

leaving only a stunted nodule of bone, representing the neck above the trochanter, in such a case the operation of section in the femoral neck can not be performed, there being no neck to divide. This advanced degree of destruction may be ascertained by careful measurement of the femur compared with the other. Even when supra-trochanteric section is practicable the state of the neck may render this operation abortive. The seat of the operation will be in an almost carious portion of bone which is unfit to yield a fibrous union, or possibly atrophy or necrosis of the upper portion of the neck may ensue by cutting off vascular supply from bone already devitalized.

2. "Another class of cases inappropriate for Adams's operation is when, the ankylosis having resulted from rheumatic arthritis, there is an exuberant deposit of new bone, forming hard nodules or spiculae around the femoral neck, itself entire. The thickening and induration existing will resist any justifiable attempts to divide the bone in this situation."

In cases, however, of deformity after acute traumatic inflammation of the hip, a high section is justifiable.

STATISTICS.

Sections through the Neck (68 cases).—In 17 the deformity was due to rheumatism; in 27 it followed hip-joint disease; in 7 to unreduced dislocations, pathological and traumatic; in 1 to osteo-myelitis of the femur; and in 16 no cause was assigned. In 3 of the patients both hips were ankylosed. The bone was divided with a saw in 40 cases, in 15 with an osteo-

tome, and in 12 the instrument is not mentioned. In 13 cases, suppuration followed the operation. In 8—Golding-Bird,¹ Croft,² Servais,³ Billroth,⁴ Willetts,⁵ Adams,⁶ Holmes,⁷ a case mentioned by Wharton⁸ and Shaffer⁹—it was excessive. In 3—Maunder¹⁰ 2 cases, Adams¹¹—it was slight, and in one Hutchinson¹² an abscess formed at the seat of section, but not connected with the bone four months after the operation. In three cases there was more or less necrosis following the operation (Golding-Bird, Servais, and Billroth).

Six deaths have been reported: One by Croft, from pyæmia, due to extensive suppuration and caries of the head of the femur. The deformity was due to hip-joint disease. One by Billroth, from pyæmia, four months after the operation, the deformity following hip-joint disease. One by Willetts, where extensive suppuration and caries of the head followed the section, and for which amputation at the hip joint was performed, the patient dying within twenty-four hours. One by Adams, eight months later, from tuberculosis. One by Holmes, from exhaustion due to long and extensive suppuration. And one by Shaffer, from relapse of the joint disease, followed by extensive suppuration and death, two years and a half after the operation. A percentage of 8.82 +. It should be stated, however, in justice to the last operator,

¹ "Guy's Hosp. Rep.," N. S., vol. xxii, p. 275.

² Adams, "Trans. Med. Chir. Soc.," vol. ix, p. 1.

³ "Rev. de Chir.," Dec., 1881, p. 1043. ⁴ Langenbeck's "Archiv.," vol. xviii.

⁵ Adams's Table, *loc. cit.* ⁶ *Loc. cit.* ⁷ "Lancet," Oct. 14, 1876, p. 535.

⁸ "Am. Jour. Med. Sci.," April, 1883, p. 101.

⁹ "Annals Anat. and Surg.," Dec., 1883, p. 243.

¹⁰ "Lancet," March 25, 1876, p. 476. ¹¹ Adams's Table, *loc. cit.*

¹² "Brit. Med. Jour.," March 4, 1882, p. 298.

that, had he been permitted to excise the joint after suppuration had taken place, the fatal result might not have followed.

In those patients in whom recovery took place bony union was reported in fifteen cases. Fifteen are reported to have some motion at the point of section at the time of dismissal. Nineteen were discharged cured, one improved, one with limb flexed at angle of 150°, and in four the deformity after a time returned.

In regard to motion, in the majority of the cases it was only slight. In two patients of Lund's, in whom there had existed ankylosis of both hip joints, free motion is reported in one, fourteen and sixteen months, the other six and nine months after the operation, the section of the two limbs having been performed at different dates. In Sands's case fair motion was obtained, and, I am informed, lasted for several years, but the false joint gradually became stiff and firmly ankylosed. In the remaining cases the motion was in time lost and the limbs became stiff.

The deformity in sixty-one cases consisted of flexion and adduction, and in seven limbs the ankylosis was in a straight position.

Sections below the Neck (Linear), 64 cases.—The deformity was due to hip-joint disease in 39 cases; to abscess of the hip joint after confinement, 1; rheumatism, 2; to injury, 1; in 21 cases the cause was not mentioned.

The section was made between the trochanters in 10; below, in 52; in 2 cases the point of operation is not mentioned. Only 11 operations were performed under strict antiseptic methods (Lister).

The result was:

Cured with firm ankylosis.....	52
Cured with motion.....	2
Result not satisfactory.....	1
Improved.....	3
Died.....	6
Total.....	64

The cause of death was, one reported by Borchers,¹ due to relapse of the joint disease; one by Billroth,² from extensive suppuration nine weeks after the operation; one by Billroth,³ pyæmia, seventh day; one by Bryant,⁴ from pyæmia, thirty-six days after an operation for deformity of both hip joints, due to extensive suppuration from bed-sores; one by Porter,⁵ from exhaustion due to suppuration above the point of operation four months later, and one by Margary,⁶ from collapse on the day of the operation after a Volkmann cuneiform and linear osteotomy of the tibia—a mortality of 9·37 + per cent.

Suppuration is reported to have occurred in 12 cases: Borchers,⁷ Stephen Smith,⁸ Hamilton,⁹ Maunder,¹⁰ two cases; Rodgers,¹¹ Maisonneuve,¹² Billroth,¹³ Porter,¹⁴ Margary,¹⁵ Croft,¹⁶ Moore.¹⁷

¹ "Med. Record," May 19, 1883, p. 541.

² "Arch. für klin. Chirurg.," 1882, p. 60.

³ "Chirurg. Klin. Wien.," 1871-'76, p. 543.

⁴ "Lancet," Dec. 22, 1877, p. 917.

⁵ "Boston Med. and Surg. Jour.," April 18, 1878, p. 505.

⁶ "L'Ostéotomie," Campenon.

⁷ *Loc. cit.* ⁸ "Med. Record," June 2, 1883, p. 589.

⁹ "Ohio Med. Recorder," Aug., 1877, p. 97.

¹⁰ "Trans. Clin. Soc.," London, vol. ix, p. 160.

¹¹ "New York Med. and Surg. Jour.," 1840, vol. ii, p. 238.

¹² "Gaz. Med. de Paris," 1847, p. 935. ¹³ "Züricher Berichter," s. 552.

¹⁴ *Loc. cit.* ¹⁵ "L'Ostéotomie," Campenon.

¹⁶ "Trans. Clin. Soc.," London, 1877, p. 93.

¹⁷ "Trans. Am. Surg. Association," vol. i, p. 111.

In Hamilton's, Rodgers's, Maisonneuve's, and Moore's cases, the operation was performed through a large wound, and before the subcutaneous method was adopted. In three patients there existed ankylosis of both hips. (Bryant, Ashhurst, and Hutchison, of Brooklyn.)

Cuneiform Sections.—Of these, 35 cases have been collected. Of these, in 27 the section was made between the trochanters; in 5 the section was made below the trochanter minor; in 3 the location was not stated—35. Of these, 28 recovered and 5 died. In 1 the result is not stated, and 1 is reported some years later as being in no better condition than before the operation.

In 9 cases suppuration is reported to have taken place, and in 22 no information is given with regard to this point. In 3, more or less necrosis is mentioned.

The cause of death was as follows: One reported by Weber,¹ from Bright's disease; one by Ders,² from exhaustive and excessive suppuration; one by Knorr,³ from amyloid degeneration; one by Sayre,⁴ from tuberculosis; and one by Lesrink,⁵ from embolism—a mortality of 14:31.

There are reported 3 cases cured with motion; 21 cured, 1 improved, and 2 cured with ankylosis in a straight line. Three cases, from their subsequent history, can not be put down as successful.

Taking the whole number of cases analyzed of

¹ Rosmanit's Statistics, *loc. cit.* ² Rosmanit's Statistics.

³ Langenbeck's "Arch.," Bd. v., s. 479.

⁴ "New York. Med. Jour.," January, 1869, p. 348.

⁵ Rosmanit's Statistics, *loc. cit.*

osteotomy about the upper end of the femur, we find:

	Cured.	Died.	Failures.
68 sections through the neck.....	56	6	6
64 sections below the trochanters (linear)....	54	6	4
35 sections, cuneiform.....	28	5	2
	<u>167</u>	<u>17</u>	<u>12</u>

giving a mortality of 10:18.

It is also found that, of the fatal cases, twelve occurred prior to 1877, and only five after that date, the cases being very nearly equal in number in these two periods.

I think, therefore, that these tables taken alone are misleading in regard to the death-rate, which they make to appear much higher than it really is under the present method of management of wounds. It would appear that the fatal cases were most numerous in the earlier history of the operation, before experience had demonstrated what class of cases were proper ones for operation. For instance, in the fatal case of Mr. Croft, Mr. Adams, although at the time advising the operation, states later that his opinion was wrong. Other cases of deformity after hip-joint disease were subjected to an operation at too early a date after the acute symptoms had subsided, or the section was made too high. Another cause of the increased mortality was the improper method of operation.

Many of the earlier sections were performed through large wounds, and extensive dissections were often made to reach the bone. Osteotomy, as well as other operations which have suddenly become popularized, as it were, has suffered from a want of a clear understanding of the cases

suited for section and the faulty methods adopted, and the earlier operations have always contributed the greatest number of fatal and unrelieved cases.

In regard to the question, What operation should be performed? as mentioned before, cases of deformities following coxalgia are the most unfavorable for section through the neck, and, as a rule, the more severe the joint trouble has been, the farther from the articulation should the section be made. The existence of a neck is an absolute necessity in Adams's operation. The amount of real shortening is an index of the extent of its destruction in all cases, dislocations being excluded. It should also not be forgotten that in this class of cases an Adams may fail to correct, or the deformity may return. This has happened in at least four patients, and a section below the trochanter minor had to be performed.

Whether an operation above or below the trochanter minor will be the best, depends upon the amount of shortening of the muscles inserted at that point, and the extent of the disease that has existed in the hip joint. If there is marked contraction, a section above the trochanter minor will not, as a rule, correct the deformity.

Whether a simple or cuneiform osteotomy should be performed is, in my opinion, of little moment. The latter has been advocated in deformities accompanied by marked adduction of the limb. I think that a linear section will accomplish as much as a cuneiform. There will, of course, be a larger gap to be filled with new bone on the inner side than where a wedge of

bone has been removed. Theoretically, the latter may appear to be the better plan, but practically it makes no difference. The length of the incision, and the fact that a cuneiform osteotomy must be made through a large wound, does not add to the risk, provided the wound is treated properly.

A division of the femur performed after the method advocated by Dr. Stephen Smith has no advantage, I think, over a simple osteotomy. The tendency for the lower fragment to slip is not great; at least there has been no record, except in one case, of such an accident, which the tenon and mortise plan did not prevent in the case reported.

The operation has the theoretical objection of causing greater disturbance of the soft parts, and makes two partial sections of the bone. The abscess complicating the case should be attributed not to the operation, but to the lack of drainage.

Volkman's excision of the hip joint by means of a chisel, as a substitute for "osteotomacia-subtrochanterica," has had but few advocates, both on account of the difficulty and tediousness of the operation, and the fact that but few cases are appropriate for the operation. The object aimed at is to obtain a movable articulation.

The question when an osteotomy should be performed is one not easy to answer. The liability of strumous joints to take on a new inflammatory action, from apparently slight injury, even some time after all symptoms of former trouble have disappeared, would indicate that some months should elapse after a "cure" before an attempt should be made to correct any malposition. Any pain about

the articulation should be a counter-indication against an operation.

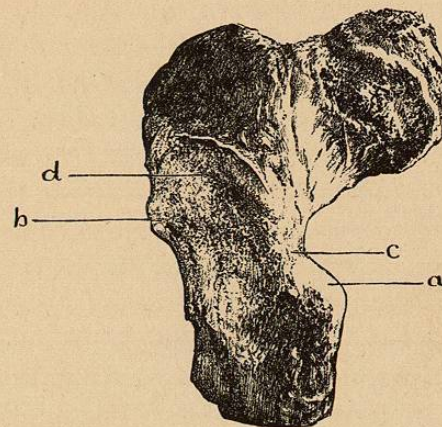
There have been but two recorded post-mortem examinations after an osteotomy at the upper end of the femur, one by Dr. E. M. Moore, of Rochester, and one by Dr. H. R. Wharton, of Philadelphia.

Dr. Wharton's case occurred in a patient nine years of age, who had suffered from hip-joint disease, and had recovered with the limb flexed at a right angle, with rotation outward and adduction. On November 25, 1882, Dr. H. R. Wharton made a subcutaneous section of the right femur below the lesser trochanter with a saw, which allowed the limb to be brought down into a good position; the usual dressings were applied, and in March, 1880, the patient was walking about the ward with the aid of a high shoe.¹ Some months later a swelling was noticed in the neighborhood of the great trochanter; this proved to be an abscess and was opened. From this time the patient grew rapidly worse, and finally died, August 15, 1883, from exhaustion. The fatal issue had no connection with the operation, but was due to a fall.

The specimen consists of the head, neck, and a portion of the shaft of the femur (Plates I and II). The head is denuded of cartilage, but otherwise does not show evidence of much disease. The section was made from a point midway between the trochanter major and minor downward and inward (*d c*, Plate I), so that the separation took place, as nearly as can be judged, in a line from this point

¹ "Am. Jour. Med. Sci.," July, 1883, p. 103.

PLATE I.



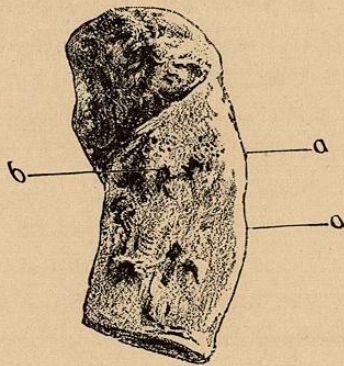
Dr. H. R. Wharton's case—the parts after an intertrochanteric operation, anterior view.

through the middle of the trochanter minor. There had been a sliding inward of the lower fragment, which has left a corresponding portion of the cut surface on the upper fragment *b* (Plate I), and also seen at *b* (Plate II), and a twisting outward on its longitudinal axis. The sloping projection (*a*, Plate I) is not due entirely to the displacement inward of the lower fragment, but in part to the rotation mentioned above. As the femur is much shorter in its antero-posterior than in its lateral diameter at this point, there would naturally be some projection when the lower portion was rotated outward to overcome the malposition due to the disease. From an examination of the cut, it is evident that the deformity has been corrected. The nature and amount of the correction are seen in Plate II. At the time of the operation there was left a V-shaped gap on the anterior aspect of the femur at the point of section; this has been filled up by new bone (*a a*, Plate II). It will be noticed that the outer line of the bone slopes inward, due to the sliding in this direction.

A careful study of this specimen shows the nature of the deformity after an osteotomy; it also shows how little is the shortening due to the operation. The displacement inward may have been due to the fact that the attachment of the psoas and iliacus were not entirely freed because the section was not made below the trochanter minor, but through it, and these muscles had drawn the lower fragment inward.

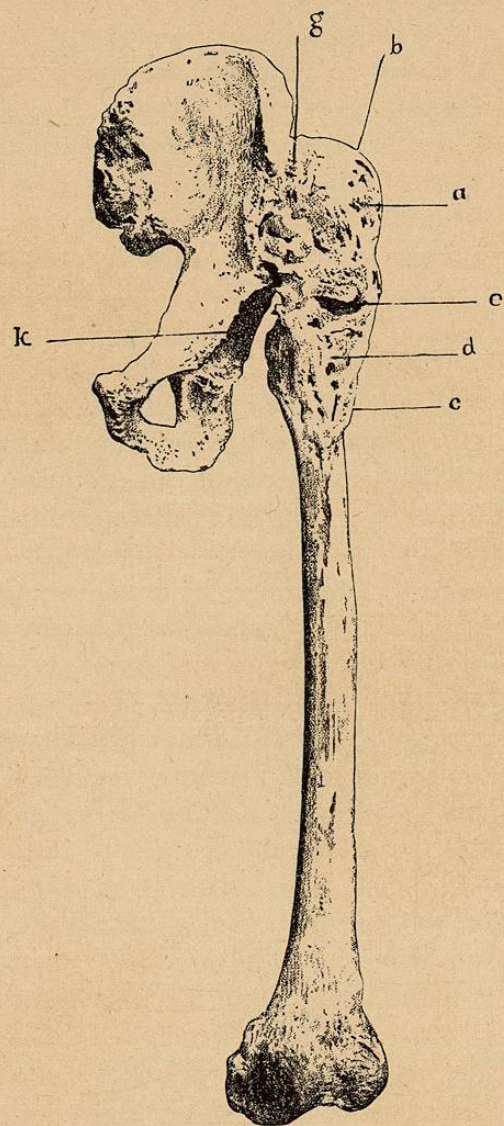
Dr. Moore's patient was an adult, in whom there existed a dislocation of the head of the femur on to

PLATE II.



Dr. H. R. Wharton's case—the parts after an intertrochanteric operation, lateral view.

the ilium, just above the upper portion of the lip of the acetabulum. The dislocation was primarily backward on to the dorsum ilii, but by manipulation it had been thrown into the position mentioned above, with the head forward, just behind the anterior-superior spine of the ilium (*a*, Plate IV), and all attempts to dislodge it from this position failed. The foot pointed directly outward, at right angles to its normal position, and the limb was hyperextended, so that walking was extremely difficult. There was shortening of two inches and a half. An attempt was made to divide with a tenotome the bands that were supposed to prevent reduction, but the knife encountered bone that seemed to surround the head and hold it in its abnormal position. An incision was then made down upon the inter-trochanteric portion of the femur on its lateral aspect, and the bone divided with a metacarpal saw above the trochanter minor. After section, the limb was rotated inward, so as to bring the foot into its normal position, and extension by means of a weight of fifteen pounds applied, the object being to obtain a joint at the point of section. Passive motion was commenced early, but, notwithstanding persistent efforts, bony union was established, the shortening of the limb being reduced from two inches and a half to one inch. There was considerable suppuration, lasting some months, but finally ceased under the use of antisyphilitic treatment, the patient exhibiting a specific eruption. For some time he was able to get about comfortably with the aid of a cane. He died two years later from phthisis. Plates III and IV are from photographs of the specimen kindly furnished



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

by Dr. Moore. Plate III is an anterior and Plate IV a lateral view of the specimen.

The head is dislocated and is seen (*a*, Plate IV) just behind the anterior-superior spine; the trochanter, covered in this situation with a shell of new bone, is posterior (*b*). The section was made midway between the trochanters, in a direction from without inward and a little downward, to a point just above the trochanter minor. The head is perfectly healthy. It is held firmly in its new position by a deposit of new bone (*b*, Plates III and IV), which covers it, except at one point (*a*, Plates III and IV) and the upper portion of the trochanter, and is continuous anteriorly below with the mass of new bone below the head, to be presently described, while above and in front of the head it is blended with the ilium (*g*, Plates III and IV). There is an enormous mass of bone, irregular in shape and perforated by many foramina, which springs from the anterior portion of the shaft from a point one inch and a half below the level of the trochanter minor (*d*, Plate IV) and extends upward and forward to a point on the ilium just below the situation of the head, where it is blended with the shell of bone covering the head (*c*, Plate IV). This mass is six inches and a half long, and is not intimately connected to the new bone forming the bond of union between the two fragments. A large opening is seen at *e* (Plates III and IV), at the bottom of which is seen the cut surface of the inferior fragment. The head is not directly united to the pelvis, but it is held by the new bone thrown out around it, the neck and trochanter major. This new bone is attached to the pelvis at *g* (Plate III). The new formation uniting