STATED MEETING, FEBRUARY 7, 1910

The President, Dr. Robert G. LeConte, in the Chair.

GUNSHOT WOUND OF KNEE JOINT.

Dr. Astley P. C. Ashhurst related the history of a girl, aged 16 years, who while sitting on her front porch one afternoon felt a sudden pain in her right knee and found she had been shot; no explosion was noticed. She walked at once to the Episcopal Hospital, a few squares distant, and was admitted to the service of Dr. Frazier (October 17, 1908), to whom Dr. Ashhurst is indebted for the privilege of operating.

Examination showed a wound of entrance just above the head of the right fibula; the track of the bullet appeared to have been more or less transverse, but there was no wound of exit. The joint was distended with blood, slightly flexed, and very painful. Two skiagraphs were made by Dr. Welker (Figs. 1 and 2): the anteroposterior view located the bullet just to the outer side of the spinous process separating the two articular surfaces of the tibia, within the joint; while the lateral view showed the bullet just at the posterior border of the articular surface. There was no evidence of injury to the popliteal vessels, though the bullet was lodged within approximately a half inch of the artery.

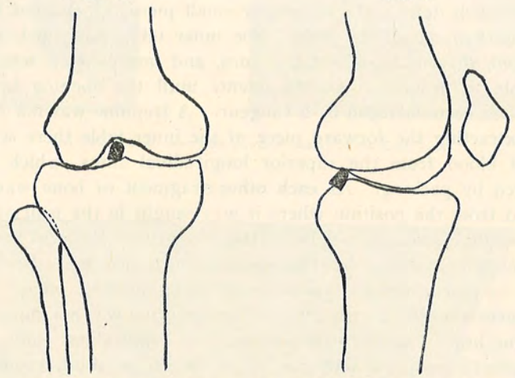
Operation (seven hours after the injury): An incision of four inches was made longitudinally on the outer side of the joint, passing through the wound of entrance. The joint was opened and a quantity of fluid blood evacuated. There was a little splintering of the head of the tibia and external semilunar cartilage. The posterior capsule was cautiously dissected off the joint nearly to the midline, when the bullet (calibre .22) was felt by the finger and easily extracted with bullet forceps. The bullet was flattened on one side, as if it had struck somewhere else first and ricocheted.

The joint was freely irrigated with hot corrosive sublimate solution (1:2000), removing more blood and clots, and was drained with a rubber tube. The external lateral ligament was

carefully repaired with chromic catgut, and the wound was closed with additional drainage (iodoform gauze) to the site of the bullet. The knee was dressed on a posterior splint.

The tube was removed on the third day; weight extension was applied October 24, as the knee showed a persistent tendency to flex. The wound was entirely healed in six weeks, without any signs of arthritis having developed; and the patient was discharged December 19, 1908, wearing a plaster cast. She was referred to Dr. Davis' service at the Orthopædic Hospital, and was fitted with a brace, arranged to allow gradually increasing

Fig. 1. Fig. 2.



Anteroposterior and lateral views of gunshot wound of right knee joint.
Fig 1, Anteroposterior view. Fig. 2, Lateral view.

motion at the knee joint. She wore this until the end of May, 1909, at which time she had full extension of the knee, and flexion to a right angle. She walks now without any limp, has flexion to 65°, and knee seems as good as ever. (See Figs. 3 and 4.)

GUNSHOT WOUND OF THE SKULL, WITH RUPTURE OF THE LONGITUDINAL SINUS.

Dr. Ashhurst also related the history of a man, aged 32 years, who shot himself in the centre of the forehead with a bullet of .38 calibre, aiming directly backward. He was at once taken

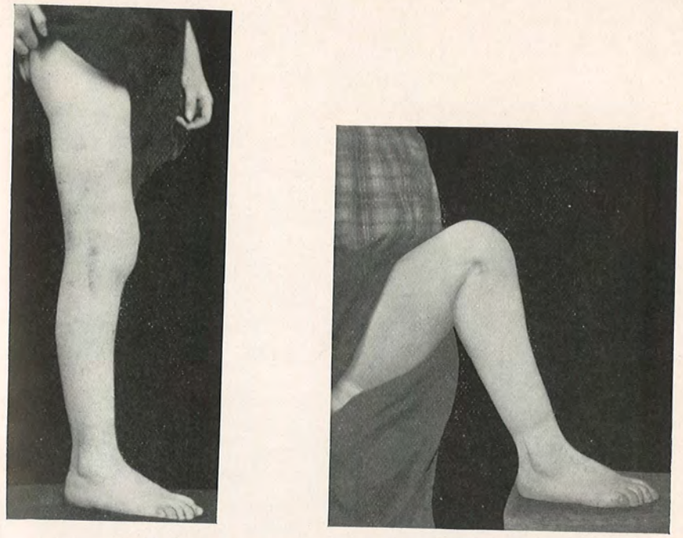
to the Episcopal Hospital, where he was admitted to the service of Dr. G. G. Davis (February 13, 1909), to whom Dr. Ashhurst is indebted for the privilege of operating.

When admitted there was moderate bleeding from a stellate wound of the soft parts directly in the centre of the forehead, below the hair border. Powder burns were conspicuous. Immediate operation was deemed advisable, as the wound was so dirty that it could only be cleaned by a formal operation. The patient was etherized, and all burned soft parts were cut away, and the wound thoroughly cleansed. One angle of the stellate opening was enlarged backward, exposing a jagged hole in the skull, about one inch in diameter; two fragments of the bullet (very much deformed) and many small pieces of charred bone were picked out of the hole. The inner table was much comminuted, driven in against the dura, and impacted; it was impossible to dislodge these fragments until the opening in the skull had been enlarged by a rongeur. A trephine was not used. On extracting the forward piece of the inner table there was a jet of blood from the superior longitudinal sinus, which was checked by packing. As each other fragment of bone was removed from the position where it was caught in the wall of the longitudinal sinus, profuse hemorrhage occurred; this was readily controlled by packing, but this packing had to be removed several times to search for and remove other fragments of bone. The dura overlying the hemispheres of the cerebrum was not ruptured, and the brain was not exposed; but the longitudinal sinus was extensively torn, and only the impaction of the skull fragments in the walls of the sinus prevented the man from bleeding to death before admission to the hospital.

For permanent control of the hemorrhage from the longitudinal sinus two strips of gauze were used, each two inches wide and 24 inches long.

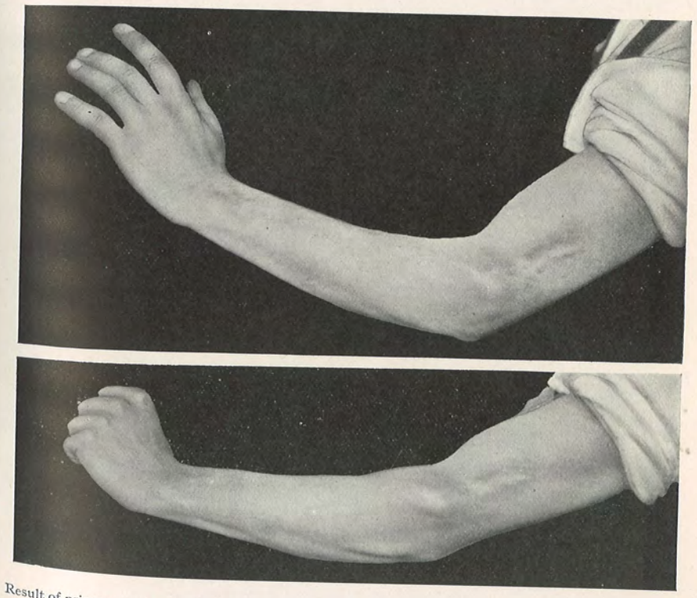
The patient did well after the operation. The packs were removed without accident three days later; and his subsequent convalescence was uneventful. He was kept in the hospital a little over three weeks; has had no symptoms referable to his head since his discharge, and is now in excellent health.

FIGS. 3 and 4.



Result of arthrotomy for gunshot wound of the knee joint.

FIGS. 5 and 6.



Result of primary neurorrhaphy for stab wound of the musculospiral nerve (16 months after operation).

AMPUTATION OF LEG UNDER ANÆSTHESIA PRODUCED BY INFILTRATION OF THE SCIATIC NERVE WITH EUCAINE.

DR. ASHHURST related the history of a man, aged 33 years, who tried to jump on to a rapidly moving freight train. His feet slipped, but he had a firm grip with his hands, and held on. His body swung in and out between two cars, his efforts to regain his footing were ineffectual, and, fearing instant death if he let go, he was dragged along for *one mile* before his cries caught the attention of the train hands; the train was then stopped, and the patient was hurried to the Episcopal Hospital, where he was admitted (October 4, 1909) to the service of Dr. Frazier, to whom Dr. Ashhurst is indebted for the privilege of operating.

The patient was almost pulseless; he had profuse hæmaturia; there was a large hæmatoma in the left loin; the left ilium was fractured through the ala; the left foot was crushed and frightfully mangled; and there was a fracture of the shaft of the left radius. Although the patient was not expected to survive, he gradually reacted under vigorous treatment, but developed pneumonia, first in the left lung, and then in the right. The hæmaturia gradually diminished. The left foot became gangrenous, but on account of the pneumonia and the other injuries amputation was postponed as long as possible. Finally, on the fifth day after the accident, in spite of the patient's bad general condition (double pneumonia, with restlessness and delirium), it was deemed imperative to remove the leg, as the stench was insufferable, and it was feared the gangrene might cause additional sepsis.

On October 9 the patient was given a hypodermic injection of morphine and atropine, and the sciatic nerve was exposed in the buttock by infiltrating the skin over it with eucaine; this was somewhat difficult as the patient began to suffocate as soon as an effort was made to turn him on his side. But by bringing his buttock partly over the edge of the table the nerve was exposed, and injected with 15 to 20 minims of 2 per cent. eucaine solution. This wound was then closed. Next the line of the proposed skin incision for the internal flap (supplied by the internal saphenous nerve) was anæsthetized by the local use of eucaine, and the leg was amputated (Sédillot's lateral-flap method, modified) without

the patient suffering more than from the tactile sensation of the instruments. All pain sense was abolished.

The patient's convalescence was tedious, but uncomplicated. The various injuries have healed, leaving no apparent disability, and he has an excellent stump.

PRIMARY NEURORRHAPHY OF MUSCULOSPIRAL NERVE FOR STAB WOUND: PERFECT FUNCTIONAL RECOVERY.

DR. ASHHURST related the history of a man, aged 17 years, who was stabbed in the left arm, probably with a penknife, about midnight of October 7, 1908. He was taken at once to the Episcopal Hospital, and admitted to the service of Dr. Frazier, to whom Dr. Ashhurst is indebted for the privilege of operating. On admission the boy had a band tied tightly around the upper arm, to control profuse hemorrhage from a punctured wound above the external condyle of the left humerus. The stab wound was enlarged by the Resident, and several spurting vessels were ligated. The next day, on examination, it was noticed that there was wrist-drop; there was complete paralysis of both the posterior interosseous (inability to extend fingers or wrist) and the radial nerves (anæsthesia over extensor surfaces of thumb and index fingers, and over the anatomical "snuff-box").

Operation was done sixteen hours after the injury. It was found that the stab had passed through the fibres of the brachialis anticus muscle almost to the bone; the proximal end of the musculospiral, cut cleanly across, was found in the wound; the distal end had retracted, but was easily found by separating the brachialis anticus and brachioradialis muscles. The distal end was then pushed under the uncut fibres of the brachialis anticus, and sutured to the proximal end by two mattress and one simple suture of fine silk, threaded in an ophthalmic needle. The two mattress sutures were passed directly through the trunk of the nerve; while the simple suture passed through the sheath only. After the suture was completed the place of union could no longer be detected with the naked eye; there was apparently perfect apposition. The wound in the brachialis anticus and the deep fascia were separately sutured with chromic catgut, and the skin was closed with silkworm gut, a small gauze wick being left for drainage. The arm was dressed on an internal angular splint. The wound healed without suppuration.

There was gradual improvement in the wrist-drop after about three months, although the patient was treated with massage and electricity for only a very short time. At the end of a year recovery was complete. There is now only the slightest evidence of impairment of power in the muscles supplied by the posterior interosseous, and no anæsthesia exists; the fingers and wrist can be fully extended, but not so vigorously as before (see Figs. 5 and 6).

THE DIAGNOSIS OF TYPHOID PERFORATION.

WITH REPORT OF CASES.

BY A. D. WHITING, M.D.,
OF PHILADELPHIA.

THE diagnosis of intestinal perforation during typhoid fever is, in the vast majority of instances, guesswork. Direct examination of the intestine, either on the operating table or at autopsy, alone will prove whether or not our surmise, *pro* or *con*, has been correct.

If we accept the findings of Brown (*Jour. Amer. Med. Asso.*, February 27, 1906, 695) based upon the statistics collected by Taylor, no fewer than 25,000 deaths occur annually in the United States from intestinal perforation during typhoid fever. This is in keeping with Osler's statement that one out of every three deaths during typhoid fever is due to perforation, which ratio is practically confirmed by the studies of the late J. Allison Scott (*New York Med. Jour.*, February 9, 1907, 245).

With this enormous number of perforations occurring annually one would naturally expect to find a great number of reported cases treated by operation—practically the only treatment giving any hope of recovery. Harte and Ashhurst (ANNALS OF SURGERY, January, 1904) were able to cite but 362 cases up to January, 1903, and Allaben, as quoted by Brown, could find but 162 reported operations between January, 1903, and January, 1907.

Granting that operative interference is the best treatment for typhoid perforation, this great discrepancy between the number of perforations and the number of reported operations would naturally lead one to conclude either that the estimated ratio of perforations to deaths is too high; or that it is most

difficult to make a diagnosis of perforation; or that but few of the operated cases have been reported.

From a study of cases of typhoid perforation that have come under my observation, and of the histories of similar cases at the German Hospital, I am forced to accept all three conclusions. The records of the German Hospital from 1900 to 1909 inclusive, show that there were treated in that institution during these ten years 2053 cases of typhoid fever, of which 206, or 10 per cent., died from various causes. In 180 of the 206 deaths there was no suspicion of perforation noted. Of the remaining 26 deaths, 17 were due to perforation, found either at operation or post mortem, and in 9 cases death was due to peritonitis, probably perforative, the diagnosis not being confirmed either ante or post mortem. If all suspected cases are classed as true perforations, perforation occurred in 1.26 per cent. of all cases; if the 9 cases not confirmed are excluded, perforation occurred in .82 per cent. of the cases. This percentage is somewhat lower than that shown by statistics published by Harte and Ashhurst, who in 8881 collected cases found perforation occurring in 2.54 per cent.

The ratio of the perforative deaths to the whole number of deaths in the German Hospital series would be, with the 9 doubtful cases included, 1 in 8; without the 9 cases, about 1 in 12, a ratio considerably lower than that advanced by Osler and by Scott.

The second conclusion, that it is most difficult to make a certain diagnosis of perforation, must be concurred in by all who have studied the subject or have seen many cases. Personally, I know of no sign or symptom that is pathognomonic of perforation; I know of no train of symptoms that will lead inevitably to a diagnosis of perforation. Nor can this be considered strange, if it be realized that the patient in question is one who is suffering from an infection which makes the abdomen the site of marked intestinal disturbances and which causes a profound toxæmia to affect every organ in his body, who may exhibit abdominal pain, and rigidity, and tenderness, and distention from the onset of the infection, and who may

present all of the supposed typical signs and symptoms of perforation during the course of the fever without the occurrence of this complication.

If from 25 to 40 per cent. of the perforative cases are to be saved, a diagnosis must be made and operative interference instituted before the patient is moribund from a rapidly spreading peritonitis. This is impossible in some instances because the added burden of the calamity of perforation overwhelms all resistance that the patient may still possess. Such cases, naturally, succumb before relief can be afforded. In the majority of cases, however, the resistance of the patient will be sufficient to withstand the complication of perforation long enough to make operative interference not only advisable but mandatory.

Perforation should be suspected in every instance where the regular course of the typhoid infection in that individual case has been interrupted by some untoward mishap. Perforation should be diagnosed in all such cases, when the mishap cannot be traced directly to some complication other than perforation.

The recognition of such occurrence presupposes a thorough knowledge of the case in question obtained by painstaking and continuous study of the patient and of the various phases of the fever presenting. The possession of this knowledge by the physician in charge makes it obligatory on him to make the diagnosis and to look upon the surgeon as his mechanician rather than his consultant, unless the surgeon has studied the case with the physician before the mishap occurred. The surgeon may be able to aid the physician in determining the presence or absence of rigidity, of beginning or established peritonitis, of free fluid in the abdominal cavity; but it would be presumptuous on the part of the surgeon to attempt to recognize the occurrence of something out of the ordinary in a particular typhoid fever patient about whom he knows nothing from previous personal observation.

While it is true that this scheme of diagnosis does not take into consideration the presence or absence of any sign or

symptom or train of symptoms that may have been looked upon as indicative of perforation, it is probable that it would be productive of less harm than would waiting and searching for symptoms that may or may not appear. Mistakes would undoubtedly be made, and some patients whose condition would contraindicate operative treatment unless it were imperative would be called upon to withstand the added burden of an unnecessary operation. Were this mistake impossible under the method of diagnosing by a sign or symptom or chain of symptoms, the latter would be a better and safer scheme by which the diagnosis should be made. Unfortunately such is not the case. In the German Hospital series, two cases were operated upon in which no perforation was found. Mitchell (*Penna. Med. Jour.*, 1908) has reported a series of 93 operations for typhoid perforation, in 19 of which no perforation was found and in 7 of which no cause for the symptoms presented could be found.

If reliance is to be placed on the symptoms that may or should be present, the diagnostician very often will be led astray. Pain is probably the most constant symptom, in typical cases being sharp and stabbing, and usually localized in the right iliac fossa. In typical cases, the pain should continue for some time. In the ordinary run of cases, the pain may be such as not to cause complaint on the part of the patient; it may be entirely on the left side, in the groin, along the penis, referred to the end of the penis, in the testicle, in the epigastrium or in any other part of the abdomen. Pain may be entirely absent, or the pain complained of may be nothing more severe than a slight exacerbation of that experienced by the patient during the entire course of the disease.

Vomiting may be a symptom of perforation, or may be the cause of it. Murphy of Chicago has stated that it is constantly associated with the perforative peritonitis of typhoid. This symptom was entirely absent in a large number of the cases in the German Hospital series.

A fall of temperature may immediately follow the perforation. It was not noted in the German Hospital cases,

possibly because the temperature was not taken always at the time of perforation, but later when beginning peritonitis caused a rise rather than a fall.

Collapse and sweating are supposed to be found in connection with the fall of temperature. These are found in a fair percentage of cases, but are not present in the majority of them.

Tenderness and rigidity generally follow perforation. The former is of less value than the latter because a great many typhoid patients have abdominal tenderness throughout the entire course of the fever. Rigidity becomes more marked with spreading peritonitis, as a rule. It must be remembered in this connection that rigidity can be elicited in any case of typhoid fever, whether perforative peritonitis be present or not, by unskilled, rough palpation. The rigidity to be distinguished is that due to reflex activity of the muscles consequent upon a beginning peritonitis, obtained by the skilful touch of the artist.

As a general rule, the pulse rate increases very markedly after perforation, running as high as 140 to 160 and becoming weak and thready. In some cases no change in the pulse rate will be noted.

A change in facial expression, which Harte and Ashhurst describe as a general weakening of the expression, may be noted at the time of perforation. By the time the attention of the physician in charge has been called to the occurrence of the mishap, this cast of countenance will generally be lost, being replaced by the former expression or that more typical of general involvement of the peritoneum. In a patient profoundly toxic, no change in expression may be noted.

It was thought, at one time, that a positive diagnosis of perforation in typhoid could be based upon an increasing leucocytosis. Unfortunately, even that sign may be claimed by only a part of the cases, it being almost as variable as most of the other signs and symptoms advanced. One or two counts would be of practically no value under any conditions, unless the normal leucocyte count of that particular case had been noted before perforation, as investigation has shown that leucopenia is not constantly associated with typhoid fever.

The two signs of perforation mentioned by Brown, namely, a "dipping crackle" elicited by a dipping palpation with the stethoscope; and the extension of tenderness in a given direction by posture of the patient, were not applied in any of the patients in this series. Whether they would be of material advantage in arriving at a correct diagnosis or not is questionable.

A brief summary of the cases in this series, details of which are appended, is as follows:

Death occurred in every case of perforation or suspected perforation where no operation was performed.

	No. of cases.
Death was due to perforation or peritonitis	26
Death was due to proved perforation	17
Death was due to possible perforation	9
Operation for perforation was performed	18
Perforations were found at operation	16
Perforations were not found at operation	2
Death followed operation for perforation	11
Recovery followed operation for perforation	7

Operative mortality was 61.1 per cent.

In conclusion I wish to thank the staff of the German Hospital for the privilege of reporting this series of cases. Most of the operations for perforation were performed by Dr. Deaver.

Following are details of cases of perforation or suspected perforation during typhoid fever occurring in the German Hospital between 1900 and 1909:

CASE I.—W.F., male aged 24; admitted April 21, 1900. Had severe pain and abdominal distention. Died from peritonitis, probably perforative. No operation. No autopsy.

CASE II.—C.K., male, aged 46; admitted August 15, 1900. Had several severe hemorrhages. Died from peritonitis. No operation. No autopsy.

CASE III.—W.J., male, aged 36; admitted March 2, 1901.

On admission abdomen was distended, there was pain and tenderness in right iliac fossa. Patient in collapse. No operation advised. Post-mortem examination, 36 hours later, showed perforation of the ileum, 4 inches from the ileocæcal junction.

CASE IV.—J.M., male, aged 28; admitted February 6, 1902, on the seventh day of typhoid. At 5.45 A.M. on the tenth day of disease, patient complained of pain in right iliac fossa, following a bowel movement. Temperature, 105°; respiration, 32; pulse, 120. There was tenderness over the right side of the abdomen, with beginning distention. At 6.20 A.M.: Temperature, 105 4/5°; respiration, 36; pulse, 136. Abdomen distended and hard. Vomiting was more or less continuous. Leucocyte count at 5.30 A.M. was 5200; at 6.30 A.M., 5600. Diagnosis: Perforation.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. No escape of gas. Considerable fluid in peritoneal cavity. The appendix was retrocæcal, swollen and injected, and was removed. A large perforation in the ileum about 8 inches above the ileocæcal junction was found and closed. Drainage tube introduced into pelvis and wound closed to drainage. Patient died 24 hours after operation from exhaustion.

CASE V.—W. K., male, aged 29; admitted November 2, 1902. Case previously reported by Dr. G. G. Ross, in *Phila. Med. Jour.*, May 2, 1903.

CASE VI.—J.J., male, aged 37; admitted February 6, 1903. While at work eight days before admission, had been suddenly taken with severe chill. Went to bed where he remained three days. Then had no pain and felt well, although somewhat tired. Remained out of bed on the fifth day, but did not return to work. On the sixth day presented himself to the out-patient department for treatment. That same evening he had a sudden, sharp, burning pain in the pubic region. In two or three hours, pain was felt in the abdomen and also in the right testicle with a sensation of retraction of that organ. Pain was constant with acute exacerbations. He vomited once. Did not void urine from onset of attack of pain until admission. On admission, temperature, 101 4/5°; respiration, 40; pulse, 128. Abdomen was scaphoid, abdominal muscles tense and markedly rigid. There was marked tenderness over entire abdomen and flanks.

Percussion note was dull over abdomen from pubes to umbilicus. Marked tenderness on rectal examination. Lungs showed impaired resonance at right apex with many crepitant râles; subcrepitant râles found over entire chest anteriorly. Catheterization caused great pain; 275 c.c. urine recovered. Leucocytes numbered 17,480. Diagnosis of peritonitis made.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. Free pus found. Drainage tube introduced into pelvis and wound closed to drainage. No search for cause of peritonitis. Death 22 hours after operation.

Autopsy: General purulent peritonitis, pus being general, but more plentiful in pelvis. Small intestine in pelvis covered with thick slough. Small, ragged circular perforation of ileum about 10 inches from ileocæcal junction. Three other ulcers having characteristics of typhoid were found. Spleen was greatly enlarged. Kidneys showed acute parenchymatous change. Gall-bladder negative. Mesenteric and retroperitoneal glands were enlarged. Appendix showed superficial inflammation, limited to the peritoneal coat, secondary in character.

CASE VII.—J.P., male, aged 18; admitted March 1, 1903, on the eleventh day of typhoid. General distention of abdomen; tenderness over splenic and gall-bladder regions; gurgling and tenderness in right iliac fossa.

At 5 P.M. on thirty-fourth day of disease, patient had severe pain over splenic area. Temperature, 104 1/5°. At 7 P.M. complained of pain over sternum, which gradually spread to epigastrium and then over entire abdomen. Slight rigidity of left rectus. General abdominal pain, more marked on left side. Some tenderness over gall-bladder. There was no distention, abdomen being scaphoid.

At 8 P.M., pain and tenderness became localized in right side and there was dulness in right flank. Slight rigidity of right rectus. Temperature, 103 2/5°; pulse, 120; leucocyte count, 18,800. Was transferred to surgical ward at 8.20 P.M., with diagnosis of perforation.

Operation by Dr. Whiting. Ether anæsthesia. Incision through right rectus. No escape of gas. Considerable cloudy fluid in peritoneal cavity. Appendix slightly injected; it was removed. Intestinal peritoneum was injected and red. Intestine searched for perforation but none found. Pus was found

behind liver, and more in pelvis. Gall-bladder was normal. Peritoneal cavity irrigated with saline, drainage tube introduced into pelvis and wound closed to drainage. Patient made an uneventful recovery.

CASE VIII.—W.C.W., male, aged 25; admitted March 24, 1903, on the thirteenth day of typhoid. Was profoundly toxic and ran a prolonged course of typhoid. On the forty-second day of disease, had a large hemorrhage from the bowel. On the forty-eighth day of disease, at 11 A.M., temperature, 104 4/5°; respiration, 28; pulse, 128. He was in a semi-comatose condition. At 11.55 A.M. was screaming with pain. No fall of temperature was noted. He very soon became more easy and at 12.15 P.M. had a large, formed yellow stool. He was perspiring freely. There was no vomiting. At 1 P.M. complained of severe abdominal pain. At 2 P.M., temperature, 105°; respiration, 36; pulse, 138.

Operation by Dr. Deaver, at 2.15 P.M. Ether anæsthesia. Incision through right rectus. Peritoneal cavity filled with cloudy fluid. Peritoneum deeply injected. Round perforation found 12 inches from ileocæcal junction, in ileum. Perforation closed. Appendix deeply congested; it was removed. Glass drainage placed in pelvis and wound closed to drainage. Patient died 26 hours after operation.

Autopsy revealed general peritonitis. Appendiceal and perforation wounds closed. Distal to the sutured perforation, three other perforations were found within a distance of four inches.

CASE IX.—J.C.L., male, aged 30; admitted April 24, 1903. Had had a bad diarrhœa for one week but had followed occupation of driver until 24 hours before admission. At that time had dull pain in right iliac fossa which gradually increased in severity. There was no vomiting. On admission, temperature, 102 2/5°; respiration, 46; pulse, 148. Tongue was dry, fissured and heavily coated. Pupils were dilated. Pulse rapid but of fair tension. Abdomen markedly rigid throughout. Tenderness over entire abdomen, more marked on right side. Marked tenderness on rectal examination.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. Peritoneum opened allowing escape of fluid fecal matter. Peritoneum sticky, lustreless, and injected,

Numerous typhoid ulcers were seen in ileum, with perforation in base of one of them. Perforation closed. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient died next day. No post-mortem examination made.

CASE X.—T.C., male, aged 31; admitted June 22, 1903. Died of peritonitis. No operation. No autopsy.

CASE XI.—A.M., male, aged 22; admitted January 13, 1903. Died of peritonitis, probably perforative. No operation. No autopsy.

CASE XII.—M.R., male, aged 14; admitted February 26, 1904, in second week of typhoid. Had been treated at home. Physician had diagnosed perforation and had sent him to hospital for operation. On admission, temperature, 98 4/5°; respiration, 24; pulse, 118. Tongue coated, red, and dry. Patient complained of pain in lower abdomen, more marked on right side. Slight abdominal distention. No mention made of vomiting.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. Cloudy, straw-colored fluid in peritoneal cavity. Ileum carefully searched for perforation, but none found. Near the ileocæcal junction, in the ileum, were a number of very thin places, at which points the mucous membrane had been apparently destroyed. At several points the intestine contained clotted blood. Wound closed without drainage. Patient ran a normal course of typhoid, temperature reaching normal on eighteenth day after operation. Recovery.

CASE XIII.—S. B., female, aged 35; admitted Mar. 25, 1904, on twelfth day of typhoid. On twenty-second day of disease patient had two hemorrhages of 600 c.c. and 400 c.c., respectively, from bowel. Temperature fell from 103 4/5° to 96 3/5°. On the twenty-sixth day of disease had another hemorrhage of 250 c.c. On twenty-seventh day, at 7 P.M., complained of severe pain in region of urinary bladder. Temperature, 101°; respiration, 22; pulse, 122. At 8 P.M. had a slight chill. Temperature, 102 2/5°; respiration, 24; pulse, 144. At 12 midnight complained of severe pain in right side of abdomen. Temperature, 104°; respiration, 28; pulse, 156. Patient did not vomit.

Operation at 2.30 A.M., by Dr. Whiting. Ether anæsthesia. Incision through right rectus. Omentum found adherent to entire right iliac fossa. Omentum liberated. Two perforations, one patent, round, in centre of large necrotic area, about two

inches from ileocæcal junction. Other found at ileocæcal junction, being closed by adhesion of ileum to cæcum. Both perforations closed. Drainage tube introduced into pelvis and wound closed to drainage. Patient had a severe hemorrhage 24 hours after operation and died of exhaustion 36 hours after operation.

CASE XIV.—R.D., male, aged 43; admitted July 15, 1904, on fifteenth day of disease. On the twentieth day of disease had sudden abdominal pain at 11.30 A.M. Temperature, 101 3/5°; respiration, 26; pulse, 96. At 1.20 P.M. had a chill followed by rise of temperature to 105 2/5°; respiration, 28; pulse, 128. There was persistent vomiting and hiccough. Patient died at 10 P.M. from peritonitis, probably perforative. No operation. No autopsy.

CASE XV.—J.T., male, aged 47; admitted December 13, 1904. on twelfth day of typhoid. On the fifteenth day patient lost 800 c.c., 500 c.c., 300 c.c., and 250 c.c. of blood by bowel in successive stools. On the sixteenth day of disease a perforation of the bowel was suspected, but as the patient was practically moribund, operation was not considered. Patient died the same day. No autopsy.

CASE XVI.—J.T., male, aged 15; admitted January 30, 1905, on the ninth day of typhoid. Abdomen slightly distended, tenderness in right iliac fossa. Spleen distinctly palpable. Patient had four distinct hemorrhages on the fourteenth day of disease and another on the twentieth day. At 12 o'clock noon on the twenty-ninth day, patient had severe abdominal pain in the end of the penis. There was no shock, abdomen was soft and flat. Temperature, 103°; respiration, 26; pulse, 100. There was no vomiting. At 2 P.M. there was some rigidity of the recti, with slight tympany. Temperature, 102 3/5°; respiration, 20; pulse, 120.

Operation at 4 P.M. by Dr. Deaver. Ether anæsthesia. Incision through right rectus. Perforation of cæcum found on inner side. Perforation closed. Glass drainage in pelvis. Wound closed to drainage. Patient died at 8.35 P.M. from œdema of the lungs.

CASE XVII.—J.N., male, aged 43; admitted May 27, 1905. Six days before admission felt sharp pain in right side radiating to umbilicus, accompanied by dull headache with occasional pains shooting through head. Since onset of attack been feeling tired

out; bowels very loose, eight movements daily, watery in character. Felt somewhat better after vomiting, being relieved of abdominal pain. On admission abdomen soft, scaphoid, with no tenderness. Two days after admission experienced sudden sharp pain in general abdomen, with abrupt rise of temperature to 105 2/5°. Expulsion of large amount of flatus gave relief of all pain. Next morning pain had returned, being localized in right iliac fossa, with considerable muscular rigidity on right side. Diagnosis of acute appendicitis made and patient transferred to surgical.

Operation by Dr. Deaver. Ether anæsthesia. Incision through right rectus. Appendix congested with exudate around it. Appendix removed. Glass tube introduced into pelvis and large quantity of sero-pus removed. Appendix opened and mucous membrane found normal. Ileum searched and several typhoid ulcers found. One perforation found, fecal matter being discharged. Wound closed to drainage. Patient ran regular course of typhoid, temperature touching normal on thirteenth day after operation. Recovery.

CASE XVIII.—W.Y., male, aged 20; admitted August 25, 1905, after four weeks' illness with typhoid. Three days after admission had sharp pain in right iliac fossa, abdomen slightly distended, increasing rigidity of both recti. Face ashen hue. Pulse rose to 160. Patient died from peritonitis. No operation. No autopsy.

CASE XIX.—W.Z., male, aged 21; admission September 1, 1905. On thirty-first day of disease, had sharp pain in abdomen which awoke him from a sound sleep. Pain lasted two hours. Several points of tenderness. with very slight distention over right hypochondrium. Patient was very thirsty and had an anxious expression. On thirty-ninth day a pelvic collection was made out. Patient died on the forty-second day of the disease, from peritonitis. No mention is made of suspected perforation. No autopsy.

CASE XX.—E.M., male, aged 37; admitted November 18, 1905, with typhoid fever, complicated by pneumonia. Nine hours before death had sudden severe abdominal pain, followed by collapse. No operation. No autopsy.

CASE XXI.—J. S., male, aged 14; admitted May 2, 1906, on eleventh day of typhoid. Had considerable pain in abdomen and

gave appearance of having been a great sufferer, being markedly emaciated and having abdominal facies. Temperature, 102°; respiration, 32; pulse, 120. There was marked rigidity on right side, board-like in character. There was general tenderness. Abdomen was greatly distended. Patient died on third day after admission from peritonitis, probably perforative. No operation. No autopsy.

CASE XXII.—J.R.H., male, aged 33; admitted May 18, 1906. For two weeks before admission had suffered from general malaise, headache, anorexia, and excessive diarrhœa. Continued at work until five days before admission. On day before admission had sudden sharp pain in left groin which extended along the penis and lasted about ten minutes. Has had two similar attacks of pain since first. There was no nausea and no vomiting. On admission, temperature, 101°; respiration, 24; pulse, 100. There was general abdominal pain and tenderness, both of which were more marked in left iliac fossa. Widal was suggestive. Leucocytes, 10,400.

Operation immediately after admission by Dr. Deaver. Chloroform anæsthesia. Incision through right rectus. Large quantity of pus escaped from peritoneal cavity. Plastic exudate throughout the peritoneal cavity. Appendix congested, not removed. Superficial search made for perforation but none found. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient died twenty-two hours after operation.

Autopsy: General plastic peritonitis. Intestine contained numerous typhoid ulcers, one of which had perforated about 18 inches from the ileocæcal junction.

CASE XXIII.—A.G., male, aged 26; admitted October 9, 1906, on the ninth day of typhoid. Had hemorrhages from bowel on the eleventh, fourteenth and sixteenth days of disease. At 9 A.M. on sixteenth day became very anæmic, with sighing respiration, and decided air hunger. Diagnosis of concealed hemorrhage made. Abdomen slightly tympanitic but not rigid. There was no mention by the patient of pain. Perforation was later suspected on account of rise of temperature from 102 4/5° to 107 4/5°, and rapid wiry pulse. There was a large hemorrhage from the bowel just before death.

Autopsy: Extensive ulceration in the last 18 inches of the ileum and about 8 inches of ascending colon. There was a perforation in the ileum 2 inches beyond the ileocæcal junction. The liver and kidneys showed acute parenchymatous change. Fecal matter was present throughout the peritoneum which was the seat of marked inflammation.

CASE XXIV.—W.S., male, aged 28; admitted December 12, 1906, with perforative peritonitis complicating typhoid fever. No operation. Died twenty-four hours after admission.

Autopsy: Perforation of ulcer of ileum, with general peritonitis.

CASE XXV.—A. F., male, aged 24; admitted December 12, 1906, with history of having had a bad cold for a week and having felt wretched. Twenty-four hours before admission had been suddenly seized with violent, sharp abdominal pain, soon followed by vomiting. Pain remained general but was more marked on right side. On admission there was marked dyspnœa, respirations rapid and labored, sputum rusty in color. Impaired resonance at right base and numerous large moist râles. Temperature, 101 4/5°; respiration, 36; pulse, 108. There was extreme tenderness over lower abdomen, more marked over appendix, with moderate abdominal distention. Leucocytes, 12,200. Diagnosis of acute appendicitis with pneumonia made.

Operation by Dr. Deaver: chloroform anæsthesia. Incision through right rectus with escape of pus when peritoneum was opened. Numerous adhesions near appendix. In breaking up adhesions, three pockets of pus were opened. Appendix to inner side of cæcum, removed. Glass drainage tube introduced into pelvis and considerable pus removed. Gauze drainage introduced into pelvis and to base of cæcum. Wound closed to drainage. A fecal fistula developed immediately after operation, which persisted for about two weeks, finally closing without operation. Nine days after operation, rose spots appeared on abdomen and a positive Widal was obtained. The patient ran a regular course of typhoid and recovered.

CASE XXVI.—L. S., male, aged 31; admitted April 8, 1907. On seventh day after admission patient had attack of severe abdominal pain in lower right quadrant with rigidity of right rectus, followed by free bowel movement. Leucocyte counts: 2 A.M., 5200; 4.30 A.M., 10,500; 6.45 A.M., 12,700; 8.15 A.M., 6400, a second count at this time giving 7100. There was no vomiting. At 2.30 A.M. patient had a large bowel movement with hemorrhage.

Operation at 11 A.M., by Dr. Whiting: ether anæsthesia. Incision through right rectus. Considerable free pus and fecal matter in peritoneal cavity. Perforation found 6 inches from the ileocæcal junction, in the ileum. Drainage tube introduced into pelvis and large amount of pus and fecal matter evacuated. Wound closed to drainage. Patient died next day. No autopsy.

CASE XXVII.—S. S., female, aged 20; admitted May 8, 1907, on fourteenth day of typhoid. On twenty-second day of disease, patient had hemorrhage from the bowel. At 11 P.M. on the twenty-fourth day, patient complained of pain in the abdomen, which was entirely relieved by catheterization. Temperature, $103^{1}/_{5}°$; respiration, 20; pulse, 124. At 8.30 A.M. on the twenty-fifth day, patient had severe pain in abdomen, more marked in lower right quadrant. Pulse became weak and running, respiration being sighing in character. Patient vomited. There was some general abdominal tenderness and slight rigidity of the right rectus. Liver dulness was not impaired. A diagnosis of perforation was made, but owing to a difference of opinion among the consultants no operation was performed. Patient died on the twenty-eighth day of disease from general peritonitis.

Autopsy: General peritonitis due to perforation of the ileum about 5 inches from the ileocæcal junction.

CASE XXVIII.—W. P., male, aged 19; admitted October 21, 1907. Had been treated at home for typhoid. On the morning of admission had had an attack of excruciating pain in the abdomen followed by very rapid pulse. No mention made of vomiting. Diagnosis of perforation made and patient sent to hospital for operation. On admission, temperature, $103^{3}/_{5}°$; respiration, 28; pulse, 124. Leucocytes numbered 10,300. The abdomen was retracted. There was no localized rigidity although there was a suggestion of greater firmness over right iliac fossa. Slight tenderness in right iliac fossa.

Operation by Dr. Deaver: ether anæsthesia. Incision through right rectus. Free air, fecal matter and pus found in peritoneal cavity. Perforation of ileum about 10 inches from ileocæcal junction was found and closed. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient continued regular course of typhoid, the temperature reaching normal on the twelfth day after operation. Recovery.

CASE XXIX.—H. G. K., male, aged 17; admitted January 28, 1908, in second week of relapse of typhoid, with history of having had a perforation the day before. Patient taken from ambulance to operating room. General distention of abdomen, with rigidity and tenderness.

Operation by Dr. Deaver: ether anæsthesia. Incision through right rectus. Free pus and fecal matter found. Intestine injected and covered with exudate. Perforation found in ileum 18 inches from ileocæcal junction. Perforation closed. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient died on third day after operation from peritonitis. No autopsy.

CASE XXX.—T. S., male, aged 17; admitted February 11, 1908, on fourteenth day of typhoid. Abdomen was somewhat full but soft. On thirty-second day of disease had severe abdominal pain, being found writhing with pain at 11.45 P.M. At 12 o'clock midnight, temperature, 103 4/5°; respiration, 24; pulse, 104. The attack of pain was followed by a large bowel movement. Leucocyte counts: 11.45 P.M., 5600; 12.45 P.M., 5700; 2.45 A.M., 5200; 11 A.M., 5300. No changes were noted in pulse or temperature and for four days the patient was distinctly better in every way.

On the thirty-sixth day the abdomen became suddenly distended, the liver dulness being absolutely obliterated. Three different leucocyte counts gave 7500, 7400, and 7300 respectively. Patient died on the thirty-seventh day.

Autopsy: There was general peritonitis due to an old perforation which had taken place in the ileum about 12 inches from the ileocæcal junction, surrounded by dense adhesions which had formed a wall of an abscess. This had ruptured and caused the general peritonitis. In this case there were no symptoms of perforation except the initial pain.

CASE XXXI.—T. B., male, aged 24; admitted April 17, 1908, on the eleventh day of typhoid. On admission the abdomen was soft but showed general tenderness. Liver and spleen were not palpable. At 12 o'clock noon on the sixteenth day of disease, patient had a severe abdominal pain, followed by rigidity of the recti and some distention of the abdomen. Patient complained of frequent desire for stool and micturition. Temperature, 102°; respiration, 28; pulse, 92. At 2 P.M., patient had a large stool

followed by another attack of severe abdominal pain. Temperature, 105 1/5°; respiration, 40; pulse, 112. Patient did not vomit. Rigidity of right rectus with distention.

Operation at 4 P.M., by Dr. Deaver: ether anæsthesia. Incision through right rectus. Slight amount of free fluid in abdominal cavity. Appendix examined and found normal. A perforation the size of a pinhead was found in the ileum about 8 inches from the ileocæcal junction. Ulcer bearing area invaginated. Glass drainage tube introduced into pelvis and wound closed to drainage. Patient ran a regular course of typhoid and recovered.

CASE XXXII.—M. W., female, aged 18; admitted December 25, 1908. History of having been sick for eight days before admission. Apathetic: tongue heavily coated; sordes on lips; heart rapid; spleen enlarged. Abdomen generally tender with some distention. Musical râles at left base on deep inspiration. Pulse, 148. Ran regular course until January 20, 1909, when complained of severe cramp-like pain in lower abdomen, at 10.45 A.M. At 12 noon liver dulness extended to costal margin; there was no tympany. Slight tenderness over McBurney's point. Continuous chill and shaking. Cyanosis. Considered at this time possible perforation. Leucocytes, 10,800. At 1 P.M., given hot-water bags to extremities and ice bags to abdomen. Color good; temperature gradually rising. No abdominal tenderness, nor rigidity. At 3 P.M., leucocytes, 8600. Complained of weight of ice bag. No rigidity, liver dulness not diminished. At 4 P.M., some slight abdominal distention, liver dulness replaced by tympany. Very slight rigidity. Has felt nauseated once but has not vomited. At 7 P.M., consultation and operation advised.

Operation by Dr. Whiting: ether anæsthesia. Incision through right rectus. Beginning peritonitis with free fecal matter in cavity. Perforation found in ileum 8 inches from ileocæcal junction, with several ulcerating areas in adjacent portion. Perforation closed and one ulcer-bearing area invaginated. Glass drainage tube introduced into pelvis and wound closed to drainage. Culture from peritoneal cavity showed pure growth of colon bacillus. Patient ran regular course of typhoid and made a good recovery.

CASE XXXIII.—E. I., female, aged 54; admitted June 14, 1909, on the seventh day of typhoid. On admission, temperature,

104 1/5°; respiration, 44; pulse, 116. The abdomen was considerably distended and somewhat tense. Spleen not palpable. The distention continued increasing, becoming drum-like. There was persistent vomiting. Peritonitis from perforation was diagnosed but it was not considered advisable to operate on account of unfavorable condition of patient. Died twenty-six hours after admission.

Autopsy: Bronchopneumonia of both lungs. Enormous distention of peritoneal *cavity* by gas, with some free fecal matter. The intestine was flat, being matted against the posterior wall of the abdomen. Typhoid ulcers of the ileum and cæcum were present, with four perforations in the cæcum. There was also focal necrosis of the liver.

DR. JOHN H. JOPSON said that Dr. Gittings and he had made a statistical study of perforation in children in a paper published recently. In this study there were analyzed 45 cases published since Elsberg's paper, which appeared in 1902. They did not find any very marked difference in the symptoms in childhood than in adult life; they did find pain, tenderness, rigidity, distention, leucocytosis, vomiting collapse,—all valuable and all present in a considerable number of cases; a certain number of these symptoms were present in a large majority of cases. Another interesting fact was that the mortality was much lower in patients below puberty than in the adult class.

DR. CHARLES F. MITCHELL thought that the difficulty from a surgical standpoint in making a diagnosis in perforation in typhoid fever is that the surgeon does not see the case before the symptoms start. Very often he is called in when the patient is suffering from general peritonitis and then diagnosis is very simple. It is important that surgeons in a general hospital where there are a large number of typhoid-fever cases should study these cases with the physician, so that the diagnosis of perforation might be arrived at earlier. Another important thing is that when called in to see a doubtful case, it is best to defer decision until one can see the patient again, in order that one may have time to consider the case carefully, rather than to be obliged the first time one sees the patient to give a final decision as to whether or not perforation is present when one knows but little of the patient's former condition.

Dr. Walter G. Elmer said that with regard to conditions simulating perforation he could recall one case of a trained nurse who in the third week of typhoid fever, and with a temperature running pretty evenly at 103°, suddenly developed all of the symptoms of perforation—a sudden drop in the temperature from 103° to subnormal, followed by pain in her right side, with increasing local tenderness and muscular rigidity. At operation he found an acutely inflamed appendix and an acute peritonitis spreading up the colon. No perforation of the intestine or appendix had taken place. The appendix was removed, the incision closed and the patient recovered. This patient presented a typical clinical picture of intestinal perforation in typhoid fever.

Dr. Robert G. Le Conte remarked that as a rule the physician does not call in a surgeon until there is grave doubt in his mind as to whether perforation has taken place. The physician expects the surgeon in a few moments to make a diagnosis in a case in which he has been doubtful for hours, or perhaps even days; and having made a diagnosis, the responsibility rests with the surgeon and not the physician. If surgeons could study these cases for a few hours, from the time when the thought of perforation has first entered the physician's mind, fewer errors of diagnosis would be made. One must not forget that perforation can take place and be temporarily closed by adhesion to a neighboring coil of intestine or to the omentum, and he believed that when one finds at operation, perforations from the size of a lead pencil to a five-cent piece, that these started as minute openings which were temporarily closed off until the whole bottom of the ulcer had necrosed. Dr. Davis showed him a very interesting specimen some years ago from a patient that had had characteristic symptoms of perforation, in whom operation was not undertaken. The patient recovered from this attack, but eight or ten days later the symptoms reappeared, ending in death. At the autopsy the first perforation was found entirely closed by a plug of omentum which protruded into the lumen of the gut, and near by a second perforation was found patulous, which had caused the patient's death.

Dr. G. G. Ross said that he had had a case presenting typical symptoms of perforation upon which he operated promptly and found a plug of omentum plastered over the opening. He presumed there was an opening at the time, but he did not disturb

the plug of omentum but stitched the edge of it and returned the bowel. Two weeks afterwards the patient had a second perforation from which he died. At post-mortem it was found that the plug of omentum had held until the bowel around the edge had sloughed and that the track of the drainage tube had become gangrenous. This was an illustration of Dr. Le Conte's point, that the patient had a perforation reinforced by nature, then a sloughing around the plug of omentum.

Dr. A. P. C. Ashhurst said that while the diagnosis of perforation in typhoid fever is difficult, it is much more difficult to diagnose the occurrence of a second perforation some days after the first has been sutured. When the patient is comparatively well in the first place and a peritonitis develops it is not difficult to detect, but when, as in a second perforation, the peritonitis simply increases, it is very difficult to make the diagnosis. If the diagnosis of these secondary perforations could be made and if the perforations were sutured, the mortality of typhoid perforation would be markedly reduced. Better than to cure perforations is to prevent their happening. Until within the last three or four years at the Episcopal Hospital they had had a tremendous number of typhoid cases, during one year about 125 in the wards constantly, and there were perforations in the usual proportion of cases. Upon the introduction of filtered water into northeast Philadelphia the number of cases in the wards dropped to an average of 10 or 12, with but 4 or 5 perforations in the last three years.

Dr. A. D. Whiting (in closing) said that as to the value of leucocytosis, he would say that it is of but little value, some cases showing an increase followed by a drop, others showing no variation in the leucocyte count even when taken hourly or half-hourly. In the early cases of this series the leucocyte count was made much more frequently than at the present time. Generally one count is made, and if that is high it is supposed to indicate trouble in the abdomen other than ordinary typhoid. A leucocyte count is made in every case of typhoid and often a normal leucocytosis is found. He thought the leucocyte count of little value in determining the presence or absence of perforation.

In general, perforation gives a doubtful picture until there is a well-established peritonitis; even then one may operate and find no perforation. There is no doubt that pain, tenderness,

rigidity, and vomiting are of great value when present, but there are many cases where these are not present. There may be perforation and death where no symptoms of perforation have been noted. Of course, the typical case, with sharp, stabbing pain, the patient writhing in agony, followed by peritonitis, rigidity and tenderness, is easy to diagnose. The stand he takes is that all calamities occurring in a case of typhoid should be suspected as being due to perforation, and that perforation should be diagnosed and operation instituted when no other complication can be found to account for the calamity.

The reason so many of the cases at the German Hospital were operated upon was because of the general theory that operation is advisable if there is suspected perforation: an unnecessary operation will not do so much harm as an unoperated peritonitis from perforation. It was lucky that so large a number of cases showed perforation. It was due more to guesswork than actual skilful diagnosis. Diagnosis of spreading peritonitis is comparatively easy, but one cannot tell whether it is due to perforation, leakage, or what not.

The time of operation after diagnosis varied from 6 to 36 or 48 hours. Some cases had been treated at home for typhoid and had been brought to the hospital after perforation had been diagnosed, and operation was at once performed. There were two such cases which died and one which recovered.

The idea of having the surgeon in attendance with the physician in all cases of typhoid is good, and should be instituted if the burden of the diagnosis is to rest upon the surgeon. The stand he takes is that the physician, who knows the case and its general behavior and can readily note the presence of any symptom out of the ordinary, should be the one to make the diagnosis and not the surgeon; if the surgeon is to help in the diagnosis he should be in attendance on the case from the beginning.

In regard to cases of slow peritonitis, with slight perforation, which had been mentioned, there are several cases in this series where there was either leakage or two or more perforations taking place at different times; others show an attempt to wall off and protect the general peritoneal cavity. In one case two perforations were found, one apparently sealed by adhesion of the ileum to the cæcum. In another case the patient had a sharp pain without rise or fall of temperature, without any other symptom at all, and afterward steadily improved for four or five days when there occurred an explosive peritonitis from which the patient died. Autopsy revealed a small perforation sealed off by adhesions between the site of the perforation and the abdominal wall, where an abscess had formed which finally ruptured.

The treatment of the peritonitis at the time of operation varies. Most of the cases operated upon by Dr. Deaver had the pelvis cleaned out, drainage being instituted by a glass tube in the pelvis and sometimes gauze into the pelvis and to the seat of perforation. In two of his own cases the abdomen was irrigated with saline solution, but in the majority of cases nothing was done beyond instituting drainage. The after treatment at the German Hospital is practically the Murphy treatment for peritonitis.

SARCOMA OCCURRING IN SCAR TISSUE OF THE BACK, WITH METASTASIS TO THE LUNG: PRESSURE NECROSIS OF THE AORTA, WITH HEMORRHAGE AND DEATH.

Dr. Addinell Hewson reported the history of a man, aged 72 years, who was admitted to the American Oncologic Hospital October 3, 1908, complaining of a growth in the scar of a very extensive burn over the spine and dorsal aspect of the right scapula.

He was injured in a railroad wreck 22 years ago, sustaining a very extensive burn, the scar of which extended on the dorsal groove from the seventh cervical to the second lumbar vertebræ, completely encircling the chest on the right side and including the shoulder and arm, fastening the right arm to the right side of the chest in such a way that the axilla was not more than 8 centimetres from the olecranon process of the ulna, this fixing the arm to the right side of the chest. There was pressure necrosis of the skin to the axillary side of the elbow.

After the healing of the burn his weight was only 70 pounds.

Later he was in a second railroad wreck, since which time he has had hæmiplegia of the left side and right-sided partial facial paralysis.

He had a fracture of the right tibia, the date of which could not be obtained; he sustained a right-sided, indirect, inguinal hernia by a fall at the Soldiers' and Sailors' Home which was reducible.

On examination a tumor was found (Fig. 7) which originated in the scar tissue over the supraspinous and infraspinous fossæ of the right scapula. This tumor was dark red in color, nodulated, and showed a tendency to break down. At the circmference it showed evidence of infiltration into the surrounding tissues. No indurated glands could be felt anywhere. The patient noticed that this growth appeared about twelve months before he was first seen. It increased very rapidly and when first admitted to the hospital its base was 20 cm. in diameter. The masses composing this totality varied from the size of a pea to 7.5 cm. by 15 cm. The elevation of these tumors was 2 cm. There was a tendency to bleed freely on manipulation.

Before admission to the hospital some of the smaller nodules had been tied off but no microscopic examination had been made. Necrosis began about eight months before, since which time the growth had been more rapid. Where the tumors had broken down there was no tendency to excavation but to an increased proliferation of the tumor mass.

The patient's height was 5 ft. 6 in. and weight 155 pounds. The pupils were normal and reacted promptly to light and distance. There was no œdema, no clubbing of the fingers, and no palpable enlargement of the superficial lymph-nodes.

The tongue was clean, the mucous membrane of the mouth was slightly pale. The pharynx appeared normal.

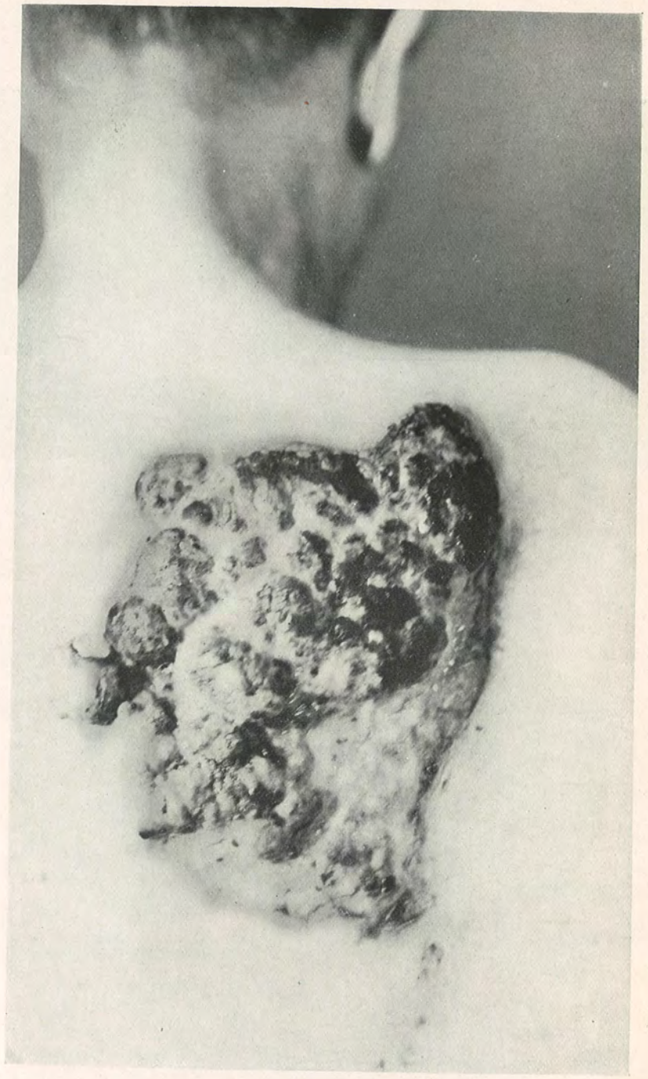
The morning temperature was 97.8 degrees; the pulse 98, regular, of full volume and tension; the respirations were 24 per minute.

An examination of the lungs showed no pathological signs.

The heart apex beat was in the sixth interspace in midclavicular line, the cardiac dulness extended from the fourth rib to the sixth interspace and from left edge of sternum to the midclavicular line; no murmurs were heard. The pulmonary diastolic sound had a decided splashing quality. An examination of the abdomen showed no pathological signs except the right-sided inguinal hernia already referred to.

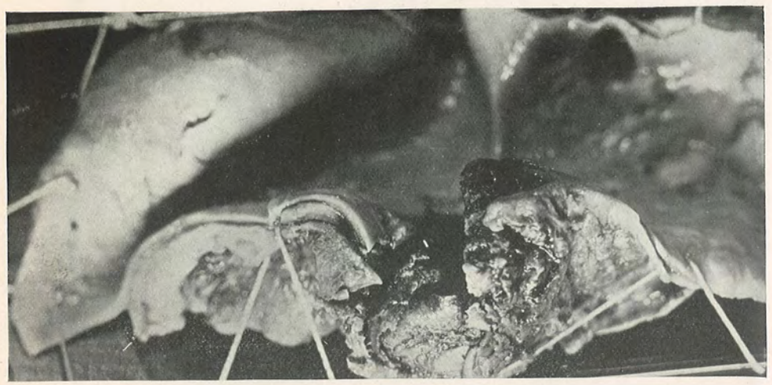
An examination of the blood showed: Erythrocytes, 3,700,000; leucocytes, 11,800; ratio, 1 to 313 +; hæmoglobin, 54 per cent.; color index, 0.73. Differential count: Polymorphonuclear neutrophiles, 77 per cent.; lymphocytes, 13 per cent.; large mononuclears, 3 per cent.; transitionals, 2 per cent.; eosinophiles, 5 per cent.

FIG. 7.



Sarcoma developing in scar tissue of the back.

FIG. 8.

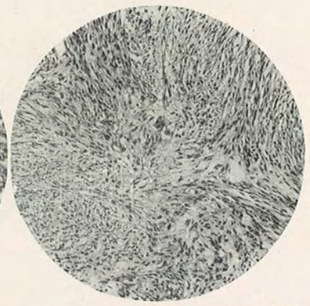


Showing erosion of wall of aorta by tumor.

FIG. 9.

Photomicrograph at the site of metastasis magnified 300 diameters taken at postmortem.

FIG. 10.



Photomicrograph of tumor of back magnified 150 diameters taken at first operation.

An examination of the urine showed: Color, dark amber; reaction, acid; specific gravity, 1016. There was a slight flocculent sediment which contained a few epithelial cells and uric acid crystals. There was no albumin, no glucose, no indican and no acetone.

After consultation with the entire Medical Board it was decided that cautery and X-ray be tried before dismissing what seemed to be a hopeless case.

Under strict asepsis and chloroform anæsthesia, a small tumor was enunciated at the most cephal part of the growth for examination and the opening closed. The caudal third of the growth was removed by a cautery knife, the remaining two-thirds were scarified with the cautery knife at red heat and one seemingly new growth was punctured in two places. The wound was dressed with dry gauze and cotton and a hypodermic injection of morphine was given. There was no elevation of temperature after this operative interference. It was noted 48 hours after the operation that proliferation of the growth had begun. The patient was out of bed three days after the operation and on the fourth day was able to walk some distance from the hospital.

On October 31 it was found that the growth had recurred over the entire area from which the tumor was removed by the cautery knife on the 12th, and that the new mass of tumor tissue was larger than that originally removed. On this date the Pacquelin cautery was again applied to the entire growth without the administration of an anæsthetic, because no pain was felt unless the uninvolved scar tissue was touched with the instrument.

A note on November 2 states that at the site from which the growth had been removed by the cautery knife, the tumor had increased to three times its original size. The electric cautery knife was then applied thoroughly to the entire mass without an anæsthetic.

Some of the cauterized material was removed on November 8 with considerable hemorrhage.

On November 15 the ward notes state that the discharge had been very profuse and offensive since the last cauterization. The patient showed a tendency to go down hill. The electric cautery was again used on November 18. On the 19th at 1.45 A.M. the nurse reported that after severe coughing there was some hemorrhage from the mouth, which lasted eight minutes. The

pulse rate was increased, regular and strong. At 4 P.M. of the same day some bright blood was found in the mucus, which was coughed up. On the 21st at 4 P.M. while sitting in the sun-parlor the patient was taken with a severe hemorrhage from the mouth, which came on without warning. The blood came out in a great gush; he became cyanosed, then strangled and died in 10 minutes.

I am indebted to Dr. C. B. Longenecker, Director of the Laboratory of Physics, for the photographs herewith submitted and to Dr. John M. Swan, Director of the Laboratory of Pathology, for reports of the pathological examination and autopsy. The examination of the specimen enucleated at the first operation resulted in a diagnosis of mixed-celled sarcoma.

The autopsy revealed the cause of death to have been hemorrhage from the aorta, due to pressure erosion of metastatic growth in posterior mediastinum between thoracic aorta and posterior margin of right lung.

In the caudal lobe of the right lung the lung tissue is replaced toward the dorsal part of the lobe by a solid mass resembling the new growth described on the surface of the body. Around this there is an area of less dense tissue, and farther removed again the lung looks normal except for the fact that it is quite moist.

There is a good-sized cavity in the part of the lung containing the neoplasm. The bronchi passing to this part of the organ are filled with clotted blood. The portion of the long tissue adherent to the mediastinal tissues presents a small opening through which a probe can be passed to the thoracic aorta immediately beneath it.

The aorta is atheromatous. On the right side of the thoracic aorta just cephalad to the aortic opening in the diaphragm there is an irregular opening with ragged edges 12 mm. in diameter, into the mass of tissue already described as adherent to the mesial surface of the right lung. The interior of this mass contains a cavity about 20 mm. deep, which is filled with semi-fluid blood. There is no attachment apparent to the underlying vertebral column. The intercostal veins where they empty into the vena azygos major are patulous and filled with blood. and no connection can be demonstrated between the cavity and the vena azygos major (Fig. 8).

The tumor is composed of spindle cells. In many places there are good-sized bundles of fibrous tissue, which are undergoing granular degeneration, and there is a good deal of œdema to be seen (Figs. 9 and 10).

DR. G. G. ROSS said that it was discouraging to think how absolutely intractable such a growth is. Still another side to the picture are the suggestions of Bloodgood and Coley, both of whom show that the results in such cases depend upon the type of sarcoma to be dealt with. The so-called fibrosarcoma of Bloodgood, a low grade of malignancy, offers some hope for local procedure; in the other malignant types it was his experience that amputation does little good. He recalled a case of fibrosarcoma in a girl 12 years of age, who had injured her wrist; she presented a deformity like a typical Colles' fracture. The X-ray showed it to be a tumor, and a local operation was done. After three years the growth had slowly recurred but was in no worse condition than when originally seen. Amputation was then done at the shoulder. That was four years ago and the girl is still perfectly well. Coley claims that there are a number of cases of more malignant type in which the use of his toxins of streptococcus and prodigiosus after amputation offer some curative results.

DR. ROBERT G. LE CONTE said that his experience in these cases was that nearly all of them die of internal metastatic growths. Whether one amputates or simply resects the diseased area, it is not the local return but the internal growth that kills. He had had perhaps ten or a dozen amputations in which there was local recurrence in but one case, and yet, in all these cases, the patients ultimately died of internal growth.

DR. SWAN said the subject of sarcoma, of course, will not be settled until the cause is found. So far as his experience had gone, nearly all sarcomata are mixed-celled growths, and he made a diagnosis of type according to the predominating cell found. As he understands it, sarcomata begin as small round-celled growths. These round cells belong to the same class of cells as those found in the connective tissue in the embryo, and they become large round cells; these become spindle cells and the spindle cells may become converted into a varying amount of fibrous tissue. The origin of the giant cell is not definitely settled. At the American Oncologic Hospital in the last two

years, three cases of sarcoma, including this one, have been treated; the other two were sarcomata of the thigh, occurring in the service of Dr. McClary. According to the examination of the thighs after amputation these growths undoubtedly originated in the periosteum. One patient remained in the hospital until metastasis occurred in the retroperitoneal lymph-nodes. The metastatic growth was of the round-celled type, while the original growth was a spindle-celled sarcoma with a few giant cells.

The occurrence of sarcoma in a scar is very interesting and somewhat unusual.

Dr. Duncan L. Despard called attention to two cases which Dr. Gibbon had already reported, one the case of a girl with sarcoma of the humerus in which he removed the growth and afterwards treated the girl with Coley's toxins; this was done over two years ago; and she still remains perfectly well. There was another case sent from up in the country with an abdominal growth, of which we never got a section, but her home physician was of the opinion from microscopical examination that it was a sarcoma. This growth was reduced 75 per cent. in size under the influence of the treatment with the Coley toxins. The patient went home and came back the second time in about the same condition as when first seen and was again treated by Coley's toxins and finally left the hospital without improvement of the symptoms. Both these cases were treated by the X-ray in addition to the toxins.

Dr. Robert G. Le Conte said that he had used Coley's mixed toxins in a number of cases without any apparent benefit except in one case, where a sarcoma of the upper jaw remained stationary for about six months. Dr. Stewart, his assistant at the Pennsylvania Hospital, attributed one most excellent result to this treatment. As an antithesis he related the history of a case of lymphosarcoma of the peritoneum, intestine, mesenteric glands and retroperitoneal glands which came under observation a year ago at the Pennsylvania Hospital. The man was so distended with ascites that no organ could be felt in palpating the abdomen, and the diagnosis seemed to lie between a tubercular peritonitis and diffuse carcinomatosis of the peritoneum. At operation the parietal, visceral and mesenteric peritoneum was found studded with growths varying from a pinhead to a penny in size, and at the upper portion of the jejunum an infiltrating tumor was found

the size of an orange. These tumors were pinkish in color and much richer in the small blood-vessels than carcinoma. The mesenteric and retroperitoneal glands were also enlarged. The abdomen was closed after removal of one of these growths from the parietal peritoneum for microscopic examination. The patient slowly grew weaker, with progressive emaciation, until he died seven weeks later. At the autopsy the growths which had studded the peritoneum had practically disappeared, and the tumor of the jejunum had dwindled to a thickening of the coats of the bowel, perhaps a quarter of an inch in depth. Nothing had been done of a curative nature for this patient except the opening of the abdomen and the handling of the tumors, yet the sarcomatous masses had receded to an enormous degree in seven weeks. This case is an example of a thing occasionally seen in lymphosarcoma, namely, marked diminution in the size of the tumor without its entirely disappearing and without prolonging the life of the patient.

TREATMENT OF CHRONIC TUBERCULOUS SINUSES BY BECK'S BISMUTH-VASELINE PASTE INJECTIONS.

BY JOHN B. SHOBER, M.D.,
OF PHILADELPHIA.

Dr. Emil G. Beck of Chicago published in the *Illinois Medical Journal*, April, 1908, a paper entitled, "A New Method of Diagnosis and Treatment of Fistulous Tracts, Tuberculous Sinuses and Abscess Cavities," and at the Sixth International Congress on Tuberculosis, held at Washington, D. C., September 28 to October 5, 1908, he presented another paper entitled, "The Surgical Treatment of Tuberculous Sinuses and Their Prevention."

In order to diagnose the extent and ramifications of chronic tubercular sinuses, with a view of determining the advisability of surgical operation, Dr. Beck injected a number of cases with a paste composed of one part bismuth and two parts vaseline and then had radiographs made. The pictures clearly showed the extent of the fistulous network in the cases and explained the reason of failure in several previous operations. They also demonstrated the uselessness of an operation which does not reach every part of the diseased tract. On the other hand, by the use of bismuth radiographs as a guide in reaching the entire seat of disease, several successful operations were performed. This announcement alone would have been sufficient to attract the attention of the profession, and in the future the method will doubtless be universally used before undertaking surgical operations in these cases.

But this was not all. The first case injected for diagnostic purposes led to a most important discovery, namely, that the

injection of liquefied bismuth-vaseline paste is not only valuable for diagnostic purposes, but for curative purposes as well. It disclosed a new method of treatment. In his first paper Dr. Beck says that after one single injection of the bismuth paste a fistula following a psoas abscess, which had existed nearly two years, entirely closed and has remained so up to date. Other cases were subjected to the same treatment with similar results. In his paper read before the International Congress on Tuberculosis Dr. Beck reported 192 cases treated by the bismuth-vaseline paste method, of which 64 per cent. were healed, 28½ per cent. improved, 6 per cent. unchanged, and 1½ per cent. died during the period of treatment or after. A large variety of cases were treated, including osteomyelitis of long bones with sinuses, empyema and tuberculous lung abscesses, suppurative sinuses of the head, sinuses following tuberculous glands, rectal fistulæ, and tuberculosis of the kidney with sinuses.

Impressed by Dr. Beck's first paper, I determined to try the method when occasion should arise. My personal experience has been confined to only five cases, but I have advised this method in consultation in a number of cases where the results have been equally gratifying.

My cases comprise 2 psoas abscess sinuses of five and three years' duration, 2 cases of tuberculosis hip joint with sinuses of two and three years' duration, in which one had been operated on twice and the other once, and one case of tuberculous sacro-iliac synchondrosis with sinuses of one and a half years' duration.

Case I.—Referred to me by Dr. F. Fremont-Smith in August, 1907, in Bar Harbor, Me. A woman of 35 years, from whom I had removed a tuberculous right kidney in October, 1907, and the pelvic organs in December, 1907.* A persistent sinus existed from an old psoas abscess which was opened in 1902. No attempt was made to treat the sinus at the time of my operations. During the five years the sinus had existed it would frequently close,

* This case was reported in the *Therapeutic Gazette*, June 15, 1908, in a paper entitled "Nephroureterectomy for Tuberculosis."

causing great pain and requiring reopening which was always followed by a large discharge of pus.

In the summer of 1907 I diagnosed a tuberculous right kidney and proposed operation, which she accepted and went with me to Philadelphia. I removed a large tuberculous kidney and ureter and a month or so later was obliged to do a bilateral salpingohysteromyomectomy for symptoms which made me suspect tuberculous disease of these organs. I found chronic pelvic inflammatory disease and a fibrous uterus. The patient returned to Bar Harbor that winter, rapidly gained health and strength and began to earn her own living. The psoas abscess sinus, however, persisted, and upon my return to Bar Harbor in June, 1908, I proposed treatment with Beck's bismuth-vaseline paste.

The opening of the sinus was just above the middle of Poupart's ligament, on the right side. Between June 25 and October 24 she had 12 injections. From the time of the first injection the character of the discharge changed from a characteristic irritating purulent discharge to a mild, thin mucopurulent discharge, and it rapidly grew less in quantity. At first I was able to inject about 3 drachms of the paste and finally not more than 30 or 40 minims, until, at last, on September 24, it had closed completely and has remained so to present date. Before her operation in October, 1907, her weight was 117 pounds. In June, 1908, when I began treating the sinus, she weighed 142 pounds. During the summer and autumn she gained 10½ pounds. I made two radiographs during the course of injections. The first shows a single tract sinus extending to and pocketing around the base of the third lumbar vertebra, and the second a month later showing the same sinus but much narrower than at first, and the third a very narrow streak of bismuth along the tract but a pocket of paste on the left side of the body of the vertebra.

This was a very instructive case and the lesson I learned from it was that I made a mistake in attempting to keep the paste in the sinus after injection, by plugging the mouth of it with guaze and strapping it down. Dr. Beck has also come to the conclusion that better results are obtained by allowing the paste to escape into the dressing. I believe that fewer injections would have been required had I done so.

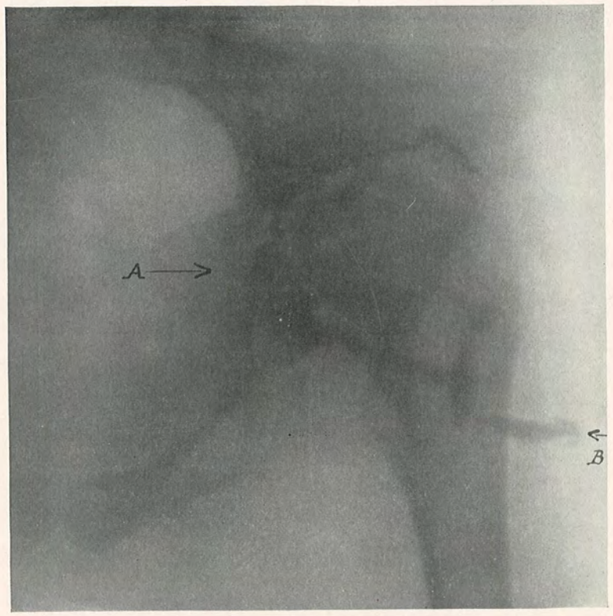
Case II.—A similar case of psoas abscess sinus in a man of 27 years which had persisted for three years. The radiograph showed a straight tract to the third lumbar vetrebra with a small pocket over the middle of its base. There were two bulging places and a widened place along the course of the tract. In this case I allowed the paste to drain into the dressings and noted that only a fraction of it escaped each time. After the fifth injection the sinus closed permanently. This case was treated in January, 1909, and has remained healed.

Case III.—Referred to me by Dr. F. Fremont-Smith of Bar Harbor, Me. The man was an expert blacksmith, 32 years old, employed in a large buckboard factory. He had first consulted Dr. Smith three years previously for bilateral, very much enlarged cervical and axillary glands suggesting Hodgkin's disease. After careful study the condition was considered tuberculous. Subsequently several of the glandular swellings were incised but no distinct abscess cavities were found. For two years he led an out-of-door life and was placed on a carefully regulated hygienic, dietetic and tonic course of treatment and for a long time took regulated doses of arsenauro with the result that all the swellings entirely disappeared and he returned to work. One year before he was referred to me, which was in July, 1908, he began to suffer pain in the left hip on exertion. In December, 1907, a swelling appeared over the lower spine and sacrum. It increased slowly for four months and then the abscess opened spontaneously. It was a diffuse swelling, the size of two hands. There was one large bunch on the left side of median line and two smaller ones on the right side. A large quantity of pus escaped and one sinus on the left side immediately above the sacro-iliac synchondrosis had persisted, discharging pus freely and requiring two or more changes of dressing daily. I had this pus examined bacteriologically and tubercle bacilli were found. Injection of the pus into guinea pigs also gave positive results. Upon examination I found a small sinus opening to left of the median line one inch above the sacrum, and in a similar position on the right side there was a small red area, almost ready to open spontaneously, which gave a sense of fluctuation. Pressure over this area and also to the left and below the sinus caused a discharge of pus from it.

I gave him the first injection on July 10, 1908, and was able

to introduce easily one ounce of the paste which caused a well marked bulging on both sides of the sacrum immediately below the opening of the sinus and also a smaller bulging below the red spot above referred to. There was distinct improvement in the character and amount of discharge from the first, and after the fifth injection there was very little purulent discharge all summer. As time went on I was able to introduce less and less of the paste. On August 22, after the twelfth injection, it was noted that there had been only very slight, thin, translucent, brownish stained serum for a long time. At this time the cavities took only one-half ounce of the paste. There was a general feeling of firmness in and around the cavities on both sides. The rounded, firmly elastic bunch on the left side felt firmer. The skin moved freely over it. On the left side the injection caused no bunching and the tissues around this area felt firm and contracted. At the time of the twenty-first injection, on October 2, 1908, I could introduce only 1½ drachms of the paste. There had been no discharge for several weeks. The patient had gained weight and strength and resumed his occupation. Through the greater part of the autumn and winter the sinus continued to discharge daily a very small amount of a thin cloudy serum, when suddenly one day there was quite a large discharge which he described as pus. He then consulted Dr. G. R. Higgins in whose care I had left him on my return to Philadelphia. Dr. Higgins gave him a few injections of the paste, and then upon the patient's request wrote to Dr. Beck and sent him to Chicago. He remained in Dr. Beck's hospital only a few weeks, where he received a few more injections with some improvement and was promised a cure. He, however, decided to return home when he continued to improve. When I returned to Bar Harbor in June, 1909, I found the sinus almost closed and was able to inject only a few minims of the paste. The area around the opposite red spot, however, was slightly soft and fluctuating. I opened it and squeezed out a few minims of occluded paste. The tissues below and around the old cavity areas were firm and contracted. The wound I made soon healed. I cauterized the opening of the old sinus which promptly closed and there has been no sign of trouble since. I believe the discharge he had in the winter was not pus but the remains of occluded paste, and this illustrates the wisdom of favoring the

FIG. 1.



Case V.—*A*, Anterior fistulous opening. *B*, Posterior fistulous opening.

escape of paste in such cases. It probably acts as an irritant if allowed to remain any length of time.

Case IV.—Tuberculous hip-joint disease with persisting sinus on outer aspect of left thigh of three years' duration, in a little girl of 8 years who had had two radical operations. This case was referred to me December 16, 1908. The radiograph showed a network of sinuses around the ankylosed joint and extending on to the sacrum and marked destruction of bone tissue and absorption around the head of the femur and the acetabulum. This case was given nine injections at intervals of four to seven days. She discarded her crutches after the third injection, her general health improved and she gained rapidly in weight. The sinus had closed February 8 and remained so until a short time ago. In August I received a letter from her mother stating the child had been feeling badly for a few weeks and the sinus had opened, discharging some of the paste and a small quantity of pus. She had two injections in December, 1909, and the sinuses now appear to be permanently closed.

Case V.—Tuberculous disease of hip-joint in a boy of 7 years, referred to me by Dr. F. L. Ober of North East Harbor, Me., on July 19, 1909, for a bismuth-vaseline radiograph for diagnostic purposes. There were two sinuses, one in the groin and the other posteriorly about two inches above the great trochanter. I injected both these sinuses under firm pressure and made the radiograph which I herewith present for your inspection (Fig. 1). It is very like the picture of the previous case and shows extensive disease around the head of the bone. In a letter dated September 9, 1909, the father says that the boy went to the Maine General Hospital in Portland in September, 1904, and the following year he was operated upon in the Bar Harbor Hospital. The wound has never healed properly and has been discharging more or less ever since. In 1906, another place was opened which has also not entirely healed. Since the injection of the paste there has been very little discharge of pus, only a slight moisture around the sinuses. His health has improved and he seems to be gaining weight and has given up the use of his crutches.

The technic and rules to be observed in making these injections are very simple. The paste consists of bismuth subni-

trate 33 per cent. and vaseline 67 per cent. The bismuth should be slowly stirred into the vaseline while hot, but not boiling. When cool this mixture forms a thick soft paste. Just before using, it should be heated and thoroughly stirred until it becomes thin enough to be drawn into a suitable syringe. Dr. Beck recommends a syringe which I show you. Care should be taken that no water should enter the sinus, which requires no treatment other than washing its orifice with 95 per cent. alcohol. It is not necessary to dry out the sinus with gauze. The nozzle of the syringe should be placed firmly against the opening and under moderate pressure the paste is slowly forced in until the patient begins to complain. A pledget of gauze is then placed against the opening and an ice bag applied for a short time. The patient should remain quiet for a few hours. An anæsthetic is not required as the injections are usually painless.

Various theories have been advanced to explain the results which follow this method. Beck believes that the action of bismuth subnitrate is bactericidal, chemotactic and astringent, and says that he investigated its bactericidal action by systematic examination of the secretions from suppurating sinuses while under treatment and invariably found a continuous decrease in the number of organisms and in many cases their final disappearance. Tubercle bacilli were no exception to the rule. He goes on to say: "Whether the bismuth destroys the bacilli by its chemical action or whether its presence acts as a chemotactic, we have not yet determined, although the evidence predominates that its chemotactic property accounts for the destruction of the micro-organisms." He also believes that the mechanical action of the bismuth paste is a prominent factor in the healing process. The diseased walls are separated, bringing them in contact with a substance in itself bactericidal and stimulating. Another factor is the well-known influence of the X-rays upon tuberculous disease in the presence of bismuth vaseline, but he admits that it can play only a secondary part in the healing, since excellent results have been obtained without the aid of the X-rays.

For obvious reasons this method is not applicable in cases of biliary or pancreatic fistulæ or in sinuses communicating with the cranial cavity or hollow viscera. There are cases in which the bismuth plug may by pressure on a vital organ produce unpleasant symptoms. Neighboring large veins may be so altered by the suppurative process as to permit the injection to break through the thin and diseased wall, and in this way enter the circulation, causing serious consequences. By animal experiments he demonstrated that the bismuth paste injected into the axilla caused death within two minutes, due to the entrance of the paste into the axillary vein, and finally blocking the branches of the pulmonary artery.

Toxic effects from the use of large quantities of the paste have been observed in a few cases. The symptoms are those of nitrite poisoning so well known to the röntgenologist in the early work of bismuth feeding and injections for diagnostic purposes. When used with a moderate degree of caution there is no danger. Injections up to 100 Grams of the 33 per cent. paste produce no toxic effect.

Among the important conclusions with which Beck closes his paper are the following: Tuberculous sinuses, fistulous tracts, abscess cavities, including empyema, can be cured by injecting them with a 33 per cent. bismuth-vaseline paste. The formation of sinuses and fistulous tracts may be prevented by opening cold abscesses, evacuating the fluid, and at once injecting a quantity (not exceeding 300 Grams) of 10 per cent. bismuth-vaseline paste and not sealing the opening. While these injections are effective in all suppurative sinuses and cavities, those of tuberculous origin respond to them more readily. This method of treatment is applicable to the suppurative accessory sinuses of the head.

Dr. G. G. Davis said that his first experience with regard to this method of treatment was caused by his trying Moorhoff's paste for caries of bones in which iodoform, spermaceti wax, and oil of sesame was used. He was not successful in getting primary healing, but they did so well that he used the iodoform wax injection in other tuberculous and discharging bone cases with

very satisfactory results. Since the report by Dr. Beck of his bismuth process he had used both substances. The results certainly are very good. Not very long ago he had several cases of discharging abscess in the wards of the Orthopædic Hospital; they were all cases of Pott's disease or coxalgia, and when he failed in other methods of treatment he had been able to cure them by means of these injections. If, for instance, in a psoas abscess, it does not heal after aspiration and injection of the iodoform emulsion, he does not hesitate to open, drain, and treat the resulting sinuses by means of bismuth injections. Likewise it is of use in osteomyelitic conditions, and has entirely revolutionized the treatment of these bony sinuses because from being the most intractable they are now frequently quite amenable to treatment. Of course, there are some failures.

As to the danger of poisoning, when it comes to coxalgias and ordinary bone cases usually there is not enough of the material used to render the danger of poisoning at all imminent, but when it comes to large cavities like empyemas, etc., in which the amount used has been very large, then the danger of poisoning is greater, and certainly deaths have occurred from it. If the symptoms of poisoning do develop it is recommended that a catheter be introduced into the sinus or wound, and hot olive oil injected, thereby liquefying the bismuth and removing it from the cavity immediately, thus preventing any further increase in the poisonous symptoms by further absorption.

Dr. John B. Shober, in closing, said, although the technic of this method is very simple, it will fail if not properly carried out. The paste should be as warm as can be borne, so that it will run easily, and sufficient force should be used to drive it throughout the entire network of the tract. Unless this is accomplished there will remain foci of disease, unreached by the paste, which will continue to cause trouble. The surgeon should himself make these injections and not leave it to the inexperienced hospital interne and never to the trained nurse.

TOURNIQUET FOR THE CONTROL OF HEMORRHAGE FROM THE SCALP DURING OSTEOPLASTIC RESECTION OF THE SKULL.

BY ALFRED C. WOOD, M.D.,

OF PHILADELPHIA,

Assistant Professor of Surgery, University of Pennsylvania; Surgeon to the Hospital of the University of Pennsylvania and to the Philadelphia, St. Timothy's and Howard Hospitals.

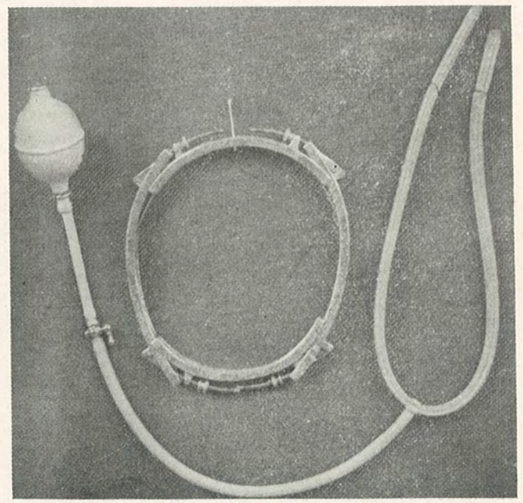
The scalp receives a larger supply of blood than any other portion of the skin of equal area. The arrangement of its vessels is peculiar. Running in the dense connective tissue layer, which, by its closely disposed perpendicular and oblique fibres, binds the skin firmly to the aponeurosis of the external oblique, they are unable to contract and retract when cut as do vessels under other conditions. These facts explain the free and persistent hemorrhage from wounds of the scalp. Under ordinary circumstances the difficulty is overcome by the application of sutures or pressure, or both.

The introduction of osteoplastic resection of the skull has given a fresh importance to the problem of bleeding from the scalp vessels. The incision, several inches in length, in many cases, and the operation being necessarily prolonged frequently, there is a loss of blood which is always serious, and may even be the cause of a fatal termination. In common with others, I presume, who have been engaged in this line of work, I have endeavored to find a satisfactory method of preventing this apparently unnecessary hemorrhage. The use of the elastic band never appealed to me. On account of the oval shape of the head, in order to be at all effective it must be applied so firmly that excessive pressure is made on the forehead and occiput, while in the temporal region, unless reinforced by inserting a pad under the band, it is insufficient

to control the vessels. The pressure forceps of Howzell and others are so much in the way of the steps that follow the scalp incision that they are but little used. I have not employed the interlocking mass suture of Heidenhain, nor the modification of Kredel, as neither seemed to me practical.

On account of the shape of the head, the irregularity of the outline of the fronto-occipital circumference of the skull, and especially in view of the receding temporal fossa, where pressure is especially important, as the base of the flap in almost all operations upon the cerebrum is at this point, an inflatable rubber tube appeared desirable. In order that the pressure might be uniform and not unduly localized to the forehead and occiput, the need of some form of external frame to form a resistance against which the tube could act was evident. Without the latter, the effect of the tube would practically be the same as the elastic tourniquet. With these thoughts in mind, I had constructed an inflatable rubber tube long enough to encircle the head and an adjustable metal band, into which the tube fits. At the centre of the inflatable tube is joined a piece of ordinary tubing through which the former may be distended. The band consists of four segments,—a frontal, an occipital and a right and left temporal—which, when joined together, have the outline of the fronto-occipital circumference of the skull, and, being adjustable, may be adapted to any head of ordinary size or shape. The temporal segments are 1.4 cm. ($^{9}/_{16}$ in.) and the frontal and occipital portions 1.6 cm. (about $\frac{5}{8}$ in.) in width; all are 0.6 cm. ($\frac{1}{4}$ in.) in thickness. The band is held together by hinged arms, upon which a thread has been cut, attached to the ends of the temporal sections and passing through eyes set on the ends of the frontal and occipital sections respectively. The size of the band is regulated by thumb-screws operating on the arms. The joints have been so constructed that the inflatable tube is fully supported in every possible adjustment of the band. At the middle of the frontal segment a hole is provided through which the inflating tube projects. Any other position may be chosen, but this seemed the most available. Inflation is secured

FIG. 1.

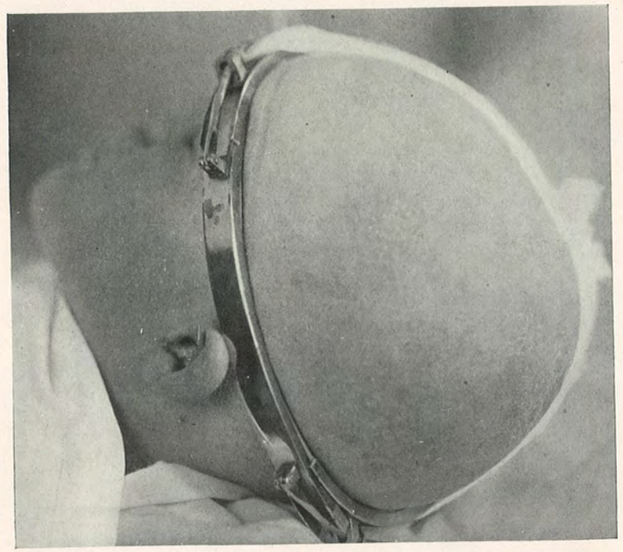


Showing the segmented metal head-band, inflatable rubber tube, inflating tube, 3-way cock, rubber inflating bulb (Wood).

FIG. 2.

Tourniquet applied. The bulb is placed on the chest for illustration. In use it is allowed to drop toward the floor.

FIG. 3.



Side view.

by means of an atomizer bulb, joined to the inflating tube by a three-way cock, by means of which the air is retained in the tourniquet or is instantly released. Instead of this cock, the air may be controlled by compressing the inflating tube by hæmostatic forceps. Both the tube and the metal band may be boiled, or immersed in the usual antiseptic solutions. In either case, it is desirable to clamp the open end of the tube in order to prevent water from entering.

To apply the tourniquet, (1) the head band is adjusted somewhat larger than the head; (2) the rubber tube is placed inside of the band; (3) a piece of gauze bandage, two inches wide, doubled upon itself so as to be one inch wide and a little more than three feet long, is carried across the head, the middle being about at the vertex, so placed as not to encroach upon the operative field; (4) the tourniquet is slipped on the head so that the frontal portion is in contact with the eyebrows and the posterior part just below the occipital protuberance; (5) the ends of the bandage are brought together and tied. The thumb-screws are then adjusted to make the metal band set closely to the head, but without causing pressure.

Directions as to those details connected with the application of the apparatus that must conform to a most rigid antiseptic technic have been purposely omitted, as each operator can best adapt these in accordance with his particular methods.

The tube is inflated by a rubber hand bulb which is advantageously operated by the anæsthetizer, although another assistant may attend to this detail. The exact amount of pressure necessary may be ascertained by placing a finger upon one of the branches of the temporal artery above the tourniquet. When the pulsation has ceased the proper tension has been obtained. Or it may be estimated with sufficient accuracy by noting the resistance to compression of the bulb. As the tube is inflated by the ordinary atomizer bulb, operated by hand, there is no danger of applying injurious pressure at any point. On the other hand, as the tube is equally supported throughout its circumference, the compression is uniform

at every point, however irregular the outline of the skull. In common with all other tourniquets that I have used, unless supported it has a tendency to roll over the eyebrows during the operative manipulations and rest on the eyes. This requires a re-adjustment, which is both time consuming and annoying. Hence the necessity of counteracting this tendency by a bandage carried across the head before the tourniquet is applied, as already described.

I have used an apparatus of this sort for several years, and in the present form for the past three years. When the tourniquet has been adjusted as above described, I have been able to complete the osteoplastic exposure of the brain with whatever other details were required without the necessity of clamping a single scalp vessel. I allow the bulb to remain attached to the tube during the operation, and if any oozing from the scalp is observed, the anæsthetizer is requested to compress the bulb once or twice, which is always effective in arresting the flow.

An objection to the use of the tourniquet in cases with severe intracranial pressure has been raised by Archibald, apparently on theoretical grounds. He thinks it possible that in such cases this circular compression might increase the cerebral pressure by preventing the escape of blood through the emissary veins to the scalp, thence to the jugulars, which it is believed may take place. I have employed this tourniquet in two cases showing extreme cerebral tension within a few months with entire satisfaction in every respect. However, this tourniquet is so constructed that the pressure is instantly released by turning the cock, and is almost as quickly restored by compressing the bulb. The inflation and deflation are not only accomplished quickly but also without the least disturbance of the patient's head, the surrounding aseptic sheets or even the progress of the operation. It is thus a very simple matter to interrupt the pressure from time to time, if the operator desires to do so.

My attention has been called recently to the fact that Cushing described in 1904 his pneumatic tourniquet. While I was

not familiar with his apparatus, I desire to give him full credit for priority. It may be noted, however, that this instrument is based upon a different principle.

The tourniquet above described is the only one with which I am familiar that provides a means of making uniform pressure throughout the entire circumference of the head, adapting itself to all irregularities of surface, and that does not make undue or injurious pressure at any point. As a means of controlling hemorrhage from the scalp incision during prolonged operations, I believe it will be found superior to any form of circular compression clamp or scalp suture so far devised.