

above the level of the upper border of the external condyle, and a line drawn parallel to and half an inch in front of the tendon of the adductor magnus. This line, Macewen states, is below and anterior to the anastomatica magna, and above the superior articular.

It is much easier to get at the inner aspect of the thigh with the leg flexed than when it is extended. The ridge of bone running from the tubercle for the attachment of the tendon of the adductor magnus to the linea aspera is a much more certain guide than a line half an inch in front of that tendon. This ridge is very easy to find, and, with the leg flexed, there is no difficulty in cutting down upon it. Another advantage in operating with the knee bent is that when the leg is extended the skin and subcutaneous tissue slides downward and forward, and thus closes over the wound in the muscles. I think also that a firmer support for the limb is obtained when the leg is flexed.

G. C. Wright,<sup>1</sup> surgeon to the General Hospital for Sick Children, Manchester, makes a section with a saw from outside, on a line above the adductor tubercle.

#### CASES APPROPRIATE FOR OSTEOTOMY.

*Infantile Cases.*—These may be considered under two classes—those in which the bones have become hardened, and those in which the process of sclerosis is still going on.

I. There can be no doubt as to the necessity of an osteotomy to correct a genu valgum after the

<sup>1</sup> "Abstracts of Medical and Surgical Cases treated at the General Hospital for Sick Children," Manchester, 1882.

bones have become hard. The question as to the date at which this condition has been reached is much more difficult to answer; and, as said before, it is not a question of age, but of *nutrition*. Thus, I lately performed an osteotomy for unilateral knock-knee on a child three years of age. She had been under good mechanical treatment for six months without the slightest effect on the deformity. In making the section, the femur was found to be very hard and very difficult to divide. Again, on doing a supra-condyloid operation on a boy eight years of age, the bones were quite soft. If the deformity had been uncomplicated, I have no doubt it could have been corrected with splints. I do not see how any fixed rule can be laid down as to the age at which an osteotomy should or should not be performed. It would seem, however, that if, after several months of careful mechanical treatment, there has been no improvement, any further use of braces is worse than useless, for if they do no good, they are certain to do harm. They cause atrophy of the limb, are a hindrance to locomotion, and a constant cause of care and expense.

In regard to the condition of the bone, the state of the tibia has seemed to be something of a guide.

If by the use of moderate force (and by moderate is meant *not* enough to cause any pain) the bone is felt to yield or spring, it is safe to conclude that the bone has not become hard. It is, however, to be remembered that the intensity of the rachitic process falls upon different bones in different degrees, and that the condensation process is often very much further advanced in one bone than in another in



the same individual. If the bone does not yield, the sclerosis has advanced so far that mechanical treatment will fail as a rule.

There is another condition which complicates both mechanical and operative treatment, but the former more than the latter, and that is a relaxation of the ligaments. A child with weak, but not relaxed, ligaments is not a good subject for mechanical treatment. In healthy children braces will fail to correct a case of genu valgum after the fourth or fifth year. I think that the practice of compelling children to wear mechanical appliances for the relief of knock-knee for years is cruel, and should be condemned. By early recognizing which cases are appropriate for mechanical treatment and those which are not, much time can be saved. I think that a relaxed ligament is an argument in favor of an early operation.

II. Those cases in which the bones have become only partially sclerosed.

Some of these cases, perhaps the majority, occurring in children at or about the fourth year can be corrected by mechanical appliances, if the external lateral ligament is strong. Yet in practice it is not often accomplished. The vast majority of cases of knock-knee are children of the poorer classes, among whom it is almost impossible to have an instrument properly applied and cared for. They have not the time, and often not the intelligence, to give their children proper attention. In proof of this, reference is again made to the statistics given on page 90. Out of fifty-seven children under five years of age affected with knock-knee, only thirteen were discharged cured,

and this at a dispensary distinguished for the care and attention given to its patients. It is a question, therefore, whether the majority of children in good health, over four years of age, would not be enabled to walk sooner by an operation, and whether more children would not be permanently cured in early life by this means than by being submitted to mechanical treatment? I must confess that my own feelings are decidedly in favor of an operation.

Properly performed, osteotomy is not a serious operation. It is not only justifiable, but is for the best interests of this class of patients. In knock-knee occurring among the better classes, I think that a fair trial of splints should be made in healthy-looking children under four or five years of age. If they fail, an osteotomy should be done.

In cases of genu valgum adolescentium the same rules apply in regard to their management as in the deformity occurring in children. It can be corrected by apparatus before the bone has become consolidated. After that by an osteotomy. The deformity is of rapid formation, and the bone soon becomes hard, so that mechanical treatment, to be efficacious, must be begun early.

The result on the bone at the point of division is to cause a condensation of the osseous structure on either side of the osteotome, and thus form a wedge-shaped cut into that tissue. Dr. A. T. Cabot<sup>1</sup> has recorded the post-mortem appearance of the bone at the point of section after a Macewen operation (Plate V), the patient dying, six weeks after section, of typhoid fever. He says: "In this figure the inner side of the bone

<sup>1</sup> "Boston Med. and Surg. Jour.," February 16, 1883, p. 154.

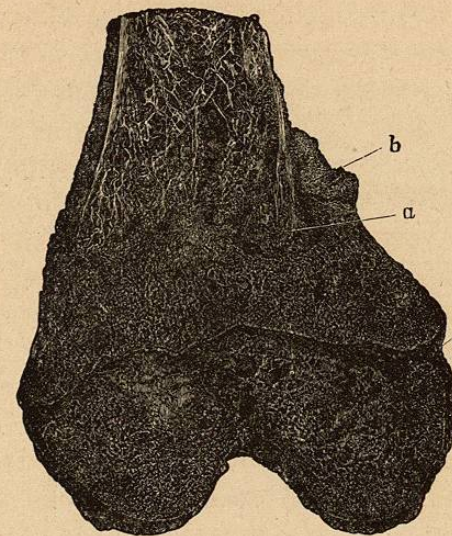


upon which the chisel was entered is to the right. At *c* we have the line of the epiphysis; three fourths of an inch above this is the line of division. On the outer side of the bone the line of the shaft is pretty well preserved. On the inner side a considerable displacement has occurred. The compact wall of the shaft has been driven down into the cancellated tissue at the point *a*. The tissue in the middle of the shaft, on the other hand, was less resistant than the more densely cancellated tissue below, so that the center of the lower fragment is impacted into the upper. A very firm locking is the consequence, and this, no doubt, greatly facilitated rapid recovery. That there has been but slight reaction in the parts above is shown by the absence of callus. The only true callus formation is seen at *b*, where a little new bone has been thrown out over the free end of the lower fragment; besides this there is only a very thin layer of new bone under the periosteum on the outer side."<sup>1</sup>

*Results.*—As to the limb. The object of a supra-condyloid (Macewen's) operation is to make a wedge-shaped incision into the lower end of the femur, just above the epiphysis, extending from within outward, the apex of the wedge penetrating the compact osseous structure on the outer aspect of the bone. By the use of the largest osteotome at the beginning, and only replacing it with the next smaller when it is absolutely necessary, on account of the instrument becoming wedged, the cut in the bone is made wider, not by any loss of substance, but by condensation of the bone on either side the instrument. In cases of

<sup>1</sup> "Boston Med. and Surg. Jour.," 1882, vol. cvi, p. 155.

PLATE V.



Dr. A. T. Cabot's case—the parts after a supra-condyloid operation.



knock-knee where the deformity is not very great, in bending the leg inward the two opposite surfaces of this V-shaped cut come into apposition, and just correct the malposition of the leg. No re-entering angle is left on the outer aspect of the femur. If, however, the deformity is great, there will exist a re-entering angle opposite the point of section on the external aspect of the bone. This, as has been proved by post-mortem examination, will fill up with new bone, the same as after a simple fracture. The effect on the bone, as a whole, is to compensate for the curve with its convexity inward, by a sharp bend having its angle at the lower end of the bone. In

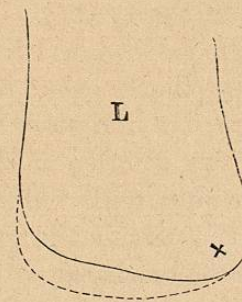


FIG. 26.

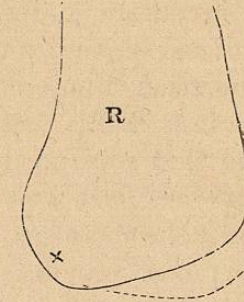


FIG. 27.

those cases where the deformity is due to a change in the shape of the condyle, where it is depressed either by growth or by the abnormal deposit of bone just above it, the result of the operation is practically to remove a wedge-shaped piece of bone, and thus raise the plane of the condyle. That there is an actual change in the plane of the two condyles after a supra-condyloid operation is demonstrated in Figs. 26 and 27. They are reduced from tracings of the



lower end of the femur before and after the operation. The cut marked R is from the right, that marked L from the left limb; the star indicates the internal condyle, the heavy line the contour of the parts before, the dotted line after the section. It will be noticed that the two condyles after the operation are upon the same plane. The distance between the two lines is the amount of correction gained by the operation. It is true that the correction in some cases is not at the real point of deformity, yet practically it is perfect as far as the position of the tibia is concerned, and this is the real deformity.

*Suppuration.*—In a carefully performed osteotomy, suppuration of any amount is rarely met. In my own experience, after a supra-condyloid operation, suppuration has occurred in four limbs only. In three it evidently had its starting-point in a piece of tissue that protruded from between the lips of the wound, and was irritated by the dressing. On removing the compress from over the wound, the pus flowed out, proving that the pad, hardened with blood, prevented its escape. The application of a large compress in the course of the abscess was soon followed by a cure. The other abscess I can assign no cause for. It was small, and gave no trouble. In two of these cases the thermometer gave no indication of the presence of matter, the temperature being normal the whole time.

#### STATISTICS.

Of six hundred and twenty-two cases of Macewen's operations (section above the condyles), as

far as can be ascertained, there have been but three fatal cases reported that could in any way be attributed to the operation. One was a case reported by Dunlap, where death was due to septicæmia secondary to a cellulitis of the thigh due to improper dressing; one, by Bull, was probably the result of carbolic-acid poisoning. Langton<sup>1</sup> reports a case in which he performed a Macewen's operation on the right femur of a patient nineteen years of age. Not much bleeding occurred at the time of the operation, but in the evening the dressings (Lister) were filled with blood; they were removed for the same cause daily during the next four days, and then a drainage-tube inserted. Ten days later the patient lost six ounces of blood; as the hæmorrhage continued, the wound was enlarged. The end of the lower fragment was found posteriorly, and from it projected a sharp spicula of bone. The ends of the fragments were excised and the popliteal artery exposed. It was then found that there was a small hole on its anterior aspect of the size of the splinter of bone. The artery was ligated above and below the point of puncture. The next day the leg became gangrenous, and an amputation was performed two inches above the end of the upper fragment. The patient died the same evening. McGill<sup>2</sup> reports a case in which, during a supra-condyloid operation, the popliteal artery was completely divided transversely, the vessel was exposed, and both ends ligated with anti-septic catgut. The patient made a good recovery, the deformity being relieved.

<sup>1</sup> "Lancet," March 29, 1884, p. 564.

<sup>2</sup> "Lancet," May 17, 1884, p. 891.



In two cases the anastomotica magna has been divided during a Macewen's operation—once by Gerster<sup>1</sup> and once by Marsh.<sup>2</sup> In both of these cases the point of the incision in the skin was determined by Macewen's rule, and the limb was operated upon with the leg in an extended position.

There have been other deaths reported, viz.: from diphtheria, meningitis, pneumonia, and uræmia; but they should not be attributed to the operation. It is claimed by Macewen, and I think justly, that Dunlap's operation was not a strictly supra-condyloid section according to his method. It was performed with a chisel, and not an osteotome, "and the line of the section was zigzag."<sup>3</sup> But as the fatal issue was not due to anything about the wound, but to an error in dressing, even this case should not be charged to the operation. Bull's case of carbolic-acid poisoning is excluded on the same ground. There has, therefore, been but one death recorded from the operation.

In thirty cases the section was made from the outside. In twenty-seven of these the bone was divided with a saw; in the other cases an osteotome was used. In eleven cases section was made with a saw in Macewen's line. In none of these did suppuration occur. There have been ten cases recorded in which suppuration has occurred after a supra-condyloid operation, and in none of these did the pus communicate with the bone. There have no doubt been many other cases in which it has occurred, but no record has been made of the fact.

<sup>1</sup> "N. Y. Med. Jour.," February 23, 1884, p. 227.

<sup>2</sup> "Brit. Med. Jour.," April 5, 1884, p. 665.    <sup>3</sup> Private note.

In one case (Taylor<sup>1</sup>) there was some effusion into the joint a day or two after the operation. Weir also reported a case where this took place some weeks after the operation, when the patient began to use this limb. In the latter case it is probable that the effusion was due to over-exercise. In two cases considerable stiffness persisted for some time (Wright,<sup>2</sup> Rabagliati<sup>3</sup>). In one case the deformity returned, and Ogston's operation was performed with a good result. In this case the section was made from the outside; the patient may possibly have been permitted to go about before the new bony deposit had become well consolidated, and the deformity thus reproduced. In one case the joint was fractured into during the section (Rabagliati<sup>4</sup>). The patient recovered, but with restricted motion in the joint. This is the only case in which this accident has ever been reported. It may have been due to the use of an osteotome of too great thickness, and driving it after it had become tightly wedged.

*Ogston's Operation.*—Out of one hundred and ten cases, only two are reported to have died—one from septic pneumonia (Baker), and one from uræmia (Thiersch), six weeks after the section. The latter can not be attributed to the operation.

Suppuration is reported by Jones, Schonborn, Sonnenburg, and Margary. In three cases it was considerable. In one it involved the joint, necessitating many incisions and drainage. In one case a troublesome synovitis persisted for some time (Callen-

<sup>1</sup> "Brit. Med. Jour.," April 7, 1877, p. 429.

<sup>2</sup> *Loc. cit.*                      <sup>3</sup> *Loc. cit.*

<sup>4</sup> "Brit. Med. Jour.," November 24, 1883, p. 1006.



der). In almost all cases there was more or less effusion for a few days. Three patients recovered with complete ankylosis, and one of them with the limb flexed at a right angle, while in four there existed for many months marked stiffness of the knee joint. Acute pain in the knee joint, lasting several days, seemed to have been not an infrequent occurrence.

In one case the saw broke, and was left in the bone. No complication followed.

*Reeves's Linear Section with Chisel in Ogston's Line.*—In thirty-seven cases, of which record can be found, the ultimate result has been good in all except one (Haward), where the chisel broke in the condyle, and was extracted. Swelling of the knee and thigh followed, with free suppuration, and after recovery the limb was straight while the patient was lying down, but, when any weight was brought to bear upon it, it bent inward. Besides the above case, suppuration has been reported in three others (Holmes, Sterling, and Briddon). Baker<sup>1</sup> states that he has collected fifty-seven cases of Reeves's operations. In one case there was effusion into the knee joint.

*Barwell's Linear Section of Femur and Tibia.*—In twenty cases, recovery is reported as having taken place in all. Suppuration from the femoral wound occurred in one case, a slight synovitis in one, and the external lateral ligament was ruptured once<sup>2</sup> during the operation. In most of these cases the tibial section was made from three weeks to three

<sup>1</sup> "Brit. Med. Jour.," 1879, vol. ii, p. 3.

<sup>2</sup> Margary, Campenon, *loc. cit.*

months after the femoral; in a few, however, both sections were performed on the same day.

*Linear Osteotomy of the Tibia* (Billroth).—Of thirty-one limbs on which this operation was performed, in thirty firm union was established. In one case a slight synovitis is reported, lasting six weeks. In one case there was high temperature and great pain, followed by gangrene of the foot, necessitating an amputation at the lower third of the leg (Margary).

*Cuneiform Osteotomy of the Tibia* (Mayer and Schede).—In twenty-two limbs submitted to this operation, recovery took place in all; in one case osteomyelitis and suppuration followed the operation.

*Cuneiform Osteotomy at lower end of Femur* (Chiene and Macewen).—In fourteen cases, there was one death from suppuration and erysipelas. At the time of death the bones were united. A good recovery is reported in the remaining cases.

In osteotomies for the relief of genu valgum there have been only three deaths that were due to the operation. Suppuration is reported to have occurred in nineteen limbs. In five cases the joint was stiff to a greater or less degree, in four firm ankylosis took place, and in two amputation had to be performed on account of gangrene of the foot. In nine limbs the result was only an improvement.

#### ILLUSTRATIVE CASES.

CASE I.—Anna A., four and a half years of age, was admitted into St. Mary's Hospital in February,