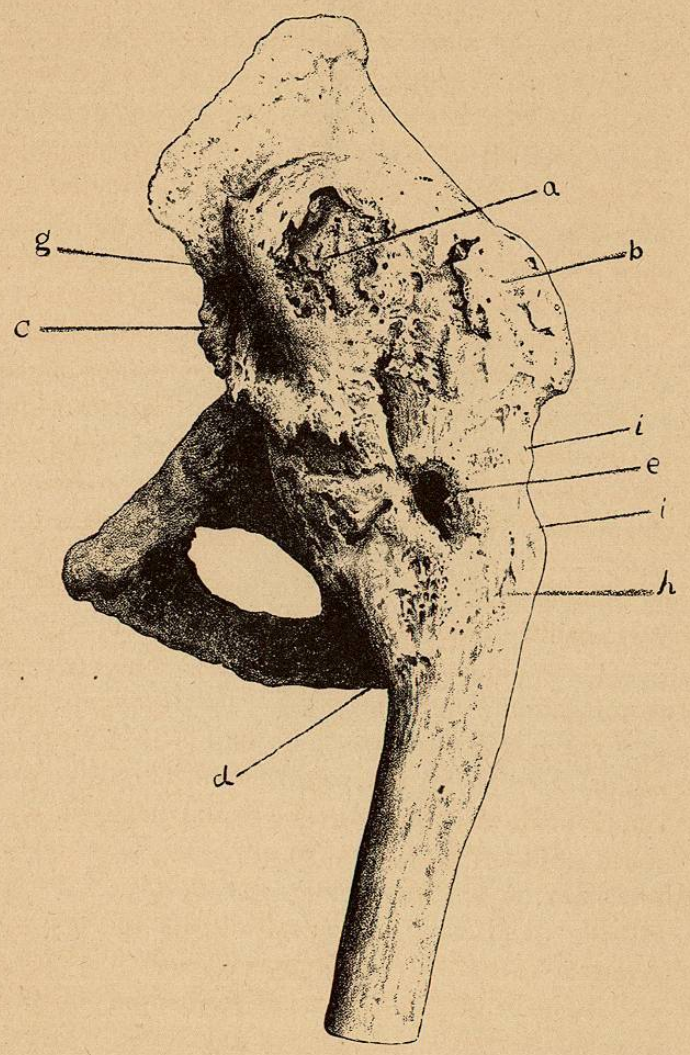
the two fragments is one and a half inches long. It springs from the periphery of the lower fragment, and from the shaft immediately below it (*h*, Plate IV), leaving the upper extremity of the cut surface free. A little above this point it is compact, and at the point of attachment to the superior portion is blended with the shell of bone covering the head. The new bone by which the shaft has been lengthened is shown (*i i*, Plate IV). The acetabulum is perfectly normal (*k*, Plate III).

This case is remarkable in many respects, whether the dislocation, the enormous growth of bone, or the amount to which the shortening has been reduced is considered. The practical question is whether, in such cases, a lengthening of the limb is possible, and if so, what is the best method of accomplishing this end?

The growth of bone about the head and neck was entirely independent of the operation, and existed at the time of its performance. The outgrowth, from a point below the level of the trochanter minor and extending upward in front of the femur, to be attached to the ilium, could not have existed at the time of the section, otherwise the position of the limb could not have been improved. It would seem probable, as Dr. Moore suggests, that in some individuals there is a predisposition for the growth of stalactites about the hip joint, and that this abnormal development of bone about these parts in the patient from whom the specimen was taken may be attributed to this predisposition. Whether the presence of a specific taint had anything to do with its production is an interesting question, but one which can not



Dr. E. M. Moore's case—the parts after an intertrochanteric operation, lateral view.

be solved. I do, however, think that, given the predisposition to exuberant bony formation, the persistent use of passive motion, in order to prevent bony union between the fragments, kept up an irritation of the parts which in this individual contributed to the development of bone in its abnormal position, and to the extent in which it was found. The limb, after consolidation, was adducted to a considerable degree, and could not have been as useful as one in a straight line or slightly abducted.

The ultimate results of all attempts to obtain a false joint at the point of section have not been very encouraging, as none have been followed by permanent success. In Barton's case, section between the trochanters, in which the operation was performed with this end in view, the patient had useful motion for six years. He then became dissipated, and the joint gradually became stiff, and, at post-mortem examination two years later, was found to be anchylosed. In Dr. Sands's case[1] (Adams) the patient for a time (two years) had a fair amount of motion. He then became dissipated, and the false joint gradually became stiff. Two cases are reported by Lund. There is no history beyond sixteen months. In two other cases (Sayre's) of cuneiform osteotomy one patient is reported to have had a considerable amount of motion at the time of dismissal, but later report[2] is to the effect that suppuration had taken place and terminated in immobility at the point of section. In the other case the patient died at the end of six months, and a false joint was demonstrated. There were,

[1] "New York Med. Jour.," vol. xviii, p. 609.
[2] "Med. Rec.," 1878, p. 174.

however, necrotic changes taking place in the bone about the new articulation.

It would seem that the difficulties attending the formation of a false joint are great, and, even if one is obtained, it is a question whether it is of any real advantage to the patient. I do not think that a false point of motion at the upper end of the femur is an advantage. In this connection Dr. Sands expresses the following opinion: "The question whether operation of this character may be expected to result in the formation of an artificial joint is not, in my judgment, a very important one. If the affected limb can be restored to its normal position and to nearly its normal length, anchylosis will be found, I think, to afford greater security than the best false joint, and to offer no serious obstacle to locomotion."

It would appear that, in those cases in which motion at the point of section persisted for some time, it was more of a hindrance to locomotion than an anchylosed limb. Further, from the fact that the tendency is toward a final anchylosis, it would seem that the time lost in the attempt, and the necessary suffering in trying to prevent the limb becoming stiff, were worse than useless.

The ultimate result of osteotomy in the upper portion of the femur as to the use of the limb is excellent.

In forming an opinion in regard to the advisability in any case of performing an osteotomy, the amount of adduction should be considered more than the flexion. I think that we are apt to look more at the latter while the former condition is the main hin-

drance to easy locomotion. I think that a moderately flexed limb, with much adduction, is more of a real deformity than one flexed to a much greater degree without adduction.

Case II illustrates this point. The actual shortening was one inch, the real shortening (and by that I mean the distance of the foot from the ground while walking) was more than two inches, the tilting of the pelvis on account of the adduction causing the additional amount of shortening.

There is still another class of cases of deformity after hip-joint disease in which an osteotomy may be performed with advantage. I refer to cases of marked flexion and adduction of the thigh due to shortening of the psoas and iliacus, and the adductors in which further flexion is possible, but extension beyond a point can not be obtained. There is no doubt but that quite a number of cases belong to this category. Some of them can certainly be relieved by extension upon an inclined plane, or by a tenotomy the adductors can be freed, but I am satisfied that all cases can not be relieved by this method. I have failed in some cases. Among the poor it is impossible to carry out with any degree of satisfaction the necessary treatment. In these cases a section below the trochanter minor is justifiable. It certainly can not be attended with much if any danger, and, although it will add a little to the real shortening, it will increase the apparent length of the limb and allow the patient to plant the foot firmly on the ground without any great amount of arching forward of the lumbar vertebræ (lordosis). I have never operated upon such a case, but can see no possible objection

to it, and would certainly do so did an opportunity offer.

On the management of the limb after the section depends the success of the operation. Various methods have been adopted, as extension, putting the whole limb up in plaster-of-Paris, a long splint, etc. I think that extension and a long splint extending from the axilla to the foot, with an angle opposite the point of section, so that the limb may be held in a slightly abducted position, is by far the best, and plaster-of-Paris the worst dressing that can be used. With the latter, displacement of the lower fragment is liable to occur, and the pelvis to become twisted, and there is no opportunity to rectify any malposition. The case reported by Dr. E. M. Moore[1] demonstrates the advantage of extension in these cases. I have in a recent case adapted this plan of treatment, and have reduced the amount of shortening to a considerable degree.

ACCIDENTS.

Except suppuration and necrosis, but few accidents have been reported.

Hæmorrhage, as a rule, is slight, and even in those sections that have been made through a large wound it was seldom that a ligature was required.

In two cases serious consequences followed from pressure on the femoral vessels.

Post[2] mentioned a case in which he had made a section of the femur just below the trochanter minor

[1] "Trans. Am. Surg. Assoc.," vol. i, 1883, p. 111.

[2] Report of "Trans. N. Y. Surg. Soc.," "Annals of Anat. and Surg.," January, 1883, p. 30.

through a large wound. The limb became gangrenous and the patient died. At the autopsy it was found that the great vessels had become caught over the upper fragment of the bone, and in that manner the circulation in the limb had been impeded.

Servais[1] reports the case of a man, twenty-three years of age, on whom he had performed an Adams's operation. No accident occurred at the time, but on the twentieth day profuse hæmorrhage took place from the femoral artery or one of its large branches, due to pressure of one of the fragments. The femoral was ligated and recovery took place. Maisonneuve is reported to have divided the sciatic nerve during an operation of section between the trochanters.

Operations upon the femur for the correction of deformities after fracture have, until within the last ten years, been attended with great danger and a high rate of mortality. Fractures of the femur are more apt to be oblique than are similar injuries of the bones of the leg, and, when vicious union occurs, the deformity is due not only to bending at the seat of fracture, but there is a much greater amount of shortening, due to overriding of the fragments, than after similar injuries to the tibia. They are therefore not as easily corrected, and a more severe operation is necessary. Out of twenty-five cases, in nine the ends of the bones were resected after a simple division; of these, suppuration is reported to have occurred in seven. Four patients died—three from pyæmia, one from shock after an amputation of the limb, and five recovered. In seven a wedge-shaped piece of bone was removed at the seat of fracture; of these, suppu-

[1] "Rev. de Chir.," December, 1881, p. 1043.

ration took place in three limbs; two patients died —one from pyæmia and one from exhaustion, and five recovered. In nine a simple section was made. Two cases of suppuration are reported; two died—one from pyæmia, and one from shock twenty-four hours after the operation, making a total of twelve cases in which suppuration occurred, eight deaths and seventeen recoveries—a mortality of 32 per cent. In one case, where there was much overriding of the fragments, Fitzgerald[1] divided the callus longitudinally with an osteotome, and then, by applying extension, brought the lower fragment down and corrected the shortening. In some cases great extending power has been applied by means of pulleys; it is not, however, unattended with danger. Horner,[2] after exposing the ends of the fragment, brought the lower fragment down by means of compound pulleys. He accomplished his purpose, but gangrene of the limb set in, and the patient died on the fourth day. The greatest mortality occurred before the antiseptic method of caring for wounds was known. Since 1876 I can find no fatal result reported. Where, from the nature or the position of the fracture, osteoclasis can not be performed and a section is necessary, the choice of the operation is not an arbitrary one. In many cases a linear osteotomy will not yield the best results; the angular deformity can certainly be corrected, but, when there is much overriding and consequent shortening of the limb, it is necessary to separate the bone in the line of the fracture, and often, in addition, to excise the ends of the fragments which

[1] "Austral. Med. Jour.," 1879, N. S., vol. i, p. 168.
[2] "Med. Exam.," Philadelphia, 1851, N. S., vol. vii, p. 32.

may have become rounded off and require to be freshened in order to obtain bony union, or the removal of a segment of bone may be necessary to bring the ends of the bone into apposition. It is probable that cases requiring correction after fracture of this bone will be rarely met, and that, with increased facilities and a better knowledge of the management of these injuries, perfect, or nearly perfect, results will be obtained in the vast majority of cases.

ILLUSTRATIVE CASES.

Case I.—H. B., ten years of age, was admitted into St. Mary's Hospital with deformity of the right hip joint following suppurative disease of that articulation. He has had caries of the spine in the middle dorsal region from which he has recovered, but with marked deformity. Three years ago the right hip joint became diseased, an abscess formed behind the great trochanter, and continued to discharge for some months. The limb gradually became flexed and adducted, so that at the time of admission it was in the condition shown in Fig. 12. On ex-

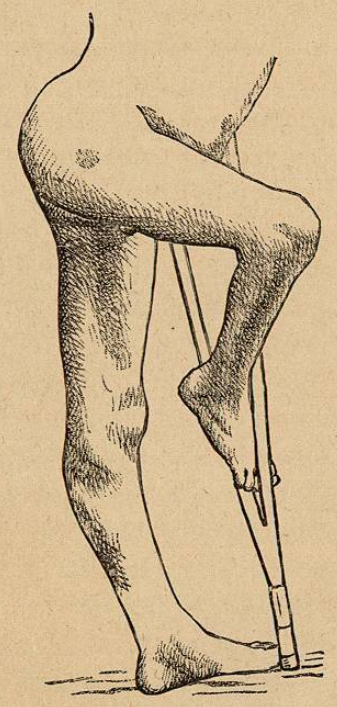


Fig. 12.

amination, the upper portion of the femur is found to be dislocated on to the dorsum of the ilium; the adductors are strongly contracted and very tense. There is a great amount of lordosis, but I think much of it is due to the spinal deformity. When placed on his back and the pelvis brought into its normal position, the limb is flexed at a right angle to the pelvis, and crosses the left at a point above the knee. There is no motion between the femur and pelvis.

In January, 1883, the following operation was performed: An incision was made about three inches long, extending from the middle of the trochanter major downward, so that its center corresponded with the trochanter minor. The bone was found to be much deeper than normal, the muscles seeming to be rolled up over it. The periosteum was raised and a V-shaped piece of bone removed with a chisel from a point just below the trochanter minor, the apex of the wedge extending into the compact tissue on the inner aspect of the shaft. The section was then completed by an osteotome. As much of the attachment of the adductors as could be safely reached was then divided; also a portion of the tensor vaginæ femoris, and the long head of the rectus. As the limb was still strongly adducted, other resisting bands were torn so that the limb could be brought down into a straight position as far as the adduction was concerned. There was still marked lordosis, which was evidently due, to a considerable extent, to the spinal deformity. The edges of the wound were partially united, leaving a central portion open. Iodoform, and a compress secured with adhesive plaster, completed the dressing. A long splint extending from the axilla to the foot, an extension-weight of five pounds was applied after the patient was in bed. The wound was some time in entirely closing. The patient was up in about five weeks. Fig. 13 is from a photograph recently taken. There appeared, a few days after the operation, considerable ecchymosis, extending over the lower portion of the abdomen, down into the right scrotum and the perinæum of the same side. A vessel of some size must have been torn in bringing the limb into position, as the tissues gave way with considerable noise.

Fig. 13.

Case II. — B. K., eleven years of age, had disease of the left hip joint three years ago, following a severe injury. An abscess formed on the outer aspect of the thigh. At the time of admission she had not worn a brace for eight months. The limb is found to be flexed on the pelvis at an angle of 140° and strongly adducted. There is no motion at the hip joint. The limb is one inch short. She walks with a very awkward gait, her toes only touching

the ground, as, on account of the adduction, she has to raise the pelvis on the diseased side so that it increases the apparent shortening to two inches. Fig. 14 shows the amount of flexion. In February, 1883, a simple osteotomy was performed just below the trochanter minor; the adductors and long head of the rectus were divided, but the limb was not disturbed much, nor any persistent attempt made to correct the abnormal position. The lips of the small wound were brought into apposition with a narrow piece of adhesive plaster, and over this a compress. A long splint and five pounds extension were applied. On the third day the extension-weight was increased to ten pounds, in order to stretch the muscles and adhesions so as to bring the lower fragment down and thus overcome the adduction and flexion. This was accomplished two days later. On removing the weight, it was found that the adduction had entirely disappeared, and the lordosis was much diminished. The weight on the extension-plasters was reduced to five pounds. At the end of five weeks the patient

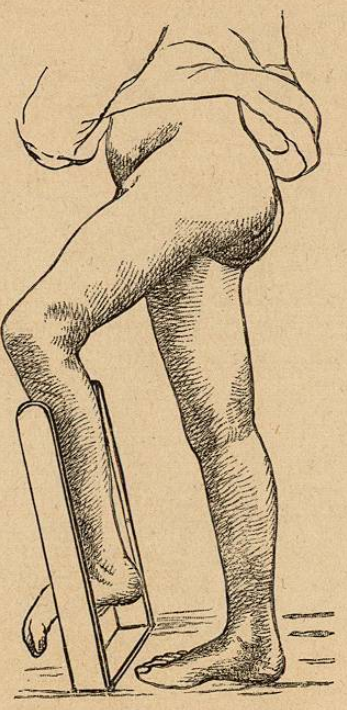


Fig. 14.

was allowed to get up. At the time of dismissal she walked well with a shoe one inch high, without the awkward swinging gait which she had at the time of admission (Fig. 15). In both of these cases the temperature at no time was over 99°.

I have given these cases in detail because I wish to emphasize certain points in the operation and after-treatment which seem an advantage. I think that it is better not to make any attempt to correct the flexion and adduction by forcibly moving the limb in different directions in order to stretch the resisting bands and muscles. The necessary friction between the fragments is certainly not an advantage. The less the parts immediately about the bone are disturbed the better, and the less liability there is for inflammatory processes to be set up. By extension with a weight of from ten to fifteen pounds, according to the age of the patient, the muscles and bands of adhesion can be lengthened in a day or two, and, when this is accomplished and the extension let up, it will be found that the limb can

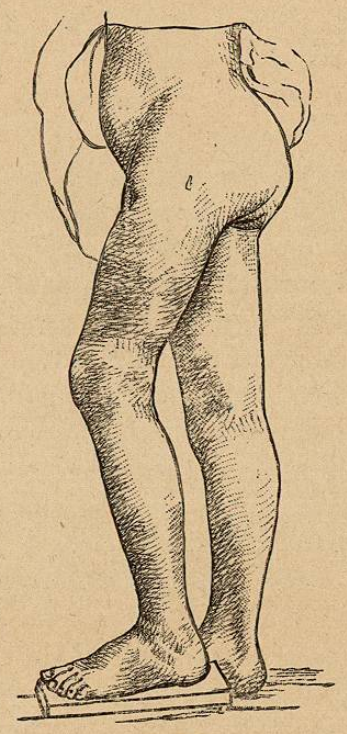


Fig. 15.

be placed in any desired position without pain. There certainly is a danger that the soft parts may get pinched between the fragments and be the starting-point of suppuration. At all events, it is a precaution in the right direction; it will certainly accomplish the purpose as well as twisting the limb while the patient is under ether, and it would seem the better plan. There is liability for the pelvis on the same side as the limb operated upon to become tilted up. From the long habit the patient has had of constantly keeping the pelvis raised in order to overcome the adduction, it will assume the same position during the period of consolidation, and, when the patient gets up, the limb is found more or less adducted, much to the annoyance of the surgeon. One may be easily deceived by the apparent parallelism of the limb, while in fact the limb in its relation to the pelvis is adducted. It is an advantage to have the limb, after consolidation has taken place, in a slightly abducted position, as it compensates to some extent for the shortening, and enables the patient to walk better.

The statement has been made by some operators that after section between the trochanters the patient "possessed all the movements of the normal limb." If by this it is intended to convey the impression that there was active motion, I can not understand the statement. Quite a number of large muscles have their origin and insertion above the point of section, they are so placed for a purpose, and that is to act on the femur. Now, if section is made below their point of insertion, they certainly can not have any effect on the motion of the limb. I do not

think that useful motion is probable after a section between the trochanter and possibly below the trochanter minor, and I believe that a patient is much better off after an osteotomy for the correction of deformity at the upper portion of the femur with firm union between the fragments, no matter whether the section be at the neck, between or below the trochanters.