lobe with scissors and feel down for the line of cleavage. The statement that the base of the prostatic tumors is covered by mucous membrane is not in accordance with anatomical facts, as can be shown by any longitudinal section of a prostate.

The advantage of the perineal operation is simply in the general surgical principle that in removing a growth from any place it should be gotten out by the shortest possible route, with the least damage to tissue and least danger of hemorrhage, and in this case the median perineal is the route to follow. The only reason it is not universally adopted is because men have not taken the pains to study the pathological anatomy of the parts.

In regard to the bad results, Dr. Alexander did not feel any fear in reference to stricture as he did the operation. It is not his custom to pass any sound through the urethra until several weeks afterward. He then passed a sound in order to see that the urethra is all right. In this operation the mucous membrane is entirely preserved around and outside the urethral orifice. It is not necessary to preserve the urethra, but to prevent stricture it is necessary to preserve a perfect smooth mucous membrane about the urethra, and that is always the case in a properly performed perineal urethrotomy.

STATED MEETING, HELD DECEMBER 5, 1910

The President, Dr. Robert G. Le Conte, in the Chair.

VOLKMANN'S ISCHÆMIC PARALYSIS.

Dr. John H. Jopson presented a boy of eight years, who was brought to him about three weeks after sustaining a fracture of both bones of the forearm, which had been treated by the use of anteroposterior splints. When the splints were removed, about ten days after the accident, pressure sloughs were found on both the flexor and extensor surfaces of the forearm. Contracture of the fingers and hand quickly followed. The contracture was typical of Volkmann's ischæmic paralysis, viz., a fixation of the part due to shortening of the flexor tendons of the fingers. There were unhealed ulcers on the flexor and extensor surfaces. Two months later the boy was admitted to the Presbyterian Hospital.

On examination of the arm, the ulcerations were found to be healed. That on the flexor surface was adherent to the subcutaneous tissues. The hand was held in a position of flexion and pronation, the fingers extended and abducted (Fig. 1). The hand could be moved about 30°. When the fullest extension possible was obtained, the fingers were flexed; when the hand was flexed, they were extended. There was anæsthesia over the distribution of the ulnar nerve in the hand.

Massage and passive motion were used for the next two months without much improvement.

Operation five months after original injury. An incision was made at the site of the scar on the flexor surface of the forearm, four inches long. The tissues beneath were adherent and were separated. The muscles were yellow in color and in a state of degeneration, brittle, and fibroid. Both the median and ulnar nerves were imbedded in fibrous tissue, and adherent, thinned out, and atrophied as if by pressure, for a considerable distance in the lower third of the forearm, but above this point abruptly becoming of normal appearance.

Muscles and nerves were dissected apart, and myotomy and lengthening of the flexor sublimis digitorum and palmaris longus

were practised. The flexor profundus was not lengthened, although contracted, this being deferred for a second operation, if necessary. The forearm and hand were dressed upon a palmar splint.

This operation has been followed by some improvement. There is an increased range of motion; the area of anæsthesia is lessening, and further improvement is hoped for, especially as the condition in which the nerves were found was one which would promise a gradual improvement.

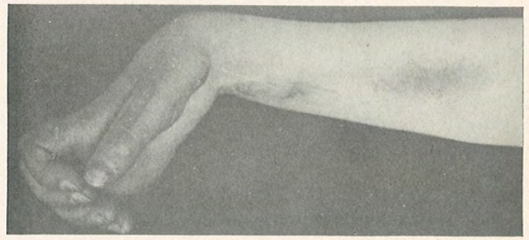
Dr. Jopson added that both the etiology and treatment of this condition have been the subject of considerable discussion, and the valuable paper of John Jenks Thomas, in the ANNALS OF SURGERY for March, 1909, contains an excellent review of the subject from these stand-points. The principal theories advanced as to the causation are obstruction to the arterial supply, interference with the return venous circulation, and compression and injury of the nerves.

The latter is looked upon by some writers, including Thomas, as a secondary and contributing but not a necessary factor in its causation. In over one-half of the cases symptoms of nerve involvement were present. Tight bandaging is not always a factor in the etiology. Whatever the cause, the changes in the muscles involved are very striking, both macroscopically and microscopically. They are found to be yellow in color, hard, contracted, the nuclei and transverse striations lost, and the connective-tissue elements increased.

Treatment is oftentimes unsatisfactory. Operative measures include lengthening of the contracted muscles by plastic operations on the tendons or, better still, upon the muscles, freeing of the nerves, and shortening of the bones by resection.

DR. GWILYM G. DAVIS said that he had seen some of these cases. Personally he was inclined to think the nerves play a very considerable part in the deformity produced. In the picture which Dr. Jopson had passed around the position assumed by the hand was almost absolutely that of ulnar paralysis. The extension of the proximal phalanges and the contraction of the distal and middle ones was most typical of that which resulted when the ulnar nerve is injured. It is believed that the injury of the median nerve does not cause so much trouble, because its distribution in the hand, as far as motor influence goes, is com-

FIG. 1.



Volkmann's ischæmic paralysis.

paratively slight, therefore when the two nerves are injured, as was apparently the case in Dr. Jopson's patient, the contraction of the muscles supplied by the ulnar nerve overshadows that of the muscles supplied by the median nerve, and the consequence is the typical contracture of Duchenne. On operation the muscles are found more or less bound together and the tendons to the nerves.

As regards the treatment, the most severe cases are at present almost hopeless, but there are a number of others not of the highest grade of severity for which very much can be done, and the line of treatment is perfectly clear. In the first place, one ought to lay back such a flap as will give proper access, and then follow the ulnar and median nerves down through the cicatrix, if necessary deliberately resecting them and uniting the ends again. As regards the tendons, they should be separated and lengthened in the manner followed by Dr. Jopson. Advantage should be taken of the fatty tissue to slip it in between the tendons, and also the use of Cargile membrane may be resorted to.

The same condition identically is produced by injuries of the forearm, the result of machinery accidents, and the same treatment is applicable.

Dr. James K. Young said that something should be said of the manipulation in these cases in addition to the operative methods. After the operation it is advisable to manipulate them after the method of Robert Jones, of Liverpool. He showed in Washington this method, manipulating first the hand, holding the arm firm, and he claimed very good results. In addition to the operative treatment such manipulation of the parts will very much improve the condition.

Dr. John H. Gibbon remarked regarding the technic of anastomosis of tendons and nerves, calling attention to a method to prevent the fixation of the nerve in scar tissue. It is known that Cargile membrane and other kinds of material are used to prevent the fixation at the point of anastomosis, but it occurred to him in making an incision to take one of the big superficial veins and make a cuff from it. He therefore resected about an inch and a half from one of the large veins, put it in salt solution until ready for it, then, resecting the nerve, slipped the cuff up on one end, brought the other end of the nerve up and sutured it, then slipped the cuff over the point of anastomosis. Although

paratively slight, therefore when the two nerves are injured, as was apparently the case in Dr. Jopson's patient, the contraction of the muscles supplied by the ulnar nerve overshadows that of the muscles supplied by the median nerve, and the consequence is the typical contracture of Duchenne. On operation the muscles are found more or less bound together and the tendons to the nerves.

As regards the treatment, the most severe cases are at present almost hopeless, but there are a number of others not of the highest grade of severity for which very much can be done, and the line of treatment is perfectly clear. In the first place, one ought to lay back such a flap as will give proper access, and then follow the ulnar and median nerves down through the cicatrix, if necessary deliberately resecting them and uniting the ends again. As regards the tendons, they should be separated and lengthened in the manner followed by Dr. Jopson. Advantage should be taken of the fatty tissue to slip it in between the tendons, and also the use of Cargile membrane may be resorted to.

The same condition identically is produced by injuries of the forearm, the result of machinery accidents, and the same treatment is applicable.

Dr. James K. Young said that something should be said of the manipulation in these cases in addition to the operative methods. After the operation it is advisable to manipulate them after the method of Robert Jones, of Liverpool. He showed in Washington this method, manipulating first the hand, holding the arm firm, and he claimed very good results. In addition to the operative treatment such manipulation of the parts will very much improve the condition.

Dr. John H. Gibbon remarked regarding the technic of anastomosis of tendons and nerves, calling attention to a method to prevent the fixation of the nerve in scar tissue. It is known that Cargile membrane and other kinds of material are used to prevent the fixation at the point of anastomosis, but it occurred to him in making an incision to take one of the big superficial veins and make a cuff from it. He therefore resected about an inch and a half from one of the large veins, put it in salt solution until ready for it, then, resecting the nerve, slipped the cuff up on one end, brought the other end of the nerve up and sutured it, then slipped the cuff over the point of anastomosis. Although

the result obtained in this case (one of long standing) was unsatisfactory, he believed the use of the superficial veins in this way would be a satisfactory method of preventing adhesions, which are so apt to occur at the line of anastomosis.

After performing this operation, he learned that some one else had thought of this method, although he had never heard of it.

Dr. J. Edwin Sweet called attention to a method of attaining the result desired by Dr. Gibbon—the use of veins or arteries of animals, stretched over glass rods and hardened in formalin, the formalin removed by washing in water, and the preparation then boiled. This method, suggested by Foramitti, has two advantages over the use of a fresh superficial vein: the one, that different sizes and lengths can be prepared and kept on hand; the other, that the tube thus prepared resists absorption longer than the fresh tissue, and would be less likely to become adherent in either the nerve or the surrounding structures.

FRACTURE OF THE PATELLA.

WITH A REPORT OF FIFTY-SIX CASES.

By EMORY G. ALEXANDER, M.D.,

OF PHILADELPHIA,

Demonstrator of Fracture Dressings, Jefferson Medical College and Women's Medical College; Assistant Surgeon, Kensington Hospital for Women; Surgeon to Out-Patient Department, Episcopal Hospital, and Children's Hospital, Mary J. Drexel Home.

This paper comprises a study of 56 cases of fracture of the patella, admitted to the Episcopal Hospital since the year 1905.

To Drs. Neilson, Deaver, Davis, and Frazier, to whose services these patients were admitted, I am indebted for the privilege of reporting these cases. To Dr. H. C. Deaver I am especially indebted for the privilege of operating upon several of these cases, and to his wise counsel, especially in suggestions of operative technic and after-treatment, do I owe much of the success gained.

The primary object of this paper is to discuss the operative technic and after-treatment, therefore little shall be said of the causes, varieties, diagnosis, and symptoms of this very important and interesting fracture.

Of the 56 cases tabulated, 37 were in males, while 19 occurred in females, a ratio of almost two to one. There is no anatomical explanation for the more frequent occurrence of this fracture among males, and, in all probability, it is due to their greater exposure and activity.

The ages in this series range from 18, the youngest, to 77, the oldest. I have arbitrarily classified them according to age as follows:

Four occurred between the ages of 10 and 20; 11 between 21 and 30; 19 between 31 and 40; 14 between 41 and 50; 6 between 51 and 60; 1 between 61 and 70, and 1 between 71 and 80.

The greatest frequency occurred between the ages of 31 and 40 years; the period, certainly, of the greatest business

activity. It is rather unusual for this fracture to occur under 20 years of age. This is probably due to the bony condition or better muscular control of the young, they being less apt to slip or fall. The youngest patient that I have any personal knowledge of was a boy aged 12 years. This case was operated upon with excellent result, by Dr. H. C. Deaver, at the Children's Hospital of the Mary J. Drexel Home.

Of the 37 males, 19 broke their left patella, while 18 broke the right. Of the females, 11 broke the left, and 8 the right patella.

It appears from this, although the numbers are almost equal, the ratio being larger in the females, that the left patella is more apt to be fractured. Anatomists claim that no asymmetry exists in the lower extremity. Is this fracture purely an accident or is there some cause for its more frequent occurrence in the left patella? Some greater muscular development, a longer step with one leg, or a firmer tread with one foot should be thought of.

The causes given in this series were: "fell," 27; "slipped," 27; "kicked," 2. The histories were somewhat indefinite on this point and I could find only 9 that actually fell from a distance, so whether the "fell" meant a slip and a fall, or a fall from a distance, I cannot say. I am inclined, however, to think the former the case. Several of the patients stated that they slipped, heard something break, and fell.

A great majority of these fractures were of the usual transverse variety, with the large fragment above. A few of this transverse variety showed the reverse to be true, the large fragment being below. Forty-nine cases were of this combined transverse type. Six cases were comminuted; these occurred in two that were kicked, and in four that fell from a distance. The number of fragments in this latter type varied from three to many. No compound fracture occurred in this series.

I have taken a picture of a normal patella in three positions: with leg extended, semiflexed, and acutely flexed. The patella with the leg semiflexed is seen at the highest point of

the condyle of the femur, and it is with the leg in this position that the fracture usually occurs. A sudden strain on the leg, with a violent contracture of the quadriceps extensor muscle, snaps the patella at its weakest and most unsupported point, the lower third.

The symptoms and diagnosis I shall omit, as there is nothing I can add to that already known of the former, and the latter is usually quite easy.

Little shall be said of the non-operative treatment, as all agree that by this method nothing but fibrous union can be hoped for, with more or less separation of the fragments. Certainly in the great majority of instances the results are far inferior to those of the open method of treatment. There are, of course, certain cases that must be treated by this method, as the aged, those in whom some constitutional condition contraindicates operation, or those, who although good operative risks, refuse to be operated upon. Comminuted fractures, with no separation or tilting of the fragments, and, in all probability, no tear in the fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule, may also be treated by the conservative non-operative method. Of the many conservative methods of treating this fracture, that employed by the late Dr. Agnew is probably as good as any.

I am fully aware that many think the open method of treatment a dangerous one and one that should be done only by a skilled operator. They are willing to operate themselves, but unwilling to teach it. It is dangerous for an occasional operator and one unfamiliar with asepsis and operative technic to do any major operation. I believe that the open method should be taught, but, at the same time, the physician and occasional operator should be alive to the fact that an operation for fracture of the patella is not a minor one, involving, as it does, the largest and at the same time one of the weakest joints in the body, and that if infection does occur, it may end most disastrously. Consequently it is an operation accompanied with a certain definite risk, and one probably attended by much more danger than a simple appendectomy, as the

synovial membrane does not seem to possess the protective power of the peritoneum in taking care of a slight infection.

The best time to operate is now thought to be after all oozing has ceased, after the exudate has reached its height and has even begun to subside, and the tissues have had time to become sealed off. This process usually takes from six to ten days, but it can be hastened somewhat by placing the leg on a posterior splint, with elevation, and the application of an ice bag. In reviewing the histories of these cases, the temperature charts, as a whole, failed to show any marked difference between those operated upon early and those in whom the operation was delayed. The immediate success of these cases depends entirely on whether or not infection occurs. This, I believe, rests between the resistance of the tissues, the virulence of the infection, if one does occur, the preparation of the patient, and the operative technic. Dr. Murphy has pointed out that in an early operation the surgeon is working in tissues somewhat devitalized and, therefore, less resisting and more apt to become infected.

In a letter, which I quote with his permission, Dr. Murphy says: "My reason for postponing the operation for six to ten days is to give the synovial membrane an opportunity to react to the irritation of the trauma and the irritation of the blood-clot in the joint. This reaction produces a cofferdamming of the lymph spaces in the subendothelial layer of the synovial membrane, and lessens the danger of infection very materially."

"We resorted to an injection of 10 c.c. of formalin and glycerine into the joint, immediately after the fracture. This produces a chemical irritation, increases the number of polymorphonuclear leucocytes in the joint, and increases the constitutional polymorphonuclear reaction. It also cofferdams the lymph spaces and insures a prophylaxis against infection. The operation is then done five to seven days after this injection."

Theoretically, with perfect technic, there is nothing to gain by delay other than to allow the oozing, especially from the torn synovial membrane, to cease, as this in an early operation

can be quite annoying. Practically, however, we know that our technic is not always perfect and that infection does sometimes occur. This is lessened by a late operation and, likewise, I believe, the patient suffers much less the first few days after the operation, and the convalescence is shortened, as there is less local reaction.

The incision should be elliptical. It makes little difference if the convexity is above or below. Some surgeons claim the convexity should be above, as it takes the scar away from the knee and is less apt to cause pain with the patient in the kneeling posture. Of the cases I was able to follow, I was unable to substantiate this claim. I think the incision should be an elliptical one, preferably below, as a greater exposure can be obtained well away from the line of fracture, and it lessens the chance of infection and after-complications, especially if silver wire is used. The incision should be carried well down on either side, as I shall point out later, to permit drainage. The next step in the operation, after reflexing well the skin flap, is to divide the prepatellar bursa and fascia lata. The clots are now swabbed out with dry gauze, no fluid being used, and if any irrigation is necessary, only saline solution or sterile water should be employed, as bichloride or other devitalizing or irritating agents are apt to increase the flow of serum and favor infection. The reflected tendon over the broken edges is now retracted, the frayed ends rounded, and by blunt dissection separated a short distance from the margin of the fracture. Often this is impossible on account of the small fragment. The raw surface of the patella should next be freshened, especially in late operations, to get rid of the adherent organizing clot. With a hand drill, beginning in the centre of the upper fragment about one centimetre from the margin of the fracture, a hole is drilled obliquely downward so as to emerge on the broken surface just at the point where the dense cancellous tissue and thin compact lamina unite. A similar opening is drilled in the lower fragment. Through these two holes a silver wire is passed, the fragments are brought together as accurately as possible, and the wires

twisted one or two times; the redundant wire is cut off, and the twisted ends that remain are reflected upwards under the tendon and gently hammered down. Some operators use two wire sutures, one being placed on either side of the patella. The tendon is next sutured with chromic gut, and likewise the torn fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule. At the lower angle of the wound, if the rent in the fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule does not extend so far down, an opening should be made to permit drainage. The prepatellar bursa and fascia lata are next sutured with chromic gut and the skin by interrupted silkworm gut sutures. The skin wound should not be sewed too tight, neither should too many stitches be applied. The angles of the wound corresponding to the openings in the fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule should be left open. As a rule, this procures sufficient drainage, but if there has been much oozing, a few strands of silkworm gut or a small piece of rubber tissue can be inserted. The leg is now placed on a well-padded, slightly convex, posterior splint until the patient has fully recovered from the effects of the anæsthetic, when the splint is removed and the leg is placed on a pillow.

The point that I wish to emphasize in the operative technic is the advantage of silver wire. Out of the thirty cases that I have been able to follow, four refractured the patella; three of these were sutured with absorbable material. The one that refractured with wire was due to a fall downstairs, and so great was the strain thrown upon the patella, that the wire cut through the upper fragment. Silver wire is certainly the most aseptic and at the same time the strongest suture material that can be used. The only disadvantage is that it occasionally has to be removed. Removal was necessary in three cases in this series. This undoubtedly can be avoided, provided no infection occurs, but even if skin infection—the most common in this operation—does occur, if the skin incision is well away from the line of fracture, and if the ends of the wire are not left too long and are well covered by the tendon, fascia lata,

and prepatellar bursa, removal of the wire may not be necessary. If the wire has to be removed, however, it can be easily done with little inconvenience to the patient. That wire causes softening of the bone around the opening is highly improbable unless some infection occurs. Wire is certainly no more irritating than any other material used in these cases, as kangaroo tendon, chromic gut, or even, as has been used, silkworm gut.

Cotton, in his excellent book on "Dislocations and Joint Fractures," states that refracture after the eighth week is rare. Only one of this series occurred in that time; the others ranging from four months to four years.

Is bony union obtained in a fracture of the patella? Some surgeons claim not. Personally, I have never examined a sutured fractured patella under the microscope and cannot say. In one of these cases I removed a wire one year after operation. I took the opportunity, clinically, to examine the union and to all appearances it was bony. In this case, even though there had been a slight skin infection followed by a persistent sinus for several months, the bone did not appear soft around the wire, and it took quite a "tug" to dislodge it. As shown by the refractures occurring in this series, the bony union, if one is obtained, is not strong. Why then not reinforce this with a non-absorbable suture?

The after-treatment of these cases is most important. The splint is removed as soon as the patient has recovered from the effects of the anæsthetic, or, preferably, it can be left on through the first restless night following the operation. On its removal, the leg, slightly flexed, is placed on a pillow. Gentle passive motion is begun in a day or so. As it is possible to move the leg through an angle of five or ten degrees without moving the patella, this much motion is taken advantage of. The passive motion is gradually increased so that by the third week the leg can be flexed to a right angle. In the last case that I operated upon, the patient could flex the leg to a right angle on the tenth day, was allowed out of bed on the twelfth, and walked the next day. He was discharged, walking, from the hospital on the sixteenth day. It is a mis-

take to keep the leg for weeks on a splint or in a cast. Not only does the patient lose much time by the delay, but the muscles become atrophied and the knee more or less ankylosed. These patients will tell you that they were a year getting a useful limb. Of the ultimate end results, say one year after operation, there is little to choose between. All that I was able to follow got a fairly good functionating result. Some complained of a little stiffness or weakness in the knee on flexion or extension. A few complained of pain in the knee before a storm. On the whole, all showed excellent results; especially was this true of the five private cases operated upon by Dr. Deaver. These patients were treated by the above method, and so excellent were the results, that one would never know, except on close examination, that they had a fracture of the patella. The others, in all probability, would have had as good a result if they could have been properly carried through the late after-treatment.

In this series, two cases died, both from sepsis. One was operated upon on the fourth day, the other on the thirty-fifth day following the accident. The first, a woman, had an abortion ten days before the accident, and when operated upon, unknown to the surgeon, had a bad discharge from her uterus. Whether this patient died from a primary infection or one occurring through her blood, it is hard to say. Her knee did not show much inflammatory change for several days after the operation, although she was profoundly septic. Repeated blood cultures were negative. A culture taken from the knee, however, showed a bacillus morphologically resembling the Klebs-Löffler. Everything possible was done to save this patient's life. Her leg was amputated three and one-half months after the primary operation, but she died two weeks later of exhaustion. The other death occurred in a man who was operated upon five weeks after the accident. I saw the operation performed and the technic was apparently faultless, but evidently some error occurred, for the knee became infected, and the patient died two months later of sepsis.

The majority of cases operated upon showed a febrile

reaction ranging from 99° to 102° a day or so after the operation, but the fever usually subsided by the fourth to the sixth day.

In those cases badly infected following the operation, the best chance of saving the patient's life is by early laying open the joint and packing with iodoform gauze.

Some surgeons claim that in comminuted fractures a conservative method of treatment should be used. This rule, as all others, has its exceptions. In one fracture that I operated upon, due to a kick, the patient fell after the blow and evidently tore the fibrous expansion of the quadriceps tendon. In another case, due to a fall from a distance, there was little tear of the fibrous expansion of the quadriceps tendon, but the fragments were tilted and separated by the effusion and clot. These two classes of cases should certainly be operated upon; in the first instance to repair the torn fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule, and in the second, to adjust the fragments and to turn out the clot. In comminuted fractures, especially if broken in many pieces, suturing the bone is often impossible, and the best that can be done is to suture the tendon and carry the patient through a prolonged convalescence.

In the letter referred to above, Dr. Murphy also says: "In cases where the patella is badly fragmented, we believe the use of a flap three-fourths of an inch wide and four and one-half inches long, from the central portion of the quadriceps tendon, passed over the patella and inserted into the ligamentum patellæ by splitting it and looping it half way around, is the most secure means of holding the patella. It does not then involve the traumas in the joint nor the presence of foreign material, such as wire or plates. It is one of the simplest means of treating these fractures, and I believe one of the most secure, following out the plan I do in my cases of resection of the patella for tuberculosis."

In fracture of the patella, if bony union does occur, close approximation of the fragments is essential. This close approximation cannot always be gained by simply suturing

the tendon and not the patella, as effusion or movement may dislodge the fragments. In suturing with an absorbable material, a close approximation is possible, but often these sutures soften, elongate, become untied or even break; especially is this so, if close approximation is not obtained and the fragments move independently of each other. In using absorbable material, passive motion must be delayed and the patient is compelled to pass through a slow convalescence, followed by a more or less stiffness of the joint that usually lasts for several months, to say nothing of the loss of time which many of them can ill afford.

Total number of fractures of the patella	56
Males	37
Females	19
Males fracturing right patella	18
Males fracturing left patella	19
Females fracturing right patella	8
Females fracturing left patella	11
Variety: transverse fracture	50
Comminuted fracture	6
Suture: silkworm gut	1
Chromic gut	15
Kangaroo tendon	2
Silver wire	31
After treatment: plaster case	15
Splint	8
Splint and case	9
Pillow	17
Splint (not operated)	7
Causes: slipped	27
Fell	27
Kicked	2
Tendon alone sutured	3
Refractures: absorbable suture	3
wire suture	1
Operated upon	49
Not operated upon	7

REPORT OF CASES.

E. W., age 42; female. Transverse fracture of patella of left knee; caused by slip. Operation 6 days later; silkworm gut suture; cast. In hospital 57 days. Highest temperature 99.3. Recovered.

S. B., age 20; male. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; chromic gut suture; cast. In hospital 27 days. Highest temperature 100.3. Recovered.

S. B., age 27; female. Transverse fracture of patella of right knee; caused by slip. Operation 2 days later; wire suture; splint and cast. In hospital 45 days. Highest temperature 99.4. Recovered.

P. N., age 43; male. Comminuted fracture of patella of right knee; caused by fall. Not operated; splint. In hospital 50 days. Recovered.

J. S., age 48; male. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; chromic gut suture; splint and cast. In hospital 33 days. Highest temperature 101.2. Recovered.

A. F., age 38; male. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; chromic gut suture; cast. In hospital 85 days. Highest temperature 100.1. Recovered.

A. S., age 55; female. Transverse fracture of patella of right knee; caused by slip. Operation 20 days later; wire suture; splint. In hospital 50 days. Highest temperature 100.1. Recovered.

A. N., age 67; female. Comminuted fracture of patella of right knee; caused by slip. Not operated; splint. In hospital 35 days. Recovered.

J. B., age 27; male. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; kangaroo tendon suture; splint and cast. In hospital 14 days. Highest temperature 100. Recovered.

H. W., age 40; male. Comminuted fracture of patella of right knee; caused by kick. Not operated; splint. In hospital 30 days. Recovered.

H. B., age 38; female. Transverse fracture of patella of left knee; caused by fall. Operation 3 days later; chromic gut suture; cast. In hospital 25 days. Highest temperature 100.1. Recovered.

W. W., age 44; male. Comminuted fracture of patella of left knee; caused by fall. Operation 1 day later; chromic gut suture; cast. In hospital 31 days. Highest temperature 100. Recovered.

G. O., age 37; male. Transverse fracture of patella of left knee; caused by slip. Operation 14 days later; chromic gut suture; splint. In hospital 35 days. Highest temperature 102. Recovered.

A. S., age 54; female. Transverse fracture of patella of left knee; caused by fall. Not operated; splint.

H. B., age 38; female. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 28 days. Highest temperature 100.1. Recovered.

H. R., age 30; male. Transverse fracture of patella of left knee; caused by slip. Not operated; splint.

W. W., age 44; male. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 32 days. Highest temperature 99.1. Recovered.

J. B., age 27; male. Transverse fracture of patella of left knee; caused by fall. Operation 3 days later; kangaroo tendon suture; cast. In hospital 34 days. Highest temperature 100.2. Recovered.

F. S., age 28; female. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 25 days. Highest temperature 100. Recovered.

R. G., age 32; male. Transverse fracture of patella of right knee;

caused by fall. Operation 1 day later; wire suture; splint. In hospital 35 days. Highest temperature 100.1. Recovered.

M. H., age 77; female. Transverse fracture of patella of left knee; caused by fall. Not operated; splint.

E. G., age 50; male. Transverse fracture of patella of right knee; caused by fall. Operation 4 days later; chromic gut suture; cast. In hospital 26 days. Highest temperature 100.2. Recovered.

F. H., age 36; male. Transverse fracture of patella of left knee; caused by slip. Not operated; splint.

L. B., age 60; male. Transverse fracture of patella of right knee; caused by fall. Operation 18 days later; wire suture; pillow. In hospital 45 days. Highest temperature 100.1. Recovered.

W. K., age 44; male. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; splint. In hospital 35 days. Highest temperature 100.2. Recovered.

E. S., age 27; female. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; pillow. In hospital 16 days. Highest temperature 99.4. Recovered.

W. H., age 40; male. Comminuted fracture of patella of right knee; caused by fall. Operation 2 days later; wire suture; splint and cast. In hospital 29 days. Highest temperature 100.1. Recovered.

E. S., age 45; female. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; wire suture; splint and cast. In hospital 46 days. Highest temperature 100. Recovered.

J. S., age 37; male. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; cast. In hospital 25 days. Highest temperature 100.2. Recovered.

C. D., age 31; female. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; chromic gut suture; cast. In hospital 41 days. Highest temperature 100.1. Recovered.

W. M., age 40; male. Transverse fracture of patella of left knee; caused by slip. Operation 1 day later; wire suture; cast. In hospital 15 days. Highest temperature 99.4. Recovered.

N. R., age 35; male. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; wire suture; pillow. In hospital 17 days. Highest temperature 100.1. Recovered.

N. R., age 35; male. Transverse fracture of patella of right knee; caused by fall. Operation 2 days later; wire suture; pillow. In hospital 12 days. Highest temperature 99.3. Recovered.

E. W., age 34; female. Transverse fracture of patella of right knee; caused by slip. Operation 1 day later; wire suture; cast. In hospital 33 days. Highest temperature 101. Recovered.

J. F., age 42; male. Transverse fracture of patella of right knee; caused by fall. Operation 3 days later; chromic gut suture; splint and cast. In hospital 32 days. Highest temperature 99.4. Recovered.

C. M., age 30; male. Transverse fracture of patella of right knee; caused by slip. Operation 6 days later; chromic gut suture; splint. In hospital 41 days. Highest temperature 101. Recovered.

W. L., age 18; male. Transverse fracture of patella of right knee; caused by slip. Operation 17 days later; wire suture; pillow. In hospital 25 days. Highest temperature 99.3. Recovered.

E. K., age 55; male. Transverse fracture of patella of right knee; caused by slip. Operation 35 days later; wire suture; splint. In hospital 67 days. Highest temperature 105. Died.

J. F., age 53; male. Transverse fracture of patella of left knee; caused by fall. Operation 7 days later; wire suture; pillow. In hospital 27 days. Highest temperature 99.4. Recovered.

J. W., age 55; male. Transverse fracture of patella of right knee; caused by slip. Operation 12 days later; wire suture; pillow. In hospital 35 days. Highest temperature 100.1. Recovered.

F. T., age 35; female. Transverse fracture of patella of right knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 115 days. Highest temperature 105.3. Died.

J. R., age 19; male. Comminuted fracture of patella of left knee; caused by kick. Operation 4 days later; wire suture; pillow. In hospital 36 days. Highest temperature 100.4. Recovered.

A. T., age 45; male. Transverse fracture of patella of right knee; caused by slip. Operation 5 days later; wire suture; splint and cast. In hospital 28 days. Highest temperature 100.3. Recovered.

A. D., age 40; female. Transverse fracture of patella of right knee; caused by slip. Operation 5 days later; chromic gut suture; splint. In hospital 45 days. Highest temperature 100.2. Recovered.

J. O., age 33; male. Transverse fracture of patella of right knee; caused by fall. Operation 2 days later; chromic gut suture; cast. In hospital 22 days. Highest temperature 99.4. Recovered.

F. M., age 30; female. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; pillow. In hospital 44 days. Highest temperature 100.3. Recovered.

E. W., age 49; male. Transverse fracture of patella of right knee; caused by slip. Operation 8 days later; wire suture; pillow. In hospital 30 days. Highest temperature 100.4. Recovered.

J. S., age 37; male. Transverse fracture of patella of left knee; caused by fall. Operation 6 days later; chromic gut suture; splint. In hospital 29 days. Highest temperature 100.1. Recovered.

T. G., age 22; male. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; pillow. In hospital 30 days. Highest temperature 101.4. Recovered.

F. H., age 20; female. Transverse fracture of patella of right knee; caused by fall. Operation 9 days later; wire suture; cast. In hospital 38 days. Highest temperature 100. Recovered.

L. W., age 28; female. Transverse fracture of patella of left knee; caused by slip. Operation 1 day later; wire suture; pillow. In hospital 34 days. Highest temperature 100.1. Recovered.

G. E., age 41; male. Transverse fracture of patella of left knee; caused by fall. Operation 5 days later; chromic gut suture; cast. In hospital 42 days. Highest temperature 101. Recovered.

M. A., age 39; female. Transverse fracture of patella of left knee; caused by slip. Operation 5 days later; chromic gut suture; cast. In hospital 61 days. Highest temperature 100.4. Recovered.

D. M., age 44; male. Transverse fracture of patella of left knee; caused by slip. Operation 8 days later; wire suture; pillow. In hospital 25 days. Highest temperature 99.4. Recovered.

W. M., age 28; male. Transverse fracture of patella of right knee; caused by fall. Operation 2 days later; wire suture; splint and cast. Highest temperature 101.3. Recovered.

G. H., age 42; male. Transverse fracture of patella of left knee; caused by slip. Operation 9 days later; wire suture; splint and cast. Highest temperature 98.3. Recovered.

Dr. Walter G. Elmer, with regard to the statistical showing that fractures of the patella were slightly more numerous in the left knee, said that in the Hospital for Ruptured and Crippled Children in a series of several thousand cases of tuberculosis in which traumatism was supposed to play a part, 55 per cent. had the right knee affected; another series was slightly in favor of the left knee. In a recent medicolegal case, the counsel for the defendant and the witnesses on that side took the stand that the injury was greatly in favor of the right knee. These figures are valuable as showing that such could not be said to be the case, but that one knee was as likely to be the seat of injury as the other.

Dr. John B. Deaver said that his experience in the treatment of fracture of the patella agrees with the views expressed by Dr. Alexander. For the last two years he had adopted this method of treatment, and the results obtained had been better and the length of time in bringing about the result much shorter. Formerly it was his practice to put the knee up in plaster after wiring, taking the case off in ten days or two weeks, after the removal of which passive motion was cautiously made. He no longer uses plaster but treats as above stated.

Dr. John H. Gibbon said that in dealing with this subject Dr. Alexander had looked at it from a distinctly modern point of view. He had said nothing about the older ways of treatment, either the subcutaneous suture or the straight incision. He believed this is the way it should be looked at. The time has passed when, if the environment for operation is proper, the patient should be treated with a splint. Of course care must be exercised in the choice of cases, for it is in the non-observance

of this precaution that the mortality comes in. It is plain that alcoholics, syphilitics, and others offering general contraindication to operation should be excluded.

With regard to points of personal technic, his preference is for an incision going below the fracture at least an inch, for then in case infection should occur, it is not immediately over the line of fracture, and moreover if a refracture occurs, it is not a compound one. He had only used a straight incision once and a silver wire suture but once. He was very much impressed with Dr. Blake's article of some years ago on this subject, which emphasized the fact that the rupture of the lateral ligaments was often the most important part of the lesion, from a pathological point of view certainly one of the most important, and should therefore receive particular attention. He suggested suture of the lateral ligament and suture of the ligamentum patellæ without suture of the patella itself. Dr. Gibbon had done this in all his cases recently. The silver wire suture will not prevent a patella from breaking if it is going to break after a number of months. It is, however, the most aseptic suture that can be used. He sutured only the lateral ligament and the ligament over the patella. The mere fact that Dr. Alexander says refracture occurs late, usually after the eighth week, is against the use of non-absorbable sutures. Although in his last few cases he had used no drainage, he believed it to be a good method not to put the sutures in too close or too tight—to allow a certain amount of drainage in this manner.

Regarding the splint, after learning from Dr. Alexander what he had been doing, in his last case he took the splint off the second day, but the patient wished it replaced because he felt more comfortable with than without it.

If the fragments are exposed and the fibrous tissue is taken away, perfect bony union will result, and there is no necessity for keeping splints on for months. Early motion is the secret of the ultimate success in these cases. Those cases in which it is not employed ultimately get the same result but not so quickly.

Dr. Harry C. Deaver said that the most important point in Dr. Alexander's paper was the after-treatment. He had not used the plaster case for a fracture of the patella for six years, nothing but silver wire. This fixes the fragment and makes it

possible to begin passive movements early, often at the end of the seventh day. It is his rule to make general passive motion with light massage. These cases were able to get out of bed at the end of eighteen days and to flex their legs to a right angle shortly afterwards, and were discharged in four weeks.

He had had five cases in his private practice, and at the end of five weeks he considered each patient practically well. He would not advise flexing of the knee very strongly at an early date without suture of the fragments with silver wire.

Dr. George G. Ross had had one unfortunate experience so far as the incision for operation is concerned. He had always used the straight incision following Dr. Deaver's practice, but after hearing a discussion recommending the horseshoe incision, he had a patient, a stout woman, at the Germantown Hospital, upon whom he made a big wide horseshoe incision and wired the patella. On the fifth or sixth day gangrene of the flap developed, with infection of the knee-joint, and subsequent death of the patient. He therefore became a little skeptical regarding the propriety of this incision. He still believed the straight incision gives ample room and does not jeopardize the blood supply of the superficial fascia.

Dr. John H. Jopson said that there was one point which had not been brought out with regard to the use of silver wire, which he thought to be of importance. Its use requires a drilling of the bone, which suture of the capsule does not. He formerly practised suture of the capsule alone, but in his recent cases he had drilled the fragments and used silver wire, as it seemed to him such treatment might stimulate the osteogenetic function of the bone, even as in ununited fractures.

Dr. George P. Müller reported a case of recurrent bilateral fractures of the patella; the patient was shown to the Clinical Surgical Society recently. The left patella was first fractured in November, 1906, and was wired with silver wire in the usual manner; in January, 1907, a refracture of the patella occurred, and it was again wired. In April, 1907, as a result of a misstep, the patient refractured the patella again and this time it was fastened with chromic gut and has since remained united. In February, 1910, he fractured the right patella and on the ninth day after the accident this was sutured with chromic catgut and has since remained united. The patient stated that in 1906, at the time of his first fracture, his brother was operated on in the German Hospital with a fracture of the right patella which was refractured in 1909.

Dr. Müller had also seen a fracture of the patella caused by the kick of a horse, in which the lower half inch of the bone was fractured, without, as far as he was able to see, opening the joint. The fragments were in fairly good position, the lower end being tilted somewhat backward, but owing to the fact that the patient was very insistent that he should be able to ride horseback without trouble in the future, he advised operation and fastened the fragments with chromic gut. The patient was placed on a posterior splint for three or four days, a plaster cast was then applied, and on the tenth day he was allowed to walk on crutches. The cast was removed three weeks after operation and the patient allowed to walk, but he complained of inability to raise the foot and toe-drag, and upon examination he was found to be suffering from paralysis of the external popliteal nerve. The case was perfectly fitting and properly padded, and accordingly the speaker believed that the nerve was injured at the time of the accident with the kick of the horse.

In addition to the possibility of infection to the joint if the skin incision is placed immediately over the line of operation, as has been mentioned, it should be added that the scar in the skin is liable to adhere to the scar in the fascia and cause more or less trouble. A wait of two weeks at least should be observed before attempting any motion. It has been emphasized that the most important part of the operation is the suture in the torn aponeurosis and as fascial tissues are not very well vascularized they should be given time to firmly unite. One does not, as a rule, allow patients operated upon for hernia to go about until the second week, and yet as a matter of fact there is less strain in these cases than in the flexion and extension of the knee-joint. If the torn aponeurosis is carefully and accurately brought together, it does not matter whether one uses silver wire, copper wire, or catgut in the patella, or whether one does not drill the patella but simply uses the mattress sutures of Blake or the circumferential suture. Personally, he preferred to drill the patella, for the reason mentioned by Dr. Jopson, *i.e.*, that it may have some influence in promoting bony union. The majority of surgeons have found silver wire unnecessary, but if an operator gets good results with silver wire he should use it.

Dr. John H. Gibbon remarked with regard to the horseshoe incision, that in all his early cases where he used the horseshoe-shaped incision he had no sloughing, but he realized it was wrong, and since then his incision had been more semilunar. He intended, when speaking before, to refer to a case of peroneal palsy, which he was sure was due to the splint. The patient had had no plaster cast, he was a very thin man; he complained of great pain over the peroneal nerve. When the splint was removed he had toe-drop, from which he very slowly recovered.

Dr. A. P. C. Ashhurst said that if it was desired to get patients walking by the fourteenth day it was well to use silver wire, as union cannot be firm then. On the other hand, if they can wear a removable plaster cast, and have massage by an adequate masseur, with passive motion, it is sufficient to use chromic catgut for sutures.

A second point is that among 49 operations there were two deaths, a fact which should not be overlooked. These operations were done in one of the best hospitals, with the best surgeons and best assistants and nurses. Within the last few weeks there has been reported from Boston a series of arthrotomies for fatty tumors of the knee-joint. The mortality from infection was about 4 per cent. Lucas-Championnière, who despises asepsis, swabs out his knee-joints with carbolic acid, and claims to have done more than 80 operations for fracture of the patella without a single death. Perhaps, therefore, the aseptic is not so good as the antiseptic method.

Dr. Lewis W. Steinbach exhibited a patient operated upon for fracture of the patella who was operated upon six weeks before, four days after her admission to the Polyclinic Hospital. The large effusion of blood into the joint was washed out, the edges of the lacerated tendon and of the ligaments were trimmed, then the widely separated fragments of the transversely fractured patella were brought together through the fascia anteriorly and laterally of the patella. The joint was fixed with a thin silicate of soda dressing re-enforced by a posterior thin splint of wood, and then interrupted catgut sutures for the integument.

After 39 days spent in bed, the splint was removed. The bone was firmly united as shown by the skiagraph, the sutures were absorbed, and the joint had a fair degree of free motion. Patient can now walk with the aid of crutches, and it is reasonable

to expect that she will soon possess normal use of the extremity.

Dr. Emory G. Alexander (in closing) said, with regard to the mortality, that although the two deaths make a large percentage in this series, he felt that with the great work being done by Dr. Murphy on the knee-joint, and the advance made by English surgeons, the technic is bound to improve, and that with these improvements will come a decrease in the mortality rate.

As far as drainage is concerned, he did not advocate it as a routine measure, but occasionally there will form an extra-capsular collection due to oozing which must be removed. As to the comfort of the splint, with his patients it has always been the opposite, they saying that the pillow is much more comfortable as it allows of freer movement. There is a certain degree of motion of the knee, about 5° or 10°, which can be gradually produced without using the patella at all, and this is the motion advocated for the first few days, not forcibly flexing the knee. The majority of refractures occur after the eighth week, a point which shows the value of silver wire suture.

THE OPEN TREATMENT OF FRACTURES.

Dr. Edward Martin made some remarks upon this subject.

FRACTURES OF THE SHAFT OF THE FEMUR WITH MARKED DISPLACEMENT.

BY RICHARD H. HARTE, M.D.,
OF PHILADELPHIA,
Surgeon to the Pennsylvania Hospital.

It would appear that fractures of the shaft of the femur have not received the careful attention and study which they merit, perhaps because it is rare that a surgeon in active professional life sustains an injury to this bone, with the possible exception of those who ride horseback, or, again, it may occur as the result of an automobile or railroad accident.

Much time and consideration have been given to the study of enlarged prostate, appendicitis, and like pathological conditions, to any of which all classes and professions are liable. And, with these commoner affections constantly in mind, it is little wonder that the femur should not, of late years, have received the attention which it really deserves.

Fracture of the shaft of the femur is not, on the whole, a very common injury, and our experience in its repair is almost entirely confined to our hospital practice rather than in our private surgical work. Of course, it must be understood that we are dealing with fractures of the shaft of the bone occurring in the active years of life and not with fractures of the neck of the thigh, which occur so commonly in persons past the meridian.

The question now to be considered, in a measure, after an accident of this description is: *Is the limb after treatment in as good condition and position as it was before the accident, following what is accepted as good results?*

It is the generally accepted opinion that from one-half to one inch shortening of the limb is a fairly satisfactory result,

but with this we shall often find considerable rotary displacement and angularity, which, if low down, frequently interferes with the function of the knee-joint, due to an excess of callus, which can be readily felt at the seat of injury.

A careful study of the museum specimens of this injury is very instructive and is calculated to modify one's previous conception of what actually takes place and what constitutes a good result.

I think the general belief among many surgeons (who should know better) is, that with general anæsthesia, it is quite possible in a transverse fracture to get good end-to-end apposition of the fragments and keep them in perfect position by means of weights and pulleys, sand bags, etc., and that a nice, spindle-shaped lump of callus will surround and hold the ends of the broken bone together, and that the leg will be as good as ever after the injury.

It may seem a homely comparison, but no person of reasonable intelligence would say that the broken leg of a piece of furniture is as good or as perfect, no matter how well repaired, as it was before being broken. And the same analogy holds good as regards the femur that has been fractured.

Let us consider for a moment some of the actual conditions which confront us, as illustrated by an X-ray photograph or any selected museum specimen.

And here a word of caution must be offered in regard to the way in which the X-ray photograph is prepared. If the tube is not directly over the seat of fracture, the deformity may be enormously exaggerated, and it is always well to have the picture taken from several points of view, as an incredible amount of misinformation may be derived from the study of only one picture.

There is always varying degree of deformity, due to overlapping of the fragments.

The lower fragment may be either in front or behind, inside or outside the upper fragment, but is never exactly where it should be, if absolutely accurate reduction of the bone had been effected.

There is invariably a certain amount of rotation and the alignment is never absolutely perfect.

It is impossible to determine by the unaided eye, touch or measurements, what the actual displacement of the fragments is. The great mass of muscles surrounding the bone, the enveloping skin and fascia and possibly extravasated blood all combine to soften the irregularities of the real outline, just in the same way as a fresh fall of snow smoothes out and diminishes inequalities of contour in a landscape.

It is, therefore, impossible to gain any appreciable idea of the extent of bony displacement which exists in these injuries without first having a carefully prepared X-ray picture.

If one will carefully study a specimen, he will have little difficulty in understanding why these patients complain of pain and weakness in the limb, of lameness, of coldness and œdema of the feet, and why the functional activity of the limb must necessarily be greatly impaired. And careful thinkers must feel that a fracture of the femur in the active years of life cannot but be a serious injury, and should demand the careful consideration of all surgeons who are treating these injuries.

It seems to the mind of the writer that the time is ripe for breaking away from the old, accepted traditions and teachings of the great men of the past: to wit, that shortening of an inch or more is the inevitable outcome of such injuries, and that nothing can be done to prevent it.

In the words of Sir Thomas Myles, who has dealt very ably in an exhaustive paper on this subject, "Are we not bound, as surgeons, to avail ourselves of all the advantages that progress in other directions has made possible for us? Is the technic which has made safe the great operations in other branches of surgery not to be utilized in this important part of our work?"

I feel that, in dealing with all cases of fracture of the shaft of the femur in persons in the active years of life, the facts should be stated frankly and plainly to the individual, and he should be made to understand clearly the risks and advantages, on the one hand, and the freedom from risk

and the disadvantages, on the other, and it will be seldom that the active, intelligent patient will not decide to place himself in our hands, with the hope that the realization of the perfect result may be obtained.

Now the question arises: How are we to obtain the ideal result in the treatment of fractures of the shaft of the femur in persons who expect or hope to continue leading an active life?

I feel confident that there is no positive or definite line of treatment open to us, except the exposure of the fragments of the bone by a formal dissection and the restoration of the fragments, actually seeing the parts perfectly dovetailed back in their original position, which is positive assurance against rotary displacement and the first step toward procuring good alignment.

The X-ray is a perfect index of overlapping and shortening, but is of little or no use in determining the question of rotary displacement.

The writer is thoroughly aware, in urging this more radical method of treatment, that he is assuming a great responsibility, which may be diminished by certain limitations.

In the first place, the operation should not be undertaken except by skilled operating surgeons, who are in the habit of doing daily operative work in the hospital. This operation should not be undertaken in private houses, except under very perfect conditions, and should never be attempted on any but reasonably strong and healthy subjects. The operator should have at his command a perfect technic, with suitable instruments and skilled assistants.

Several methods might offer themselves for our consideration: such as wiring the fragments together; the introduction of an intermedulary splint; the use of absorbable pegs of bone or ivory, or some modification of Parkhill's screws and clamps; and lastly, the use of a steel plate and screws as recommended by Mr. Lane.

Time will not admit of discussing all the above mentioned methods, some of which are rarely employed.

The older method of suturing with wire, by drilling the ends of the bones and simply passing the wire around, has been in vogue for many years. It is open to certain objections, particularly in transverse fractures, as it does not retain the fragments in absolutely perfect position and presents more the character of a flail joint, and does not offer the amount of support that is so imperative in dealing with these cases.

However, in long oblique fractures, conditions are different, and the introduction of a wire through a hole drilled in the two fragments and then passing around the bone possibly two or three times to make a sort of ferrule, will suffice often to hold the splintered fragments in position.

Beyond this, the wire is not desirable in dealing with this class of injuries. The use of the wire can be facilitated greatly by using a heavy curved needle, which enables the operator to circle the bone without doing appreciable damage to the soft parts.

The plate and clamp method, as advocated by the late Dr. Parkhill, offers many advantages, insomuch that the wound can be practically closed and the plate left on the outside of the soft parts, and, after union has taken place, these screw supports can be readily removed and the wound will heal up in a very short time. It may, however, be open to the objection that the wound can never be absolutely closed during the process of repair; and it plays very much the same part, in the support of the femur or humerus, that the unfractured fibula does in the support of the tibia when the latter has been broken. It is a most ingenious method and deserves worthy consideration in dealing with this class of injury.

The later method, which has been brought into such prominence by Mr. Arbuthnot Lane, is the one which to-day is receiving the greatest amount of attention.

It consists in the use of long, steel screws, four to six in number, according to circumstances, fastening a strong steel plate which holds the bones rigidly in accurate position one with the other, and which is allowed to remain in the wound after it has been closed, thereby assuring absolute support to the broken ends during the process of repair. In many cases, the plate may be worn by the patient indefinitely, without causing any discomfort or inconvenience, but if irritation should arise from this, it is open to the objection that it must be removed by a second, though trifling, operation.

The essential feature of all these methods mentioned is the perfect and accurate reduction of the displacement by extension in some form, which is often very difficult, particularly if it is an old injury where attempt at repair has already been made.

To facilitate this, the method devised by Dr. Martin of making extension directly on the upper end of the lower fragment in the wound and drawing it down by extension weights or pulleys, is one of the very best means at our command of correcting the deformity, so far as the actual extension is concerned.

The writer is disposed to regard this method as preferable to the extension of the leg by the use of pulleys, etc., as before recommended in another communication.

Dr. Martin has devised an ingenious pair of clamps which, after the ends of the bones have been accurately adjusted, facilitates the application of the plate and the introduction of the screws. I think this can again be very much modified by the use of curved retractors. This enables the operator to free the bone from any old adhesions, particularly on the opposite side of the wound, and then hold it accurately in position after the readjustment and while the plate is being applied. These retractors, by their simplicity, are preferable to many of the heavy forceps and clamps which have been devised.

The greatest care must be exercised to see that the drill and the screws accurately correspond to each other in size and length, so that the screws will have accurate bearing along their entire course. Care must also be taken to see that the screws are not so long as to perforate the opposite side of the bone, and it is advisable always to have a number of screws of different lengths, corresponding to the size of the bone to be dealt with.

Before dismissing this subject, the site of the incision is worthy of consideration. The wound, which must necessarily be large, is preferably made on the outer side of the quadratus femoris muscle on the anterior surface of the thigh, rather than on the outer side of the leg between the line of the flexor and extensor groups of muscles. The latter incision has the advantage, however, of allowing the more perfect drainage, but the anterior wound can be readily drained by making a counteropening directly down through the muscles, through which a small wick of gauze can be introduced and retained for forty-eight hours, which insures rapid removal of all serum which necessarily collects after so large a wound, thus minimizing the possible risks of infection.

It is important also that, in closure of the wound, all dead spaces should be obliterated as much as possible by the introduction of deep buried catgut sutures.

Mr. Lane lays great stress upon using instruments with as long handles as possible, so as to obviate introducing into the wound even the gloved hand, thus minimizing possible risk of infection.

When the patient is placed in bed, the limb should be thoroughly supported by long lateral supports, either splints or a plaster case, to insure absolute rest of the parts. If this method of treatment is carried out, it will be found that the limb will correspond accurately in measurements to the sound limb, both with regard to length and position. All muscular spasm disappears, as we have no irregular or ragged ends of the bones to cause irritation to the soft parts.

In concluding these remarks, the writer does not wish to advocate the open method of treatment in all cases of fractures of the shaft of the femur, but only in those cases where it is impossible to get reasonably accurate approximation of the bones, as can be readily shown by the use of the X-ray photograph.

This method is not applicable to very young children nor to old or enfeebled persons, but only to those who are in good health and whose habits of life would naturally tend toward a favorable result.

The greatest care must be exercised, not only as to the method of technic employed, but in determining whether or not one's patient will co-operate with every effort of the surgeon to bring about a perfect result.

Too great emphasis, then, cannot be laid upon the importance of dealing with these cases as soon as possible after it has been demonstrated by the X-ray that the ends of the bones are not in accurate position, because the difficulty of the operation is greatly enhanced by allowing these cases to remain for several weeks before operating, in the hope that, by weight and extension, the bones will be brought into better position. The many adhesions and new callus resulting from this delay all add untold difficulties in attempting to bring the ends of the bones into position.

Finally, may I be permitted to offer a word or two of advice to those who may desire to practise some of the suggestions which I have made and who are without any practical experience in this line of work?

1. Find out all that is possible about the seat of fracture by the use of carefully prepared X-ray plates, the pictures to be taken at various angles.

2. Consider carefully what method you think is likely to give the best results.

3. When the fragments are exposed, have a proper pair of calipers to determine the diameter of the bone, and see that the screws in no case penetrate the opposite side.

4. Be certain that you have suitable instruments, proper drills and screws, and also competent assistants, so that you can complete the operation quickly and with as little destruction to the soft parts as possible.

5. Be sure before closing your wound, that it is thoroughly dry and that all dead spaces are obliterated, so that there will be no possible chance for the development of a small hæmatoma, which is so conducive to later infection.

6. Remember in dealing with this class of surgery, that the parts are hard and unyielding, and everything must fit accurately and securely. Nothing can be drawn or pulled

into position, as in dealing with the soft parts. Do not trust too much to nature with the hope that she will correct defects in your joiner work.

7. If possible, try and practise this operation on the cadaver before trying it on the living.

NOTE.—In reviewing a certain number of cases treated after the method above described, the author finds that care must be exercised not to allow the patient to bear his weight upon a limb which is apparently in good shape, as the repair of these injuries requires much longer time than simple fractures, and the callus, though apparently strong, is in many instances soft and yielding; if the patient is allowed to walk too soon, lateral deformity will occur, due simply to the outward bowing of the limb, as the result of superinduced weight of the body.

In this case, it will be noticed frequently that the screws have drawn away from their attachment in the shaft of the bone, and the plate will be forced off at an angle corresponding to the bowing of the limb. Too great care cannot be taken to supplement the use of the plates by suitably applied splints and extension, which should be maintained all through the process of convalescence, thus obviating the tendency to displacement.

DR. JAMES K. YOUNG said that in the treatment of vicious and ununited fractures Lambott's method is an improvement over the Parkhill method. It consists in the use of screws, which are inserted directly in the bone without the use of the drill. The screws are drill pointed. The fracture is held in place with special forceps, by which they can be placed in better position, the apparatus held together with a part outside the soft parts, and, as has been demonstrated by Dr. Wills of Los Angeles, Dr. Robertson of Warren, Pa., and others, the fractures may be accurately set and held during union. After the apparatus has been in place for a time the screws may be readily removed by means of a key.

DR. GWILYM G. DAVIS said, relative to the method of approximation, that plates alone do not play such a very large part in

the approximations of these fractures. In a bone which has big ends and is small in the middle, the ends are cancellous and the shaft is compact. A fracture of the ends is almost always transverse, and therefore the displacement is not great and the necessity of marked fixation at the ends does not exist. But in fractures of the shaft it is a different proposition. Compact bone is to be dealt with, and usually a fracture through compact tissue is oblique. In case of a transverse fracture in the shaft, a medullary splint should be used as Murphy has done. As regards the method of separating the fragments, it can be done by bending them up, and the splint can be sprung into place. In fractures of the shaft of the femur one cannot put on plates strong enough to hold them without the aid of outside force. Here a plaster-of-Paris bandage or outside splints are strongly indicated.

DR. JOHN B. ROBERTS said that the speakers seemed to be more sure of the reliability of measurements of the lower extremities after fracture than he was. A good many years ago he and others measured the bare bones of the lower extremities, and found that in limbs never subjected to fracture there was a marked difference between uninjured femurs and tibiæ of the same individual. With even a considerable difference in the length of the lower legs, whether it be in the femur or in the tibia, the individual may walk with very little limp. Personally he paid very little attention to measurement of the legs after fracture of the thigh, but depended upon his eye as to the approximate amount of shortening, when he had the patient lying in bed with the pelvis straight. Although he used X-ray pictures for confirming the clinical examination, he realized that they may be very deceptive, and should never be used in court without the recognition by all parties that an expert radiographer may make very deceptive pictures. Such deceptive pictures are very likely to be made, unless the man who takes them knows the anatomy of the region and the probable site of the fracture before the exposure to the X-ray is made and takes plates in two planes.

Nature approximates symmetry in the skeleton, but hardly ever reaches it. X-ray plates are an assistance in surgical work, but the results must be checked up by clinical examination, by inspection, palpation, etc. He had long advocated the open treatment of fractures under special circumstances. He was inclined to believe, however, that it is by no means true that

the majority of fractures should be treated by open method. Many fractures of the femur, in addition to permanent traction to overcome shortening, need lateral support by plaster-of-Paris or other splints. The cases which are particularly likely to require incision and open treatment are the fractures near the junction of the upper and middle third of the femur, where eversion and flexion at the hip-joint are liable to occur from the action of the psoas and iliacus muscles.

He had noticed in this discussion that the word plaster "cast" has been used a good deal as a method of treating fractures. It is rather odd that surgeons are very apt to use this improper term. The encasements which are often used in fractures of long bones should never be called "casts." They are not casts. They are really moulds. A better term instead of plaster cast is gypsum encasement or gypsum splint.

Dr. George E. Pfahler presented a skiagraph made two weeks before, showing the remarkable power of nature to unite fractures. In this instance, the bones overlapped about one inch, and even then the sides of the two fragments were about half an inch apart. Nature has bridged this gap. When sending patients for examination, in dressings, the surgeon should mark on the dressings approximately the location of the fracture, so as to be able to bring the central ray over the line of fracture. To determine the position of the fragments stereoscopic plates should be made, or two plates should be made at right angles to each other. When this work is accurately done and properly interpreted there can be no error.

Dr. A. P. C. Ashhurst said that the enthusiastic Mr. Lane and some of his colleagues in England seem to think that the results without operation are intolerable. Dr. Harte and Dr. Martin, however, believe that certain cases do very well without operation, and recommend operation only in certain selected cases. Two years ago with the aid of the interne at the Episcopal Hospital, Dr. Ashhurst traced six cases of fracture of the femur, including forty of the shaft, and they found that 60 per cent. of the fractures of the shaft got a perfect result, while 32.5 per cent. more, making 90 per cent. in all, had no disability other than a slight limp. It seemed to him that those who advocate operation in all cases might at least publish the results of operative treatment, and let it be seen if in as large a series of cases as excellent results as these can be obtained.

Dr. Richard H. Harte (in closing) said that he agreed with all the gentlemen who had spoken in discussing these papers, but he would like to ask why is it that in all cases of fracture of the thigh Dr. Roberts has shortening? Is the broken leg always the short leg? Of course it is known that there is a certain amount of asymmetry in the results, but the man who treats a broken thigh without careful and accurate measurements is not giving his patient the best chance for good results.

With regard to broken plates, the trouble is that the plates ordinarily used are tempered too high, for if properly tempered and made of good steel it should be possible to bend them double and back again without breaking them. The old silver plates were far too easily bent and offered no support whatever.

Dr. Ashhurst speaks of a perfect result. What is meant by this term? Dr. Harte's idea of it is a limb that is perfectly straight, the patient walking without any limp, and no irregularity to be detected in the measurements. These are difficult to obtain.

He emphasized that he did not advocate that every fracture of the thigh should be opened and plated, but he did think this procedure to be indicated in cases where there is difficulty in keeping the fragments in position.

The mortality in these accidents should not be as great as they are in opening and wiring the patella, because in this latter operation there are two complicating conditions, a little bone to work on, and an opening into the joint in the body which is least calculated to take care of itself in infection.

INDEX.

PAGE

Annual Address—The Patience of Surgery—Astley Paston Cooper Ashhurst, M.D.

Abscess; Early (Treves) Operation for Psoas..... 121
Abscess, Subphrenic Complicating Appendicitis..... 154
Abscess, Subphrenic Following Appendicitis After Six Months..... 156
Alexander, Emory G..... 191
Alexander, Samuel..... 168
Amputation of Leg Under Anæsthesia Produced by Infiltration of the Sciatic Nerve with Eucaine..... 29
Angioma, Extensive of the Upper Extremity: Varicose Veins Simulating a Femoral Hernia..... 76
Anæsthesia Produced by Infiltration in Amputation of the Leg..... 29
Aorta, Pressure Necrosis of; From Sarcoma Occurring in Scar Tissue of the Back..... 53
Appendicitis Complicated by Subphrenic Abscess..... 154
Appendicitis Complicated by Volvulus of the Small Intestine..... 157
Appendicitis Followed After Six Months by Subphrenic Abscess.... 156
Appendicitis Followed by Volvulus of the Small Intestine..... 158
Articulation; Osteomyelitis of the Sacro-iliac..... 121
Ashhurst, Astley P. C.....
.....26, 27, 29, 30, 51, 77, 106, 154, 156, 157, 158, 208, 220

Back, Sarcoma Occuring in Scar Tissue of; with Metastasis to the Lung: Pressure Necrosis of the Aorta with Hemorrhage and Death 53
Beck's Bismuth-Vaseline Paste Injections; in the Treatment of Chronic Tuberculous Sinuses..... 60
Breast, Cystic Disease of 90
Brooks, Macy 16

Calculous Cholecystitis 85
Cholecystitis, Calculous 85
Christian, Hilary 20
Chromo-Ureteroscopy in Functional Kidney Diagnosis 110

PAGE

Chronic Tuberculous Sinuses, Treatment of; by Beck's Bismuth-Vaseline Paste Injections 60
Combined Cystoscopic and Rontgenographic Examination of the Kidneys and Ureter 1
Coplin, W. M. L. 106, 119
Cyst, Hydatid of the Liver 24
Cystic Disease of the Breast 90
Cystoscopic Examination of Kidneys and Ureter 1

Davis, Gwilym G. 67, 80, 84, 188, 218
Deaver, John B. 8, 15, 75, 88, 93, 181, 204
Deaver, Harry C. 184, 205
Despard, Duncan L. 58, 76
Diagnosis of Typhoid Perforation 32
Dilation of the Prostatic Urethra for the Relief of the Symptoms of Prostatic Enlargement 23
Disease, Cystic of the Breast 90
Displacement, Marked in Fractures of the Shaft of the Femur 210
Ductless Glands, the Relation of to Surgery 112

Early (Treves) Operation for Psoas Abscess 121
Elmer, Walter G. 50, 202
Enteroptosis 107
Epulis and Sarcoma of the Jaw; Surgical Aspect of 97
Eucaine; Amputation of leg Under Anæsthesia Produced by Infiltration of the Sciatic Nerve with 29
Extensive Angioma of the Upper Extremity: Varicose Veins Simulating a Femoral Hernia 76

Femur; Fracture of the Shaft of, with Marked Displacement 210
Fibula and Tibia, Fracture of; Value of Tenotomy in Some Cases of 83
Fracture of the Patella 191
Fracture of the Patella Treated by Subcutaneous Purse-String Suture 74
Fracture of the Tibia and Fibula; Value of Tenotomy in Some Cases of 83
Fractures, Open Treatment of 209
Fractures of the Shaft of the Femur with Marked Displacement 210
Functional Kidney Diagnosis by Chromo-Ureteroscopy 110
Gibbon, John H. 76, 93, 165, 189, 204, 208
Girvin, John H. 85
Glands, Ductless; the Relation of to Surgery 112
Gunshot Wound of the Knee Joint 26

PAGE

Gunshot Wound of the Skull with Rupture of the Longitudinal Sinus 27

Harte, Richard H. 210
Hewson, Addinell 53
Hodge, Edward B. 77
Horwitz, Orville 8, 10, 21
Hydatid Cyst of the Liver 24
Hypodermic Injections of Salicylate of Mercury in Treatment of Syphilis 16

Incurvation of the Penis; Plastic Operation for the Relief of 10
Intestine; Volvulus of the Small; Complicating Appendicitis 157
Ischæmic Paralysis, Volkmann's 187

Jaw; Surgical Aspect of Epulis and Sarcoma of 97
Jopson, John H. 49, 80, 89, 165, 187, 206

Kidneys, Combined Cystoscopic and Rontgenographic Examination of 1
Knee Joint, Gunshot Wound of 26

Laceration of the Axillary Portion of the Capsule of the Shoulder-joint as a Factor in the Etiology of Traumatic Combined Paralysis of the Upper Extremity 123
Laminectomy, Sacral for Tubercular Monoplegia 122
LeConte, Robert G. 50, 57, 58, 84, 166
Leg, Amputation of Under Anæsthesia Produced by Infiltration of the Sciatic Nerve with Eucaine 29
Liver, Hydatid Cyst of 24
Longitudinal Sinus, Rupture of; Gunshot Wound of the Skull 27
Lung, Metastasis to, in Sarcoma; Occuring in Scar Tissue of the Back 53

Mackinney, William H. 1
Martin, Edward B. 183, 209
Marked Displacement in Fractures of the Shaft of the Femur 210
Median Perineal Prostatectomy; Technic of 168
Metastasis to the Lung from Sarcoma in Scar Tissue of Back 53
Miller, Albert G. 1
Miller, Morris Booth 166
Mitchell, Charles F. 49
Metastasis to the Lung from Sarcoma in Scar Tissue of Back 53

PAGE

MILLER, ALBERT G. 1
MILLER, MORRIS BOOTH 166
MITCHELL, CHARLES F. 49
Monoplegia, Sacral Laminectomy for Tubercular 122
MÜLLER, GEORGE P. 95, 107, 166, 206
Musculospiral Nerve, Primary Neurorrhaphy of, for Stab Wound 30

Necrosis, Pressure of the Aorta from Sarcoma Occurring in Scar Tissue of the Back 52
NEILSON, THOMAS R. 21, 184
Nerve, Musculospiral, Primary Neurorrhaphy of; for Stab Wound ... 30
Neurorrhaphy, Primary of Musculospiral Nerve for Stab Wound 30

Open Treatment of Fractures 209
Osteomyelitis of the Sacro-iliac Articulation 121

Paralysis, Volkmann's Ischæmic 187
Patella, Fracture of; Treated by Subcutaneous Purse-string Suture 74
Patella, Fracture of 191
Penis, Incurvation of; Plastic Operation for the Relief of 10
Perforation, Typhoid, Diagnosis of 32
Perineal Prostatectomy, Median; Technic of 168
PFAHLER, GEORGE E. 1, 7, 9, 220
Plastic Operation for the Relief of an Incurvation of the Penis 10
Primary Neurorrhaphy of Musculospiral Nerve for Stab Wound: Perfection Functional Recovery 30
Prostatic Enlargement, Dilatation of the Prostatic Urethra for the Relief of the Symptoms of 23
Prostatic Urethra, Dilatation of; for the Relief of Symptoms of Prostatic Enlargement 23
Prostatectomy, Median Perineal; Technic of 168
Prostatectomy, Suprapubic; Technic of 181
Psoas Abscess; Early (Treves) Operation for 121
Relation of the Ductless Glands to Surgery 112
ROBERTS, JOHN B. 21, 24, 74, 219
RODMAN, WILLIAM L. 94, 109
Röntgenographic Examination of Kidneys and Ureter 1
ROSS, GEORGE G. 50, 57, 94, 206
Rupture of the Longitudinal Sinus, With; Gunshot Wound of the Skull 27

PAGE

Sacral Laminectomy for Tubercular Monoplegia 122
Sacro-iliac Articulation, Osteomyelitis of 121
Salicylate of Mercury in the Treatment of Syphilis 16
Sarcoma and Epulis of the Jaw; Surgical Aspect of 97
Sarcoma Occurring in Scar Tissue of the Back, with Metastasis to the Lung: Pressure Necrosis of the Aorta, with Hemorrhage and Death 53
Scar Tissue of the Back with Sarcoma; with Metastasis to the Lung 53
Sciatic Nerve, Infiltration of in Amputation of Leg 29
Shaft of the Femur; Fracture of with Marked Displacement .. 210
SHOBER, JOHN B. 60, 89
Shoulder-joint; Laceration of the Axillary Portion of the Capsule of as a Factor in the Etiology of Traumatic Combined Paralysis of the Upper Extremity 123
Sigmoid, Volvulus of the 77
Sinuses, Chronic Tuberculous; Treatment of by Beck's Bismuth-vaseline Paste Injections 60
SITER, E. HOLLINGSWORTH 23
Skull, Gunshot Wound of, with Rupture of the Longitudinal Sinus 27
SPEESE, JOHN 94, 97, 106
Stab Wound; Primary Neurorrhaphy of Musculospiral Nerve for .. 30
STEINBACH, LEWIS W. 208
STEWART, FRANCIS T. 7, 24
Subcutaneous Purse-string Suture in Fracture of the Patella 74
Subphrenic Abscess Complicating Appendicitis 154
Subphrenic Abscess Following Appendicitis After Six Months 156
Suprapubic Prostatectomy, Technic of 181
Surgery; the Relation of Ductless Glands to 112
Surgical Aspect of Epulis and Sarcoma of the Jaw 97
SWAN, JOHN M. 57
SWEET, J. EDWIN 112, 190
Syphilis, Treatment of by Hypodermic Injections of Salicylate of Mercury 16

TAYLOR, WILLIAM J. 76, 90
Technic of Median Perineal Prostatectomy 168
Technic of Suprapubic Prostatectomy 181
Tenotomy, Value of in Some Cases of Fracture of the Tibia and Fibula 83

PAGE

THOMAS, T. TURNER 110, 123, 153
Tibia and Fibula, Fracture of; Value of Tenotomy in Some Cases of 83
Tourniquet for the Control of Hemorrhage from the Scalp During Osteoplastic Resection of the Skull 69
Traumatic Combined Paralysis of the Upper Extremity; Laceration of the Axillary Portion of the Capsule of the Shoulder-joint as a Factor in the Etiology of..... 123
Treatment of Chronic Tuberculous Sinuses by Beck's Bismuth-vaseline Paste Injections 60
Treatment of Syphilis by Hypodermic Injections of Salicylate of Mercury 16
Treatment, Open of Fractures 209
Tubercular Monoplegia; Sacral Laminectomy for..... 122
Tuberculous Sinuses, Chronic; Treatment of by Beck's Bismuth-vaseline Paste Injections 60
Typhoid Perforation, Diagnosis of 32

UHLE, ALEXANDER A. 1, 8
Upper Extremity, Angioma of the; Varicose Veins Simulating a Femoral Hernia 76
Ureter, Combined Cystoscopic and Röntgenographic Examination of 1

Value of Tenotomy in Some Cases of Fracture of the Tibia and Fibula 83
Volkmann's Ischæmic Paralysis 187
Volvulus of the Sigmoid 77
Volvulus of the Small Intestine Complicating Appendicitis..... 157
Volvulus of the Small Intestine Following Appendicitis..... 158

WHARTON, HENRY R. 75, 76, 79, 80, 81, 83
WHITING, A. D. 32
WOOD, ALFRED C. 69
Wound, Gunshot of the Knee-joint 26
Wound, Gunshot of the Skull, with Rupture of the Longitudinal Sinus 27
Wound, Stab; Primary Neurorrhaphy of the Musculospiral Nerve for 30

YOUNG, JAMES K. 121, 122, 152, 189, 218