STATED MEETING, MAY 1, 1905.

The President, HENRY R. WHARTON, M.D., in the Chair.

ACUTE GANGRENOUS APPENDICITIS IN TYPHOID FEVER SIMULATING PERFORATION.

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CARRIE C., aged twelve years, was admitted to the Medical Wards of the Presbyterian Hospital on March 6, 1905, under the care of Drs. Musser and Talley. Her history was as follows:

Family history negative. Previous medical history included a severe attack of diphtheria seven years ago. For two years she has suffered with attacks of what were called "indigestion," which were accompanied by vomiting and severe abdominal pain lasting for from several days to a week, and of increasing severity. In view of her subsequent history, their relation is of importance. About the middle of January she was observed to be very languid, had no appetite, and complained of pain in the head and back, sometimes also in the abdomen. She developed a cough, and the sputum was said to have been blood-tinged. For several days before admission she had been quite ill.

On admission her face was rather pale; tongue clean; lungs negative; heart, first sound not entirely clear, valvular sounds sharp; spleen palpable; a few rose spots on abdomen; abdomen soft, flat, and not tender. Temperature, 102° F.; respiration, 36; pulse, 112. Urine negative and normal.

For the next few days the temperature ranged from 100⅖° to 103⅗° F., with marked daily remissions. The diazo and Widal examinations were positive. The treatment consisted of liquid

diet, sponges, and hot mustard foot-baths for the control of fever. Whiskey, ℥ i q. d., was added on the 9th of March. So far the case had pursued the course of an ordinary typhoid of moderate severity. Abdominal symptoms of severity had been absent. There was no diarrhœa.

On the 9th of March the temperature reached 104⅘° F. at 11 P.M., and then began to drop after a sponge. At 5 P.M. of the 10th it was 103° F. Another sponge was given, bringing it down to 101⅘° F.; and at 8 A.M. it was 100⅗° F., an assisted drop of 4⅕ degrees in nine hours. In the meantime, however, at 6.30 A.M., she was suddenly seized by violent pain in the right side of the abdomen, extending from ribs to pelvis, and had a slight chill. The pain, which was paroxysmal, continued for about two hours, when she vomited, and had a bowel movement, after which she was more comfortable. The abdomen was not distended but slightly rigid, more so on the right than on the left side, and there was a point of marked tenderness in the right iliac fossa.

When seen at noon she was quiet, not complaining of spontaneous pain, tender over the abdomen on both sides, especially the right, with a rigidity also generalized, but most pronounced in the lower right quadrant, and increasing its area from hour to hour upward towards the costal region. At 11 A.M. the temperature was still as low as 101° F.; respirations, 48; pulse, 156, but of fair volume and strength. The facial expression was good. A leucocyte count made on the 8th, two days previous, showed 3600. Four hours after the onset of the pain, the count was 10,800. A diagnosis of perforation of the intestine was made from what seemed fairly typical symptoms. The sudden onset of pain, the vomiting, the increasing abdominal tenderness and rigidity, with a rising leucocyte count, and rapid pulse seemed to warrant such diagnosis. The drop in temperature was not as rapid or as extensive as is often seen in perforation. Vomiting had ceased, and pain was not complained of except on examination. Peritonitis, however, was evidently spreading.

The patient was operated upon eight hours after onset of pain. Ether anæsthesia. Lateral incision, outer border of right rectus. Much free cloudy fluid in peritoneal cavity. The ileum was hooked out and rapidly gone over upward and back again for perforation, but none was found. Mesenteric glands much enlarged. The appendix was then brought into view, seen to be

gangrenous in its distal portion, removed, and found to be perforated and containing a concretion. Free abdominal washing with salt solution brought much cloudy fluid from the pelvis. Tubular and gauze drainage was inserted in pelvis and loin space. The time of operation was twenty-five minutes, some time being lost in examining the ileum, and more consumed in careful washing.

At the conclusion of the operation the pulse was 180, but the patient soon reacted under free stimulation and hypodermoclysis. The temperature continued to decline until 4 A.M. of the following day, when it touched 98° F. Thereafter the surgical condition gave little anxiety. The wound did well, draining freely at first, later granulating slowly. Abdominal symptoms quickly ameliorated. The patient's general condition improved rapidly at first, and then continued typical of a typhoid infection. The temperature rose again and was 102⅗° F. on the evening of the second day after operation, and then ranged between 99° and 102° F. The pulse continued good under free stimulation. On the 18th the temperature touched 98⅗° F., and then declined to normal more rapidly. Fourteen days after operation it became and remained normal.

The appendix when examined was found to be much inflamed, gangrenous for about two-fifths of its length in the distal portion; the mucous membrane inflamed throughout, and with a large concretion incarcerated in the gangrenous tip. At this point there was a small perforation. No typhoid ulcers of mucous membrane. Cultures gave abundant staphylococci.

The influence of typhoid fever on the appendix, and the occurrence of inflammations of that organ during and after typhoid fever, have attracted considerable attention, especially during the last few years, and it seems to be well recognized that the appendix often shares with the intestine in the pathological lesions, although in a varying degree. Among the pathological lesions noted are swelling and rigidity of the organ, congestion, peritoneal exudate of fibrinous character, infiltration with cells typical of the typhoid process, various lesions of the mucous membrane of an inflammatory or ulcerative nature, from simple swelling to superficial, deep, and perforating ulcerations, and complete necrosis. In addition to

those cases of "typhoid appendicitis" in which such typhoid lesions are present, and in which the symptoms depend upon them alone, there seem to be one or more varieties of appendicitis which occur in the course of typhoid fever, in which the pathological process is practically identical with that observed in appendicitis occurring in the otherwise healthy individual. Kelly and Hurdon, in their book on the "Vermiform Appendix and its Diseases," have entered rather thoroughly into a study of the subject, and have attempted to classify the cases pathologically and clinically. In their pathological classification they make the folowing three types:

1. Those in which the appendix participates in the typhoid lesions.

2. Those in which a secondary infection with pyogenic organisms is engrafted upon the typhoid infection.

3. Those in which a simple appendicitis develops, the appendix not being involved in the typhoid infection, but in which it is probable that the attack is often precipitated by the congestion which accompanies it, without necessitating any specific typhoid lesions.

As to the frequency of these lesions, they add that the appendix is involved in one-third of all cases of typhoid fever, and that of the perforative cases there is a perforation in the appendix in 5 per cent. (Some statistics give a little higher, others a lower percentage than this.) They believe that the second class, viz., that due to typhoid lesions, associated with a secondary infection, furnishes a large proportion of the cases of acute perforative appendicitis occurring in typhoid fever. As to the third type, they cannot estimate its frequency, but point out the deleterious influence which the hyperæmia attending the disease might be expected to exert upon a kinked, stenosed, chronically inflamed organ, perhaps containing a concretion.

The clinical classification which Kelly and Hurdon make differs a little from the pathological classification. It is as follows:

First group. Accidentally associated appendicitis, or a rousing into activity of a latent or chronic inflammation by typhoid fever.

Second group. Appendicitis of mild or severe type arising from typhoid infection of the lymph-glands, or ulceration of the appendix.

Third group. Appendicitis following typhoid fever within such a brief time as to suggest strongly a chance relation.

Kelly's and Hurdon's studies have apparently led them to the belief that the large majority of cases so far reported have been cases in which the typhoid process has been the main feature in exciting the appendiceal inflammation. They have encountered no case in a child where the appendicitis has developed in the course of typhoid fever. In our case, the history of recurring attacks of a painful type of so-called "indigestion" within the last year, the appearance of the appendix at operation, the presence of a concretion, and the results of the examination by the pathologist, make it very probable that it was one of the chronic or relapsing variety roused into activity by the hyperæmic and favoring conditions of the enteric attack, but not depending for its origin on any special typhoid lesion.

The question of diagnosis is of some interest. This case was mistakenly diagnosed as one of typhoid perforation. Perforation it was, but of another type, and which would presumably be associated with its own peculiar train of symptoms. We have already described the symptoms present, and mentioned one or two in which it differed in degree or kind from those typical of perforation. The condition, however, called for operation as strongly as if an anatomically and pathologically correct location of the lesion and its character had been arrived at, information desirable to obtain beforehand where possible, but of infinitely less importance here than the procedure for its relief. We believe that the rapidity of the process in this case is exceptional, even for appendicitis in a child, in whom we know by recent studies that the process is

apt to be more rapid and more insidious than in adults. There is not usually much difficulty in distinguishing between appendicitis and perforation in typhoid fever, as Deaver emphasizes. As he states, the shock is not so great, the change in pulse-rate is not so rapid, the fall of temperature is infrequent, and the course when watched and not operated upon is not so rapidly to a fatal termination. In our case, there was a fall of temperature, but it came about the same time that the daily decline usually occurred, and it did not drop as suddenly nor go as low as the temperature usually does during perforation, and hence, while it was pronounced enough to invite further study, it lent one of the few doubtful features to an otherwise apparently clear case of perforation. In every other respect the distinguishing features between the two conditions, as cited by Deaver, would have lamentably failed.

The advisability of operating for appendicitis during the course of typhoid fever is one which naturally has the keenest interest for the surgeon. We often hear it stated in discussions on typhoid perforation that laparotomy is well borne in typhoid fever. But certainly since, and possibly before, Maurice Richardson pointed out the difficulty of diagnosing between some atypical cases of typhoid fever, especially at the beginning of the attack, and some cases of appendicitis, and the humiliation involved in a needless operation for the one, as well as the dangers of a delayed operation in the other, and since the same distinguished surgeon has asserted the truth of the statement that operations in typhoid fever, even those of themselves comparatively slight, have a high mortality, we find some of our most radical surgeons emphasizing the necessity of caution in this field. In the early stages of the disease operation is nearly always successful; but even here it may form a complication which later on will seem to be unfortunate. Hence it is that we find Kelly advising a waiting policy unless the symptoms are exceedingly urgent; Murphy counselling against operation unless perforation has taken place; and Deaver, in his latest word on the subject, saying that, while in the early stages the result of operation is nearly

always favorable, later the operation may be a serious complication, and even cause a fatal result. Hence he favors temporizing where possible where appendiceal inflammation develops after the third week is under way, and operation after recovery from the fever. Deaver strongly advises against operating during the height of the disease, except for pus or perforation, and quotes Harte's and Ashhurst's statistics of operation for typhoid appendicitis. Of twenty-six cases which they collected, seven died, the mortality being heaviest from the second week onward.

Dr. Richard H. Harte said every one recognizes the gravity of typhoid fever and also of appendicitis; when they occur together, the combination is most serious. At times it is impossible to differentiate between appendicitis and typhoid perforation. If the case is seen early and the course of the disease traced, then one may usually tell the difference, and also be able to operate early; this, however, the surgeon rarely has the chance to do. Symptoms in typhoid perforation are usually more marked, coming on with flash-like rapidity, while appendicitis is commonly more insidious. Both demand immediate operation. Concerning rules for waiting in these cases as quoted and endorsed by Dr. Jopson, Dr. Harte is not in accord. Waiting is a rather dangerous procedure. Marked irritation in the right iliac fossa developing during typhoid fever is often attributed to appendicitis, and the physician waits in the hope that these symptoms will subside. But if, instead of appendicitis, typhoid perforation has occurred, the abdomen should be opened immediately; every fifteen minutes means the loss of chances for saving the patient's life. Dr. Harte has noted that, in cases operated on immediately after perforation, the recovery rate is much greater than when intervention is deferred. For this reason a waiting policy possesses elements of danger. If appendicitis be actually present, the uncertainty is still greater. Hence, if during typhoid fever the diagnosis of appendicitis is made and the symptoms of perforation develop, the abdomen should be opened as soon as possible. Unless he misunderstood Dr. Jopson's quotation of Kelly's statements regarding the frequency of appendicitis in typhoid fever, Dr. Harte does not find them supported by his experience. He has operated in quite a large number of cases of typhoid fever, and does not consider appendicitis so frequent as some writers would lead one to believe. The surgeon cannot say absolutely that appendicitis is present during typhoid fever unless he operates. Dr. Harte has found very few instances of appendicitis among the cases of typhoid for which he has operated, although he and his colleagues at the Pennsylvania Hospital have operated for this condition during the course of typhoid. In thus speaking about operation, it is recognized that every operator knows the gravity of opening the abdomen of a typhoid patient, and desires to avoid it if possible. All the existing conditions are such as to render operation a very grave procedure. In twenty-six abdominal sections for typhoid perforation, Dr. Harte has made the error of operating in two cases when perforation was not present; fortunately, both patients recovered.

Dr. John H. Gibbon said that he had operated upon two cases of appendicitis during typhoid fever. In one case it could not be demonstrated that the condition was the result of typhoid ulceration of the appendix. In the other, however, there were three distinct typhoid ulcers of the appendix, one being at the base and completely occluding the lumen of the organ. It is thought that in this latter case there might have been no cause for operation had there been no obstruction of the appendix. The first case was operated upon for one of perforation, but in the second case it was not thought that a perforation was present, but the symptoms were sufficiently marked to warrant the opening of the abdomen. In the case reported by Dr. Jopson, a noticeable fact is that, although the temperature dropped, the pulse fell from 144 to 128, which does not usually take place in a perforation of the intestine. Dr. Gibbon believes that a differential diagnosis of appendicitis during typhoid fever and perforation of the bowel is extremely difficult, yet in the former condition the symptoms are never so sudden and severe as in the latter.

Dr. W. Joseph Hearn endorsed the statements of Dr. Harte regarding the need for early operation. If the general symptoms usually accompanying perforation are marked, whether they are due to typhoid perforation or gangrenous appendicitis, the sooner operation is performed the better it is for the pa-

tient. Dr. Hearn usually gives intravenous infusion of saline solution and then at once operates. In a proportion of cases this is successful, though he has also lost many cases. Operation will be successful if performed in time. The rule to be followed is not to wait.

Dr. Jopson, in closing, said the figures relating to involvement of the appendix during typhoid fever needed explanation. In 119 cases of typhoid reported from Boston and Baltimore, there was macroscopic evidence of involvement of the appendix in 19. The other statement that one-third of the cases was involved referred to the microscopic picture afforded by the appendix. As to the diagnosis of appendicitis from perforation, many cases of appendicitis come on early in the course of typhoid when irritation in the right iliac fossa is greater than can be attributed to the latter disease. Operation is then safest and intestinal perforation can be excluded because of the early stage of typhoid. Waiting at this time is also more justifiable than at any other. At this stage most mistakes in diagnosis are made. Differential diagnosis in cases such as the one reported is not necessary, even though desirable. There is no way of distinguishing the two conditions except by the preceding history, and even that is liable to lead to mistake as in this case, where symptoms of appendicitis came on as rapidly as they do in perforation during typhoid fever; gangrene and rupture seemed to be almost simultaneous with the pain. The age of the child and the generally bad condition of the intestine doubtless favored gangrene.

FRACTURE OF THE HEAD OF THE TIBIA.

Dr. Henry R. Wharton reported the case of a man, aged fifty-five years, who was admitted to the Presbyterian Hospital, June 24, 1902, having fallen from a bicycle and injured his left knee. When seen by the reporter, a few hours after his admission, the left knee and upper portion of the leg were swollen and painful. An examination revealed a fracture involving the outer portion of the head of the tibia. There was marked effusion into the knee-joint and adjacent bursæ. The patient suffered great pain, which seemed entirely out of proportion to the extent of the injury, and was probably due to the associated synovitis. He stated that when he fell from his bicycle he landed

upon the left foot, and his body was rotated, when he felt something give way in the region of the knee. An X-ray examination showed that there was a separation of the triangular piece of the outer portion of the head of the tibia, with upward and outward displacement of the fragment, necessarily involving the knee-joint.

The limb was placed in a long fracture-box and the region of the fracture was treated by the application of lint saturated with lead-water and laudanum, and after a few days, when the swelling to a certain extent had subsided, a plaster-of-Paris dressing was applied. This dressing was used for six weeks, and after this time the patient began to use his crutches, and at the end of ten weeks was able to walk with the aid of a cane. He had at first very limited motion of the knee-joint, but this improved with use, and finally he regained good use of the limb.

An examination of this case eighteen months after the injury showed that he walked well, but still had some impairment of joint motion at the knee. Extension was perfect, but he could not flex the knee beyond a right angle.

A second case was as follows: A baggage-master, in throwing a bundle of papers from his car while the train was upon a curve in rapid motion, was thrown from the car, striking upon both feet, receiving injuries of both legs which prevented him from rising from the ground. He was admitted to the Presbyterian Hospital, May 29, 1904, several days after the accident. An examination showed that the right leg and knee were greatly swollen; there was also marked swelling in the region of the left ankle. A fracture was located at the outer portion of the head of the right tibia. There was also marked effusion into the right knee-joint and adjacent bursæ. Great pain was complained of in the region of the knee, which was much increased by pressure and attempts to move the joint. An X-ray examination showed fracture of the outer portion of the head of the tibia, involving the joint; no injury of the bones could be discovered at the left ankle.

This patient was treated by a plaster-of-Paris bandage extending from the toes to the upper portion of the thigh. The patient left the hospital at the end of a month, still wearing the plaster-of-Paris dressing.

An examination of this case nine months after the accident

showed firm union in the fracture, but still some impairment of the joint motion in flexion. The patient, however, has a useful limb.

A third case of the same injury was as follows: A man, aged forty years, was admitted to the Presbyterian Hospital, February, 1905, having sustained an injury of the left leg in wrestling. He stated that he fell from a step a distance of a few feet and struck upon his left foot, his body twisting as he struck the ground, and he felt something tear in the region of the knee, and fell over helpless.

When seen by Dr. Wharton, a few hours after his admission, he was suffering intense pain in his left limb, which was very much swollen, and the knee-joint and adjacent bursæ were swollen and tense. An examination disclosed crepitus at the head of the tibia, near the knee-joint. An X-ray examination revealed fractures of the external portion of the head of the tibia and of the internal tubercle of the tibia, with involvement of the knee-joint, and upward and outward displacement of the external fragment of the tibia.

The limb was treated in a long fracture-box for a few days, with the application of lead-water and laudanum. For the first few days the pain was so great that morphine had to be freely used to give him any ease. At the end of this time, under anæsthesia, attempts were made by manipulation to press the displaced fragments inward and downward. The limb was then put up in a plaster-of-Paris bandage, including the foot, and extending to the upper portion of the thigh. The patient was more comfortable with this dressing, but suffered at times from severe attacks of pain, which he said came on suddenly, the pain radiating from the knee, up the thigh, and downward to the leg. These attacks were so severe at times that morphine was required.

At the end of seven weeks he was allowed to get up on crutches, but after being up for a day he noticed that the foot became hot, and presented a superficial, burning sensation. On inspection it was found that the toes on the dorsum of the foot were markedly discolored, and were hot and painful to the touch. Upon removing the plaster-of-Paris bandage, it was found that the redness extended well up upon the dorsum of the foot, and to some extent involved the skin over the ankle, the plantar surface

of the foot being neither painful nor discolored, and there was no swelling of the foot. There was no paralysis, the patient being able to flex and extend the foot. He also suffered from severe attacks of pain in the region of the fracture, which passed from the patella to the inner portion of the thigh and also the leg and foot. These paroxysmal attacks of pain were so severe that no relief could be obtained until morphine was given hypodermically.

From the distribution of the pain and the location of the trophic disturbances, it was thought that the external popliteal nerve was probably caught by the displaced fragment, or was pressed upon by callus, and after consultation with Dr. Willard, it was decided to expose the nerve for the relief of this condition. The patient was anæsthetized, and upon examination of the joint it was found that the knee could be flexed to a little more than a right angle. The nerve was then exposed by an incision, and the trunk laid bare for about three inches. It was found that it was not pressed upon by the fragment nor pinched by callus. The upper half of the exposed nerve was normal in appearance; the lower half, to a point where it passes over the peronæus longus muscle, was enlarged and of a deeper color, and the sheath was thickened and contained some reddish serum. The sheath was opened and the nerve was thoroughly stretched. The wound was closed and dressed, and the limb was placed in a posterior binder's-board gutter.

The pain after the operation was very slight, one dose of morphine only being required. The discoloration of the foot and ankle has gradually diminished, and at the time of the report, more than two weeks after the operation, the foot has resumed its natural color.

Dr. Wharton remarked that fractures of the head of the tibia involving the articular surface present several points of interest. First, as regards the mechanism of these fractures. As far as he could learn, they usually result from a fall upon the foot, in which there is a rotation of the body, with twisting of the knee. Another point of interest is the extreme pain accompanying these fractures, probably due, in fractures involving the external tubercle, to injury of the external popliteal nerve and the rapid effusion which occurs into the knee-joint and adjacent bursæ. The pain and trophic disturbances may occur immedi-

ately upon the reception of the injury from injury of the nerve at the time, or may follow later from pressure upon the nerve by a displacement of the fragment, or by callus. In the last case reported, it is interesting to note that the trophic disturbance seemed to be confined to the distribution of the musculocutaneous nerve rather than to that of the anterior tibial nerve, as there was at no time paralysis resulting in foot-drop. Stimson states that fractures of the head of the tibia are slow in repair, and quotes seven cases recorded by Poncet in which the average time of union was about four months.

Restoration of function after these fractures is seldom complete, the occurrence of synovitis and arthritis, with backward displacement of the fragment, interfering with the normal joint motions of the knee. Extension is usually normal, but there is generally more or less interference with complete flexion of the joint. Repair is probably much less prompt than in fractures involving other portions of the tibia.

Dr. John H. Jopson briefly described a case now under his care which corresponds very closely to those reported by Dr. Wharton. The patient is a railroad man, who, while superintending the shifting of cars in the dark, stepped out of a door, six feet from the ground, in the direction the train was moving. He lighted on his feet on loose ballast, and one leg immediately went from under him; there was severe pain in the knee and inability to rise. The mechanism evidently consisted in turning and twisting the leg at the time it struck the ground with considerable force. There was effusion of blood into the joint and underneath the bursa of the quadriceps. When seen several hours later, the patient still complained of severe pain, and there was tenderness over the knee, especially on the outer side. Crepitation could not be elicited, and there was neither shortening nor irregularity. The condition was thought to be laceration of the lateral ligament, but a week later the X-ray showed a small oblique fracture of the outer part of the head of the tibia running down from the joint, and thus splitting off a fragment of the bone. Pain in the knee persisted for three or four weeks until a final immobilization with plaster-of-Paris dressing. Now, at the end of six weeks, there is no pain, and the patient appears to be doing well; the final result cannot of course be predicted.

SUTURE OF THE FEMORAL ARTERY.

Dr. Edward Martin reported the case of a man, twenty-three years old, who was admitted to the University Hospital, May 18, with a history of having been wounded the day before by a piece of steel chipped off from a side set by the blow of a ten-pound hammer. There was an immediate profuse bleeding, the blood spurting to a distance of two inches. This was controlled by means of a tourniquet. There was found a wound about half an inch in length at the junction of the middle and lower third of the left thigh directly over the course of the femoral artery. On the removal of the tourniquet there was no further bleeding; the wound was thoroughly cleansed and a sterile pad was held in place by means of a tight bandage. During the night there was a moderate degree of oozing, and examination the following day showed a tumor about the size of a man's fist, fusiform in shape, giving an expansile pulsation and a harsh bruit. Popliteal and tibial pulsations were absent. A tourniquet was applied at the level of the perineum and a 17-centimetre incision was made with its centre of the wound of entrance. On opening the deep fascia a large thrombus was found, to the outer side of which lay a small jagged piece of steel. There was in the anterior surface of the femoral artery a ragged wound 2 centimetres in length opening into the lumen of the vessel. The artery was freed above and below and a loop of large gut was thrown about it in each position. The tourniquet was then removed, bleeding being controlled by traction upon the loops, which also rendered the vessel more accessible to suture. Fine curved-faced needle had No. 0 chromicized gut and No. 8 silk were employed for the sutures, five of which were applied. On relieving tension, there was a spurt of blood at the most ragged part of the wound, requiring the insertion of a sixth suture. On removal of the traction ligatures the artery pulsated below. The fascia was sewn above it with chromicized gut sutures. Drainage was inserted, since it was quite certain that the wound had been infected by the foreign body. The external wound was closed. The patient made an uninterrupted convalescence, pulsation being detected in the popliteal artery on the following day, and remaining thereafter.

Dr. Martin said that the interest attaching to cases such as this is incident to the fact that the opportunity of suturing a

large artery rarely occurs in the course of surgical practice, since such wounds when accidentally inflicted are in themselves unusual, and when they do occur are likely to be attended by bleeding so profuse as to be fatal before aid can be rendered.

Although medical literature contains a number of instances of attempts at sewing both arteries and veins, Murphy was the first to thoroughly popularize the method by a series of brilliant experiments, and, finally, by a clinical experience which still remains the most striking practical demonstration of the practical utility of the method. The common femoral artery had been almost completely severed by a bullet. This vessel was resected, and the proximal end was invaginated into the distal for a distance of one-third of an inch by means of four double-threaded needles which penetrated all the coats of the artery. A row of sutures was then placed around the distal end, penetrating only the media of the proximal portion, after which the adventitia was drawn over the line of union and sutured. A wound of the vein inflicted at the same time was also sutured. Convalescence was uninterrupted, the patient making a complete recovery.

In the experimental work on this subject, there has been more or less insistence upon the need of avoiding the intima in the placing of sutures. This, however, seems to have no bearing upon the formation of clot, which is always possible, and which, perhaps, in the majority of cases may be expected, though Dörfler, in a collection of forty-three experimental cases in which the intima was included in the suture, noticed that there was thrombosis in but five.

Brewer, in attempting to close a wound in the femoral artery, noted that the sutures tore out, and was led to a suggestion which has been attended with considerable success, namely, the application of rubber adhesive plaster about the vessel, the outer wall of which is previously dried by swabbing with ether. Experimentally, this method served admirably, though it is noteworthy that thrombosis occurred at times.

In the application of sutures to a wounded artery, the needles should be round, pointed ones, and of such diameter that the thread which they carry fills the holes made by them. The immediate bleeding of the suture points is overcome by the use of catgut, though silk is the suture material of choice. No effort should be made to avoid the intima, though the inclusion of this

coat in the suture does not add materially to the strength of the union. In attempting to prevent the entrance of the needle into the lumen of an artery, there is danger that the tough media may not be included, and thus the line of union may almost immediately tear out from the effect of blood-pressure. For a partial cut or tear the continuous suture is preferable.

The likelihood of thrombosis is in direct proportion to the amount of damage done to the intima, hence the artery should be handled gently, and the least possible mechanical interference compatible with its proper stripping and exposure, and the application of the suture should be the rule. Infection is almost certainly followed by thrombus, and of course exposes the patient to the danger of secondary hæmorrhage. Of this, however, there is now little fear. The line of suture should be reinforced by stitching the adventitia closely about the artery, and moreover additional support should be given by a suture of the overlying soft parts.

For end-to-end closure the invagination method of Murphy has proven successful. Its application is also easy.

Perhaps the most surprising feature of these artery sutures is the fact that there has been no case of aneurism yet reported, though more than two dozen clinical cases are on record. There are comparatively few positions in which such a procedure as suture of an artery is absolutely essential. In all the smaller vessels complete ligature would be the method of choice. When the carotid artery is wounded, its ligation is so often followed by secondary cerebral degeneration that an attempt at suture is clearly indicated. The common femoral is also a vessel which should be sutured, though even in this case, providing the vein remains intact, the danger of gangrene is comparatively slight. The abdominal aorta is essentially a vessel fitted for suture in case of wound. Theoretically, at least, a suture or invagination of the renal artery, or of the superior mesenteric, may at times be feasible, or in the latter case even the implantation of the divided end of the vessel into the aorta. The possibility of closing a wound of the artery also suggests for consideration the desirability of opening these vessels in cases of threatened embolic gangrene.

Dr. Francis T. Stewart reported the case of a man, aged thirty years, who was struck on the inner side of the right thigh

by a small piece of steel, which penetrated the tissues, leaving a slit-like opening in the skin about one-fourth of an inch long. When admitted to the Germantown Hospital shortly afterwards, there was still considerable bleeding, although a tight bandage had been wound around the limb. When Dr. Stewart saw the patient the following day there was no bleeding and no swelling of the thigh. Several X-ray pictures failed to locate the piece of steel. Eight days after the accident, during the night, the patient was awakened by severe pain in the region of the wound. The thigh rapidly swelled, and pulsation soon became evident both to the eye and to the hand. There was no external bleeding, no thrill, and no bruit. Pulsation could be felt in the anterior and posterior tibial arteries. Twelve hours later a long skin incision was made along the course of the femoral vessels. The upper end of this incision was deepened until the femoral artery could be compressed between the fingers of an assistant. The artery was then traced downward to the middle of Hunter's canal, where a ragged opening about one-eighth of an inch in diameter was found. The artery was then grasped distal to the wound by the second hand of the assistant, and the wound was closed by a continuous silk suture penetrating all the coats of the vessel, an intestinal needle being employed. A second continuous suture of silk involving the sheath of the vessel was applied for a reinforcement. No leakage being detected after the removal of compression, the muscles were sutured with catgut and the skin closed with silkworm gut, drainage being omitted, although the tissues were extensively infiltrated with blood. The leg was maintained in an elevated position for two weeks. The wound healed without infection. The anterior and posterior tibials pulsated with undiminished force from the time of the operation until the patient left the hospital.

Dr. Stewart added that it was interesting to note that in 1759 Hollowell successfully closed a wound in a brachial artery following venesection by passing a needle through the lips of the wound and tying a silk ligature beneath the needle. In 1762, Lembert proposed arterial suture and experimented on the horse. Following this, however, repeated experiments on animals seem to demonstrate that uncontrollable bleeding from the stitch-holes would occur, that a thrombus would form at the point of suture, or that sepsis and secondary hæmorrhage would follow. It was

also feared that an aneurism might develop at the line of suture, or that a clot embolus might be washed into the circulation. In 1889, Jassinowsky showed by a large number of experiments on dogs and calves that these accidents were not to be feared. Most operators have followed his plan of operation, which is as follows: Control of the circulation. Isolate artery and push the sheath back. Suture the media and adventitia with interrupted sutures of fine silk. Take off the clamps with simultaneous compression of the vessel wound. Sew the sheath, then the fascia, then the skin. The continuous suture is believed to be preferable because of its rapidity, and because there is no tendency towards leakage between the points of insertion; and that a suture involving all the coats of the artery is preferable, because it is easier to apply and much more sure to hold. Hubbard (*Boston Medical and Surgical Journal*, vol. xlvi, 1902), in an article in which he collects twenty cases of arterial suture, states that in five cases a suture involving all the coats was successfully employed, and quotes Dörfler, who demonstrated experimentally that a suture passing through the intima would neither cause bleeding nor thrombosis.

Dr. Richard H. Harte advised trial of suture in case of wound of the femoral or of any other large artery; if this fails, ligation can later be performed. He had seen a hospital resident wound the iliac artery with a Hagedorn needle while assisting at an operation for hernia. Hæmorrhage was profuse, the blood spurting a distance of eighteen inches. Dr. Harte exposed the vessel at once and sutured it with silk. The man did well, the case, of course, being much more favorable than was that of Dr. Martin's. Some weeks later the man died from another condition, and inspection of the wound showed that repair of the vessel was perfectly satisfactory. Hence he would not hesitate to suture a vessel, as he believes this to be good surgery. The opportunity seldom presents, but when it does, it should be met by suturing.

Dr. De Forest Willard said that Dr. Brewer's work upon the suture of arteries is a most valuable contribution. Although wrapping the vessel with rubber tissue introduces into the body a foreign element, yet Brewer's reports are very satisfactory. Dr. Dorrance, of the University of Pennsylvania, is now conducting experiments for Dr. Willard, employing, instead of rub-

ber tissue, flaps of fascia to enclose and support the wounded vessel. It is yet too early to draw conclusions, but present indications are that this method will prove of value. By this means it may be possible to succeed in closing vessels whose walls are not strong enough to hold the sutures or the edges of which are too ragged to approximate. The fascia is, of course, left with a base of attachment to preserve its vitality.

Dr. Martin, in closing, emphasized the facts that a growing clinical experience has failed to demonstrate a single case of aneurism following suture of the large arteries. The absence of secondary hæmorrhage and diffuse traumatic aneurism is equally astonishing. It still remains to be proven that in the human either partial or complete wounds can be sewn with an absolute assurance against thrombus, and it is doubtless true that in many of the successful cases reported thrombi formed. However, the possibility of opening even the largest vessels, such as the aorta, and closing them again with safety, suggests a variety of forms of intra-arterial surgical interference, particularly in the direction of preventing gangrene in cases of embolic plugging. Indeed, this has been once attempted because of threatened gangrene of the leg. It is conceivable that an extraordinarily prescient surgeon might thus relieve one suffering from the early stages of mesenteric embolus.

A NEW METHOD FOR IMMEDIATE ENTEROSTOMY.

Dr. Francis T. Stewart said that in cases of enterostomy in which immediate opening of the intestine is mandatory, there is considerable risk of infection of the peritoneal cavity by fæcal contamination. The packing of gauze around the loop about to be opened sometimes averts this danger. Careful suturing of the bowel is an expedient which may succeed, but in cases in which the intestinal wall is stretched and thinned by marked distention it is practically impossible to insert a needle in the bowel wall without entering the lumen and causing leakage. Up to the present time the Paul's tube or one of its modifications has been the best means for safely draining the intestine in these cases. During the past winter he had employed the following method in three cases, two of which died shortly after operation. After opening the abdomen, the desired loop of bowel is drawn into the wound and emptied of its contents by a gentle milking process. A clamp is then placed at either extremity of the loop to prevent the reflux of fæces into it, and the whole is surrounded by gauze packing. One-half of a Murphy button is inserted into the empty loop of the intestine through a small incision, and the other half is squeezed into the end of a long rubber tube whose caliber is slightly smaller than that of the flange of the button, thus making a tight joint. The two halves of the button are then pressed together, or, in other words, a lateral implantation is made between the rubber tube and the bowel. The clamps are now removed and the fæces allowed to drain through the rubber tube into a receptacle on the floor. Whether a bar has previously been placed beneath the bowel or not, the intestine should be securely fastened to the margins of the wound by sutures in order to prevent the prolapse of any additional coils of intestine; with a collapsed bowel, the sutures may be introduced without fear of leakage. By this method an absolutely air-tight joint is made between the bowel and the rubber tube, so that the intestine is drained without the slightest possibility of infection of the peritoneal cavity. By the time the button has sloughed through the bowel (at the end of the third day in his surviving case), adhesions will have effectually closed the peritoneal cavity. The dressing need not be distended until the button comes loose.

VOLVULUS OF THE OMENTUM.

Dr. Francis T. Stewart said that in a paper read before the College of Physicians, November, 1903, he reported a case of torsion of the omentum, and appended an abstract of eight other cases. Since then, Rudolph (*Wiener klin. Rundshau*, 1903, Nos. 44–47) has collected twenty-nine cases, of which twenty-three were intra-abdominal. He states that in one case only was the exact diagnosis made before operation. Sonnenburg (*Arch. Internat. de Chirurgie*, vol. i, fasc. 1), Noble (*American Journal of Obstetrics*, 1904, vol. xlix), and Scudder (Annals of Surgery, December, 1904), have also reported cases. These, together with the present case, make thirty-three thus far reported. A hernia was found in all cases except five. He now was able to report a second case. The patient was a policeman, aged thirty-four years, and weighing 250 pounds, who entered Professor Keen's service in the Jefferson Hospital, April 8, 1905.

Up until three years ago he was in the best of health; every few months since that time he would experience a sharp attack of indigestion, with severe pain in the abdomen. For the past fifteen years he has had a reducible inguinal hernia about the size of a lemon on the right side, which has never bothered him, and for which he has never worn a truss. Just after breakfast, the day preceding admission to the hospital, he felt one of his attacks approaching, the pain, however, being more severe than usual. On admission to the hospital there was severe abdominal pain, especially on the right side. The greatest point of tenderness was just below and to the right of the umbilicus, rigidity of the abdominal muscles was general, but especially marked on the right side. Owing to the thickness of the belly-wall and to the rigidity of the muscles, no mass could be felt, although the right side seemed to be slightly more prominent than the left. The hernial sac was empty. The temperature was 98.5° F.; pulse, 90; respirations, 20; there had been no vomiting; the bowels had moved the previous day. A diagnosis of acute appendicitis was made and the abdomen opened thirty hours after the onset of pain. After some difficulty, the appendix was found between the layers of the mesocolon and excised. It measured six inches in length and, except for several ecchymotic spots in the mucous membrane, was normal. A further search of the abdomen brought to light a mass of omentum, dark red in color, much harder than normal, and evidently in the first stage of gangrene. On pulling the omentum from the abdominal cavity, a twist consisting of three complete turns from the patient's right to left was found just below the transverse colon. After amputation, the spread-out mass measured twelve inches longitudinally and fifteen inches transversely, and weighed one and one-half pounds. At its free edge the omentum presented five large pockets, due to a folding over of the edge with subsequent adhesions. The abdomen was closed without drainage, and the patient made an uninterrupted recovery.

STATED MEETING, JUNE 5, 1905.

The President, HENRY R. WHARTON, M.D., in the Chair.

SILVER PLATE AND SCREW FIXATION IN FRACTURES OF THE TIBIA.

DR. JOHN H. JOPSON showed a boy in whom he had treated a compound fracture of the tibia by primary fixation of the fragments by means of Halsted's silver splint and screws. The wound had healed with the splint *in situ*, and the result was a perfect one as far as the fracture was concerned. There were certain advantages of the splint and screws over silver wire in the primary fixation of recent fractures which Dr. Jopson thought were sometimes overlooked. In the present case, operation was demanded in the first place because of the difficulty of reduction of an oblique fracture of the tibia complicated by a small wound. The broken ends had rotated in opposite directions. After incision, reduction was satisfactorily accomplished. To have now drilled and wired the fragments would have required much more manipulation and traumatism than the use of the splint and screws, which were easily applied without disturbing the relations of the bone in the wound, and which held the fragments firmly in apposition. Union took place as rapidly as in a simple fracture. Steel screws were used, as silver ones were not at hand. Nearly three months have elapsed since operation, and while the wound is still solid, there is a little tenderness and swelling of recent development at the site of the splint, which probably means that it will require removal.

DR. JOHN B. ROBERTS said that this method had been for years a favorite with Dr. L. W. Steinbach, with whom he was associated at the Polyclinic Hospital. The expedient was uniformly successful in holding together the fragments, but he thought that lately Dr. Steinbach is not so enthusiastic regarding its use. He finds that some of the cases are followed by suppu-