CHAPTER V.

OSTEOTOMY FOR GENU VALGUM.

The earliest operation for the relief of genu valgum of which there is any record was performed by Mayer, of Würzburg, in 1851. He made a cuneiform osteotomy of both tibiæ, through an open wound, with a saw. In one limb the line of incision healed upon the sixth day, and firm, bony union was established on the twenty-fourth day. He then operated upon the other limb. He accidentally divided the posterior tibial artery and vein, and the patient died of tetanus on the sixty-second day. He operated upon two other patients with good results. Billroth,[1] in 1873, divided both the tibia and fibula for the relief of knock-knee. Mr. Annandale[2] excised the lower end of the femur in a case of marked knock-knee. The patient was cured with an anchylosed joint. Schede[3] removed a wedge-shaped piece from the tibia, and divided the fibula with a chisel in a case of genu valgum with success. Ogston, in 1876, separated the internal condyle from the femur, and, sliding it up, brought the two condyles on the same plane. Since then several operations have been devised to accomplish the same end, which may

[1] Langenbeck's "Arch.," 1875.
[2] "Edinb. Med Jour.," 1875, p. 18.
[3] "Lond. Med. Rec.," June 15, 1877, p. 246.

be classed under two heads: Operations upon the condyle, and operations upon the shaft of the femur or tibia.

1. OPERATIONS UPON THE CONDYLE.

Ogston's operation was to separate the internal condyle from the shaft, and then to slide it up until the two condyles were upon the same plane, and thus swing the tibia inward. The following is his method of performing the operation: After the patient is well under the influence of an anæsthetic, and the limb rendered bloodless, the leg is flexed on the thigh as far as possible, and the femur rotated outward. A long tenotomy-knife is introduced three and a half inches above the tip of the internal condyle, on the inner side of the thigh, and so far back as to be opposite the ridge running between the linea-aspera and the condyle. Its blade is then carried forward, downward, and outward over the front of the femur, with its cutting-edge directed to the bone, when its point can be felt under the skin in the groove between the condyles, where the patella would normally have been lying in the extended position of the limb, the cutting-edge is pressed against the bone, and the soft parts divided with a slow movement in withdrawing the knife. The external wound thus made should be about one third of an inch long, and form the entrance to a subcutaneous tunnel running obliquely over the front of the femur and ending in the cavity of the joint. An Adams's saw is then introduced into the tunnel, and the condyle sawn off by directing the edge of the instrument straight backward. When it is estimated that the

edge of the saw has arrived near the popliteal space it is withdrawn, the knee completely extended, and with the hands, and the operator's knee as a fulcrum, the patient's knee is then forcibly straightened by bending the leg inward, the remaining connections of the condyle with the femur giving way with a crack on the application of very moderate force, and instantly the leg becomes straight. The whole operation is done under strict antiseptic rules (Lister), and the limb put up in splints in a corrected position. Fig. 21 represents the line of Ogston's section.

Reeves[1] modified Ogston's operation by making the section with an osteotome in the following manner:

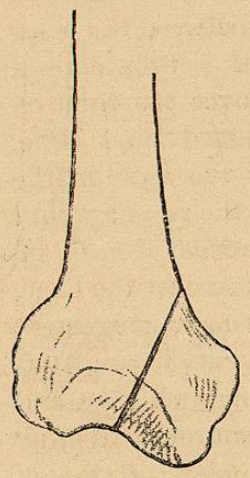

Fig. 21.

A scalpel, previously dipped in carbolized oil, is introduced obliquely just above the tubercle for the attachment of the tendon of the adductor magnus, and the soft parts and periosteum are divided in the line of the Ogston's section, the length of the wound in the soft parts being long enough to easily admit the osteotome. This instrument is then introduced, and, commencing on the ridge of bone going from the tubercle for the attachment of the tendon of the adductor magnus to the linea aspera, is driven downward and outward toward the inter-condyloid notch; the bone being *divided only as far as the cartilage on*

[1] "Brit. Med. Jour.," May 25, 1878.

its articular surface. The condyle is then loosened by using the chisel as a lever, and is separated completely by forcibly straightening the limb, which is at once put up in a permanent dressing. Fig. 22 shows the extent of the cut in the bone in Reeves's operation. He claims that by this method the joint is not entered either by the chisel or in forcibly sliding the condyle up, the cartilage being bent to accommodate itself to the new position of the condyle. It may be possible in a few cases to prevent the osteotome from entering the joint, but, in sliding the condyle up, the cartilage is lacerated and the joint thus opened.

Another operation, having in view the raising of the plane of the internal condyle, is described in the "Edinburgh Medical Journal," 1879, p. 881, by Mr. Chiene, as follows: "Find the tubercle on the internal condyle to which the long tendon of the adductor magnus is attached. An incision two or three inches in length is made over the tubercle in the long axis of the limb; the incision commences half an inch below the tubercle, and is carried upward for a sufficient distance. After the division of the skin and the fascia, the tendon of the adductor magnus is exposed. Pass in front of the tendon, between it and the fibers of the vastus internus. The bone covered by periosteum is exposed, and the superior-articular artery is seen and

Fig. 22.

divided, after passing a double ligature below it and tying the vessel. The periosteum is then crucially incised and turned aside, exposing the bone. With a chisel and mallet a wedge-shaped portion of bone is removed from the base of the condyle, immediately above the tubercle of attachment of the adductor magnus. The breadth of the wedge will depend on the amount of the deformity. The long axis of the wedge runs downward and outward toward the notch between the condyles. The wedge is at a higher level than the epiphyseal line." He

Fig. 23.

Fig. 24.

then bends the lower portion so as to displace the condyle upward. Fig. 23 shows the extent and position of the wedge removed in Chiene's operation.

Macewen performed an operation somewhat similar to that of Chiene, except that he removed the wedge in Ogston's line, and then, folding up as it were the internal condyle, corrected the deformity. Fig. 24 represents Macewen's first operation.

Schmitz,[1] of St. Petersburg, performed an Ogston's operation through a large wound, claiming as an advantage that he could see what he was doing.

All of these operations have one thing in common, namely, operating upon the internal condyle. Ogston's seems the most dangerous, on theoretical grounds, in that the joint is directly opened, yet inflammation has rarely followed it, and out of the number operated upon failures have been very few, and a fatal issue has been exceptional. In most of the cases there has been effusion of blood into the joint. A case of suppuration has been reported, but the pus was outside of the joint. There has been one case of ankylosis at a right angle, but neither necrosis nor inflammation of the bone has ever been reported. The object aimed at by either an Ogston's or Reeves's operation is to separate the internal condyle from the shaft, and then to slide it up so that its lower surface shall occupy a higher plane, and thus carry the long axis of the tibia inward and correct the deformity. In neither of these operations are the ligaments divided or weakened. In some few cases over-correction has been made, and a genu varum has resulted. In Reeves's operation the joint is certainly not entered by the chisel in some cases, although it is broken into in all. On anatomical grounds, these operations are correct in those cases in which the defect lies entirely in the internal condyle. After correcting the deformity there remains a re-entering angle on the lower surface of the articular end of the femur. This in time is filled up partly by osseous material and

[1] "Centralblatt f. Chir.," April, 1879.

partly by connective tissue derived from the serous surface of the condyle (Thiersch).

An objection was raised by Thiersch, at the seventh congress of German surgeons, held in 1878, to Ogston's operation for genu valgum, in that he feared the interruption of the epiphyseal cartilage might easily interfere with the growth of that portion of the bone.[1] I am not aware of any case in which this result has been reported. Recently, through the kindness of my friend, Dr. F. Lange, I have had the opportunity to examine a case in which atrophy or arrest of development has occurred after an Ogston's operation. The patient is a healthy-looking girl, eight years of age, on whom, in 1878, when two years old, an Ogston's operation was performed for unilateral genu valgum of the left limb. For two years nothing abnormal was noticed, but at the end of that date the left knee began to bend outward, and walking became difficult.

This outward displacement continued to increase, and with it the embarrassment in getting about. There has been no pain about the knee joint. On examination, there is found to exist a marked genu varum on the left side when the leg is extended which disappears on flexion. The joint looks broader than the right, and measures one inch more in circumference than the other. The anterior surface of the external condyle is prominent, owing to a displacement of the patella inward. The internal condyle is much smaller than the corresponding one of the right limb, and its lower border is on a plane an inch higher than that of the external, and

[1] "London Med. Record," June 15, 1878, p. 269.

there is a corresponding loss of substance on the inner side of the femur, in the location where the internal condyle should be in the normal limb; its anterior aspect is also more posterior. It is felt as an oblong excrescence on the shaft of the bone, and is much smaller in all its diameters than the one in the corresponding limb. It evidently has not kept pace in its growth with the rest of the bone, if indeed it has grown at all. The space left by the change in the plane of the condyle is occupied in front by the patella, which is dislocated inward and does not leave its abnormal position in any motion of the leg. The inner head of the tibia has increased in height more than its external, so that it partially occupies, in the extended position, the gap left at the lower end of the femur. The operation-wound is represented by a slight cicatrix. The increase in the circumference of the knee is due to the displacement of the patella.

From this description it is evident that the operation, by cutting through the epiphyseal cartilage, has seriously interfered, if it has not entirely arrested, the growth of the internal condyle, and has left the patient in a much worse condition than if the operation had not been performed. This case exhibits a fatal defect in Ogston's operation upon patients who have not attained their full growth. And the same remark is applicable to all operations upon the condyle that in any way interferes with the epiphyseal cartilage.

Reeves's is a difficult operation to perform. The section has to be made slowly, and you are near important vessels. If the ligaments are relaxed or

weakened so that they stretch, it is very difficult to slide the partially detached condyle up. In two cases I failed to correct the deformity from this cause. It, however, has this advantage: that recoveries are much more rapid than after any other operation.

Both Macewen's and Chiene's cuneiform osteotomies at the internal condyle were successful. They are difficult operations to perform, and they have the disadvantage of being done through an open wound. They have not been repeated by any other operators.

2. OPERATIONS ON THE SHAFT.

In 1877, Macewen corrected a case of genu valgum by making a transverse section of the shaft of the femur from the inside, a short distance above the epiphyseal line of that bone, in the following manner: After rendering the limb bloodless, with a sharp-pointed knife an incision was made at a point where the two following lines meet—one drawn transversely a finger's breadth above the superior tip of the external condyle, and a longitudinal one drawn half an inch in front of the adductor-magnus tendon. This line of division is above the epiphyseal cartilage. Fig. 25 shows the line of section in Macewen's second operation.

Mr. Barwell, acting upon the theory that knock-knee is a deformity due always to changes in the femur and tibia, makes a section above the epiphyseal line of the femur, and corrects one half of the deformity. Two weeks later he divides the tibia and fibula near the knee joint and corrects the other half,

thus performing three osteotomies. He certainly obtains no better results than Macewen does by a single section. In some cases, however, of very marked genu valgum, a femoral section does not correct enough, and then a section of the tibia should be done; but, as a rule, there is no necessity of performing more than one osteotomy, and when there is no necessity it is worse than useless.

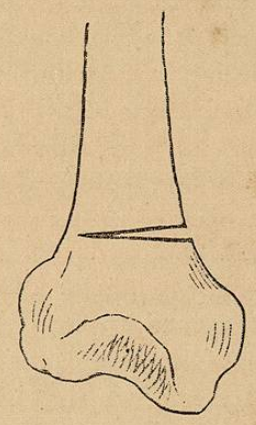

FIG. 25.

MacCormac[1] advocates section from the outside, making the division just above and parallel to the articular surface. He penetrates the bone to three fourths of its thickness and then fractures. Dr. E. H. Bradford, of Boston, has repeated MacCormac's operation, and speaks well of it.[2]

Taylor[3] divided the shaft of the femur from the outside a hand's breadth above the joint. This operation is evidently only applicable to cases of genu valgum due to femoral curves.

Reeves[4] advocates the division of the femur just below its middle, and states that he has performed this operation seven times. He calls it mid-femoral osteotomy. Its advantages, he thinks, are: First, the bone is divided nearly at its smallest part; therefore, Second, the operation is more quickly done.

[1] "Antiseptic Surgery," p. 189.
[2] "New York Med. Jour.," January, 1881, p. 26.
[3] "Brit. Med. Jour.," April 7, 1877, p. 429.
[4] "Brit. Med. Jour.," December 10, 1881, p. 935.

Third, the deformity is readily corrected, and the large callus which forms when supra-condyloid osteotomy is performed is avoided. Fourth, the effusion into the joint, which sometimes follows the supra-condyloid operation, is avoided. Fifth, recovery is quicker. Sixth, multiple osteotomies are done away with.

All these operations upon the shaft are above the epiphyseal cartilage, and at such a distance from the joint that the articulation is not entered by the chisel, and seldom fractured into in straightening the limb. Sections above Macewen's line are seldom made. They are applicable only to those cases of genu valgum due to femoral curves, and even in this class it is not often that the deformity is due to this cause alone, overgrowth of the bone just above the internal condyle, or changes in the condyle itself, being superadded. Division just above the epiphysis is applicable to all cases of knock-knee dependent on femoral changes, whether the section is made from within outward (Macewen), or from without inward (MacCormac). It is true that in the former the limb is slightly shortened, while in the latter it is lengthened, but the difference is too little to be taken into account, provided the same operation is performed on both limbs. Reeves's objection to the supra-condyloid operation, in that the joint is at times affected, I think of little moment. Effusion into the articulation is very seldom seen, and, when it does exist, is soon absorbed. Mid-femoral operations are applicable to but few cases. The presence of a large callus is exceptional in my experience, and the time necessary for firm bony union to take place is the same in both cases.

But few operators have adopted either Taylor's or Reeves's mid-femoral line of section. The majority make the division just above the epiphysis.

Of the operations for the correction of genu valgum, that devised by Macewen has superseded all others. It is easier to perform, is applicable to all cases, is so far removed from the joint that there is no danger of injury to it or its ligaments, and at the same time is near, if not directly, at the point of abnormal deviation.

I have had experience with but one other, and that is Reeves's section in Ogston's line.

Macewen's supra-condyloid operation may be performed in the following manner: The patient having been etherized, an Esmarch's bandage is applied, extending well up on the thigh so as to be entirely out of the way during the operation. The leg is fully flexed on the femur, the thigh rotated outward, so as to give easy access to its inner portion just above the knee joint, and the limb is laid on a sand pillow, which has been molded to the knee and lower portion of the thigh, so as to give a firm bed for its support during the operation.

An incision is then made down on the ridge of bone running from the tubercle for the attachment of the tendon of the adductor magnus to the linea aspera, at a point a finger's breadth above a line drawn inward from the lip of the external condyle. The incision should be made parallel to the long axis of the limb, and a little longer than the width of the largest instrument. Keeping the knife in position, the largest osteotome is then passed down on it as a guide, and, when on the ridge of

bone, the knife is withdrawn and the instrument rotated so that the cutting-edge is at right angles to the line of incision. It is better to begin the section from this point, directing the osteotome outward and forward, for by so doing the inner and posterior-lateral portions of the femur are divided first, and you are working away from the vessels. After the compact tissue of the femur has been divided, the progress of the osteotome through the central portion of the bone will be more rapid until the external shell is reached. This will be readily known by the greater resistance offered to the instrument. If the osteotome becomes wedged, it should be replaced with the next smaller. After the bone has been divided on its inner anterior and posterior aspect, and the instrument has penetrated into the compact bony tissue on the external aspect of the femur, the osteotome is withdrawn and the leg extended on the thigh, the wound having been covered with a sponge wet with carbolized water. Then grasping the lower portion of the femur just above the point of section with one hand, and the leg with the other, using the latter as a lever, the remaining portion of the femur is fractured. The wound should be treated in the manner mentioned on page 22. After placing a compress over the wound, the whole limb, from the toes as far up on the thigh as possible, is bandaged with a flannel roller, and over this plaster-of-Paris bandages placed. Before the latter sets, the leg is to be carried inward, so as to bring it a little beyond the long axis of the femur; or, in other words, to overcorrect the deformity. Care should be taken to keep the leg well extended on the thigh while the plaster

is hardening. In order to keep the limb in position while the plaster is drying, it is an advantage to place a roll of flannel, about four inches in diameter covered with rubber cloth, between the thighs above the point of fracture, and, using it as a fulcrum, to bend the two legs together and tie them. The feet should rest on a pillow, in order that the knees do not become flexed. Care should be taken that the two fragments are in such a position that there may be no lateral displacement. In one case I have seen a sliding backward of the lower fragment, but not enough to cause any trouble, yet it is well to avoid this. After the splint has well hardened, the patient is returned to the bed and the limbs suspended by passing a bandage under the middle of the leg and over the bed cradle, or any suitable apparatus that may be at hand can be used. Suspension seems to give comfort. On the third day the wound is examined, the splint is left on for four weeks, when it is removed and the patient allowed to use his limbs, and, if the union seems firm, to go about.

The operation described above varies from that of Macewen in three particulars: 1st. In the omission of Listerism; 2d. In the position of the limb during the operation; and, 3d. In the method of treating the wound. The reasons for the first and third variations have been given when describing the operation of osteotomy, page 24. The reasons for the second are as follows: Macewen operates with the limb fully extended[1] and rotated outward, and makes his incision where the two following lines bisect one another—a line drawn transversely a finger's breadth

[1] "Lancet," December 28, 1878, p. 911.