the average size for a boy of fourteen. Hence the head has enlarged very much since the bones exfoliated thirteen years before. But instead of the opening left by this exfoliation enlarging pari passu with the growing head, it has greatly contracted. Adjusting the necrosed bones accurately together and exclusive of the lost piece, the aperture left by their exfoliation must have been 17 by 11 cm. At fourteen years of age this opening had contracted to 8 by 5 cm. Not only had contraction taken place in the horizontal plane, but the deep furrow on top of the head shows that a marked contraction had taken place in the vertical plane.

That the epilepsy and mental dulness have been caused by the contraction and consequent pressure, and by the physical alteration in the structure of the cortex itself by the burn, I think there can be no doubt. The only wonder is that he is not wholly idiotic as well as epileptic.

While I had little hope of benefiting the boy by any operation, it seemed to me he ought at least to have the possible chance of benefit from the relief of pressure, provided such an operation would not be almost certainly fatal. As described in the notes, my idea was to make the entire calvaria movable so that it could be lifted like a lid on top of the head. If, then, the brain had any power of expansion it might lift the calvaria and so get more room.

The apparent immediate result seemed to promise considerable improvement, but after two years I fear that this will be slow in its progress and will not be as great as could be desired. Yet the lessened frequency of his epileptic attacks is a positive improvement and he is certainly somewhat less dull than he was when I first saw him.

STATED MEETING, HELD MARCH 4, 1907.

The President, Dr. John B. Roberts, in the Chair.

I. FRACTURE OF THE GREATER TUBEROSITY OF THE HUMERUS, WITH DISLOCATION OF THE HUMERUS INTO THE AXILLA. IMMEDIATE REDUCTION OF DISLOCATION. ON SEVENTH DAY NAILING OF FRAGMENT OF TUBEROSITY IN PLACE.

II. FRACTURE AT THE ANATOMICAL NECK OF THE HUMERUS AND DISLOCATION OF THE HEAD INTO THE AXILLA, WITH FRACTURE OF THE SHAFT. DIFFICULT REMOVAL OF HEAD OF HUMERUS.

BY WILLIAM WILLIAMS KEEN, M.D.,
OF PHILADELPHIA,
Professor of Surgery, Jefferson Medical College.

I.

E. F. K., æt. fifty-nine, first consulted me January 29, 1907. Three days before, on January 26, in getting off a trolley car on the ice-covered street, he slipped and fell, striking his left shoulder,—he rather thinks upon the point of the shoulder, though he is not certain of this. He also thinks that when he found himself about to fall he threw up both arms violently in the air, as would be very natural, but he is also not quite sure of this.

The moment the accident occurred he felt great pain about the head of the humerus, and the whole arm was useless; he was scarcely able to even move his fingers. He was taken to the Pennsylvania Hospital. Here he was attended by Dr. William Drayton of the resident staff, and I owe to him and to Dr. Montgomery, the skiagrapher, the early history of the case and the skiagraph. A dislocation into the axilla was diagnosticated and was reduced under ether. No crepitus was felt until after

reduction of the dislocation. An X-ray picture was then taken, which showed a fracture of the greater tuberosity (Fig. 1). The arm felt much better after the dislocation was reduced. No bruise existed about the shoulder to show the point of impact when he fell. When he came out of the ether, the arm was so bandaged to his body that he was unable to move it in any direction and hence whatever disability may have resulted from the fracture of the greater tuberosity cannot be definitely stated, as no opportunity for muscular movement had existed. He left the hospital the same day.

When he saw me, three days after the accident, I found the arm securely bandaged with a shoulder-cap splint and he was very comfortable. Examination of the excellent X-ray picture showed that the greater tuberosity was broken off in a triangular fragment, the base being uppermost and the apex extending about to the surgical neck. The fragment was drawn upward and backward so that it lay between the spine of the scapula and the head of the humerus. Evidently, if it remained there, it would be a serious bar to abduction of the arm to or beyond the horizontal, and probably also to other movements, and external rotation of the arm would be impaired or lost. I, therefore, took him to the Jefferson Hospital and had Dr. George W. Spencer and Dr. W. F. Manges try different positions of the arm, to see if any of them approximated the humerus to the fragment in such a way as to restore their proper relation, for it was clear that the fragment could neither be brought to its normal position by manipulation nor held there by any suitable dressing.

Several attempts were made to effect this purpose by elevation of the arm and external rotation with retention of the arm in place by plaster dressing and in other positions, but all were failures. I, therefore, determined to operate by exposing the parts, drawing the fragment of the tuberosity into place and holding it there by wire nails. Though at that time I knew of no case thus operated upon, it seemed to me both rational and reasonable to do so.

Operation, February 2, 1907.—I made a vertical incison a little in front of the middle of the acromion directly down through deltoid to the bone, separating the fibres of the deltoid as far as possible rather than cutting them. As soon as I reached the bone, I detected the anterior edge of the bony fragment lying at the

FIG. 1.

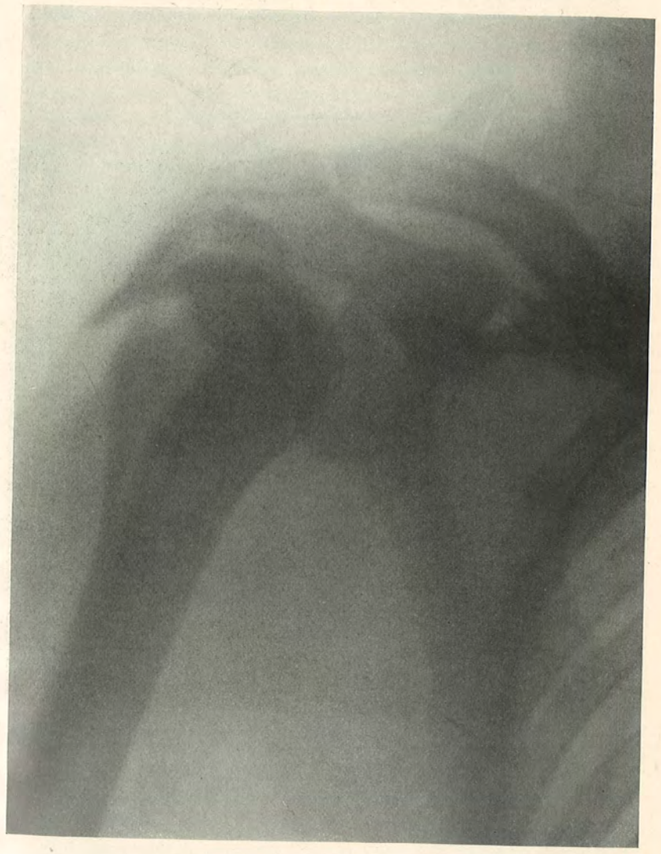
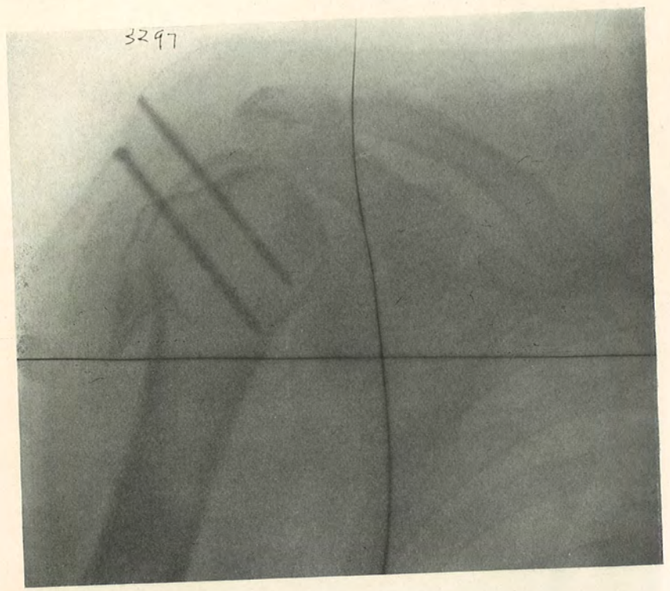


FIG. 2.



posterior margin of the wound. Carrying my examining finger under the anterior edge of the wound, I found the rough, raw surface from which the tuberosity had been torn away at a considerable distance from the anterior margin of the wound. The fragment torn away from the humerus was separated from it by about 5 to 6 cm., and lay posteriorly between the head of the bone and the acromion and spine of the scapula. Evidently no union other than perhaps a very poor fibrous union could ever take place between the normal surface of the bone and the capsular ligament and the raw surface of the fragment. Moreover, the position of the fragment would interfere with the usefulness of the arm, for whenever the arm was raised, this ectopic piece of bone would be a sort of wedge between the acromion and spine and the head of the humerus. An assistant, therefore, rotated the humerus externally as far as possible. This brought the posterior edge of the raw surface of the bone to the anterior edge of my incision. I was able then to expose this raw surface by strongly retracting the anterior edge and next to draw forward and downward the fragment of bone so that I brought it nearly into its normal position. It was impossible to get it absolutely into its former place. I found the best means to replace the torn fragment of bone was by seizing the tissues around it with the Allis "tissue forceps." These practically resemble the one-prong tongue forceps, the opposite blade being a simple curved notch rather than the broad surface of the tongue forceps.

Holding the fragment in position, I drilled two holes in it and nailed the fragment in place by means of two wire nails 7.5 cm. in length and about 2 mm. in diameter. These were long enough to allow the head of the nail to protrude beyond the skin. A large portion of the nail, of course, was outside the bone, corresponding to the thickness of the deltoid, the fat and the skin (Fig. 2).

The wound was then entirely closed, excepting where the nails protruded, and at the lower angle where I inserted a small bit of gauze for a temporary drain, especially because there was considerable grumous blood accumulated at site of fracture.

His highest temperature was 100°, and he made a perfectly uneventful recovery. One nail was removed without difficulty at the end of two weeks and the other at the end of the third week. The wound left by the nails healed quickly. Passive motion and massage were begun at the end of four weeks.

REMARKS.

Until very recently fracture of the tuberculum majus of the humerus has been believed to be very rare. In the statistics of Gurlt, covering one hundred years, he records but 46 examples found in literature and in museums. Usually the fracture accompanies dislocation. Gurlt found only 4 cases of fracture unaccompanied with dislocation, and even one of these was not free from doubt.

The systematic use of the X-rays, however, has entirely disproved this notion and has shown that, on the contrary, it is a not uncommon fracture. I have asked several skiagraphers in Philadelphia as to their experience, with the following results:

Dr. Manges of the Jefferson Hospital has only had one case; Dr. Kassabian has seen 4 in about 800 fractures; Dr. Leonard has no exact record, but recalls 2 of the great tuberosity alone, and at least 6 cases with other associated fractures; Dr. Pfahler of the Medico-Chirurgical Hospital in 84 cases found 7 such fractures with no other lesion, and 3 cases of this fracture associated with dislocation; Dr. Frederic Montgomery of the Pennsylvania Hospital, in 75 cases of injury of the upper end of the humerus has found 3 cases of this fracture including the present case; Dr. Pancoast, at the Hospital of the University of Pennsylvania, writes as follows: "In looking over the skiagraphs I have made of fractures of the upper part of the humerus, I found 6 cases of fracture of the tuberosity, which seem to belong in a class by themselves. In one of them there is also an incomplete fracture of the surgical neck, and in another, either an incomplete or an impacted fracture of the surgical neck. In this last case, no fracture whatever was diagnosed clinically. The other 4 cases were purely uncomplicated. In addition to these cases, I found 3 with fracture of the anatomical neck and the tuberosity. In all these 7 cases, as in the first 5, the tuberosity is a separate fragment by itself.

"The fragment representing the tuberosity varied in size from a thin scale of bone to the entire tuberosity and part of the neck below it.

"In 1 case only, out of the 12, am I certain that a clinical diagnosis of fracture of the tuberosity was made prior to the skiagraphic examination, but such a diagnosis could hardly have been expected in the seven distinctly complicated cases."

These six observers have, therefore, seen at least 21 uncomplicated cases and 18 more with other associated lesions, all, presumably, within about four or five years. Through their courtesy, I was able to show 23 of these 39 skiagraphs.

Before the X-rays were used, the lesion was generally diagnosticated as a severe "contusion" or "bruise" of the

FIG. 3.

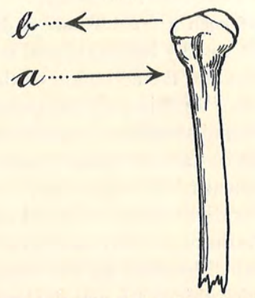


Diagram to show the opposite direction of the two forces acting on the head of the right humerus. *a*, direction in which the bone is forced in the dislocation; *b*, direction in which the muscles act either in suddenly throwing up the arms to prevent the fall or in the involuntary endeavor to prevent the dislocation.

shoulder, which often permanently disabled the arm to a greater or less extent. Now we know that the condition is more frequent and the consequences much more serious than has been believed.

Whether the cause is always the direct result of a fall or blow on the shoulder, or whether it may result from muscular contraction alone, is disputed. Doubtless both of them act together, the dislocation acting in one direction (inward) and the sudden contraction of the muscles in the opposite direction (outward) (Fig. 3). In the present case the blow dislocated the humerus, but the sudden and violent elevation of the arms to prevent his fall might well have produced the fracture in a man of fifty-nine, even if there had been no fall.

The pathology of the lesion has been well ascertained by the findings at operation and by the extraordinary good fortune of Jössel, who in 1880 reported the facts ascertained by the dissection of 9 cases of habitual dislocation of the shoulder. He found the supra- and infra-spinati torn loose, retracted and in fatty degeneration, part of the capsule was torn loose and the head of the humerus was in contact with the deltoid and the acromion. Of 8 cases of old dislocation operated on by Kocher, in 6 the tuberculum majus was torn off. Last year Perthes reported 10 cases of luxation of the shoulder, in 6 of which there was either a fracture of the tuberosity or the muscles were torn loose from the bone.

The results of such a fracture are a displacement of the fractured fragment usually backward and upward between the head of the humerus and the acromion or the outer end of the spine of the scapula. In this position, union of the fragment is often improbable and sometimes impossible. The fragment, if of any size, is an obstacle to upward movement of the arm. The loss of attachment of the supra- and infra-spinati and the teres minor involves diminution or loss of external rotation of the arm, and, as Perthes especially has shown, permits repeated and finally habitual dislocation of the head of the humerus. In fact, in his opinion this is the principal reason why habitual dislocation occurs.

Formerly the diagnosis was in most cases only presumptive until the advent of the X-rays. In fat persons especially it was often impossible to make a diagnosis if this fracture was associated with other fractures or with dislocation. The contour of the shoulder, in a minor degree, however, resembles a dislocation, as shown by the prominence of the acromion and a furrow below this prominence. The head of the bone may be broader than normal; if the fractured fragment is of any size, a groove can sometimes be felt between it and the head of the bone; crepitus may be felt but sometimes is absent, especially while the dislocation is unreduced, as in the present case, and it will usually be impossible to lift the arm above the horizontal—even passively—and external rotation is lost or lessened. The deltoid is sometimes atrophied as a result of injury to the circumflex nerve.

As long ago as 1886, Bardenhauer suggested suture as a means of treatment; but it seems not to have been done till 1898 by W. Müller. The latter surgeon excised an oval portion of the capsule of the joint and sutured the muscular attachment by advancement (Vornähung) of the external rotators. In 1904 Perthes operated on 2 cases by means of double-pointed, U-shaped nails. Both of his cases were ancient fractures, one being operated on over three years and the other five years after the accident. He made the posterior incision of Kocher for excision of head of the humerus, in one case chiselling a part of the spine and the acromion (which were wired later), and turning downward and forward a large deltoid flap. In both the results were good.

My own case is, I believe, the first in which a primary operation has been done. I made a vertical incision, seized and drew downward and forward the fractured piece, and, after external rotation of the arm, nailed the fragment as nearly as possible in place by two disinfected wire nails which were afterwards removed.

I should have delayed publishing the case until I could report the final result, but that a long absence in the immediate future prevents my waiting. Every indication points to a speedy and satisfactory result, as there is little ankylosis of the joint. Passive motion has just been begun.

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II.

CASPER K., æt. sixty, first consulted me December 23, 1905, with Dr. A. P. Hull of Montgomery, Pa., to whom I owe the following history:

On November 18, 1905, he fell from the top of a wagon of fodder about 10 feet, falling on his feet. The fodder followed, fell upon him and threw him forward. He fell, striking on his right shoulder. He was helped up and walked to his brother's house about 100 feet away.

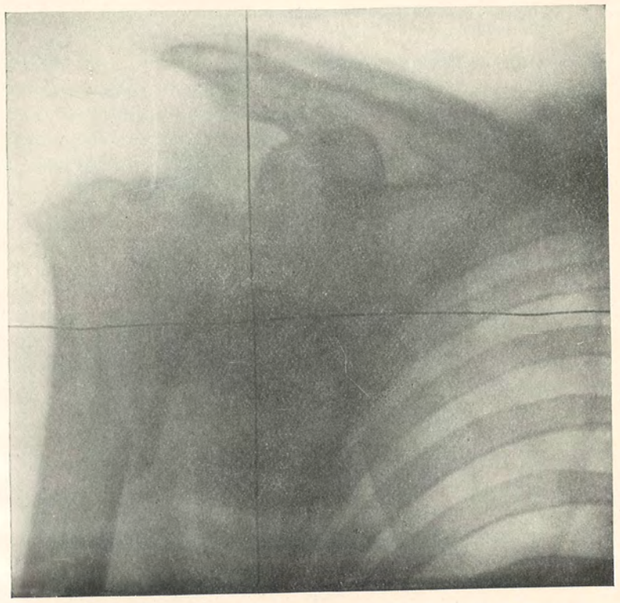
Dr. Hull saw him two hours later and found a subcoracoid dislocation. Under chloroform this was reduced and the forearm put in a sling. At the end of three weeks, as he had not called as directed, the doctor went to see him and found that the dislocation had been reproduced; he also discovered crepitus on moving the arm. The patient states that he has had pain ever since the accident. He has slept poorly, though occasionally he has had a good night. He has had to lie with extra pillows propping him up most of the time since the accident. His appetite is fair, bowels in fair condition. He has worn a sling most of the time.

On examination I saw clearly a marked fulness under the coracoid, like a subcoracoid dislocation, but there was no outstanding elbow, nor any change in the axis of the upper arm in relation to the body. The acromion was very prominent; a hollow existed below it; there was flatness over the muscles of the shoulder posteriorly and fulness in front under the coracoid. On attempting to rotate the arm, crepitus was easily elicited, but as movement was very painful, I decided to wait till I could get an X-ray picture of the arm. The arm was greatly swollen, especially over the forearm, there being less and less swelling from the elbow up toward the shoulder. The entire arm from shoulder to elbow was also still very much discolored from the effused blood.

December 26.—On examining the X-ray picture (Fig. 4) I found that there was a fracture exactly through the anatomical neck and that this fragment was dislocated inward under the coracoid process. In addition to this there was a vertical fracture from the upper end of the shaft downward to the surgical neck.

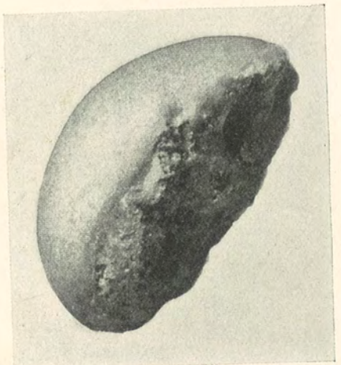
Operation, December 27.—I first made an incision from the coracoid process down nearly to the insertion of the deltoid. I separated the fibres of the deltoid, watching carefully for the

FIG. 4.



Fracture-dislocation of shoulder. Fracture of anatomical neck and shaft of humerus. Dislocation of head into axilla.

FIG. 5.



Fracture of anatomical neck of humerus.

circumflex nerve and the long tendon of the biceps. I did not at any time see the circumflex nerve. The tendon of the biceps was dislocated inward from its groove and the capsule of the shoulder joint opened. On inserting the finger, I found that the upper end of the humerus was almost entirely smooth and it was, of course, utterly hopeless to obtain union even if I had succeeded in replacing the dislocated head of the humerus or if it had any reliable blood supply. A considerable amount of fluid, black blood, evidently effused at the time of the accident, was liberated from the tissues. On dissecting toward the inner side, so as to lay bare the dislocated head of the humerus, I found it lying so much to the inside of my incision that it was evidently much more accessible by a separate incision. This started from just below the insertion of the tendon of the great pectoral in a direct line toward the sterno-clavicular articulation, reaching to a point below the middle of the clavicle. I separated the fibres of the great pectoral by blunt dissection and finally found the head of the bone with its fractured surface looking toward the middle line and the articular surface toward the humerus,—*i.e.*, completely rotated. It was very adherent, but gradually I was able to loosen it and finally to pry it up very slowly and carefully, lest I should either do harm to the nerves or to the axillary vessels which lay immediately in contact with it. By combined prying upward and traction by means of a large sequestrum forceps, I finally dislodged the head entirely (Fig. 5). Very deep in the wound a vessel immediately began to bleed very copiously: I was able, fortunately, instantly to put a finger of the left hand upon it and arrest the hæmorrhage. It was so deep, however, that it was impossible to ligate it through the existing incision. Accordingly, I divided completely the great pectoral tendon about 3 cm. from the humerus. This gave me wide access to the axilla and I was able finally to seize the bleeding vessel, which would have been otherwise inaccessible. The vessel was double ligated as it was bleeding from both directions. A few other small vessels required ligation. The parts were then irrigated with salt solution and the tendon of the great pectoral overlapped and sutured with twenty-day chromicized catgut. The long head of the biceps was replaced and sutured in place with catgut. A drain was placed in each wound, that in the second incision going deeply into the axilla, and the wounds were closed.

The arm was placed next the chest, the forearm flexed in front of the chest with a pad in the axilla and a Velpeau bandage applied.

On the evening of the day of operation his temperature rose to 101 degrees, but by the second day it was down to the normal and so remained. He went home on January 7, eleven days after the operation.

Dr. Hull writes me, February 1, 1907: "He can raise his arm to two-thirds of the normal height; the wasting of the muscles of the shoulder is disappearing with use and he can use the arm right well in digging, etc."

Fracture of the anatomical neck of the humerus is an extremely rare injury. Stimson [1] states that the only reported specimens of fresh fracture without discoloration or additional fracture through the tuberosities are those of Boyer and Spence. The cases of fractures associated with discoloration are more numerous, yet even they are so rare that Stimson himself "had seen only one case in which the diagnosis seemed probable," and a second undoubted case. Hamilton [2] also in his very large experience in fractures saw only one case. The present is the only case that I have ever seen.

This fracture may be either intra- or extra-capsular. "It is probable, since bony union is not denied to this fracture (*i.e.*, intra-capsular fracture), that the line of separation is not always, or generally, perhaps, completely within the insertion of the ligament, but that it is in some degree extra-articular if not extra-capsular. If it is entirely intra-articular, no doubt union of the fragments can never take place and necrosis with suppuration must ensue, demanding, at a period not very remote, an operation for the removal of the fragments, the same as in compound fractures. Gibson, however, thinks that the fragment occasionally remains, being gradually absorbed and changed in figure." [3]

In this particular case the specimen I think shows that

[1] Fractures and Dislocations, third edition, 1900, 216.
[2] Fractures and Dislocations, sixth edition, 1880, 234.
[3] Hamilton, ibid.

the fracture was wholly intra-articular. In addition to this the head of the bone was not only not displaced within the capsular ligament, but was thrust wholly outside of it, far into the axilla. Impaction of the upper fragment into the lower is not uncommon, as in fact would be natural from the force necessary to break off such a limited rounded fragment. If there is impaction, union, of course, may take place.

The last edition of Stimson's work was published only a few years after the X-rays were discovered and before their general use. Hence he makes no reference to their use in such cases. These rays have made perfectly possible correct diagnoses of fractures about the shoulder joint, such as the present case and the other one that I report this evening, a fracture of the greater tuberosity. Before the discovery of Röntgen, such cases were always obscure. In Stimson's next edition, without doubt, certainty will take the place of presumption in the diagnosis.

In the present case fracture of the anatomical neck was associated with dislocation and complete rotation of the fragment and also with a longitudinal fracture of a sharp fragment from the inner side of the shaft as far down as the surgical neck. When the head is in place, crepitus can often be elicited. Had the lesion been limited to fracture and dislocation of the head, no crepitus would have been felt. Undoubtedly, the crepitus felt at the time of my examination, almost six weeks after the injury occurred, was between the fragment fractured from the shaft of the bone and the shaft itself, for the skiagraph shows that the fractured and dislocated head could not have produced the crepitus. That this second fractured fragment should not have been united with the bone at so distant a time and yet, as the later history shows, never have undergone necrosis or caused any trouble is both surprising and gratifying. Union, of course, took place later.

The acromion is usually much more pronounced than normal, but it is not so prominent, nor is the furrow under it so well marked as in a subcoracoid dislocation. The skiagraph shows well the very great distance between the upper

end of the shaft and the acromion, although, as will be observed, the shaft is evidently pulled upward (to the midpoint of the glenoid cavity) by the action of the muscles and the arm is shortened by so much. Unfortunately, I did not make any measurements of the comparative length of the two arms.

When it is not dislocated the fractured head of the bone can usually be felt within the capsular ligament and its abnormal mobility determined. When it is dislocated into the axilla, as in my own case, it can also be felt as a marked abnormal prominence either directly below, or below and external to the coracoid. If the head is not displaced outside of the capsule, it is usually displaced with reference to the shaft of the bone, so that the upper end of the bone is considerably broadened.

After all, the Röntgen rays serve the best purpose and I think are an absolutely reliable means of diagnosis. It is precisely in these obscure lesions that the X-rays help us the most.

The usefulness of the patient's arm at the present time is quite as much as one ought to expect from so serious and complicated a case and especially one that had been neglected by the patient for so long.

Dr. Gwilym G. Davis mentioned a case of fracture of the anatomical neck of the humerus which he saw many years ago when a resident in Dr. Morton's service. The patient was an old person who had a fracture through the anatomical neck, with dislocation of the fragment into the axilla, under the pectoral muscle. An incision was made along the border of this muscle and through this the fragment was removed.

Dr. James K. Young has seen recently in consultation one case of fracture of the greater tuberosity of the humerus, the X-ray of which he exhibited, in which the diagnosis was made by him from the clinical symptoms. It was an illustration of the point mentioned by Dr. Keen regarding the manner in which this fracture is received, the patient falling with the arm high in the air. A second feature of this case, and a point not mentioned by

Dr. Keen, was the peculiar position of the resulting ecchymosis, which followed the biceps tendon and appeared down the front of the arm almost to the elbow. The disability following the accident was attributed by Dr. Young to injury of circumflex nerve.

Dr. George G. Ross said that at the German Hospital they see a number of fractures of the anatomical neck of the humerus. They treat them by applying ordinary dressings without resort to operative procedures. This fracture is not uncommon and the ultimate results are usually good. One man of forty-five years received the fracture three weeks ago, is now having passive motion applied, and can bring the arm almost to a right angle.

Dr. Lee said he had been three of the cases which Dr. Montgomery skiagraphed. He also saw Dr. Keen's case when the man first came to the receiving ward and also after reduction. Crepitus persisted and the provisional diagnosis was fracture of the coracoid process.

Dr. Keen, in closing, said in reference to fracture of the anatomical neck, that operation is not needed if the fracture extend outside the capsule, unless the raw surfaces of the bone are reversed and cannot be brought in contact, or unless the separation be entirely intracapsular and the fragment therefore be deprived of all blood supply. There was no hope of union in his case, without operation, as the fragment was displaced at a distance and was also reversed. He did not agree with Dr. Ross that the accident is a common one. Dr. Young's statement regarding the ecchymosis in his case is an interesting observation. In Dr. Keen's case there was no ecchymosis present, but when present its extension down the biceps would be of diagnostic value.

FRACTURE OF FEMUR AND PELVIS.

Dr. Robert G. Le Conte presented a boy of eight who on January 1, 1907, was caught on the fender of a trolley car and rolled along the ground, it being uncertain as to how much weight came upon him. He sustained a fracture of the upper third of the left femur, a fracture through the left ilium just to the outer side of the sacro-iliac joint (Fig. 1), a wound of the perineum extending to but not opening the membranous urethra, a scalp wound and general bruises over the entire body. Now, about ten weeks after the injury, the boy is able to walk well, although he does so with some limp. As the anterior and posterior spines of

the ilium of the left side are lower than those on the right, it has not been determined how much shortening, if any exists in the left leg.

GUNSHOT FRACTURES OF FEMUR AND FOREARM.

DR. LE CONTE presented a man of twenty-six who was shot on September 1, 1906, with a 38-calibre revolver, in the lower part of the left thigh and also in the left forearm near its middle. The thigh was fractured very obliquely; the line of fracture ran from below upward and from the outer anterior aspect inward for a distance of nearly 3 inches. The long, thin upper fragment had penetrated the knee joint and interfered markedly with motion. Four weeks ago an incision was made on the outer aspect of the thigh and 1½ inches of the spike-like portion of the upper fragment was removed sub-periosteally without opening the knee joint. There was firm union of the fragments. The two skiagraphs (Figs. 2 and 3), before and after operation, show very well the portion of bone removed. Motion at the knee joint has now increased to a little over a right angle and he walks without a limp.

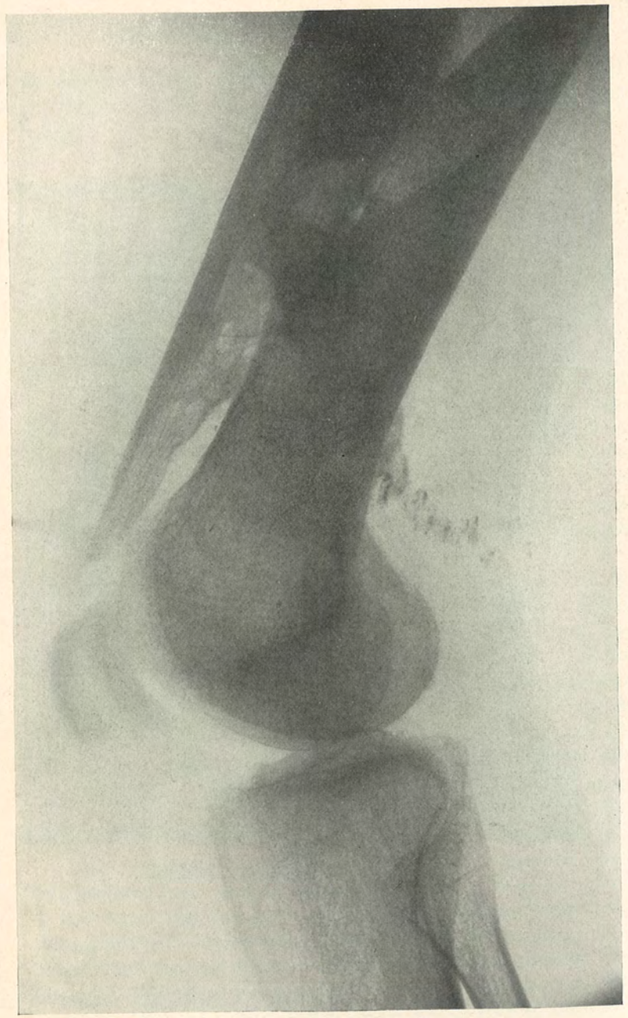
The bullet which passed through the forearm fractured the radius into three pieces, the middle piece or fragment being 2½ inches long and having been driven into the muscles on the radial side of the forearm. The lower fragment had been driven toward the ulna and had become united to it. There was entire absence of pronation and supination, and flexion and extension at the wrist joint was almost gone. From the skiagraph (Fig. 4), which shows the position of the fragments accurately, and also small particles of lead embedded in the muscles, it would look as if the fragments were separated by the interposition of muscular tissue and that no union had taken place.

A long dorsal incision was made the same day that the femur was operated upon, and on exposing the fragments of the radius it was found that the upper and middle fragments were firmly united, while the lower one had grown fast to the ulna. This latter fragment was separated from the ulna and brought into line with the rest of the radius, drilled and wired to the middle fragment (Fig. 5). Now he has nearly 50 per cent. of pronation and supination and quite 50 per cent. of flexion and extension at the wrist.

FIG. 1.

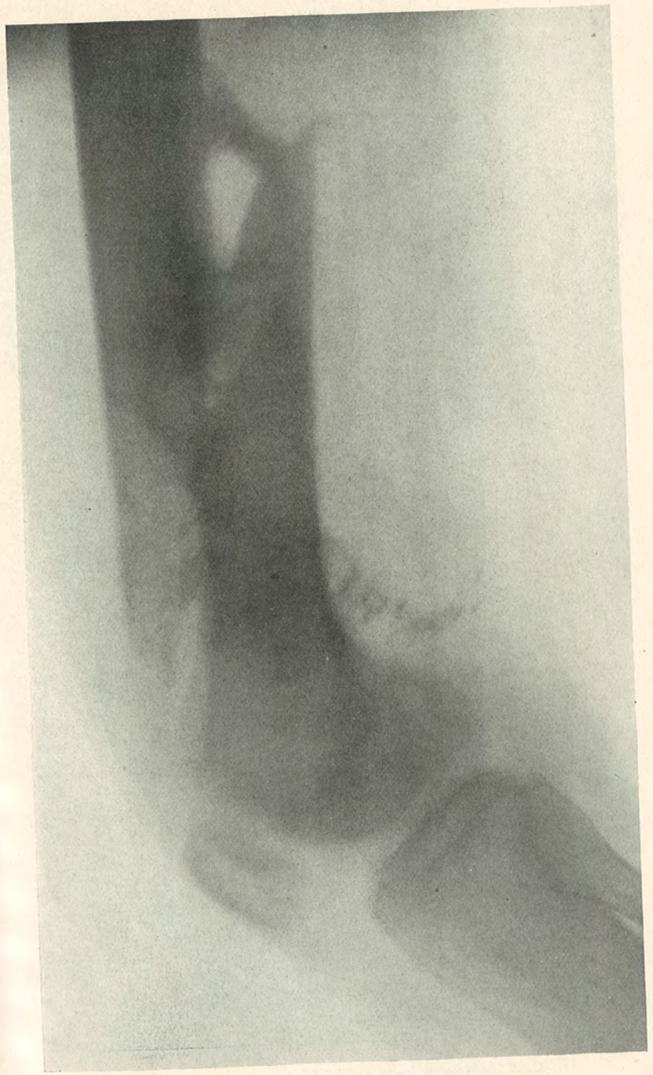
CASE I.—Showing fracture of the left thigh and left ilium.

FIG. 2.



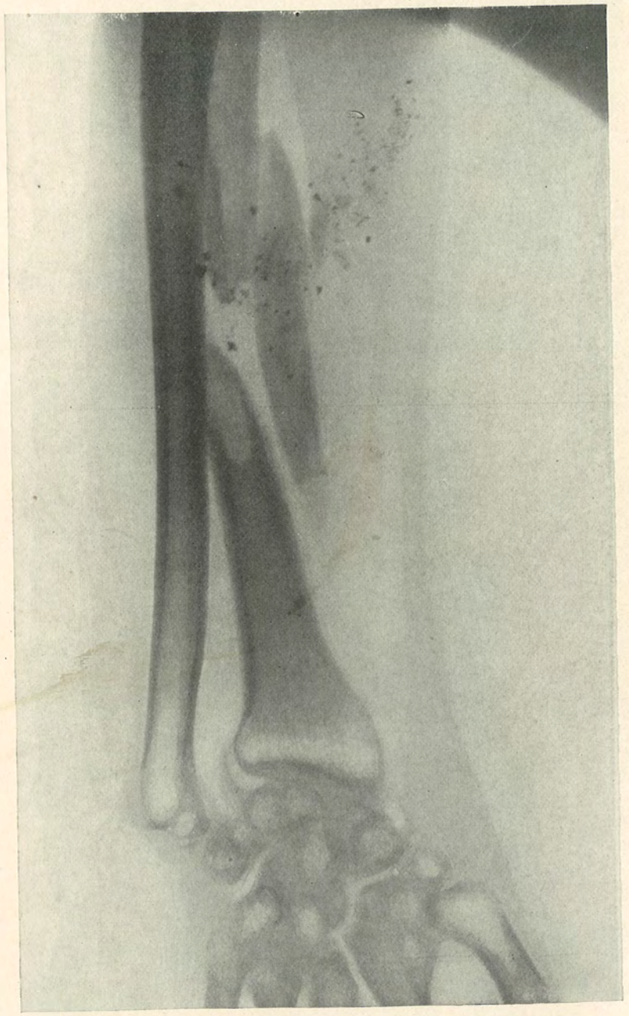
CASE II.—Gunshot fracture of the left femur, before operation.

FIG. 3.



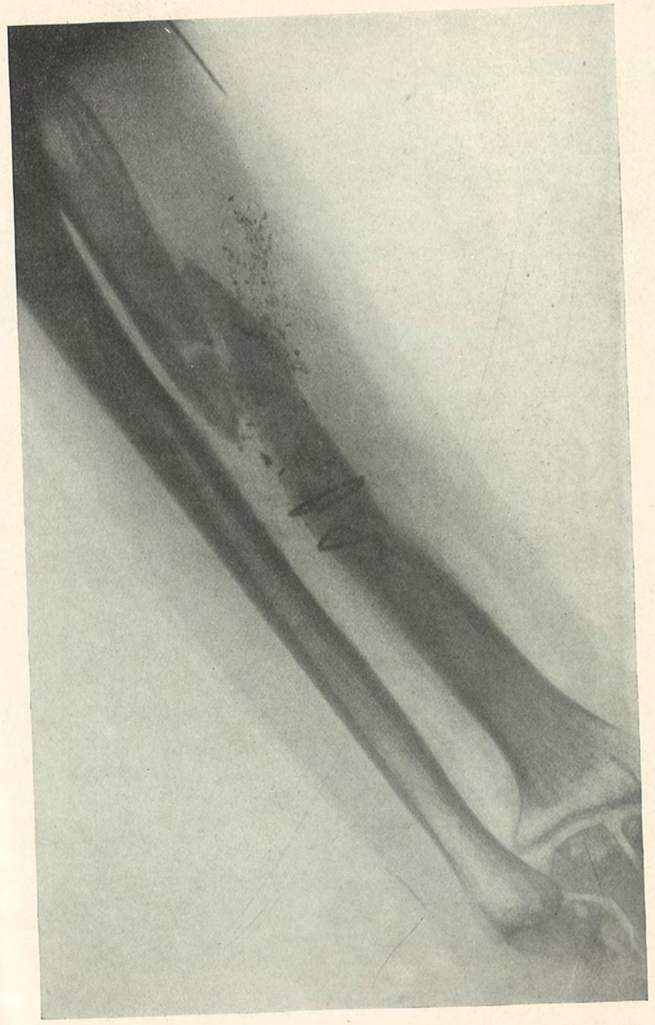
CASE II.—The same after removal of the spike-like process.

FIG. 4.



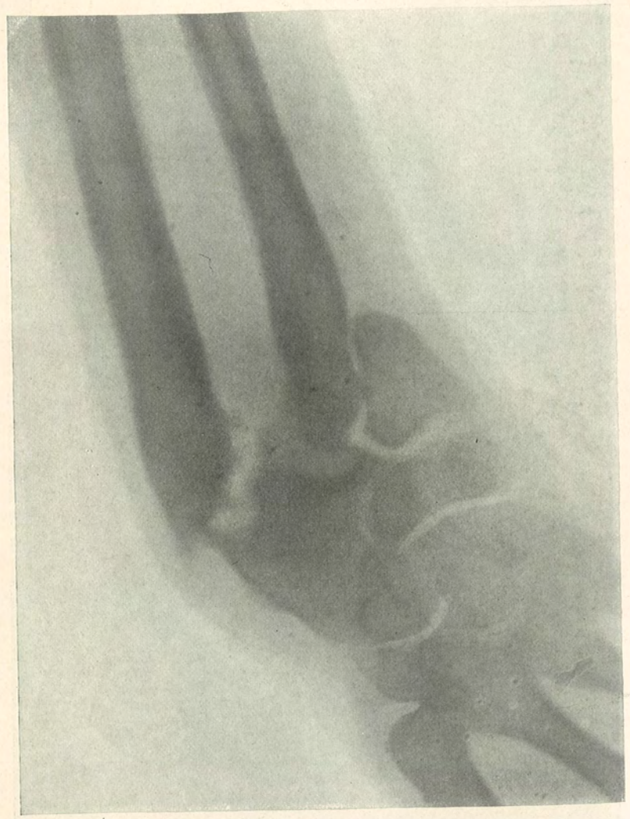
CASE II.—Gunshot fracture of left forearm, before operation.

FIG. 5.



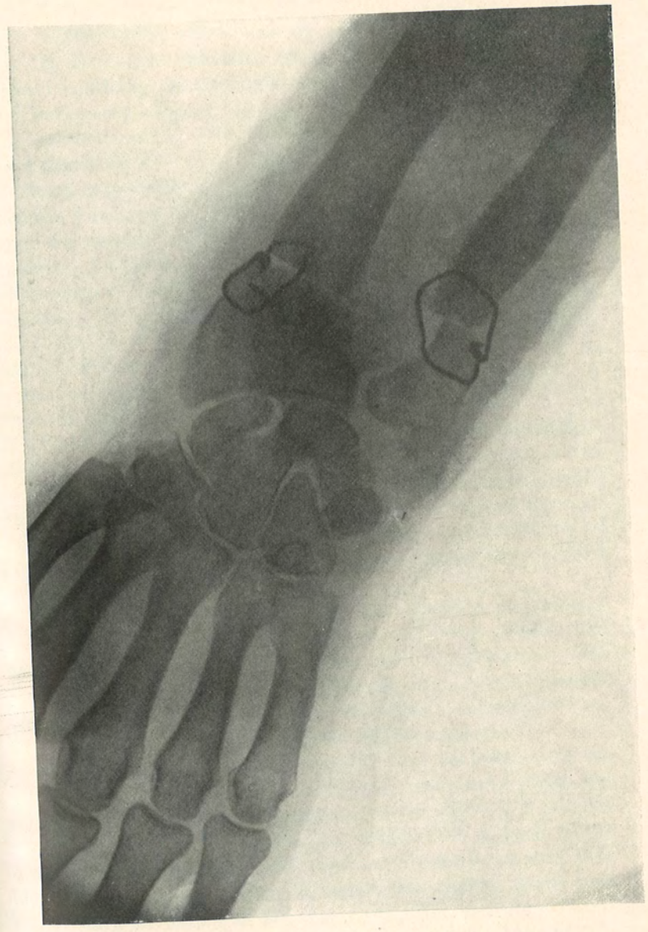
CASE II.—The same after wiring.

FIG. 6.



CASE III.—Deformity following compound fracture of the radius and ulna.

FIG. 7.



CASE III.—The same after correction.

COMPOUND FRACTURE OF RADIUS AND ULNA.

Dr. Le Conte presented, also, a man aged thirty-two, who sixteen months ago had his right forearm caught in a bread mixer, and sustained a compound fracture of the radius and ulna about 1½ inches above the wrist joint, with a long oblique fracture of the external condyle of the humerus. As a result of this injury the hand was deflected to the ulnar side, between 45 and 50 degrees, rendering it practically useless (Fig. 6). At the elbow joint the motion was very good, although the deformity was marked. Two and a half weeks ago an incision was made on the dorsum of the radius and a second over the outer aspect of the ulna. With considerable difficulty the lower fragments of the radius and ulna were loosened from their bed of fibrous tissue and brought into a straight line, drilled and wired (Fig. 7). It is too early yet to foretell the degree of usefulness which will return to the hand.

Dr. Richard H. Harte, speaking of the results obtained in the forearm first described, said that he saw the operation and at first it appeared impossible to obtain any satisfactory result. There seemed to be multiple fractures and the wound appeared to contain a particle of lead. It seemed as though resection of the fragment would be necessary, but a good result was obtained without.

The other patient was shown by Dr. Harte to the students at the University. Deformity was extreme, being greater than he had ever before seen at the lower end of the radius. The part looked much as though it was the site of an enormous osteo-sarcoma. A great deal of exuberant callus was removed and the indications are that good results will be secured.

Dr. George G. Ross mentioned a case of fracture of the pelvis in a man caught between a swinging crane and a pillar, and rolled around the latter. In addition to the fracture there was rupture of the posterior wall of the bladder. A catheter in the bladder discharged only blood for twenty-four hours and then bloody urine. During one day 96 ounces were passed. After four or five days the man was operated upon. The ascending ramus of the pubis was fractured on both sides and the broken ends protruded into the bladder. It was impossible to reduce them. The man died of sepsis a few days later.

PARTIAL GASTRECTOMY.

WITH REPORT OF TWO CASES.

BY CHARLES H. FRAZIER, M.D.,
OF PHILADELPHIA.

FOLLOWING close on the heels of the agitation in favor of the surgical treatment of appendicitis came the invasion of the surgeon into the therapeutic field in diseases of the biliary passages. It was not long after he had laid down certain surgical laws or principles governing the treatment of cholelithiasis and cholecystitis, that he began to encroach upon the territory of the internist and lay claims based upon pathological and clinical evidence to the right to treat the chronic dyspeptic. One is struck with the immense amount of surgical literature touching upon gastric surgery, that has appeared in journals during the past five years, and one would draw the conclusion that the general surgeon here and elsewhere saw and operated upon not an inconsiderable number of cases each year. In looking into the reports of five representative hospitals in Philadelphia for the year 1905, I was amazed at the paltry number of cases of gastric ulcer or gastric carcinoma that were tabulated in the surgical tables. There were, all told, about 30 cases of gastric ulcer, 1 duodenal ulcer and 14 cases of carcinoma. My own experience in gastric surgery during the past year has been limited to 10 cases, including 2 perforating wounds of the stomach, 4 cases of gastric ulcer, 1 of atonic dilatation, and 3 cases of carcinoma. This array of figures would seem to cast a reflection either on the surgeon or the internist, or both. The surgeon might be held to account if either in technique and dexterity or in his selection of cases the results were not such as to warrant the internist entrusting his patients to the surgeon's care. The published statistics do not seem, however, to bear out this theory. The fault seems to lie rather with the internist, either in his failure to recognize the

existence of an ulcer as the disturbing lesion in the chronic dyspeptic or on his unwillingness to admit and take advantage of the permanent relief to be obtained by properly chosen and properly executed surgical procedures. In the out-patient department of one hospital there were 176 cases of so-called chronic gastritis and not one case of gastric ulcer treated in the wards, while in another there were 321 cases in the out-patient department, and but 4 ulcer cases treated in the medical and surgical wards. With the absolute superficiality and disregard of the modern methods of accuracy, so prevalent in the average dispensary service, is it not likely that some cases of chronic ulcer are overlooked and perhaps a greater number of cases of carcinoma unrecognized in the operable stage? To a certain but lesser extent the same is probably true of cases seen in private practice. If in weighing the evidence the surgeon is found reprehensible, it may be because, in his earlier experience, he was less discerning in his selection of cases and advised operations in cases in which the findings and the results proved the impropriety of such measures. Nothing has done more to discredit the gastrojejunostomy than its performance in cases of atonic dilatation of the stomach without pyloric stenosis. The patients suffering from this lesion are often of the neurasthenic type; many have had movable kidneys, if they have not already been anchored for the time being by one of the innumerable methods, or symptoms referable to the appendix or ovary if these have not already been removed.

The first of the cases in the report was a man fifty-four years of age. He was a lithographer by profession but attained greater notoriety and reputation as a professional foot-racer. He had never been addicted to the excessive use of alcohol or tobacco, and until the onset of his present illness he did not know what it was to be sick. About two years prior to his admission to the University Hospital his appetite began to fail and he began to lose weight. He complained at times of a good deal of pain after eating, and about eighteen months later he began to vomit. His condition became more and more aggravated until, when first seen, he vomited after every meal; he had constant pain in the epigastrium

and his weight fell from 150 to 98 pounds. It was noted in his clinical record that, among other things, he had signs of arteriosclerosis; his urine contained neither albumin nor casts, the hæmoglobin was 60 per cent., red blood corpuscles 4,080,000, and white blood corpuscles 10,720. From the analysis of the stomach contents it was reported that Oppler Boas bacilli were present, that there was no free hydrochloric acid or lactic acid, and a total acidity of 58. The stomach was somewhat dilated but there was no palpable mass. Despite some of the negative findings, the age of the patient, his emaciation, the duration of his illness, the presence of Oppler Boas bacilli led us to view the case as one of carcinoma of the pylorus, probably too far advanced to admit of more than a palliative operation.

The operation was performed October 24, 1906, under morphin-ether anæsthesia, with the patient in the reverse Trendelenburg position. Through a 3½-inch incision a little to the right of the mid-line the stomach was exposed and an extensive area of induration discovered in the pyloric portion of the stomach. There were two palpable lymph nodes in the greater and three in the lesser curvature. There were, however, no adhesions to surrounding structures and the lesion, still regarded as carcinoma, seemed especially suitable for a partial gastrectomy. The four vessels, two in the lesser and two in the greater curvature, were ligated, enough of the gastrocolic and gastrohepatic omentum was tied off to include the enlarged lymph nodes from the pylorus to the Mikulicz-Hartmann line. Clamps were applied to the duodenum and the stomach, the intervening tissue divided with a cautery knife, the respective ends of the duodenum and stomach closed with two layers of sutures and an anastomosis effected with the Murphy button between the posterior wall of the stomach and the jejunum (no loop gastrojejunostomy).

As after many of these operations, the patient's convalescence was remarkably short and free from any discomfort. On the fifth day he was sitting in a chair and on the eleventh day he left the hospital. When last examined, three months after the operation, he had gained 34 pounds; he had been entirely free from pain and had vomited but twice, and then after an indiscretion in diet.

Report from the Laboratory of Surgical Pathology.—Specimen No. 1159. The specimen consists of the pyloric portion of the stomach, on the external surface of which there were a few small glands about the size of a pea, and numerous fibrous adhesions. The ulcer occupied the region of the pyloric ring, and here the mucous membrane was thickened and eroded. Histological sections of tissues from the base of the ulcer failed to show any evidence of new growth. The mucous membrane was seen to be the seat of an inflammatory process; there was a decided infiltration of leucocytes, distention of the blood vessels, and some free blood in the tissues. The inflammatory action extended into the submucous coat where the blood vessels were quite distended and the tissues hyaline in appearance, resembling chronic granulation tissue. The muscular coats were involved to a lesser extent in the inflammatory process. In the numerous sections examined it was impossible to demonstrate any evidence of malignant infiltration.

Upon hearing the pathological diagnosis the questions arose in my mind as to whether it would have been possible to have made a correct clinical diagnosis in this case and whether if the benign nature of the lesion had been known at the time of the operation some other procedure should have been adopted. I think it would have been quite impossible from the naked-eye appearance of the tissue, either before or after its removal, to have distinguished it from a malignant lesion. The ulcer belonged to the indurated class which, according to Mayo, predominate over the non-indurated in the proportion of 85 to 15; the dimensions of the lesion, furthermore, suggested malignancy; and the enlarged lymph nodes which were present, though associated sometimes with ulcer, are more constant in carcinomatous conditions.

As to the clinical history and findings, the duration of the lesion—two years—should have pointed rather to ulcer, as the average duration of carcinoma before the surgeon is consulted has been estimated at nine months. Vomiting is complained of in the majority of cases of cancer, as it would be in a benign pyloric stenosis, and emaciation is common to both. It has been shown by analysis of a large series of cases that too much reliance should not be placed in the clinical and gastric analysis of the stomach contents. Thus in a series of 67 examinations of test meals reported by Graham (*Boston Medical and Surgical Journal,* vol. clv, No. 8), in only 32 was there free hydrochloric acid, in 42 lactic acid and in 13 both lactic and hydrochloric acid. In 10 cases no blood was found and in but

27, about one-third, could a tumor be felt before the operation. The absence of free hydrochloric acid, lactic acid or blood, and the absence of tumor did not preclude the possibility of the lesion being of a malignant nature. The lesson to be learned from these statistics is the danger of placing too much reliance upon what might be called the refinements of laboratory diagnosis. How many cases does the surgeon see in which the question of operation has been fatally deferred because what are regarded as the positive diagnostic features of carcinoma are absent either singly or collectively?

As to the surgical procedure which was adopted in this case, I am disposed to think that even had I known at the time of the operation that I was dealing with an ulcer, I would have performed a partial gastrectomy. Of the three possible operations—gastroduodenostomy, gastrojejunostomy or gastrectomy—the choice would rest between the two last, as the extent and seat of the lesion would have rendered the first impracticable. As between the gastrojejunostomy and pylorectomy, preference should have been given to the latter because of the danger of malignant degeneration. Though complete cicatrization might have followed a gastrojejunostomy, while the process was going on, or even subsequently the lesion might have undergone malignant ulceration. Observations at the Mayo clinic have made out a very strong case in favor of the relation of cause and effect between ulcer and cancer, despite the skepticism of the clinician or clinical pathologist. Thus, quoting again from Graham (loc. cit.), in over three-fourths of their cases (79.5 per cent.), the pathological evidence was good (54 per cent.) or fair (25.6 per cent.). Taking the clinical histories together with the pathological findings, in over half the cases the combined evidence pointed to an ulcer as the lesion, upon which a carcinoma had been engrafted. If, therefore, "ulcer is the great and fertile soil of cancer," a strong argument may be advanced in favor of what appears at first sight the more radical procedure. As to the relative mortality, I doubt whether in benign conditions the mortality following the excision of the pyloric portion of the

stomach be much, if any, greater than after gastrojejunostomy, and the expectation of life should be greater because the favorite seat and a common predisposing cause of carcinoma has been removed. Rodman (*Journal of the American Medical Association*, 1906, vol. ii, p. 842) found but one death in a series of 31 pylorectomies for ulcer in the hands of five surgeons.

The second of the two cases included in this report was a gastric carcinoma. The patient was fifty years of age. According to her statement she had not observed any trouble with her digestion till seven months ago. She then began to complain of pain in the epigastrium and soon to vomit one or two hours after meals. The subsequent course of events, taken together with the presence of an easily palpable tumor in the pyloric region, and the gastric analysis, all suggested carcinoma of the pylorus. As the tumor was movable and the patient's general condition good, the case seemed quite favorable for a radical operation, and when the stomach was exposed at the operation this proved to be the case. The tumor had not spread beyond the pyloric portion of the stomach wall and had invaded but few lymph nodes. Accordingly, a partial gastrectomy was performed, the tissue removed including 1 inch of the duodenum, all that portion of the stomach up to the Mikulicz-Hartmann line, and the palpable lymph nodes. As in the first case, a gastrojejunostomy was effected with a Murphy button.

The recovery from the immediate effect of the operation was as satisfactory as one would have hoped for. At the end of a week the patient was sitting up in bed, had not vomited since the operation, and relished the food on her dietary. Two days later, however, she began to vomit and to complain of gastric distress; there was a little distention of the abdomen, but no rigidity or tenderness. The bowels were very loose and did not respond to any internal medication. The temperature meanwhile had been normal. Twelve days after the operation the patient began to fail very rapidly and on the fourteenth day she died.

An examination post mortem discovered almost a complete separation of the line of union between the stomach and jejunum. The Murphy button had passed on some two or three feet beyond the site of anastomosis. This result was quite unlooked for, and

it was the first unfortunate experience which I have had with the Murphy button, in so far as concerned the union of the apposed surfaces. Whether it was due to some mechanical defect in the button or to imperfect blood supply of that portion of the stomach at which the button was introduced, is a matter only of speculation. Had I not taken steps to prevent separation by the introduction at intervals of three or four interrupted sutures around the button I should have attributed the accident to an error of technic. In both of my cases the same technic was followed; the steps of the operation corresponded to the method of Billroth, in which the stump of the duodenum is completely closed and an independent gastrojejunostomy is performed. In neither case were there any technical difficulties; the pyloric end of the stomach was easily isolated, the gastric and superior pyloric arteries on the lesser curvature and the gastroduodenal and the inferior gastro-epiploic artery on the greater curvature ligated. Care was taken to avoid the middle colic, since occlusion of this vessel causes gangrene of the transverse colon. Clamps were applied to the stomach and duodenum, the intervening portion resected and the operation concluded in the conventional way.

The diagnosis of cancer of the stomach has been touched upon briefly already; suffice it to make two remarks with reference to the presence or absence of tumors. First, that on no account should there be any delay in recommending operation or exploration because of the absence of the tumor, since in a very considerable number in the early stage no tumor can be detected. Secondly, that the presence of a palpable tumor does not preclude the possibility of a radical operation. A small tumor near the pylorus on the anterior wall may be felt quite early in the course of the disease when it is still in the operable stage, whereas a large posterior cancerous mass may not be palpable until long after the time when it might have been removed.

The selection of the operation for gastric carcinoma depends upon whether a radical or palliative operation may be indicated. At first the operative treatment of gastric carcinoma consisted chiefly in palliative gastro-enterostomies, because cases were not seen in the curative stage. The surgeon's

experience with this operation has been most disappointing, both as to the mortality and as to the expectation of life. The Krönlein, Mikulicz, and Mayo statistics show that the average prolongation of life is only five months and that the mortality is from 15 to 33 per cent. At best there is but one chance in seven of getting over the operation, and then but five months more to live. Despite this wretched showing, the surgeon is quite justified in advising the operation when the patient is suffering intense pain, vomiting persistently and starving to death. I operated upon a patient of this description a little over a year ago; he was in a most forlorn condition, suffering intensely and emaciated to a degree. He survived the operation a little over a year, but in the meantime his gastric symptoms had been relieved, his vomiting ceased, he gained weight and one day he was carried off with an apoplectic seizure.

As compared with the discouraging results after gastro-enterostomy, there is an increasingly brighter outlook for partial gastrectomy. The mortality is (Mayo) in some hands only 10 per cent., and 25 per cent. of the operative recoveries live more than three years. Of the three most common locations of carcinoma—the stomach, the breast and the uterus—the stomach from the operative standpoint is the most favorable. Eighty per cent. or more are in the pylorus; this portion of the stomach is easily removed and a rich vascular supply guarantees repair of the visceral wounds. Of still greater significance is the distribution of the lymph nodes. These are so arranged on the lesser and greater curvature that they all lie to the right of the Mikulicz-Hartmann line, and can be removed easily by including with the pyloric end of the stomach portions of the gastrohepatic and gastrocolic omentum. For this reason in the treatment of malignant disease the stomach, as compared with the uterus or breast, is a much more favorable organ for operative intervention.

Dr. John B. Deaver said he was not surprised at Dr. Frazier's statement regarding the comparatively few cases of carcinoma recognized in the medical dispensaries. As long as

dispensaries are run in the slipshod manner they now are, there will be few cases referred from them. It is disappointing to think of the way these dispensaries are conducted, the patients being rushed through, this one ordered prescription No. 4, that one No. 6, and so on. At the German Hospital, Dr. Deaver diagnoses a fair number of cases of ulcer and cancer of the stomach which are sent to him, and no doubt his medical colleagues could do the same under proper circumstances.

He does not agree with Dr. Frazier as to the general value of the Murphy button. He has seen mishaps with it in cases of enterostomy, in spite of the fact that the nurse in charge was always careful to see that mechanically the buttons were all right. He has long since discontinued its use, which can well be done when there are still the various forceps and the needle and thread. The results in stomach resections in Dr. Deaver's hands are good.

What is more needed at the present moment than anything else is that either an earlier diagnosis be made, or, in the light of suspicious symptoms, abdominal incision recommended.

Dr. W. W. Keen, in speaking of the findings of the pathologist in Dr. Frazier's first case, said that when there was a difference between the pathologist's findings and the clinical history he was inclined to be guided by the latter in preference to the former, for the pathologist as well as the clinician makes mistakes. In Dr. Frazier's case where the microscope showed no carcinoma, in the speaker's opinion the clinical history pointed to the fact that carcinoma would have developed, and he showed good judgment in doing a pylorectomy.

In carcinoma of the stomach operation is often too long delayed. Adhesions often prohibit operation in cases where there is a palpable tumor. Dr. Frazier was fortunate in his first case in not finding adhesions so extensive as to prevent removal. In general, if in three or four months a gastric disorder becomes no better under careful treatment, abdominal section should be made. In this way carcinoma will be detected early before there is a palpable tumor, and relatively good results will be secured.

Dr. John H. Gibbon, in speaking of the differential diagnosis between indurated ulcer and carcinoma of the stomach, said there is nothing more difficult unless it is deciding whether to do a gastro-enterostomy when there is an ulcer at the pylorus. There are no rules for these cases. In a personal case reported

several years ago there was a palpable mass and he expected to find a cancer. He found a mass in the stomach and did a gastro-enterostomy, intending to do later a resection. The woman at once improved and to-day is well, the lesion evidently being ulcer instead of a cancer. Another case was exactly the opposite, cancer being present when the diagnosis of indurated ulcer had been made. The case, however, was inoperable and the patient died, there being cancer of the suprarenals also. Moynihan states that differentiating points are hardness and glandular involvement in cancer and more extensive adhesions in ulcers.

Dr. Gibbon does not agee with Dr. Frazier that partial gastrectomy is no more dangerous than posterior gastro-enterostomy; hence the importance of differentiating between ulcer and carcinoma. He also has had trouble with the Murphy button, particularly in a case of end-to-end anastomosis of the large bowel in which ulceration due to the button was followed by abscess behind the colon and death in five weeks. Murphy is now using an oblong button with the intestinal side larger and heavier than the other in order to prevent the accidents caused by the older form; but this is not appreciated by many, especially by foreign surgeons. Still, trouble may occur with the new pattern.

A palpable mass in the stomach does not always mean carcinoma, as shown by the presence of the ulcer in his case. Robson has shown that where there is a palpable mass one is justified in operating, although under such circumstances one feels that he is operating too late. Dr. Gibbon agrees with Dr. Frazier that in cases of cancer partial gastrectomy is preferable to posterior gastro-enterostomy. Although the latter gives great relief for a few weeks, improvement lasts only a short time.

Dr. Gwilym G. Davis said the referring of but few cases of early gastric cancer is not entirely the fault of the out-patient medical men, but is due partly to force of circumstances. Typhoid fever is so rife that admission to other cases is denied and hence chronic stomach affections that should be carefully studied have to be turned away. Dr. Davis agrees with those who eschew the use of the Murphy button, as he came to grief with its employment some time ago in an end-to-end anastomosis of the small intestine. If in a stomach lesion he believes he is dealing with cancer a radical operation is performed; if the lesion is regarded as an ulcer, he performs posterior gastro-enterostomy as being less dangerous than the former.

Dr. Frazier, in closing, mentioned a case somewhat similar to that of Dr. Gibbon's, as an example of the improvement and apparent restoration of health which may follow gastro-enterostomies. The patient was operated upon about four years ago for a tumor at the pyloric end of the stomach, which was believed to be carcinoma. He was very much emaciated at the time, owing chiefly to obstructive symptoms. A posterior gastro-enterostomy was done and the patient rapidly gained in strength and weight, and was apparently wholly restored to health; consequently the lesion is believed to have been an ulcer, although there was a distinct mass which was quite palpable before the operation.

As to the terms partial gastrectomy and pylorectomy, he thought that the term pylorectomy might now be employed to include not only resection of the pylorus, but resection of the pyloric portion of the stomach, that is, up to the Hartmann-Mikulicz line.

The unfortunate results in the second case of gastrectomy may not have been due to the use of a Murphy button. It is only fair to say that the button used in this particular case was found upon its removal at the autopsy to have been imperfect in its construction and mechanism. Whether or not this defect was responsible for the accident it is impossible to say, although perhaps it would be only fair to give the button the benefit of the doubt.

STATED MEETING, HELD APRIL 1, 1907.

The President, Dr. John B. Roberts, in the Chair.

(*a*) CHRONIC PANCREATITIS RESEMBLING CARCINOMA; (*b*) A SERIES OF BREAST CASES, BENIGN AND MALIGNANT; (*c*) A SERIES OF GOITRE CASES.

Dr. William L. Rodman reported these cases, with presentation of patients. The first patient was a man of 56, first seen one year ago when he was suffering from jaundice and marked cachexia. He had lost 15 pounds and his symptoms were suspicious of carcinoma though no positive diagnosis was made. Opening the abdomen revealed in the head of the pancreas a densely hard mass large as a fist. This appeared to confirm the suspicion of cancer of that organ, but because of the possibility of chronic pancreatitis the gall-bladder was drained. The man was out of bed on the second or third day and made an unusually rapid and gratifying recovery, drainage being kept up for 3 or 4 weeks. In the light of the results, the case is regarded as one of chronic interstitial pancreatitis, probably due to the habits of the man, who used alcohol freely.

Benign Tumors of the Breast.—Dr. Rodman next presented three patients illustrating the results of plastic resection of the mammary gland for benign tumors. He was greatly impressed by Dr. Warren's description of this method at the meeting of the American Medical Association in Portland, and has since employed it in 17 or 18 cases, regarding 15 of which he has full notes. Two of the patients shown were the first and last of the series. All did remarkably well. The diagnosis of benign growth was made in each instance and there has been no recurrence or evidence of malignancy in any of them. It should be remembered, however, that one cannot always be absolutely sure, hence the clinical diagnosis should always be supplemented by microscopic examination of the removed specimen, as the majority of mammary tumors are malignant and all of them potentially so. One of the patients was