the ultimate object of all of them being to eliminate the breaking down of the bowel along the suture lines and preventing peritoneal infections and localized abscesses. I believe that of the earlier operations the three-stage Mikulicz operation was devised for that particular reason, to do away with the peritoneal infections and breaking down of the colon along its suture lines. It is one of the best and most practical operations today, and with the average surgeon yields the best results of all the types of operations described. The objection to the Mikulicz operation
is that in bringing the bowel out one is not able to do as radical a removal of the carcinomatous area and adjacent colon, as well as the neighboring lymph-vessels and glands, and is really the only serious objection to the Mikulicz operation.

I believe the ideal surgical procedure is some method in which the cancer and its neighboring tissue can be thoroughly and completely removed and an end-to-end anastomosis made, which, after all, seems to be the most physiologic type of anastomosis, the important factor being that it must be protected or made in such a way that the possibility of breaking down of the bowel along the suture line and leakage which would produce localized or general peritonitis is practically nil. I believe this can be accomplished by using the free edge of the attached omentum around the operated field of the colon in such a way as to make that portion of the colon extraperitoneal, and have it thoroughly protected by the living omentum. This method will eliminate the possibility of leakage or peritonitis and also will prevent other loops of ileum or small intestine becoming adherent to the line of anastomosis. The latter not infrequently is a source of intestinal obstruction.

To prove that this is correct or that this principle of making the colon operation extraperitoneal is a practical and sound one, one hardly ever deals with a peritoneal infection when a carcinoma is resected in the upper rectum or lower sigmoid by a sleeve operation in which the entire anastomosis is placed extraperitoneal below the peritoneum of the culdesac. I have never seen a peritoneal infection from the radical resections of the upper rectum or lower sigmoid when the anastomosis, no matter how poorly made, was placed below the peritoneum of the culdesac. This important principle of placing the operative portion of the colon extraperitoneal by means of the omentum has obviated this great difficulty and obstacle of leakage and peritonitis, which is really the one factor that has held the surgery of the colon back from the proper position of perfectness that it should have.

The first case for operation is a man fifty-two years old, who has a definite large mass, which can be felt through the rectum,
and which is shown by the x-ray and fluoroscopic examination to be a carcinoma of the lower sigmoid and upper rectum. To add to his difficulties he has had $2\frac{1}{2}$ per cent. of sugar in his urine, from which he is now free after medical treatment, and also has an enlarged thyroid, which, however, has no active toxic or exophthalmic symptoms. His symptoms have been peristaltic cramps and excruciating pain during bowel movements. His stools contain not a great deal of blood, but a fair amount of mucus and tissue shreds. He has lost about 15 pounds in weight, but his pulse and general appearance are not bad.

The patient is placed in an extreme Trendelenburg position and a midline incision is made from the pubis to the umbilicus (Fig. 319). On opening the peritoneum a large circular carcinoma, which is freely movable, involving the upper rectum and lower sigmoid, about the size of a man's fist, can be seen in the hollow of the sacrum, and as we examine the mesentery there seems to be no glandular involvement. The mesenteric blades on each side of the rectum and sigmoid are caught with clamps and divided, and in this way the entire portion of the rectum clear down to the external sphincter is now freed by dull finger dissection without the slightest difficulty. There is practically no bleeding. The entire procedure so far is quite bloodless (Fig. 319, B). Intestinal clamps are now placed one above and one below the carcinomatous mass, and a purse-string of silk is placed about 2 inches above the first clamp on the sigmoid side, and a second purse-string of silk below the second clamp on the rectal side. The bowel is divided between the purse-strings and the clamps and cut away by means of an electric cautery. I will now free the sigmoid portion by dividing some of its mesenteric attachments and the outer blade of the parietal peritoneum, so as to make it quite freely movable. The assistant stretches the sphincter of the rectum gently, and a rubber catheter is passed up from below through the rectum to the point of the purse-string. I can now feel the catheter. I will put one ligature through bowel and catheter. The assistant now makes traction on the catheter (Fig. 320), and the entire remaining portion of the rectum is easily everted out through the
the anus. The purse-string of the everted bowel is cut and the bowel is left open. A catheter is attached to the sigmoid portion

Fig. 319.—A, The line of incision, extending from the pubis to the umbilicus. B shows the intestinal clamps in position, one above and one below the carcinomatous mass. A purse-string suture is placed about 2 inches above the first clamp on the sigmoid side, and a second purse-string suture is placed below the second clamp on the rectal side.

of the divided bowel (Fig. 320), and the catheter is pulled through along the course of the rectum and through the everted bowel
(Fig. 321). The mesenteric vessels are ligated and sutured and the entire peritoneal surface is closed around the drawn through sigmoid. The abdomen is now closed in the usual manner. The everted rectum is amputated on a level with the anus and an end-to-end anastomosis with interrupted sutures is made with the cut end of the sigmoid (Fig. 322, A). The bowel is then pushed upward and held in position with a small amount of gauze. It will be noted from Fig. 322, B that the anastomosis is below the reflection of the peritoneum. In other words, the entire surgical procedure is extraperitoneal.
I have operated a number of these cases, and find that within eight to ten days there will be a small amount of slough come away from the region of the anastomosis, and in about three weeks you can feel in the rectum a perfectly well-formed anastomosis. These patients have perfect stools, well formed, with-

Fig. 321.—Showing how the catheter is pulled through along the course of the rectum and through the everted bowel.

out the slightest difficulty of sphincter control, and are more comfortable and more satisfied than with any other type of surgical procedure that I know of around the rectum and lower sigmoid. This type of operation is far more practical in the female than in the male, and many times cannot be carried out in the male with any degree of success.
The next case that I will operate is a woman forty-eight years old, who had the symptoms of an acute obstruction two and a half months ago, and for which a temporary cecostomy was performed to relieve the obstruction. The carcinoma is located in the lower descending colon and upper sigmoid, and is quite an extensive growth. It is interesting to show these 2 cases on account of the difference in location of the carcinoma. In these
2 cases two entirely different surgical procedures have to be performed, and yet there is one underlying principle which will be carried out, that I believe is absolutely essential to the success of the surgery of the colon and which will render its mortality as low as possible by doing away with leakage and peritoneal infection. This principle is that all anastomosis and all surgical procedures of the colon should be made extraperitoneal as a final step. In the first case, just operated, where the carcinoma was located in

![Diagram showing location of temporary cecostomy and incision made at second operation for the removal of the carcinoma.](image)

Fig. 323.—Diagram (Case II) showing location of temporary cecostomy and the incision made at second operation for the removal of the carcinoma. The incision extends from several inches above the umbilicus down to the inguinal region.

the upper rectum and lower sigmoid, I made a complete operation in one step by resecting the carcinoma and then doing a sleeve anastomosis, which placed the anastomosed bowel extraperitoneal. While in the second case, where the carcinoma is in the descending colon and upper sigmoid, I will do the second step of this operation by removal of the carcinoma, making an end-to-end anastomosis, but rendering the operated portion of the colon extraperitoneal by means of the free edge of the living
omentum, believing this last step to be the most important and final step which renders the mortality almost nil. Then, finally, some time later I will close the cecostomy as a third step in the operation.

I will now make a left rectus incision (Fig. 323), extending from several inches above the umbilicus down to the inguinal region. On opening the peritoneum one can very readily see a fairly freely movable mass in the upper sigmoid. On splitting the outer blade of the mesocolon the tumor can be lifted right out through the abdomen, and, as you see, is not quite as large

Fig. 324.—Showing intestinal clamps in position (Case II). One clamp is applied 3 inches above the tumor and the other 2 inches below. The bowel is then divided between the clamps by means of an electric cautery.
as the tumor in the first case. Two intestinal clamps are now applied 3 inches above the tumor and 2 inches below the tumor (Fig. 324), and the bowel divided between the clamps by means of an electric cautery. The mesenteric vessels are caught by forceps and the entire mass is dissected away. The blood-vessels in the mesocolon are ligated and an end-to-end anastomosis is made. The two ends of the bowel come together very easily for an end-to-end anastomosis especially by freeing the outer blade of the mesocolon. The first suture that I place is that nearest the mesentery (Fig. 325, A), which is run through and through, interrupted, and is tied, and the other two are mattress sutures. Three more sutures, one at each side and one above, around the circumference, are through-and-through sutures, which are held, but left untied. The next step is a simple over-and-over suture going through all the coats, mucosa, muscularis, and peritoneum (Fig. 325, B). This, if properly placed, is as efficient as any type of suture for proper coaptation and union. Gastro-intestinal catgut is used. The interrupted sutures are now tied and a final Cushing suture of waxed silk (Fig. 325, C) is placed around the bowel. I believe that this type of anastomosis, when properly performed, is as efficient as any type, but there is always a tendency to leakage, which we can easily avoid by the next step, which I consider the most important of the entire procedure.

I will divide the great omentum between ligatures on the right side near the pyloric end of the stomach, so as to allow the omentum to swing freely over the field of operation, as seen in Fig. 326, A. If the carcinoma is on the right side in the ascending colon, then I divide the omentum on the left side at the body of the stomach so as to allow it to swing over to the right side. The great omentum is tucked over the entire area where the anastomosis has been made, first along the parietal peritoneum and folded over the colon at its anastomosis, where it is attached with a few interrupted catgut sutures, and swung back to the parietal peritoneum on the median side of the incision (Fig. 326, B). Then the omentum is sutured around the entire peritoneum and the incisional wound, so that the entire colon is covered by the great omentum, and is practically shut off from
Fig. 325.—A, Location of first sutures. These are through-and-through interrupted sutures. B, Simple over-and-over suture going through all the coats, mucosa, muscularis, and peritoneum. C, A final Cushing suture of waxed silk is placed around the bowel.
the general abdominal cavity (Fig. 327). Leakage is practically impossible by this method. Not only does this omental covering

![Diagram](image_url)

Fig. 326.—*A*, The great omentum is divided between ligatures on the right side near the pyloric end of the stomach, so as to allow it to swing freely over the field of operation. *B*, Cross-section showing how great omentum is tucked over the entire area where the anastomosis was made, and reflected back to the parietal peritoneum of the incision.

protect the general peritoneal cavity from leakage, but it also prevents the small intestines from becoming adherent to the anastomosed area of the bowel, where slight leakage may occur,
and it gives a new collateral circulation by the blood-vessels from the omentum perforating and becoming anastomosed with those in the bowel wall, giving it greater vitality. The abdomen is closed with the exception of a slight strip of gutta-percha for drainage down to the omentum.
I want to show you a patient on whom I operated eight years ago. This woman had what appeared to be an inoperable mass (carcinoma) in the ascending colon midway between the hepatic flexure and the cecum.

I carried out the following procedure: A right rectus incision was made. On account of the shortness of the great omentum

![Diagram showing site of anastomosis and rubber tube which was sutured in at the time the anastomosis was made.](image)

...
Fig. 329.—A, Cross-section showing how lid fits into abdominal cavity. B, Diagram showing wound covered by metal blade. This blade is fitted into the incision just as a lid fits on a kitchen boiler, allowing the carcinoma to be treated by x-ray as often as necessary by simply removing the lid from the abdominal wound.

by x-ray as often as necessary by simply removing the lid from the abdominal wound. Before, however, putting on the lid
each time the omentum was lined with rubber dental tissue and the cavity filled with sterile vaselin. The cecum was then picked up through a gridiron incision and a temporary cecostomy performed. Three months later through the primary incision the entire ascending colon and cecum with the mass were removed. The omental transplant, which was still adherent to the parietal peritoneum, was utilized to cover up the closure of the bowel and the anastomosis between ileum and transverse colon. The cecostomy wound and the original wound, through which the resection was performed, were closed. A slight drainage of gutta-percha was placed down to the omentum. The patient made an uneventful recovery. She is, as you see, a well-nourished woman. It is eight years since the operation. She has had one child since and she is 40 pounds heavier than she has ever been.

The point that I want to bring out in this procedure is, first, conservative method of exposing the apparently inoperable mass to x-ray treatment in addition to a primary cecostomy, and then going in three months later and doing a radical operation with an end-to-end ileocolostomy without the slightest difficulty. I believe the exposure of very large carcinomatous masses that have infiltrated the surrounding tissue are well treated by x-ray before removal by this method of exposing the mass through an open wound held open by means of a metal lid, as I have demonstrated in this procedure.
ANEURYSM OF THE POPLITEAL ARTERY

Aneurysm of Popliteal Artery Following a Slight Trauma to the Under Surface of the Thigh. Treatment. Discussion on Aneurysm.

Presentation of Patients Showing End-results in Operation for Fracture of the Long Bones and Operation on an Intracapsular Fracture of the Neck of the Femur.

Patient F. S. W., white, male, aged forty-five, entered the hospital January 14, 1921.

Complaint.—Pain in calf of left leg and foot, with disturbed circulation in the leg and foot, inability to walk on account of this pain.

Onset.—About two years ago the patient was trying to close a trunk by sitting on it and jarring it down, striking the under surface of his thigh on the outer edge of the cover of the trunk. A short time after in walking down the street he noticed pain in the calf of his left leg. He has had this pain off and on ever since, though at periods he is entirely relieved. The pain is of a dull, aching character, beginning in the calf and going down on the inner surface of the leg to the toes. He says the pain is particularly severe in his toes, and especially in his great toe. The pain in the great toe becomes finally very dull until this part becomes numb. This condition occurs usually early in the morning, and he states that at this time there is no discoloration of the calf of his leg or foot. Patient claims that the blueness caused by disturbance of the circulation in his foot and leg has developed recently. At the present time he is unable to walk
owing to the swelling in his leg, which is very marked, but which does not extend into the foot or toes. He does not think that the swelling is affected by allowing the foot to hang down or be placed in an elevated position.

**Past History.**—He has had the usual diseases of childhood; no other sicknesses of any kind, and no other accidents besides the one mentioned.

**Family History.**—Father died at the age of seventy-seven of heart disease. Mother died of diabetes at age of seventy-seven. Four sisters and five brothers are living and well; no history of tuberculosis or carcinoma in the family. Venereal history is negative.

Eyes and ears are normal. Tonsils have been removed.

Chest: There is no shortness of breath or palpitation of the heart.

Gastro-intestinal tract is negative.

**Habits.**—Nothing of importance.

**Physical Findings.**—General.—A well-developed white male, about forty-three years of age, who is apparently in good physical condition, complaining of pain in his left leg, feet, and toes.

Regional.—Eyes react properly to light; otherwise negative. Teeth are in fair condition. Sinuses are negative. Skin is warm, moist, and elastic; some discolored areas over left foot and calf of the leg; patches along the anterior and inner surface of the leg, some of which are the size of a dime.

**Chest.**—Lungs and heart are negative.

**Abdomen** is negative.

**Reflexes.**—All are present.

This patient applied to me for treatment a year and a half previously, suffering from pain in the left leg, and after a careful examination, including x-rays, he was referred to one of the leading neurologists in the city, who examined him carefully and kept him under treatment for a short period, at which time the patient made some improvement and was not seen again by me until he entered the hospital on the date given above. We were of the opinion at this time that he was suffering from some form
of infection, and therefore set about hunting for a focus responsible for this condition.

The Roentgen examination showed evidence of some infection in the apical ends of some of the teeth. The Roentgen examination of the left leg was negative. The tarsal bones of the left foot showed a tendency to lipping and spur formation. The roentgenologist interpreted this as a hypertrophic arthritis.

During this period the pain was so severe in the leg and foot that the member was placed in a fracture-box filled with cotton and dry warmth was applied by means of an electric heater. On January 19th a linear rash came out along the mesial and anterior surface of the leg, which corresponded to the position of the internal saphenous nerve. The diagnosis of herpes zoster was accordingly made. This was treated by means of dusting-powder and of collodion dressings. The patient gained considerable relief with the appearance of the rash, which relief lasted for a period of a week, at which time he was discharged from the hospital. After returning to his home the pain recurred in the foot and leg, and this time it had all the characteristics of a postherpetic pain. The pain was not of so severe a nature as to prevent the patient being about and reporting at the office from time to time. In a careful examination on January 25th there was a slight suspicion of an indurated area in the upper portion of the popliteal space, and though this portion of the leg had been repeatedly examined by myself and consultants, and though x-ray pictures of the complete leg and thigh had been taken, it was deemed advisable to repeat the x-ray examination, directing especial attention to the upper part of the popliteal space.

The accompanying skiagrams (Figs. 330, 331) tell their own story, showing a deposition of salts laid down in concentric layers in this position and a dilated blood-vessel in the upper part of the popliteal space, the dilatation continuing up into the lower part of the femoral vein. From this evidence a diagnosis of an aneurysm of the popliteal artery was made. Owing to the seriousness of the condition a consultation was held with
Dr. Arthur Dean Bevan and Dr. Hugh T. Patrick. All were agreed that this was an aneurysm, and that the only sane procedure was the institution of surgical intervention. Accordingly, the patient was sent to the hospital.

He was admitted to St. Joseph's Hospital on March 30th and operation was performed on March 31st. The operation consisted

in an extensive incision along the border of the semitendinosus muscle of the left leg, cutting down upon the aneurysmal sac, which was easily located, having particular regard for the small anastomotic vessels about the mass. Careful dissection of the sac with practically no hemorrhage. Ligation was performed proximal and distal to the aneurysm, with excision of the sac. Closure

![Fig. 330.—Roentgenogram (Case 1), lateral view, showing aneurysm. Note that the dilated vessel was in the upper part of the popliteal space, the aneurysm continuing up into the lower part of the femoral vein.](image)

![Fig. 331.—Roentgenogram (Case 1), anteroposterior view.](image)
of the wound, leaving no bleeding points. The aneurysm (Fig. 332) was of the fusiform type, even though the major portion of the tumor was on the posterior side of the vessel, which anatomic position was produced because of the proximity of the tumor to the underlying bone, thereby preventing the expansion in an anterior direction. The aneurysmal sac was filled with broken-down, degenerated blood-clots, which had unquestionably existed for a considerable period of time. It was apparent at the time of the operation that the collateral circulation was well established and great care was exercised not to disturb these small vessels. I wish to lay considerable stress upon the question of a surgical technic that is free from traumatizing action, as I believe the outcome of such operations is dependent upon the ability of the operator to complete this procedure with a minimum amount of trauma.

This patient is brought into the clinic this morning to show the final result, nearly a year after the operation.

In looking over the literature on the general subject of
an aneurysm a very thorough review has been made by Drs. Baldwin Lucke and Marion H. Rea, Journal of the American Medical Association, September 21, 1921, and I quote from that article Osler's definition of aneurysm: "A tumor containing blood in direct contact with the cavity of the heart, the surface of a valve, or the lumen of an artery." This article deals with aneurysm, particularly following disease, and therefore may not be of any particular interest in the report of a traumatic aneurysm, only in so far as the general subject is of interest. The following statistics from Lucke-Rea's paper is of interest:

In a review of 160,145 postmortem examinations 1452 aneurysms were encountered, or 1 to each 111 persons, equals 0.9 per cent. Some of their conclusions are of interest: Aneurysm is more common among the Anglo-Saxon than the Teutonic races. It is most common during the fourth and fifth decades. It occurs earlier in the negro. It is more common among negroes than among the Caucasian race. It is four times more frequent in males than in females. In a report on 12,000 postmortems at the Philadelphia General Hospital based upon 321 intracorporeal aneurysms the diagnosis was made in 43 per cent. of the cases.

In the report of Dr. A. MacLaren (Annals of Surgery, September, 1921) he quotes from Gibbon, which I believe is of interest and is sane teaching: "Arterioplasty seldom safe or necessary." In the same article Dr. MacLaren suggests obliteratorive aneurysmorrhaphy as the choice method of procedure. In a report by Dr. William Ott from the Mayo Clinic (Annals of Surgery, November, 1921) this report seems to show that the best results were obtained especially in the smaller vessels by proximal and distal ligation and division of the aneurysmal sac.

In conclusion, I wish to state that on the basis of the review of the literature made it would seem advisable in the traumatic type of aneurysm not to operate too early, unless, first, gangrene seems imminent, or second, infection sets in; that the treatment of choice is rest, with aid to the circulation by position and time allowed for the collateral circulation to become established, and when operative procedure is finally instituted, as I have stated
before, the greatest amount of care should be exercised in order to prevent undue traumatism.

Before concluding the clinic this morning I wish to show you some interesting end-results in the operative treatment of fractures of the long bones.

As I have repeatedly said in previous clinics, the question of showing pathologic conditions of bones and joints, and particularly where they have been immediately restored to proper position and function, is interesting, but the point of prime importance to the medical profession is to learn something of the ultimate fate of these conditions. I therefore wish to present 2 patients with their accompanying x-ray pictures and photographs which represent the end-results in fractures to the humerus.

The first patient, Mrs. F. O., aged forty, entered the hospital September 8, 1921, following an accident in which the auto-
mobile in which she was riding was demolished by a railroad
train. The Roentgen findings were as follows: Comminuted
fracture through the head of the right humerus; the head was
fractured, dividing it into two fragments (Fig. 333), the lower
fragment is the larger; the lower half of the head is displaced
downward and inward; the upper half of the head is displaced
upward, outward, and forward; the shaft is displaced upward,
outward, and forward. The scapula is negative for fracture and
the clavicle shows no fracture. The left forearm showed a com-
minuted fracture through the distal end of the left radius; the
fracture extends into the joint; the styloid is displaced outward
and anteriorly; the styloid process of the left ulna is fractured
and displaced inward. The general position of the fragment is
good.

Clinically, the comminuted head of the right humerus was
dislocated, and because of the comminution only one line of pro-
cedure could be followed, that of open operation, for its reduc-
tion and alinement.

Operation consisted in cutting down and manipulating the
fragments of the head back into the fossa by means of a Lane
skid. These fragments were maintained in position and in alinement with the shaft of the humerus by means of two nails that still show in the roentgenograms. Lane technic was used throughout. Closure in the ordinary manner. Plaster-of-Paris cast applied. The accompanying roentgenogram (Fig. 334) shows the complete bony union of the fragments in relatively good position, while the photograph (Fig. 335) shows the degree of motion which is practically normal.

Fig. 335.—Photograph taken seven months after operation, showing the degree of motion in right arm and the extent to which patient can raise the arm.

The second case is a similar one, the patient coming to the hospital following an accident with a fracture at the surgical neck of the left humerus, with the head completely dislocated out of the joint (Fig. 336), and which fragment was reduced by open operation and secured in place by the use of two nails driven into the fragments at different angles. The operative history is as follows:

Open operation, reducing the head of the humerus by manipulation, bringing the distal fragment in line with the proximal, using careful instrumentation within the joint so as not to injure
Fig. 336.—Roentgenogram of left humerus of second patient, showing a fracture at the surgical neck of the left humerus, with the head completely dislocated out of the joint.

Fig. 337.—Roentgenogram taken after operation showing how head has been reconstructed.
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the synovial covering of the joint, and securing the fragments in place by means of two wire nails. Lane technic was carried out religiously throughout.

A second roentgenogram (Fig. 337) is reported to show bony union complete and the function of the joint entirely normal.

The third case is a so-called intracapsular fracture of the right femur (Fig. 339), and because of the position, high in the neck, the blood-supply is disturbed to a degree where a good result will only be obtained by the interposition of an autogenous bone transplant, which in my opinion is the operation of choice in fractures of the neck of the femur. I am very partial to this form of treatment in patients that are of the proper age and physical condition to undergo an operation of this character. I am of the belief that the transplant first fixes the fragments in

Fig. 338.—Photograph showing extent to which patient can raise arms. Extension and motion are practically normal.
place during the period of callus formation and mechanically prevents absorption of the neck, which practically always takes place in conditions not treated by this method, and second, the introduction of a large autogenous transplant with its accompanying periosteum permits the establishment of a blood-supply in the head of the femur much more quickly and more efficiently than is possible in any other way.

The incision used in approaching the hip-joint is an L-shaped incision which exposes the anterior surface of the neck of the femur through a triangle which I have described as follows: The inner leg of the triangle is made up by the tendons of the psoas and iliacus muscles as they come down over the joint to be inserted into the lesser trochanter. The upper and external leg of the triangle is made up by the tendon of the gluteus minimus muscle as it comes out to be inserted in the upper portion of

Fig. 339.—Roentgenogram showing intracapsular fracture of the right femur.
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Fig. 340.—Incision for exposure of fracture of the femur.

Fig. 341.—Diagram showing exposure of field.

the great trochanter. The base of the triangle is made up by the intertrochanteric line. I am of the opinion that this method of approach to the hip-joint is very desirable, as no structures
of any importance are encountered in the line of incision and the position of the fragments, particularly in those conditions in which the head of the femur has been turned, may be brought into proper alinement with more ease and precision than with any other incision.

Fig. 342.—Roentgenogram taken after operation showing fragments secured in position by an autogenous bone-graft containing its periosteum.

I present in closing this clinic the end-result in the type of case just operated upon for a similar condition operated five years ago, the patient then sixty-two years of age, whose function is complete in every way, and the accompanying roentgenogram shows how beautifully the head has united and the transplant, which was taken from the tibia of the same patient, has been incorporated into the bone of the neck. It is of interest to note
in the roentgenogram (Fig. 343) at this time, practically five years after operation, that the compact tissue of the outer surface of the femur is continued into and apparently incorporated in the transplant which extends through the middle of the neck into the head of the femur.

In closing the discussion I cannot help saying a word respecting the necessity of bone and joint surgery requiring a special surgical technic for its performance. With the resulting number of infections that occur in this kind of work throughout the country I think the time has arrived when those devoting a large amount of time to this branch of surgery should dwell more upon the importance of special preparation for surgeons who desire to follow this particular specialty.
TWO CASES OF ILEOSIGMOIDOSTOMY

Colitis and Its Surgical Management. Report of Cases Treated by Ileosigmoidostomy.

Colitis, one of the common lesions seen by every physician, at times is a most trying condition that taxes the endurance of the medical man as well as the patient. The symptomatology varies from a slight discomfort in various portions of the colon to prostration and exhaustion in some of the more severe forms.

The condition is relieved frequently by some form of medical management, only to return after varying intervals in all its intensity. The internist has had better results than the surgeon in treating most forms of colitis. The persistence or recurrence of symptoms has influenced the physician to resort to various types of surgical interference in some patients. Among these procedures the so-called short-circuiting technic of Lane, or ileosigmoidostomy, has been employed.

The lower ileum has been united with the sigmoid colon without any other effort at control of the intestinal current. Barium meals traced with the fluoroscope may pass along the entire course of the colon independent of the anastomosis, or the “side-tracked” loop of large bowel may fill with inspissated contents and the intestinal current pass by way of the anastomosis. In an effort to avoid the stasis of intestinal material in the loop of large bowel the ileum has been resected at a point close to the ileocecal valve and the anastomosis made with the sigmoid. This scheme, however, is equally unsatisfactory, as retrograde peristalsis carries the contents backward in the large
gut and masses of hardened feces accumulate in the ascending and transverse colon.

In addition to the deposition of solid material in the blind loop there is at times an intermittent accumulation of gas much like that seen in Hirschsprung's disease or megacolon. The symptoms are so similar at times that it seems we might be justified in classing some of these cases as acquired megacolons. The abdomen distends to a marked degree, simulating the appearance of a late pregnancy. The patient suffers with colicky pains. Relief comes as soon as the gas is expelled. Increased peristalsis is seen and felt. One patient described the sensation as that of vigorous fetal movements. Another likened it to the writhing of a snake in her abdomen.

The result of this procedure at times has been a patient in worse condition than existed originally. One patient after being subjected to an ileosigmoidostomy developed so much distress from gas distention that she voluntarily restricted her diet until a marked loss in weight and strength occurred and a phthisis developed. During the night and forenoon the abdomen distended with gas until respiration was interfered with. A series of enemas was used daily until the gas passed, and in this way a fairly comfortable afternoon and evening were obtained. Most of the patient's energy was consumed in the forenoon struggle, and the remainder of the day was passed in bed or a wheel chair. For a number of months before secondary operation the patient was under most competent medical management, yet obtained but little relief. With local anesthesia and gas the abdomen was explored. The ileum at a point about 10 inches proximal to the cecum was found attached to the sigmoid colon. The ileum was resected distal to the anastomosis and the ileo-cecal region brought through the abdomen. The large bowel was resected proximal to the anastomosis and the proximal end brought through the abdominal wall. Following this procedure the gas disappeared and the bowels moved without artificial aid. The patient died from her lung condition before restoration of strength.

A second patient who had been given an ileosigmoidostomy-
for persistent colitis with marked distress showed at secondary operation that the ileum, having been resected at the ileocecal valve and carried across the abdomen, was anastomosed to the

sigmoid with about a foot of the ileum protruding distal to the line of union. This redundant portion of small bowel had distended until it was about 4 inches in diameter. During peristalsis

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this end passed back and forth in the abdomen until it kept the patient in constant unrest. She had lost weight until she was little more than a skeleton and had become a complaining, weeping wretch. The ileum was detached from the sigmoid and returned to the cecum. In three weeks the improvement was most startling. Under competent medical management she has become comfortable and is rapidly returning to normal strength.

Both these patients suffering from a non-ulcerative colitis had their condition made much worse by operation. In both instances there was a gas distention of the large bowel proximal to the point of anastomosis giving rise to an additional complaint. To be sure, ileosigmoidostomies have been created without these bad results, yet having observed these two persons in my own work and having seen a number of similar patients in the work of my associates, I would hesitate to advise any such procedure. If one feels that this operative treatment must be given, it seems that some provision might be made for the escape of gas on the surface of the abdomen from the blind loop of bowel.