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THE TREATMENT OF TRAUMATIC GENU RECURVATUM BY CORRECTIVE, SUBARTICULAR OSTEOTOMY ON THE TIBIA AND BY BONE TRANSPLANTATION

By

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Every fracture which forces the articular surfaces of the knee joint out of their normal articulation holds great risk of severe sequelae arising in joint function which may take the form of defective stability and consequent difficulty in walking developing into complete invalidity. In particular a fracture of the tibial condyles or an epiphysis displacement here easily brings about a depression of the upper articular facet of the tibia in younger people. Depending upon the site of the depression in relation to the articular surfaces, either side displacement occurs or possibly hyperextension combined with side displacement. The latter is denoted as Genu Recurvatum traumaticum. This sequel is found rather seldom and is difficult to treat. The anatomic change which is the cause of hyperextension means that the upper articular surface which normally lies on a horizontal plane slants obliquely so that it inclines forward. The principle of the treatment must therefore be to return the articular surface to its normal position again. The operation however is neither well known nor much used, and our patient had been fitted with orthopedic splints and sent to the Institute for the Disabled, to be trained in another occupation.

CASE HISTORY

Record No. 420/55.

The patient is an agricultural student, aged 19, who apart from the affection under discussion has always enjoyed good health. The patient was admitted for the first time into the Surgical Department of Roskilde County and City Hospital in 1950 following left-sided trauma of the knee. There was displacement of the epiphysis in the upper left end of the tibia. After reduction the extremity was bandaged in plaster

for 7 weeks. The roentgen check showed the fracture position to be ideal. After this accident the left knee became hyperextended to an increasing degree. In 1953 the patient was again admitted to the department following a fresh trauma to the left knee. This time rupture of the collateral tibial ligament was diagnosed. The knee could then be hyperextended about 25°. Plaster bandage was applied for 7

Fig. 1.
The patient before the operation.

weeks. The side displacement and hyperextension still persisted after this. Then the patient suffered increasing trouble from his loose left knee joint and in October, 1953, he was admitted to the Orthopedic Hospital for treatment. Here plaster bandage was applied first for 2 months without effect. In January, 1954, a leather splint was designed as a support for the left knee. The patient attempted in vain to use this splint, and in the summer of 1954 he could only walk between half an hour and an hour since he was compelled to remove the splint owing to the irritation of his skin. In October, 1954, the patient was again admitted to the department with a view to a possible arthrodesis. On admittance, while the left knee joint overstretched about 25° combined with pronounced side displacement, (Fig. 1) nothing otherwise abnormal was found.

There were no deceptive symptoms and no accumulation in the joint. 9 cm atrophy of the thigh and 1 cm atrophy of the lower leg were measured. The other joints of the extremity were natural and there was no sign of trophic disturbances. The roentgen examination of both knees showed normal conditions on the right side. On the left side on the lateral projection the tibia's upper articular surface inclined plainly

forward, so that the axis of the tibia and the articular surface formed an angle of about 20° (Fig. 2).

This fact explained both the side displacement and the hyperextension. If a well-outlined diagram of the knee joint is studied (Fig. 3), it will be seen that under normal conditions the collateral ligaments will stretch when the tibia advances over the forward part

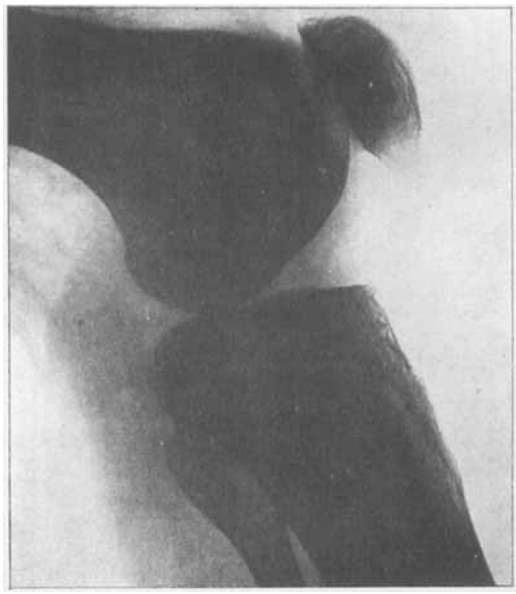

Fig. 2.
Lateral projection of the left knee joint before the operation.

of the femoral condyles, owing to the fact that the distance between the attachment of the collateral ligaments to the crus and to the femoral condyles increases in front. This stretching of the collateral ligaments does not occur when during extension the femoral condyles slip down from the abnormally oblique articular surface of the tibia. It should therefore be possible to prevent both the side displacement and the hyperextension by bringing the upper articular surface of the tibia up into a normal position again. If one studies the diagrammatic plan of the knee joint, this should not present any great difficulty. It is clear from the sketch that the whole upper end of tibia corresponding to the stippled line can be moved without disturbing the ligaments of the knee. The lateral collateral ligament is quite free of the tibia. The inferior ligament of the patella is plainly attached below the line and, medially, the collateral ligament is only firmly attached upward to the extreme rear part of the tibial condyle. Thus the upper part of the tibia

with the articular surface can be removed and with the knee flexed it should be possible to raise the articular surface to the extent required.

The operative method was first tried using a special preparation[1] since at that time it was not known whether similar operations had been undertaken previously. It was demonstrated that the operation was practicable without great difficulty and in October, 1954,

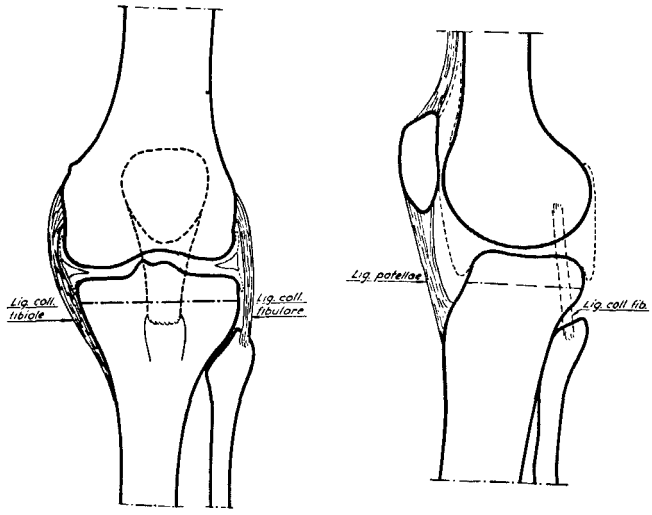

Fig. 3.
The site of the osteotomy in relation to the knee joint capsule and the ligaments.

the operation was performed in $N_2O + O_2 +$ Ether. In a bloodless field and with the knee flexed to 90° a curved incision was made extending from the lower and posterior margin of the one femoral epicondyle passing down in front under the uppermost part of the tuberosity of the tibia and further across to the other femoral epicondyle. Then the accessory extension apparatus was opened transversely about 1 cm below the line of the knee joint. The upper end of the tibia was isolated from the collateral ligaments and with a circular saw we cut into both sides of the inferior patellar ligament and underneath the folds of the knee joint capsule. We tried to keep the two incisions on the same horizontal plane. Success was checked by applying a scalpel to each incision. Then the two incisions were joined by a milling-cutter and finally the side margins were cut through while carefully protecting the collateral ligaments. With thin sharp chisels the last section was attacked to the rear until contact was made with the rearmost com-

[1] The preparation was kindly put at our disposal by the University Medicinal Anatomical Institute.

pact lamella which was preserved intact. By applying the chisels to both sides of the patellar ligament it was easy to tilt upward the upper end of the tibia. Now a 7 cm long by about 3 cm wide bone graft was taken from the tibia of the healthy leg. The graft was divided diagonally so that two wedges were obtained which were about 3 cm high at the rear. The wedges were applied so that they corresponded with the

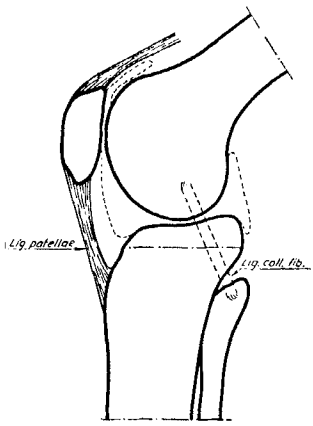

Fig. 4.
Diagram of the left knee joint before wedging.

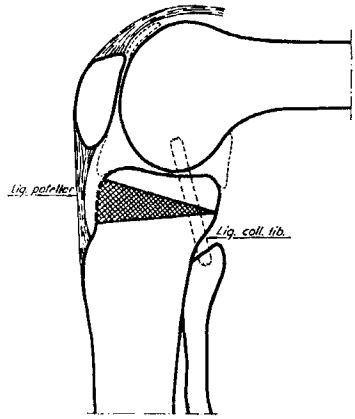

Fig. 5.
Diagram of the left knee joint after wedging.

middle of each of the two articular surfaces of the upper end of the tibia, and thus we endeavoured to obtain equal loading of both wedges. After this bone chips were taken from the iliac crest and packed to fill the space between the wedges and that between the wedges and the collateral ligaments (Fig. 5). The accessory extension apparatus was connected with catgut, nylon in the skin. Plaster bandage was applied to the knee in 90° flexion and the postoperative course was not complicated. After 1 month the knee was corrected to 130°, after a further month to 150° and after the third month bandaging ceased. The roentgen check showed regular progressive healing (Fig. 6). Movement and walking exercises were then commenced and after 3 weeks training the left knee moved 180/60 without side displacement and there was no accumulation in the joint. Walking developed naturally apart from an insignificant limping. On a renewed check 6 months after discharge the gait was completely natural and the patient has again taken up his work in agriculture.

After the operative treatment had ended it was found on studying the literature that a similar operative method had been adopted by *Brett* (1935), while in De Palmas' Monograph "Diseases of the Knee"

(1954) this intervention is denoted as *Brett*'s method. This order of priority is not correct, however, since *Brett* himself writes in his work: "The technique used was similar to that suggested by *Lexer* in 1931, but the writer was unacquainted with *Lexer*'s work at the time of using this operative measure", exactly the same circumstances as prevailed on the appearance of the present article. *Lexer* (1931) however

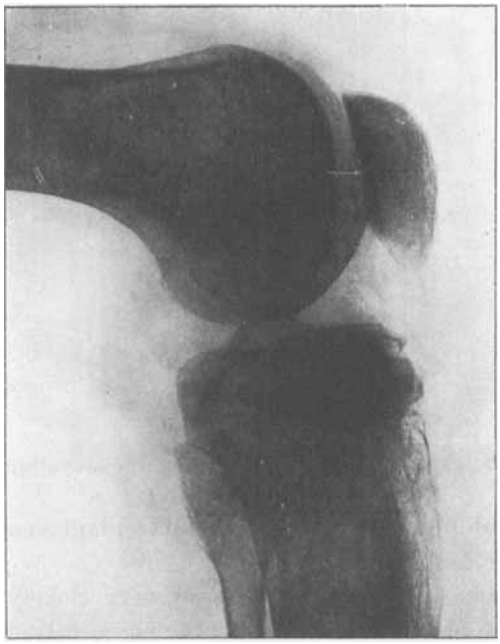

Fig. 6.
X-ray after about 4 months postoperatively.

advises that the tuberosity of the tibia should be first chiselled away before the osteotomy is undertaken and afterwards that the tuberosity should be made fast again. He does not stress the importance of performing the osteotomy above the attachments of the collateral ligaments. *Lohe* (1931) publishes two cases of genu recuratum in a 16 year old and in a man aged 39. Both recovered normal knee function with the aid of an osteotomy according to *Lexer*'s method. *Lohe* also reports that the method may be also used when side displacement is found and this means that he must have undertaken the osteotomy above the attachment of the collateral ligaments. *Campbell* (1932) performs the osteotomy below the tuberosity of the tibia and constructs such a large wedge that the upper end of the tibia lies horizontal. In order to secure the position he employs a wedge from the tibia while

the remainder of the defect is packed with bone chips. This method is hardly to be recommended since the side displacement is not corrected by this operation. *Irwin* (1942) also undertakes the osteotomy below the tuberosity. This author cuts out a wedge posteriorly in that he simultaneously prepares a notch in front in the foremost upper compact lamella and retains a corresponding projection below. This pre-

Fig. 7.
The patient about 4 months after the operation.

vents slipping out in the rear although side displacement is not corrected by this method either.

Brett (1935) whose method approaches very closely that published here performs the osteotomy in almost the same way, but yet employs the longitudinal incision through the accessory extension apparatus of the knee joint on each side of the patellar ligament. Furthermore *Brett* strengthens his position with chips and does not use wedges. Finally he applies plaster bandage to the knee joint in extension and for only 6 weeks. The line of the incision ni the accessory extension apparatus may be described as of lesser importance while the use of massive bone wedges in combination with plaster bandaging of the knee in 90° flexion must give considerably greater assurance of preserving the position obtained.

The method published here deviates only in detail from that of *Lexer* and of *Brett*. Both for these authors and in the present case the operation has produced such good results that its undertaking can only be encouraged.

It will be certainly possible also to achieve a correspondingly good result with poorly healed tibial condyle fractures, where only the one condyle is depressed, since it is also technically practicable to make the

approach by the sides of the collateral ligaments and in other respects undertake the wedging in the same way as described in this article.

SUMMARY

About 4 years after epiphysis shifting in the upper end of the tibia a 19 years old male developed a pronounced traumatic genu recurvatum. The condition which was completely invalidising was treated by a subarticular corrective osteotomy on the tibia combined with bone transplantation. The recovery was so complete that the patient has returned to general farm work.

RESUME

Il s'est produit chez un jeune homme de 19 ans, environ 4 ans après un décollement de l'épiphyse de l'extrémité supérieure du tibia un genu recurvatum traumatique prononcé.

L'état qui était complètement invalidant a été traité par ostéotomie corrective subarticulaire du tibia avec transplantation osseuse.

La guérison a été complète et le malade a pu reprendre ses occupations normales dans l'agriculture.

ZUSAMMENFASSUNG

Ein 19-jähriger Mann entwickelt ungefähr 4 Jahre nach einer Epiphysenlösung am oberen Tibiaende ein ausgesprochenes, traumatisches genu recurvatum. Der Zustand, der zu vollständiger Invalidisierung führte, wurde mittels korrigierender Osteotomie der Tibia und Knochentransplantation behandelt. Vollständige Heilung, derart dass der Patient gewöhnliche Landarbeit wiederaufnehmen konnte, wurde erzielt.

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