TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, February 7, 1898.

The President, J. EWING MEARS, M.D., in the Chair.

A CASE OF HARA-KIRI WHICH TERMINATED IN RECOVERY.

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THE case herewith reported illustrates almost perfectly the horrible act of self-destruction called hara-kiri, which has been practised by the Japanese *Samurai*, or gentlemen of the military class, for centuries; and than which probably nothing shows more strongly the force of education. The *Samurai* from his earliest years is taught to look on hara-kiri as a ceremony in which he may be called to play a part as principal or second. In the families which cling to the traditions of ancient chivalry the child is instructed in the rite and familiarized with the idea as an honorable expiation of crime and blotting out of disgrace. If the hour comes, he is prepared for it, and bravely faces the ordeal which early training has robbed of half its terrors.

The ceremonies observed at hara-kiri are many; and the greatest consideration is shown for the feelings of the principal. None but his friends and the high officers of the court are permitted to be present. For a long time after the revolt against the Tycoon the rite was a daily occurrence in the prison at Yeddo. The victim is placed on a low platform, or *jisaiba*. This is surrounded by a canvas screen, for

none of the lower grade officers in attendance are permitted to be spectators. The condemned man is attired in the dress of ceremony, wearing his wings of hempen cloth. He is seated on a rug in the Japanese position, with two *kaishaku* on either side. The *kaishaku* on the left side announces his name and surname, and says, bowing, "I have the honor to act as *kaishaku* to you. Have you any last wish to confide to me?" The condemned man accepts the offer or not, as the case may be. He then bows to the sheriff, and a dirk, nine and a half inches long, wrapped in white paper, is placed on a stand such as is used for offerings in temples. He takes the dirk and stabs himself on the left side below the navel, drawing the knife across to the right side. As he falls forward, the *kaishaku* on the left side cuts off his head with a single stroke of his sword. The *kaishaku* on the right takes up the head and shows it to the sheriff. The body is then given to the friends for burial. In most cases the property of the deceased is confiscated.

The ceremony observed at hara-kiri appears to vary slightly in detail in different parts of Japan. In all cases, however, where the criminal disembowels himself without condemnation and without investigation, the offence is considered not proven, and the property is not confiscated, because he is no longer able to defend himself.

The following graphic description of the ceremony, as witnessed by Mr. Milford, Secretary to His Majesty's Legation, Japan, serves to illustrate the pomp and ceremony observed on the occasion:

"The ceremony, which was ordered by the Mikado himself, took place at 10.30 o'clock at night in the temple of Seigukuji, the head-quarters of the Satsuma troops at Hiogo. The victim had been convicted of ordering the troops to fire on the foreigners at Kôbê. A witness was sent from each of the foreign legations,—seven in all. After some little delay, the guests were invited to follow the Japanese officers into the main hall of the temple, where the ceremony was to be performed. From the high ceiling hung

a profusion of large gilt lamps and ornaments peculiar to Buddhist temples. In front of a high altar the floor was covered with beautiful white mats; on a low platform, raised three or four inches from the ground, was laid a rug of scarlet felt. Tall candles placed at regular intervals shed a dim, misty light, just sufficient to let all the proceedings be seen. The seven Japanese took their places on the left of the raised floor and the seven foreigners on the right.

"After a few minutes of delay, a stalwart man, thirty-two years of age, with a noble air, walked into the hall, attired in his dress of ceremony, with the hempen cloth wings which are worn on great occasions. He was accompanied by a *kaishaku* and three officers. (The office of *kaishaku*, or executioner, is that of a gentleman, and is in many cases performed by a kinsman or friend of the condemned man; and the relation between them is rather that of principal and second than that of victim and executioner. In this instance the *kaishaku* was a pupil of the victim, and was selected by his friends from among their own number for his skill in swordmanship.) With the *kaishaku* on his left, the condemned man advanced slowly towards the Japanese witnesses, and the two bowed before them. Then drawing near to the foreigners, they saluted in the same way. Slowly, and with great dignity, the victim mounted the raised floor, prostrated himself before the altar twice, and seated himself in the Japanese fashion (knees and toes touching the ground, and the body resting on the heels,—always a position of respect) on the felt carpet, with his back to the altar and the *kaishaku* crouching at his left side. One of the three attendant officers came forward bearing a stand of the kind used in temples for offerings, on which, wrapped in paper, lay the short sword, or dirk, of the Japanese, with a point and edge sharp as a razor. This he handed, prostrating himself, to the condemned man, who received it reverently, raising it to his head with both hands, and placed it in front of himself. After another obeisance, he said, in a clear voice, betraying no sign of fear or emotion, 'I, and I alone, un-

warrantedly gave the order to fire on the foreigners at Kôbê, and again as they tried to escape. For this crime I disembowel myself. I beg you who are present to do me the honor of witnessing the act.'

"Bowing once more, he permitted his garments to slip to his girdle and remained naked to the waist. Carefullv, according to the custom, he tucked his sleeve under his knee to prevent himself from falling backward, for a noble Japanese gentleman should die falling forward. Deliberately, and with a steady hand, he took the dirk that lay before him, and looking at it wistfully, almost affectionately, for a moment, he seemed to collect his thoughts for the last time; then stabbing himself deeply below the waist on the left side, he drew it slowly across to the right side, and turning the knife in the wound, he gave a slight cut upward. During this operation he never moved a muscle of his face. Finally, drawing out the dirk, he leaned forward and stretched out his neck. At that moment the *kaishaku*, still crouching by his side, sprang to his feet, poised his sword for a second in the air, and with one blow the head was severed from the body. The *kaishaku* in dead silence made a low bow, wiped his sword, and retired from the raised floor. The stained dirk was solemnly borne away as proof of the execution."

There are many records of the extraordinary heroism displayed in hara-kiri. When, for example, the Tycoon, defeated and determined to fight no more but to yield everything, had fled to Yeddo, a member of his council came to him and said, "Sir, the only way in which you can now retain (?) the honor of the family of Tokugewa is to disembowel yourself. To prove to you that I am sincere and disinterested in what I say, I am here, ready to disembowel myself with you." The Tycoon, flying into a rage, said that he would listen to no such nonsense and left the room. But his faithful follower, to prove his honesty, thereupon retired to another part of the castle and solemnly performed the hara-kiri.

Three months before his admission to the Pennsylvania

Hospital, Henry H., aged forty years, butcher by occupation, because of the loss of eyesight, became very depressed, so that his friends became apprehensive about him, and rarely permitted him to remain alone. He succeeded, however, in stealing a small butcher's knife from the block, concealed it in his clothing, and walked quietly into the yard, where he deliberately thrust the knife into his abdomen on the left side, and drew it across to a corresponding point on the opposite side, severing all the parietal integument and allowing a large amount of the viscera to escape. He was presently discovered standing in the yard holding a large loop of intestine in his hand, which he exhibited with a tragic air, asking, "What do you think of that?" He was immediately seized by two men, placed in the bottom of an express wagon which was standing in front of the house, and driven to the Pennsylvania Hospital. No time was lost in sending for the attending surgeon, as I happened to be in the Receiving Ward on his arrival. While an anæsthetic was being administered, his clothing was removed, and the protruding mass of bowels was kept covered with hot, wet towels. After the patient was prepared so that a careful examination could be made, it was found that a large transverse wound, eight to nine inches in length, had been made in the abdominal wall, on a line just above the umbilicus, the knife having entered a point corresponding to the left nipple-line and passed across to a corresponding point in the opposite side. From the wound were found protruding the transverse colon, omentum, and a large mass of small intestines, a portion of which, about fifteen inches in length, had been severed from its mesenteric attachment and stripped of its peritoneal covering. In addition to this mutilation, the entire protruding mass of intestine had become soiled from contact with clothing and dust from the bottom of the wagon in which the patient had been conveyed. In order to control the hæmorrhage, the wound was enlarged by an incision in the median line, which enabled me to remove some clots and secure some large mesenteric branches which were bleeding

within the abdominal cavity. After a thorough cleansing with hot distilled water, the intestinal mass was replaced within the abdomen, with the exception of that part of the ileum which had been severed from its mesenteric attachment. About eighteen inches of this injured bowel were resected, care being taken to excise well within the edge of healthy omentum and uninjured intestine, so that the bowel could be accurately approximated, which was done by means of Murphy's button, making an end-to-end anastomosis. The edge of the cut mesentery was accurately approximated on both sides with continuous catgut sutures. During the manipulation all exposed portions of the intestine were protected with towels, which were kept wet with hot sterile water. After another thorough douching and washing out of the abdomen with hot water the abdomen was closed, first by the introduction into the peritoneum of a continuous catgut suture, after which deep retaining stitches of silkworm gut were passed through all integument down to the peritoneum. These were left intact until all the other planes of tissue were accurately approximated with catgut sutures. Lastly, the deep retaining stitches were tied, thus giving much additional support to the wound. Just before the final closing of the wound a "two-way" glass drainage-tube was introduced into the lower part of the vertical incision. The usual antiseptic dressing was applied.

The patient's condition during the operation was fairly good, showing little evidence of shock. The after-treatment varied little from the usual methods pursued in dealing with abdominal operations, by the withdrawal of all food, depending for the first forty-eight hours entirely upon rectal alimentation; then the administration of small quantities of peptonized milk by the mouth, in drachm doses. The tube was flushed hourly for the first day, and afterwards every two hours. It was removed on the second day at the dressing of the wound, which was perfectly clean. On the fourth day the patient had four slight bowel movements.

On the seventh day the wound and temperature showed

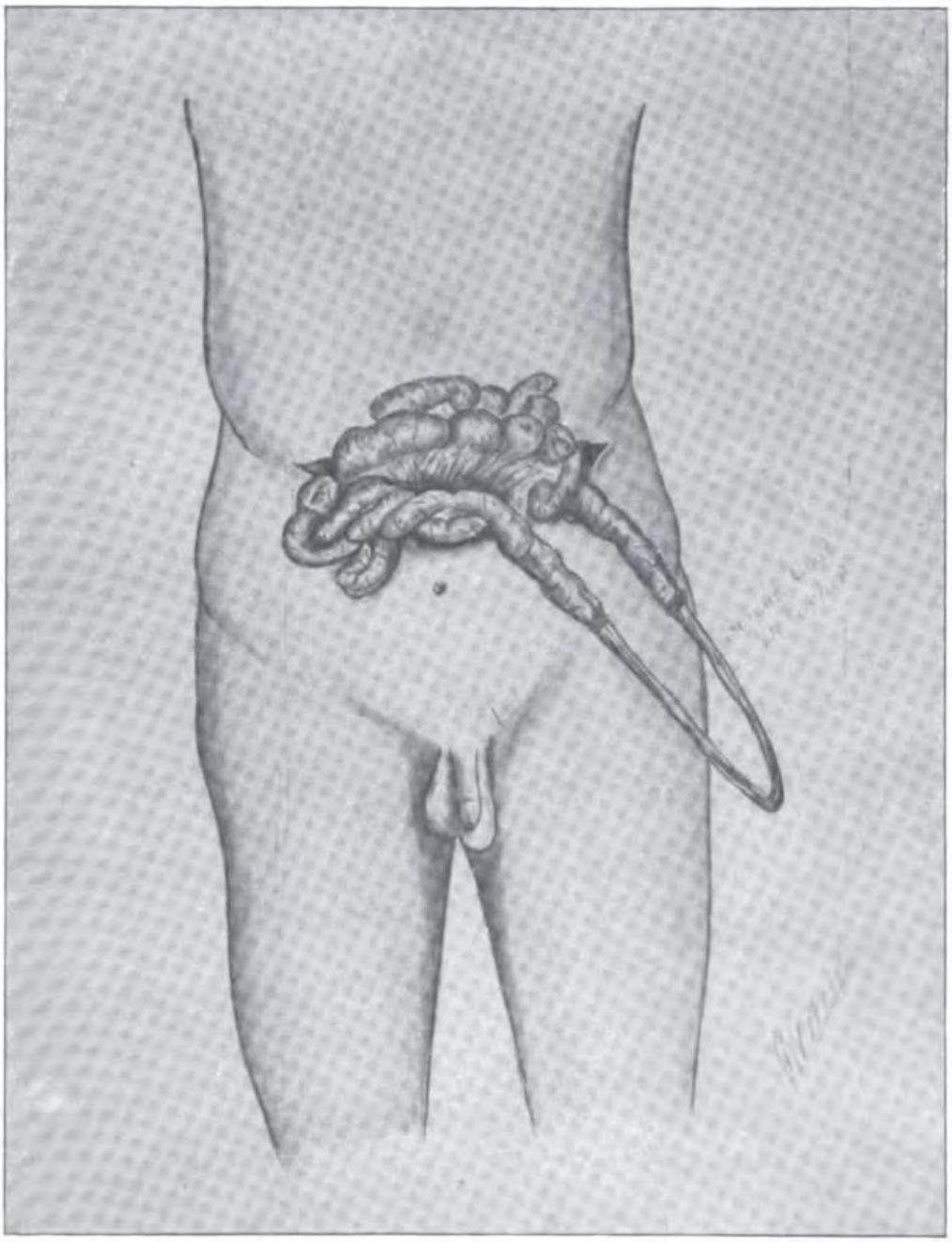

FIG. 1.—Abdominal wound, showing protrusion of intestines.

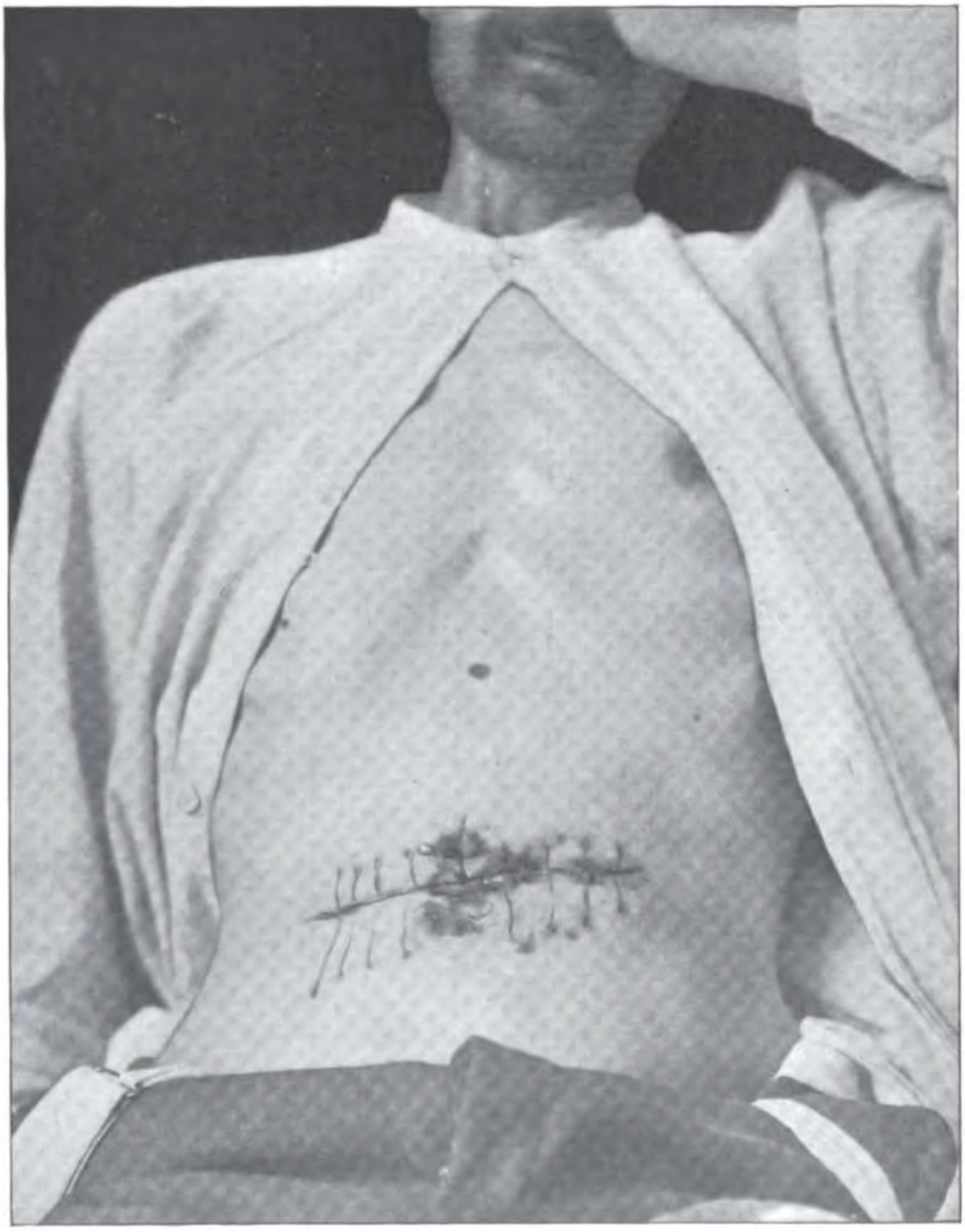

FIG. 2.—Showing wound with retained sutures.

evidences of some irritation; and on the eighth day an abscess developed in the abdominal walls, which was evacuated by breaking into the line of union with a director. After this the temperature dropped, and remained normal during the rest of his stay in the hospital.

A skiagraph was afterwards taken of the abdomen, which revealed the button in the median line below the promontory of the sacrum. The bowels were moved daily without any trouble, though, as the patient was a chronic dyspeptic, the stomach was at times irritable. All stitches were removed on the twelfth day and the button was passed on the eighteenth day. After that the patient made an uninterrupted recovery, so far as his physical condition was concerned. Mentally, he is a confirmed melancholic, and has since been removed to the State Hospital for the Insane at Norristown.

In summarizing this unusual case, I cannot help thinking that there were several factors which greatly aided in its favorable termination. Among these may be mentioned the short lapse of time between injury and surgical assistance; the temperature of the day, which was high, prevented chilling of the exposed abdominal viscera, thereby diminishing the tendency to shock; and the thorough douching with hot sterile water during the operation and hourly flushing of the abdominal cavity for two days afterwards. Then, too, by the use of Murphy's button much time was saved in making the anastomosis, thus obviating undue manipulation of the bowel, which always tends to produce for a time a certain amount of paresis of its coats which complicates the after-treatment of the case.

The question naturally arises, How shall we deal with intestinal wounds, or where disease has reduced the lumen of the bowel, so that it is no longer able to perform its normal functions? Under these circumstances we are compelled to excise the injured or diseased portions and endeavor to establish a continuous patulous tract throughout. The methods to be selected depend somewhat on the nature and extent of the injury. Where it is possible to bring the ends

of the bowel together easily, and to make a good joint upon which there is likely to be little traction, the end-to-end suture is greatly superior to any other method, because peristalsis will follow its natural course, and because there is little danger of stricture at the line of juncture. If this mode of union is decided on, the method devised by Maunsell, of first invaginating the bowel, offers one of the most rapid and thorough means of approximating the cut ends of the intestine. If speed is essential, as in the above-mentioned case, Murphy's button, which has made the operation, so far as mechanical aid is concerned, as nearly perfect as possible, may be employed. The chief objections to such devices are the insufficient size of the opening, the possibility of constricture, and the danger of the button becoming impacted.

If from any cause it is found impossible to approximate the cut ends of the bowel, they should be closed, and the coils above and below united by one of the methods of lateral anastomosis.

The length of the intestine that can be excised with recovery has been a question of both clinical and experimental interest. A number of cases have been reported where over a yard of the bowel has been removed. Trzebicky's experiments show that recovery depends not so much on the amount of the intestine removed as upon its situation. Patients in whom the first part of the jejunum had been excised showed more evidences of inanition than where other parts of the bowel were involved. He found that in animals half of the small intestine could be resected if the duodenum were left intact.

DISCUSSION.

Dr. John Ashhurst, Jr., said that he had seen this patient when he was admitted to the hospital, and could testify to the very desperate condition he was in. No one supposed that he would recover, for patients commonly perish after abdominal wounds of very much less severity. It recalled to his mind what Dr. Harris used to say as to the Cæsarean operation, that when it was performed with a cow's horn it was often more successful

than when done with the surgeon's knife. There could not have been an abdominal section more successful than this, and a majority of the cases in which a surgeon would feel justified in even less extensive interference would be apt to terminate fatally.

COMPOUND FRACTURE OF THE HUMERUS.

DR. THOMAS G. MORTON presented a boy, thirteen years of age, who was admitted to the Pennsylvania Hospital, November 9, 1897, immediately after he had been injured by falling from a wagon and being squeezed in between the wheels and a passing trolley car. Upon examination the principal injury was found to be a fracture of the left humerus about the middle, attended by a large wound on the inner side of the left arm, on a line with the vessels, where the bone had apparently been driven through the skin. The fracture was comminuted.

The arm was placed upon an internal, angular splint, after the fracture was supposed to have been fully reduced, which required considerable manipulation, as the fragments of bone were greatly displaced. A pasteboard splint, moulded over the shoulder and arm, was also applied. There was considerable swelling of the arm and forearm, with feeble radial pulse observed soon after the arm was dressed. A radiograph, taken at this time (see Plate), showed an irregular, oblique fracture, with a detached fragment of the bone lying transversely between the upper and lower extremities of the fractured bone. The fragment measured an inch and a half in length by half an inch in width.

Several efforts were made, by manipulation, to bring this separated portion of bone in relation with the other fragments, and to retain it with splints. A radiograph, taken two weeks later, however, showed that there was no improvement in the position of the fragments and no effort at union of the bone.

Resection was accordingly determined on to remove the separated fragment, and the operation was done on the sixteenth day after the accident occurred. An incision was made on the inner side of the arm, in a line with the vessels, where the upper end of the lower fragment had become simply subcutaneous. It was found that this lower fragment had been forced through the

muscles in front of the humerus by the violence of the original injury, and was firmly held in this position. This condition had prevented the approximation of the fragments. It was found to be impossible to extricate the bone from its unnatural position until a free incision had been made on the outer aspect of the arm. The sharp, jagged, detached piece of bone between the upper and lower ends of the shaft of the humerus was then removed. Its dimensions were one and a half inches by one-half inch, as already stated. The upper and lower ends of the fractured bone were freshened, one-quarter of an inch being taken from the upper and one-half inch from the lower fragment. Close approximation of the bones was effected by sutures with silver wire. (See Plate.) Firm union soon followed, and the boy was discharged from the hospital, with a useful arm, January 13, 1898, about nine weeks after the accident.

DR. G. G. DAVIS said that a couple of years ago he had a case almost identical with this one, only of the femur instead of the humerus. The femur was broken at the junction of the middle and lower third, the upper end of the lower fragment was pushed downward and slightly outward, and the lower end of the upper fragment was displaced forward and appeared to be almost under the skin. There seemed to be a distance of almost two inches between the broken ends of the bone, but the skin was not broken. All attempts to reduce the deformity failed, so he incised and found a shell of bone about one and a half inches long, placed endways almost exactly, as is shown in the skiagraph, except that it seemed to be more firmly planted between the two ends of the bone so as to keep them apart. After the removal of this piece the reduction was readily effected and the ends were wired. In wiring bones he believed that it was best to use very thick wire; the wire used by him is at least one-sixteenth of an inch thick and extremely heavy. He was convinced that a considerable portion of the difficulties which arise in the treatment of ununited fractures comes from the fact that the wire which is used is not sufficiently firm to support the bone, while extremely thick silver wire does support it.

DR. JOHN ASHHURST said that he always used thick wire, bending the ends down or even turning them around the bone and hammering them firmly into position, thus gaining more secure fixation than can be got by simply twisting the wire. If

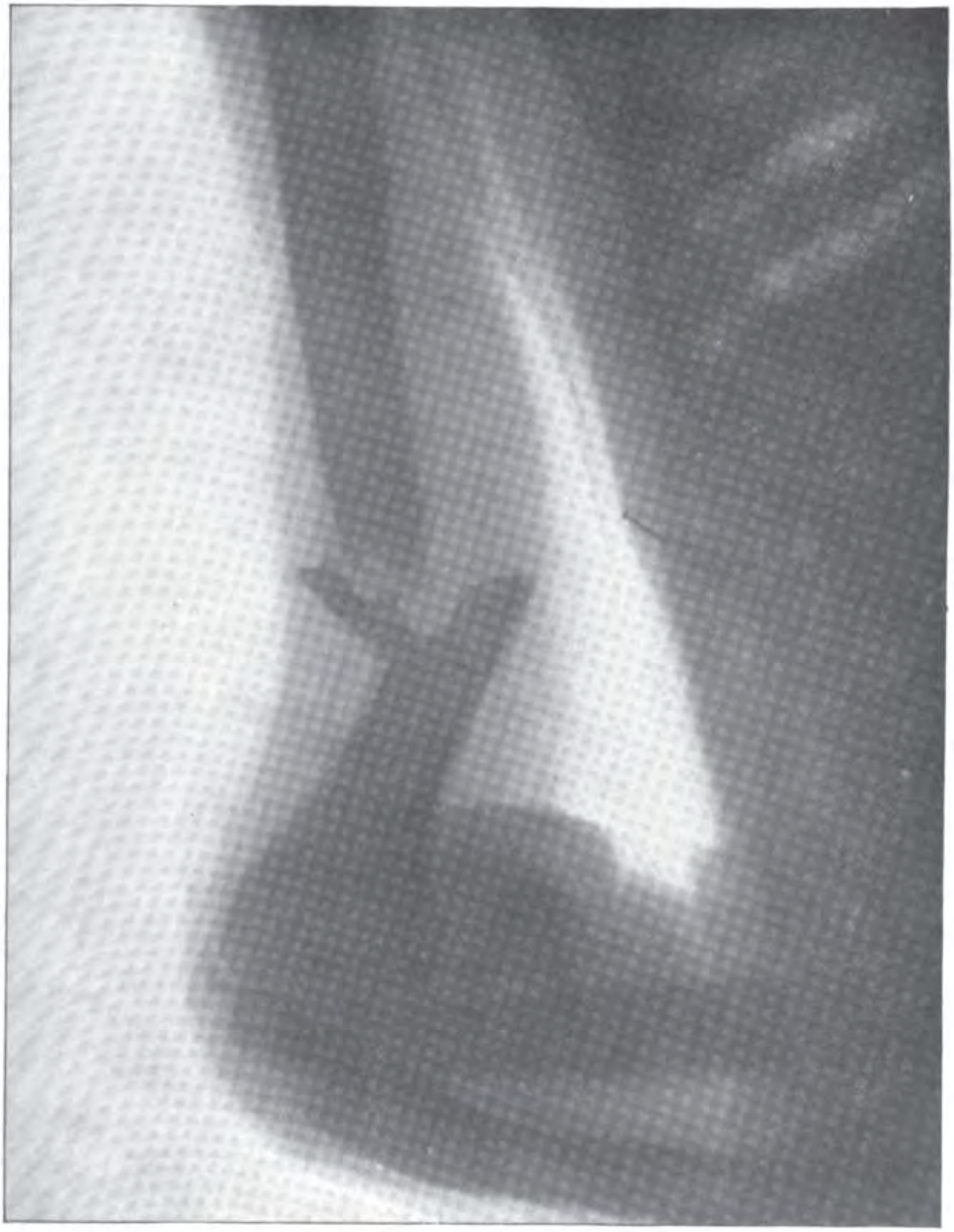

FIG. 1.—Comminuted fracture of the shaft of the humerus. (Morton.)

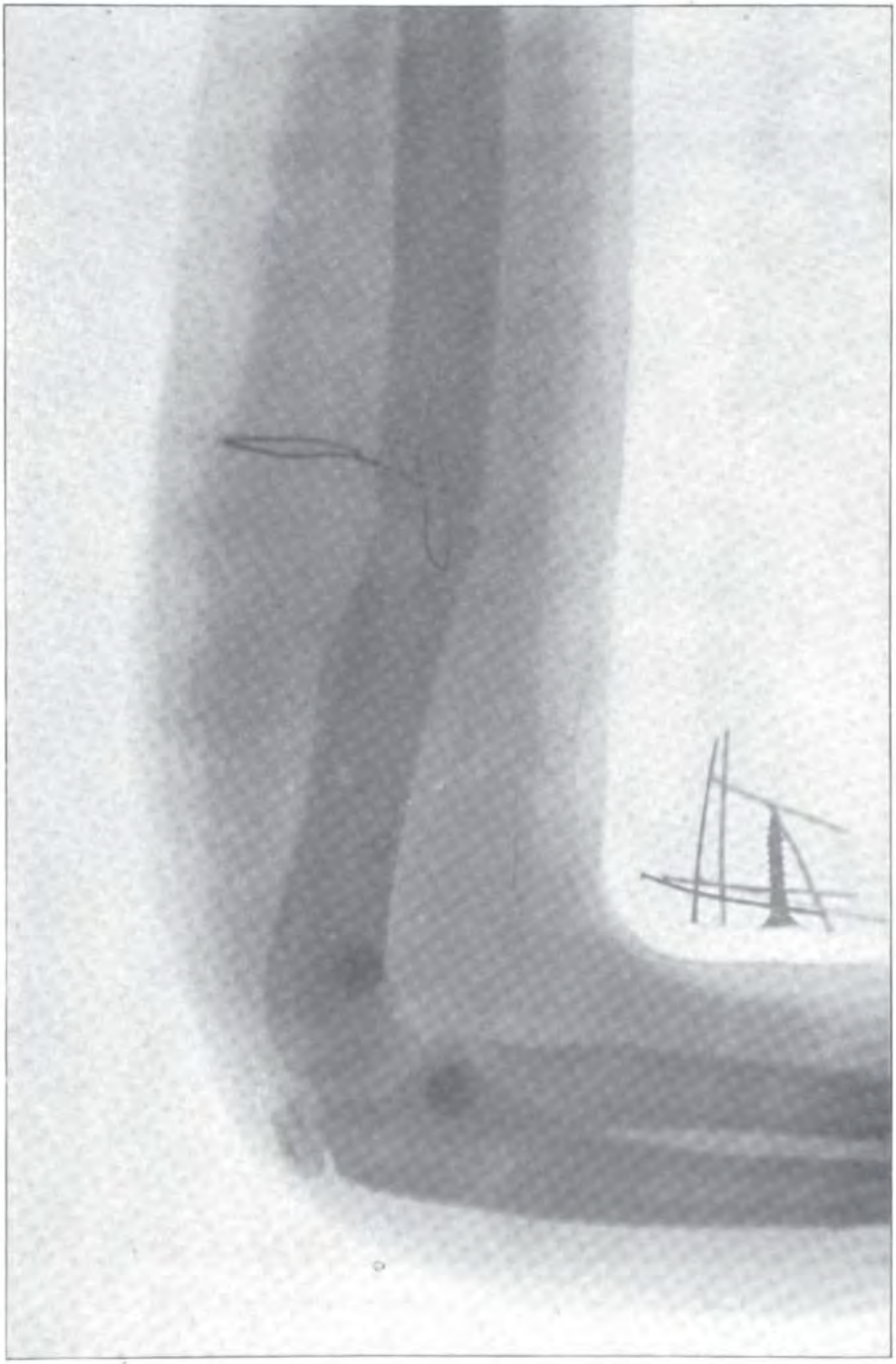

FIG. 2.—Comminuted fracture of the shaft of the humerus; loose fragment removed; main fragments secured in apposition by wire. (Morton.)

the operation is properly done there is very little risk of the wire coming away or causing irritation. In the jaw it might do so, owing to the difficulty of preventing wounds in the mouth from becoming infected, but in the long bones it gives no trouble, and may be left in with safety. In ununited fractures of large bones he employed the silver splint and screws, as used by Halsted, which are better than the wire, as giving firmer fixation, but where the bone is small the heavy silver wire is very satisfactory. It is an advantage to hammer the wire down and even to give it a half turn around the bone, somewhat like a ferrule. He had never seen any irritation caused in this way, and he had patients walking about the city now with silver wires in their legs, or silver splints, without any inconvenience.

Dr. W. Joseph Hearn said he always used heavy wire, as it gives fixation and acts as a splint. He also always left it in and hammered it down. He had a case recently where he was compelled to wire both the radius and ulna. The radial side healed, but the ulnar side became infected. Wherever infection occurs, the bone is soft. He never had any difficulty in getting it out, simply taking a pair of forceps and firmly grasping the wire without untwisting, pulled it out. In his last case he found that sufficient callus was present to hold the bone in position. In patellas, where he had wired only twice, he had never had any trouble.

Dr. DeForrest Willard said he had a skiagraph which resembled very closely the one presented by Dr. Morton, except that it is of the femur. He wired this case three weeks ago, as there was no attempt at union seven weeks after the fracture. The skiagraph showed that the upper fragment was separated from the lower, while a fragment of the bone had been carried outward and had united upon the side of the shaft. He bevelled the two edges and wired them with the heaviest silver wire he could procure. Heavy wire acts very admirably in supporting and splinting the bones, while light wire allows them to move. As to the removal of the heavy wire, he nearly always turned it down and hammered it into the bone, permitting it to remain if it gave no trouble. If it does harm, it is just as easy to cut down upon it in the depths of the wound as if it were just under the skin, and by obtaining primary union one is less likely to have infection.

PERICÆCAL ABSCESS WITHOUT APPENDICITIS.

DR. W. JOSEPH HEARN reported the following case: A girl, seventeen years of age. Previous health good. No history of previous attack of indigestion. Six hours after a late supper of indigestible food she was taken with severe abdominal cramps and vomiting. The pains were over the entire abdomen. Her family physician gave anodynes to relieve her. Within twenty-four hours the pain was all gone, except some tenderness on the right side over the region of the cæcum. In the next twenty-four hours the pain and tenderness increased, with temperature 102° F. and pulse 106. Within the next twenty-four hours she was admitted to the Jefferson Hospital. The temperature was 101°, pulse 120. No abdominal distention, but the facial expression was characteristic of intense abdominal suffering. A point over McBurney's line was exquisitely sensitive. The most gentle pressure produced the most excruciating pain. The diagnosis of appendicitis was corroborated, and she was operated upon the same evening at nine o'clock. When the peritoneum was reached it was found to be opaque and thickened,—œdematous. This was carefully opened, fearing adhesions to the bowels. This was followed by an immediate escape of one and a half ounces of pus. The cavity was dried thoroughly and the peritoneum opened outside of the pus-cavity and the parts packed around with iodoform gauze. On separating the parietal peritoneum from the visceral it was found that the pus-cavity was between the cæcum and parietal peritoneum. The cæcum was highly inflamed, and at the focus of abscess almost gangrenous. The appendix was next sought for. It was apparently missing, but by tracing down the longitudinal band of the colon (there were no adhesions of the end of the cæcum) it was found, or could be felt, in the sub-cæcal fossa (of Lockwood and Rolleston), between the layers of mesocolon, as the cæcum itself, while completely covered with peritoneum, has no mesentery. The outer layer of the mesocolon was divided in a vertical direction, and the outer layer was chosen both for convenience and to better preserve the blood-supply to the colon, and the appendix secured and removed. The layer of mesocolon was then closed with catgut sutures. The abdominal cavity was protected with iodoform gauze and the ends of the gauze left out of the wound. Retaining sutures were

put in to close the wound upon the gauze not removed, which was done in seventy-two hours. Only a small piece of gauze was replaced over the abscess-cavity. The appendix, while in not a healthy condition, was not what we might term an appendicitis. The changes that had taken place in the mucosa were evidently secondary to the perityphlitis. The patient made a good recovery. The appendix was examined by Dr. Thomas Leidy Rhoads, who reports that sections were taken from the distal end and the middle of the appendix, hardened in Huydenhain's solution, infiltrated with paraffin, and stained with hæmotoxylon and eosin.

On examination the mucosa is found enormously swollen, the glands eroded, but a few remnants of the glandular structure remaining. The submucosa is likewise greatly inflamed, but the cell-infiltration does not seem to extend to the muscular coat. The peritoneal coat is not involved in the inflammatory process.

DR. JOHN ASHHURST, JR., said that he was satisfied that there are cases of typhlitis apart from appendicitis. In one case in which he operated, while the appendix was inflamed it was apparently less diseased than that in Dr. Hearn's case, and was certainly less inflamed than the cæcum generally.

DR. HEARN rejoined that he could not explain an abscess in the location named. Dr. J. Chalmers Da Costa, who assisted him, agreed with him that it was a case of pericæcal abscess. Had it been an old case with many adhesions he could never have found the appendix, and, as it was, he had only found it by following up between the folds of the mesocolon. After going to so much trouble to find it he decided that he would remove it. He believed there are secondary affections of the appendix from disease of the cæcum. There were no adhesions at the end of the cæcum. We can, no doubt, have cases of perityphlitis, but they must be very rare. The appendix was three inches from the abscess cavity and between the two layers of the mesocolon. There was no connection between the two.

OSTEOTOMOCLASIS: A PRELIMINARY NOTE ON A MODIFIED OPERATION TO CORRECT CURVED TIBIA.

By W. BARTON HOPKINS, M.D.,

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As indicated by the name suggested, osteotomoclasis, the operation to be described consists of combining in a modified form both the operations of osteotomy and osteoclasis to correct a curve or bend of a long bone resulting from congenital malformation, rickets, or vicious union after fracture. Briefly stated, two operations are done, incomplete osteotomy and osteoclasis. At the first operation the bone is divided with a chisel not completely, but through more than one-half of its thickness at its inner curve. After the skin-wound has healed, but before repair of the bone has sufficiently advanced to restore the original strength at the weakened point, a period easily included between one and three weeks, the osteoclast is applied, and the deformity corrected by a fracture in the bone at its weak point. The only case upon which the operation has been performed is the following:

S. M., a healthy Italian girl, aged three years, was admitted to the Pennsylvania Hospital December 29, 1897, with bow-legs. The legs were evenly and markedly bowed, so much so that she crossed them in walking. January 10, 1898, under ether, both tibiæ were chiselled half through from within outward, but no attempt was made to break the bones. The small skin incisions were neatly closed with fine catgut sutures, and each was dressed simply with a small pad of gauze, no splint being applied. January 21, eleven days later, the child was again etherized, and the deformity of both legs was readily corrected with the osteoclast, very little force being required to effect this result. Though

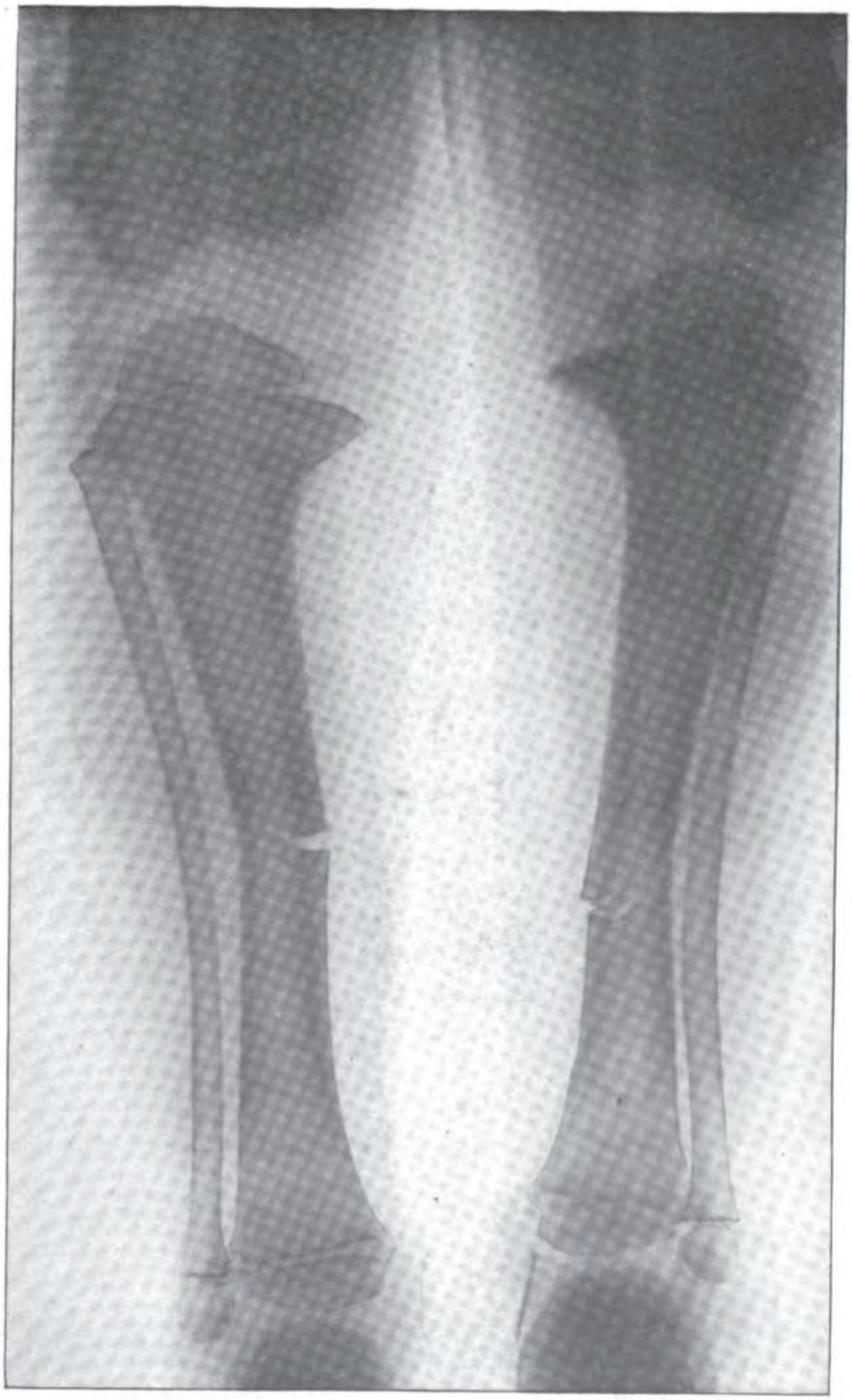

FIG. 1.—Osteotomoclasis.

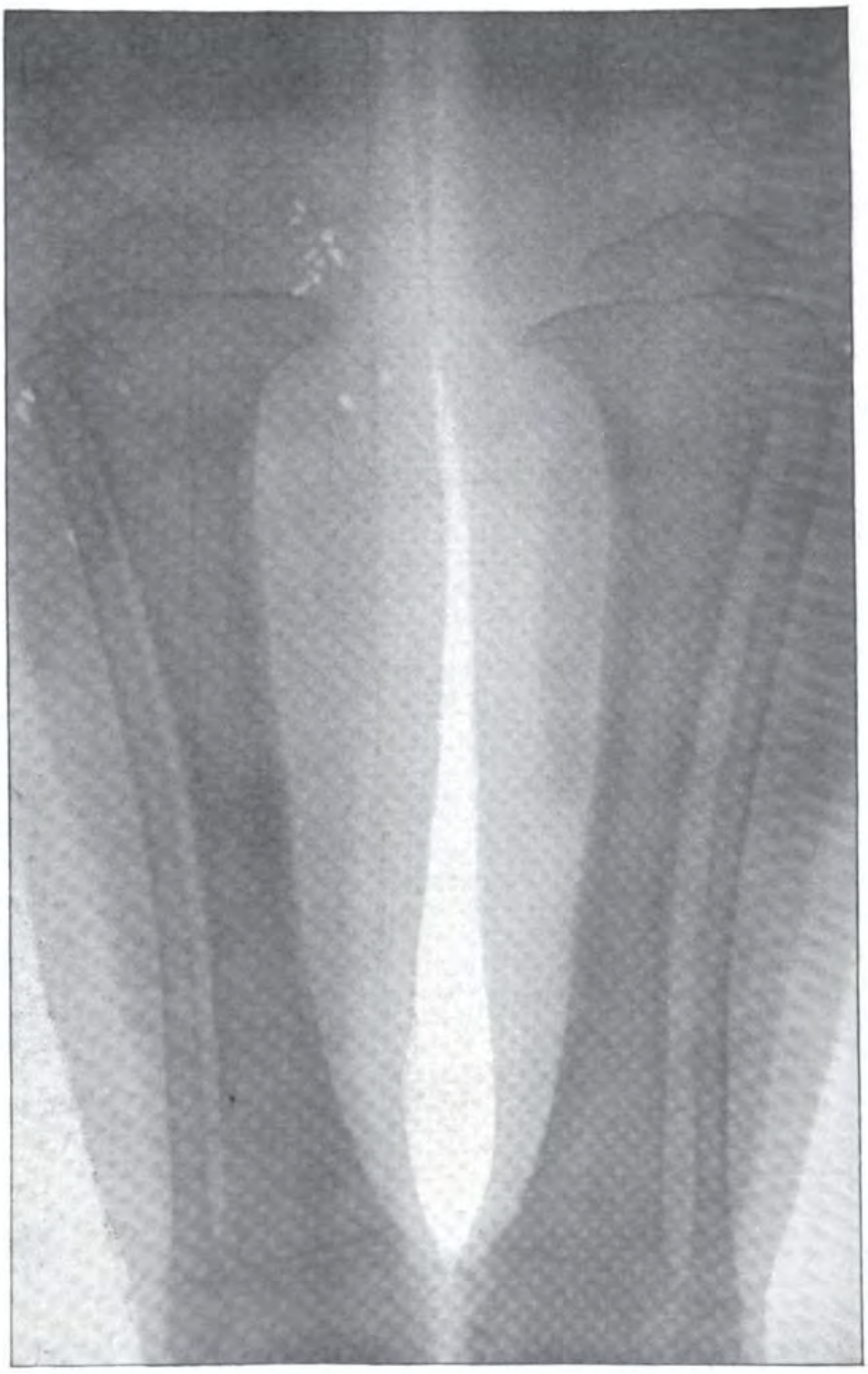

FIG. 2.—Representing appearance of bones two months after osteotomoclasis.

both bones yielded with an audible snap, the fracture in each proved to be incomplete, as shown in Fig. 1. This excellent skiagraph was taken while the patient was still under ether. Careful scrutiny will demonstrate (1) the chisel cut of two weeks' standing, having undergone no apparent process of repair; (2) fracture of the bone from a point corresponding to the bottom of the chisel cut, to the approximately neutral axis of the bone; and (3) the bending of the remaining portion of the shaft.

The limbs were encased in plaster of Paris.[1]

The possible advantages of combining, at times, osteotomy and osteoclasis were suggested to me by the conditions observed to have been produced by performance of simple osteoclasis for pronounced bow-legs in a sturdy child of eighteen months, as shown in Fig. 3. The remarkable similarity of the bone lesions to those subsequently found, as shown in Fig. 1, readily accounting for the suggestion. In this case the bones yielded with an audible snap, revealing a fracture which on removal of the osteoclast proved to be incomplete in both tibiæ. The inner half of the shaft will be seen to have parted while the outer half is only bent, the continuity of the bone remaining, therefore, to this extent intact. Considerable force was required, but the pads placed upon the three pressure-plates of the osteoclast prevented any bruising or damage of the soft parts. The knee pad rested on the inner aspect of the head of the tibia, the ankle pad upon the inner malleolus, while the apex pad was placed at the middle of the leg. Each of the three pads was kept in accurate position by strips of rubber adhesive plaster, which held the pressure-plates, pads, and limb firmly together.

In studying the action of the osteoclast some familiarly

[1] March 17, 1898, nearly two months later, the dressings were removed and the limbs found to be firm and straight.

Figure 2, taken at this time, affords an interesting study of the skiagraphic appearance of the bone lesions under conditions of absolute fixation. If osseous opacity to X-rays correspond to osseous density, which we have no reason to doubt, the processes of repair have more than fulfilled their work in restoring the lost continuity of the bone which existed, as indicated by the shaded points, especially in the right tibia, at the site of operation.

known principles relating to the strength of bodies and their resistance to force may be referred to. Letting a square beam of wood represent the shaft of a bone, discounting for the time the variations in form which modify its strength, the manner in which an osteoclast exerts its force would test the transverse strength of such a beam. The transverse strength of a beam is represented by two elements, its resistance to compression of one-third of its thickness and its resistance to extension of the remaining two-thirds. The line of equilibrium at which compression terminates and extension begins, being the neutral axis. "The limit of stiffness is flexure, and the limit of strength or resistance is fracture." The limit of stiffness is more easily reached than the limit of strength; if, therefore, a transverse cut is made in the beam on the side to be stretched, the latter will be weakened relatively more than by a similar cut made on the side to be compressed. The side to be stretched or extended will be fractured whether a cut is made or not, the continuity of the beam being preserved, if at all, at that portion which is only flexed, not broken. What is true of a beam of wood is, so far as present purposes are concerned, equally true of the shaft of a bone. Partial section, therefore, as described, would seem to be a rational preliminary step to osteoclasis by reducing many times the force required by the latter and by locating accurately the point of fracture. The use of the osteoclast to supplement the work of the chisel, where, as in hospitals, this rather cumbersome apparatus is available, is, for reasons presently to be mentioned, advantageous. Whether in certain cases osteotomy may be made a safer operation by combining with it osteoclasis as a subsequent step is a question which can only be decided by experience. In children so poorly nourished and unhealthy that traumatism of any kind is likely to provoke suppuration, the danger of a bone section cannot be ignored. It is in cases, therefore, whose general condition in prudent hands negatives the performance of osteotomy, that I venture to propose the modification of the latter I have suggested, as for them I believe it would prove

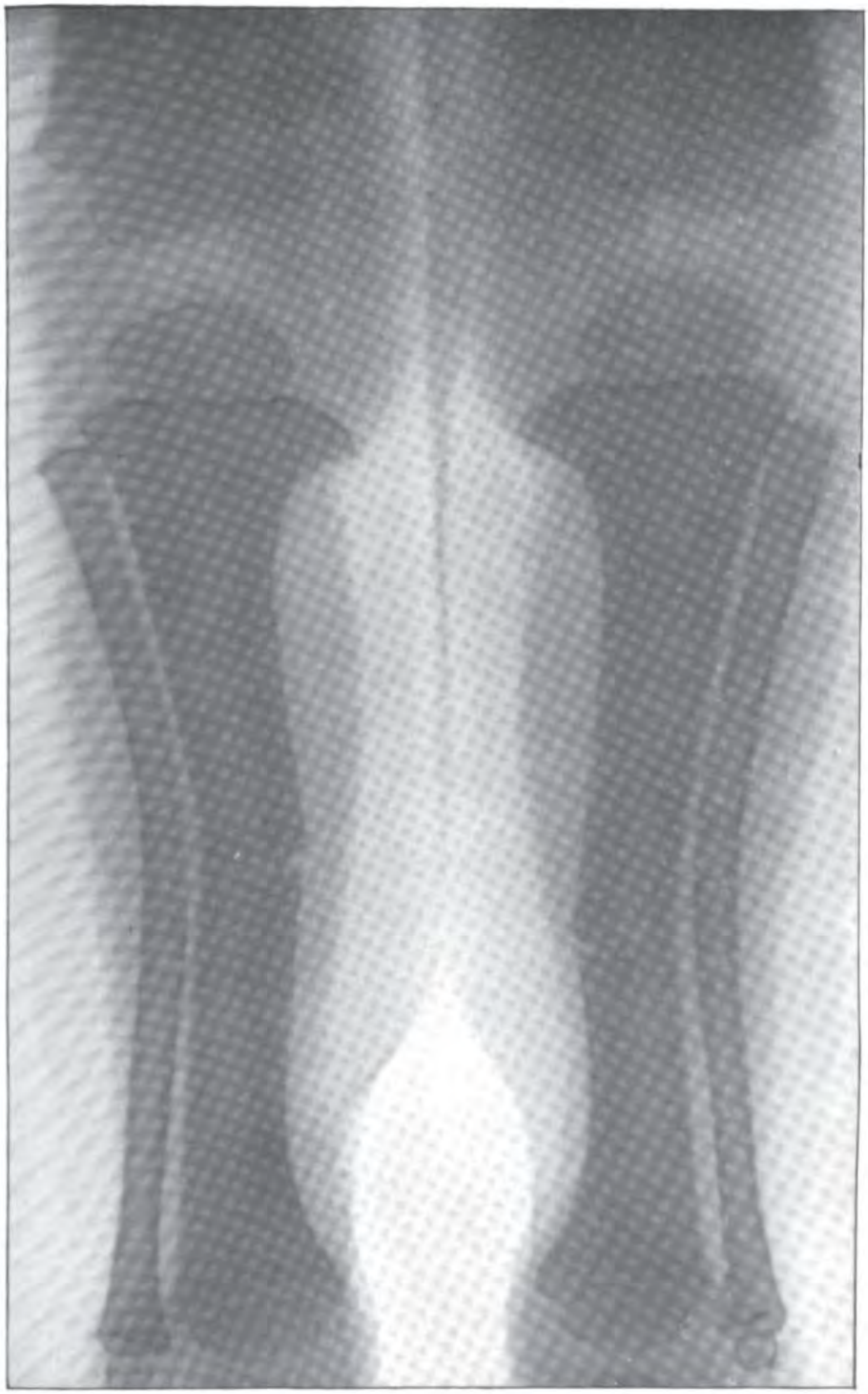

FIG. 3.—Showing condition of bones immediately after osteoclasis. The fibulæ are excessively bent by a retaining bandage.

FIG. 4.—The osteoclast.

safer. Osteoclasis, although having fallen to a great extent into disuse, is especially useful for correcting trifling curves in tender bones in children whose parents cannot go to the expense and trouble of apparatus necessary for a cure by gradual means. Intelligently employed it is neither haphazard nor barbarous, and should not in my opinion be allowed to become an obsolete operation. But our subject relates to that class of cases to which simple osteoclasis is inappropriate, either because the bone is too hard or the apex of deformity is too near a joint to yield to a degree of force which can without risk be applied; suitable cases, in other words, for osteotomy. To claim, without qualification and with such scant data as we have before us, that the operation under consideration is safer than osteotomy would be premature, and would be making an unfair and prejudicial comparison with a most valuable, safe, and tried measure. This much, however, may be said; that osteotomy causes a compound fracture, the modified method a simple fracture; osteotomy produces usually a complete fracture, while by the modified method the fracture is incomplete; after osteotomy fixation is required immediately, by the other method no fixation is required, during the existence of a wound; when suppuration occurs after osteotomy, which, however, it rarely does, it is complicated with loss of continuity in the bone,—a suppurating compound fracture. Should suppuration occur after the first step in osteotomoclasis it would involve only a bone cut, not a bone section, and would be surgically far less serious than if accompanied by loss of continuity. Following the second step, after the skin-wound has entirely healed, there is of course no risk of suppuration, as the fracture produced is a subcutaneous one. Osteotomy, on the other hand, requires only one etherization, while the modified method requires two. The osteoclast shown in Fig. 4 is the one which has been used in these cases. It is very simple, easily adjusted, and powerful, but is not particularly original. The two counter-plates and the C-shaped clamp can be placed at any point desired on the pair of shears, and retained by binding screws beneath. The

apex plate is swivelled to the clamp screw. The pressure plates present concaved faces and have flanges on their lateral borders to secure the necessary pads in position. It may be said of instrumental osteoclasis that it possesses the great advantage over what may be called manual osteoclasis, in that the force used with it is under perfect control, ceasing instantly the bone yields, producing thereby usually an incomplete or green-stick fracture, while the force applied by manual effort, on the contrary, cannot be so controlled, but goes on with a rush when the resistance of the bone ceases. After osteotomy, in applying the plaster-of-Paris dressing, I always prepare to open a small trap-door by placing a wall of lead ribbon around the wound. Through this, should it become necessary to obtain access to the latter, a window can readily be cut. In healthy children this is, however, a very rare contingency, as primary union is almost invariably the rule.

The excellent skiagraphs accompanying this paper were taken by Dr. Starbuck at the Pennsylvania Hospital.

[Dr. Hopkins remarked, in closing the discussion on his paper, "The fact that in four cases which came under the observation of one Fellow of the Academy evil consequences resulted from osteotomy proves, I think, that there are certain dangers in the operation to be guarded against, which, as I have stated, should not be ignored."]

DISCUSSION.

Dr. John Ashhurst, Jr., said: This operation is certainly a very ingenious one, but there is a possible objection to it, and that is that the incision made in the bone, as described by Dr. Hopkins, makes a gap when fracture is effected in the line of extension rather than in that of flexion. In the ordinary operation, as practised by Dr. Macewen, a wedge-shaped osteotome is used and the incision is made in the line of flexion, so that a gap is left in that position. There is always a probability of the bone gradually returning more or less to its original position, and a mistake, which he had seen made by many operators, is in not

obtaining sufficient correction. They are satisfied with making the leg straight, and when the child recovers, in the course of two or three months, it will be found that the bowing has returned. The object of the cuneiform incision is that when the limb is straightened, the two cut surfaces coming together, the gap being on the outer side, or that of flexion, there will be less danger of the deformity recurring. If the incision is made as Dr. Hopkins has suggested, there certainly will be additional risk of reproduction of the deformity. This objection is more than theoretical; but, even apart from that, he did not see why this method should be preferred to simple osteotomy, which is a very satisfactory operation.

Dr. DeForrest Willard said it seemed to him that there were objections to this procedure. In the first place it prolongs the time of cure, and he could not see that the advantages to be gained were sufficiently compensatory; in osteotomy the operation is completed at the one time. Osteotomy is theoretically a compound fracture, but practically it is only a simple fracture from the moment of the closure of the wound. For seven or eight years he had not seen one single case fail after osteotomy, nor had he seen one drop of pus during that time. Cases heal immediately and absolutely in which the entire correction has been done at one sitting. Formerly he did cuneiform osteotomies on badly bowed legs, and a few times had suppuration, but for several years he had performed only simple osteotomies. Instead of taking out a piece he had allowed a V-shaped space to remain in the posterior portion of the bone, which has been filled in with callus, using the precaution to employ an apparatus, when possible, for a year after completion of the osteotomy cure. He had never had any serious results. In only one case had he been obliged to do a second operation; an apparatus could not be afforded, and the child was allowed to go home too early.

It would seem to him that the advantage of deferring the osteoclasis for two or three weeks after the osteotomy is not compensatory, as it is easy to straighten the bone by the hand or the osteoclast immediately after the osteotomy, and produce the same result at once which Dr. Hopkins does at a later period. Usually he did not make a complete fracture, but a green-stick break, or he allowed the fragments to interdigitate, being careful not to permit any displacement. After fixing the bone in a

gypsum splint in an over-corrected position, he always got a speedy and quick cure. The operation of aseptic osteotomy had been with him so absolutely complete and perfect as well as safe that he had learned to positively prognose a complete cure, without fever, without pain, without discomfort, and without suppuration. After aseptically locking these cases up in plaster-of-Paris he did not look at them for six or eight weeks, when the cure is complete. Having so good an operation already established, he thought the burden of proof with regard to a new operation lies with the originator to show the advantage over the old one. The vital question is, Does this prolongation of procedures delay the cure, and does it in the end accomplish any more desirable result?

DR. H. R. WHARTON said he had seen quite a number of osteotomies done by other men and had done a good many himself, but had seen very few bad results. He had seen but four cases that did badly after an osteotomy. One was in a young person where a double osteotomy was done for a knock-knee, in which a profuse suppuration occurred and a subsequent operation was necessary to remove sequestra. He eventually recovered with good motion of the knees. In a second case profuse suppuration of the wound followed by necrosis of the tibia occurred after osteotomy. In another case secondary hæmorrhage followed an operation for curved tibias requiring ligation of the anterior tibial artery some weeks after the operation. A fourth case of osteotomy for knock-knee in which non-union resulted at the end of three months, a good result was obtained by opening the wound and freshening the edges of the wound with an osteotome.

DR. G. G. DAVIS thought the osteoclast which Dr. Hopkins had shown to be one of the neatest and best that he was acquainted with, and that it was an aid in completing the division of the bone and straightening it. The trouble he had had in the manual breaking of bones, even in the course of osteotomy, caused him to desire some more efficacious means. As regards the division of the operation in two stages that he was in doubt about it. Many of these cases are to be in the hospital as short a time as possible, and the addition of ten days might be an objection.

DR. R. H. HARTE said that osteotomies were among the simplest class of cases that surgeons had to deal with, and there

are no cases so sure to be followed by satisfactory results. There is one point that he thought to be a good one, and that is the performing of two osteotomies on the same patient at the same time. If the osteotomy is on one limb at a time, he always followed the suggestion made by Professor Ashhurst as to over-correction. He used a straight splint and padded the upper and lower end and the centre, by which means over-correction was secured. He placed plaster-of-Paris on the outside and closed with a light gauze dressing. Children never have any trouble afterwards. No elevation in temperature is the rule, and the cases invariably do well.

DR. J. EWING MEARS, in connection with this subject, reported a case which came under his observation twenty years ago at St. Mary's Hospital. A child was brought in suffering from a fracture of the tibia at the junction of the upper and middle thirds, produced by an ice-wagon passing over the limb. An effort was made to get as correct an adjustment as possible. The fracture was treated with lateral splints, and the result was good. The union of the bone occurred promptly, and it was observed, after removing the splints, that the child, who had been bow-legged with curvature of the bone before the accident, had practically a straight leg on the injured side, while the other was still deformed. An interesting point is that the parent of the child instituted an action against the ice company whose wagon did the injury, and he was summoned as a witness. The lawyer for the plaintiff brought the child to his office to have him examined after a lapse of one and a half years. On stripping the child he showed him very conclusively that the injury had been of great benefit to the child, and told him that if he went into court the chances were he would be non-suited, or fail to get damages, because of the actual benefit that had been derived by reason of the accident. The suit was withdrawn and the case was dismissed. Of course, this was some years ago, before osteotomy was practised as it is at the present day.