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FOLLOW-UP EXAMINATION OF A SERIES OF ARTHRODESIS OF THE KNEE-JOINT

By

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When the working ability of a patient has substantially deteriorated owing to instability, deformity or pain in the knee-joint, the possibilities of operation are few at the moment. In far-advanced cases arthrodesis of the knee-joint is often the only means of restoring the patient's ability to work.

Arthrodesis of the knee-joint still has its problems. As the knee-joint is situated between two long lever arms, complete immobilisation during the consolidation period has proved difficult to achieve (*Morris et al.* 1951, *Steward et al.* 1958). This is the main reason why many methods of arthrodesis have not fulfilled the hopes placed in them and have been gradually abandoned (*Brittain* 1952). In 1948 Charnley drew attention to the advantages of the compression method (*Charnley* 1948). The method bearing his name was described by Key in 1932 and has gained an ever stronger position among operative methods for arthrodesis of the knee-joint (*Key* 1932, *Charnley* 1948, 1958, *Morris et al.* 1951 and *Steward et al.* 1958).

MATERIAL

At the Orthopaedic Hospital, Invalid Foundation, Helsinki during the period 1946–1965 arthrodesis of the knee was performed on 106 patients, of whom 59 were men and 47 women. Age groups are shown in Table 1.

In no case was arthrodesis performed bilaterally. The youngest patient was 15 and the oldest 76. The longest observation period was 20 years and the shortest 1 year. 100 patients came to the follow-up examination, and follow-up information is lacking in respect of 6 patients only.

Table 2 shows the grouping of the material according to the indication for operation.

Table 1.

Age	Men	Women
Below 20	6	7
20-29	16	8
30-39	15	5
40-49	11	15
50-59	8	4
60-69	3	6
Over 70	—	2
Total	59	47

Table 2.

Indication	Men	Women
Tuberculosis	29	18
Polio	8	8
Arthrosis	3	12
Fract.	13	3
Rheuma	—	2
Other indication	6	4
Total	59	47

The largest group was tuberculosis, though the proportion of this disease has steadily decreased in recent years. Among the aftereffects of polio arthrodesis was indicated by an unstable joint which hindered walking.

Pain after fracture was the result of secondary osteoarthritis. Seven such cases were the result of war wounds, five of accidents at work and one of a traffic accident. The "other indication" group includes the after-effects of ostitis and of injury to soft tissues of the knee region, where deformity or instability were indications for arthrodesis. There was one case of tabes dorsalis and one of other type of neurotrophic arthropathy.

METHODS

Four methods were mainly used in performing arthrodesis of the knee-joint. Many different surgeons were concerned, so that no far-reaching conclusions can be drawn as to the superiority of one method over another.

By the Charnley method articular cartilage was removed in the normal way and opposing resected surfaces were pressed together with the Charnley compression device in fifty three cases. The limb was immobilised in a long plaster boot for six weeks, after which the compression device was removed and the boot exchanged for

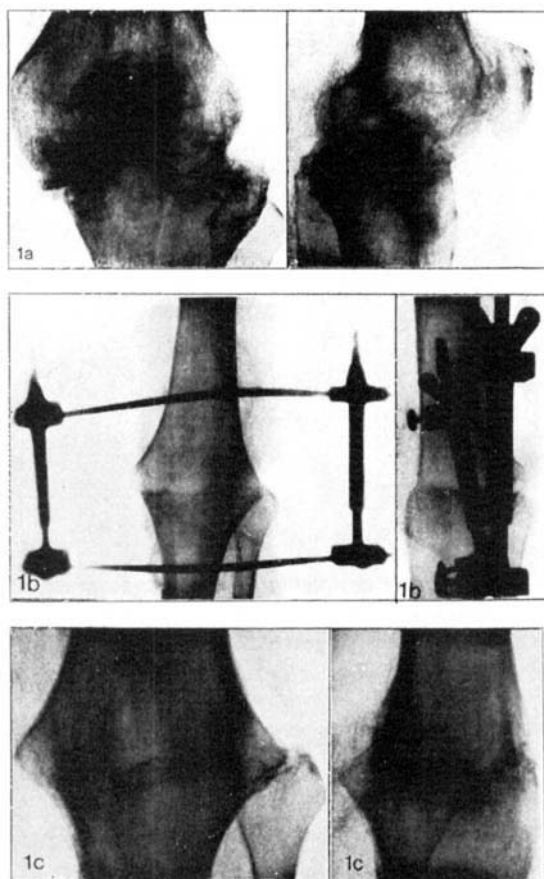


Figure 1. 47 year old housewife, dgn. arthritis tuberculosa genus sin. Patient's knee at angle of 150° after tuberculosis of knee. Patient can only walk with crutches. Mobility of knee 160–150°. Patient also suffers from pulmonary tuberculosis. A: Condition before operation. Anti-tuberculous treatment started. B: Immediately after Charnley arthrodesis. C: Knee 6 months after Charnley arthrodesis. Patient satisfied with result, and walks without pain. Patient again at work. Anti-tuberculous medical treatment continued for 2 years after operation.

a plaster cylinder for 1–2 months. In 20 cases the patella was embedded over the arthrodesis area (Figure 1).

For screw fixation two spongiosa screws were used. These were screwed to the opposite condyle of tibia or femur in seventeen cases. The limb was immobilised either in hip spica or a plaster boot, at a later stage of consolidation always the latter. Length of immobilisation was determined by the progress of consolidation, which was checked at one-month intervals both radiologically and clinically. It appeared, especially in cases where the screws did not reach to the cortex in the

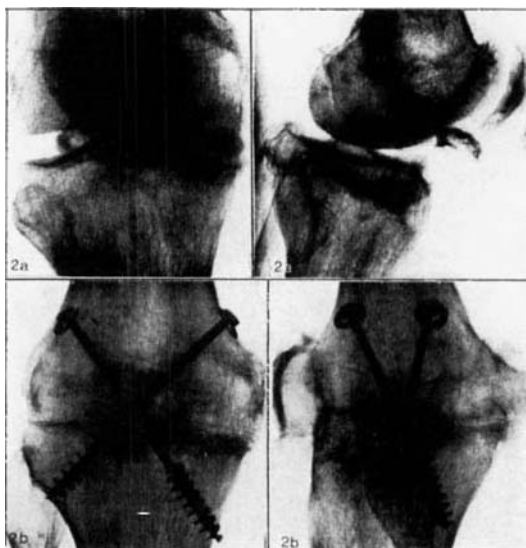


Figure 2. 63 year old slaughterman, in motor collision 1948. Right knee thereafter painful and gradually growing worse. Loose bodies removed from knee 1957, causing some improvement, but patient still unable to work. A: Knee before operation. B: Arthrodesis genus dx. 1958. Fixation with two spongiosa screws. Patella embedded in forepart. Condition shown here is 7 weeks after operation, when arthrodesis was considered consolidated. Patient able to move almost painlessly with stiffened knee.

opposite condyle, that consolidation was prolonged and tended to lead to fibrous union. In connection with this method the patella was embedded over the arthrodesis in seven cases (Figure 2).

Nine patients were operated by passing a metal wire coil through femur and tibia and drawing the ends of the bones together with a third coil between. In four of these cases the patella was also embedded over the arthrodesis. The limb was immobilised in hip spica, which was later exchanged for a plaster boot (Figure 3).

In 27 cases arthrodesis was performed without internal metal fixation. Hip spica was used immediately after operation in all these cases. This was exchanged later for a plaster boot (Figure 4). In 17 cases of these the patella was embedded in an indentation made in the tuberositas tibiae. In some cases the patella was screwed to tibia or femur (Figure 5).

RESULTS

Owing to diversity of material and multiplicity of operative methods there was some variation in the recovery of patients after operation. Complications which occurred are shown in Table 3.

Wound edge necrosis recovered without special treatment in every case and caused no prolongation of the treatment given. When ar-

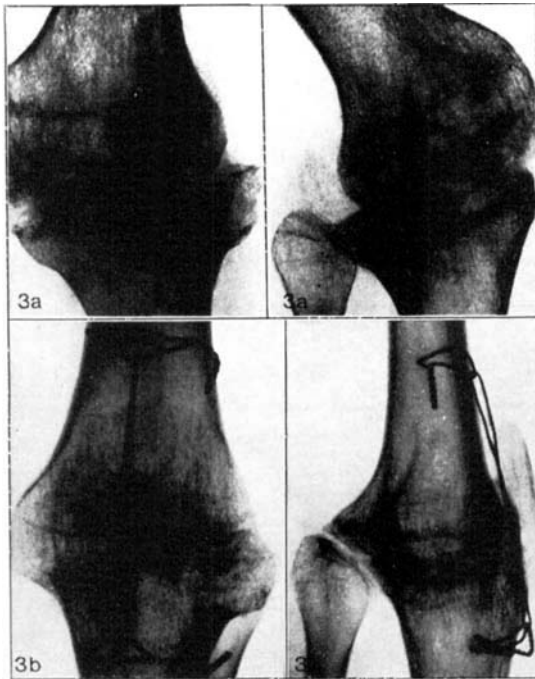


Figure 3. 22 year old dressmaker, dgn. Tuberculosis genus sin. Patient had tuberculosis of left knee at age of 3. Knee brace worn continuously. Pain strain 25° valgus and 30° extension deficiency. Flexion possible at 120°, movements painful. A: Condition before operation. B: Result 7 months after operation.

Result considered good.

throdesis was performed without internal fixation amputation from the thigh was necessary for two patients because of infection in the arthrodesis area; it was also necessary for one patient operated on by the Charnley method. The latter cases was a tuberculous knee with extensive caseous areas of infection. In the group "other complication" there were two cases of temporary peroneal paresis evidently caused by stretching or other reason. Both recovered uneventfully later. Post-operative arterial thrombosis occurred in two patients, which led to amputation of the leg in one and amputation of the toe in the other. Arthrodesis led to consolidation in both cases. The after-effects of polio were present in both, as a result of which blood circulation in the lower limbs had been poorer than normal before operation.

Table 4 shows the extent to which the different methods have been used, and the primary consolidation times achieved.

Table 3.

Method	Edge necrosis	Infection	Amputation	Other complication
Charnley	6	—	1	1
Screw fixation	1	1	—	1
Wire fixation	1	—	—	1
Without fixation	4	—	2	2
Total	12	1	3	5

Table 4.

Method	No.	Consolidated			Not consolidated	No information
		under 3 mths	3-6 mths	over 6 mths		
Charnley	53	35	11	3	3	1
Screw fixation	17	5	5	5	2	—
Wire fixation	9	2	4	1	—	2
Without fixation	27	4	3	10	7	3
Total	106	46	23	19	12	6

In the majority of those treated by the Charnley method consolidation occurred in less than three months of immobilisation, and in only three patients did arthrodesis not lead to consolidation. In two of these it was observed that contact between the bone surfaces at the point of arthrodesis had been achieved only over a very narrow area, and in the other consolidation was prevented by infection. In some of those treated by other methods ossification also occurred in less than 3 months, but the number of these was smaller in regard to the number of operated cases.

In the present material there were no cases of unwanted valgus or varus deformities. In general patients were able to move easily with an arthrodesed knee, and polio patients in particular walked noticeably better with a stabilised lower limb. Three patients complained of pain in the ankle during prolonged walking, and two of pain in the hip on the same side. Mobility of the hip was good in these cases. Six patients felt pain in the lower back. In at least one case this was considered due to disc degeneration and obesity. Three cases were polio patients, one of whom had a paralytic scoliosis.

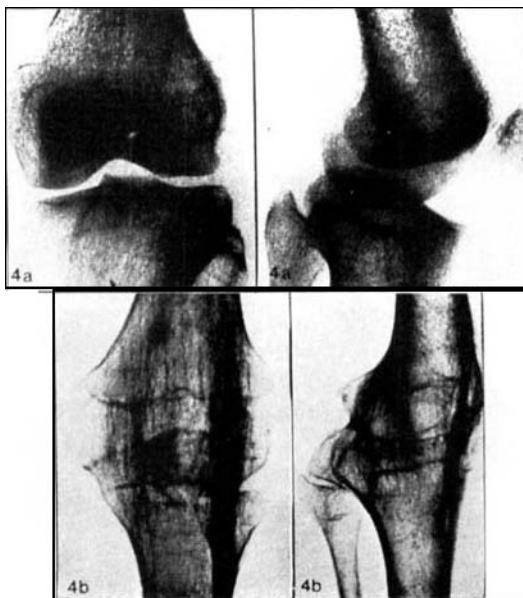


Fig. 4. 35 year old farmer, dgn. Seq. p. p. Paresis extr. inf. 1. sin. Contract. genus. Had poliomyelitis at age of 7. Knee in 135° flexion-contraction. A: Condition before operation. B: Arthrodesis performed without internal fixation, Patella embedded in resection area. Condition shown here is 20 years after operation. Patient does agricultural work and is satisfied with result.

As Table 3 shows, there was 12 cases in which consolidation was not achieved after the first operation. In 10 of these rearthrodesis was performed. In only one case did re-arthrodesis not lead to consolidation. The reason was infection in the operation area.

DISCUSSION

On the basis of the follow-up examination it was observed that arthrodesis of the knee joint was indicated when pain or instability caused by earlier paralysis hindered the patient's movements. In the present material bilateral arthrodesis was not performed on a single patient. There may also be reason to consider other treatment in cases where the hip on the same side has already been stiffened or where the patient in other respects is unprepared for arthrodesis of the knee. After arthrodesis patients as a rule were able to move freely, and no serious discomfort was felt by the majority: they were even capable of heavy physical work. The methods used led in most cases to consolida-

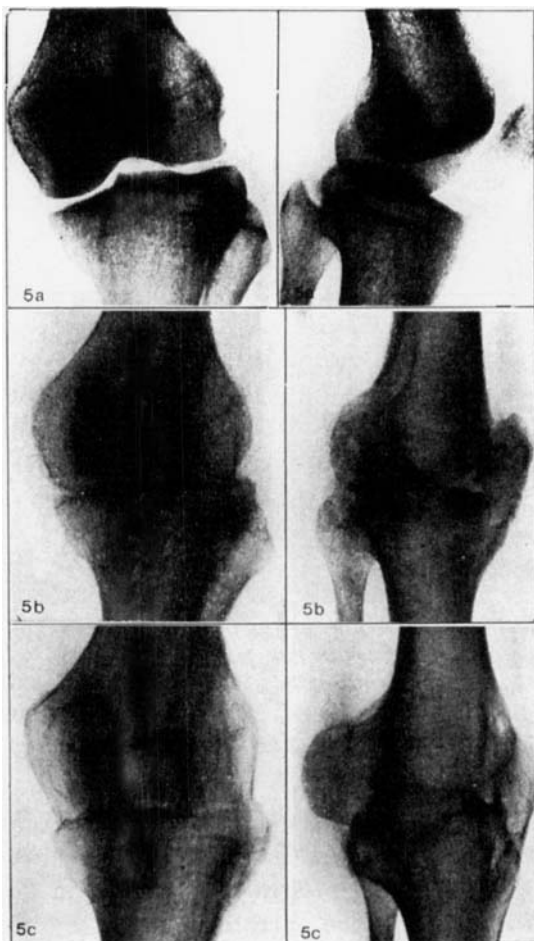


Figure 5. 28 year old female furrier's assistant, dgn. Seq. p. p. Paresis extr. inf. 1. sin. Patient had poliomyelitis at age of 13, left lower limb paralysed. Left knee unstable, tendency to dislocation. Pain. A: Condition before operation. B: Arthrodesis performed without internal fixation but with patella embedded over resection point. Condition shown here is 4 months after operation, when arthrodesis was considered consolidated. C: Condition 18 years after operation. Patient entirely without discomfort. Patient does light work for a living.

tion, though the best results were clearly achieved by the Charnley method, which usually produced consolidation in less than 3 months. A more exact definition of the consolidation period was not considered suitable in the present study because patients often came for post-operative examination at intervals of 2-4 weeks. It is evident than in

some cases consolidation occurred in a noticeably shorter time than 3 months. The majority of complications and pseudarthroses appeared in cases without internal fixation. On the whole patients were satisfied with the results of operation, and the only cases considered as failure were those in which infection made amputation necessary. Their number, however, was very small in relation to the total number of arthrodeses performed.

SUMMARY

The authors examined 106 patients on which arthrodesis of the knee had been carried out. One hundred patients arrived for follow-up examination. Fifty-nine were men and 47 women. The youngest patient was aged 15 and the oldest 76. The series includes 47 tuberculous knees, 31 with osteoarthritis from fracture or other cause, 16 with sequels of poliomyelitis. Four methods of operation were used, as follows: Charnley's method—53, crosswise spongiosa screws—17, three wire coil compression—9 patients. In 27 cases there was no internal metal fixation. The fastest consolidation was obtained by Charnley's method, 36 cases ossifying in under 3 months and 46 in under 6 months. Results achieved by the various operative methods have been analysed, and the aim of the follow-up examination has been to elucidate the extent to which a stiffened knee has hindered a patient's working capacity.

RESUME

Les auteurs ont examiné les cas de 106 malades chez lesquels avait été pratiquée une arthrodèse du genou et dont une centaine se présentèrent à l'examen complémentaire. La série d'observations comprenait 59 hommes et 47 femmes. Le plus jeune malade était âgé de 15 ans, le plus vieux de 76 ans. Dans cette série de cas, il y avait 47 genoux tuberculeux, 31 avec ostéoarthrite provenant d'une fracture ou d'une autre cause, 16 ayant des séquelles de poliomyélite. Quatre méthodes opératoires avaient été utilisées: méthode de Charnley 53, fixation spongieuse transversale par vis 17, compression par enroulement de trois fils 9. Dans 27 cas, il n'y avait pas de fixation métallique interne. La plus forte consolidation avait été obtenue par la méthode de Charnley, 36 cas s'étant ossifiés en moins de trois mois et 46 en moins de six mois.

Les résultats obtenus par ces différentes méthodes opératoires ont

été analysés et le but de l'examen complémentaire a été d'élucider dans quelle extension un genou raide a entravé la capacité de travail du malade.

ZUSAMMENFASSUNG

Die Verfasser untersuchten 106 Patienten an denen eine Knicarthrodese ausgeführt worden war. Einhundert Patienten kamen zur Nachuntersuchung. 59 waren Männer und 47 Frauen. Der jüngste Patient war 15 Jahre und der älteste 76. Reihenfolge umfasst 47 tuberkulöse Kniee, 31 mit Osteoarthritis nach Bruch oder anderen Ursachen, 16 mit Folgezuständen nach Poliomyelitis. Die vier folgenden Operationsmethoden wurden verwendet: Charnleys Methode-53, gekreuzte Spongioschrauben-17, Dreidrahtschlingenkompression-9 Patienten. In 27 Fällen wurde keine innere Metallfixation gebraucht. Die rascheste Konsolidierung wurde mit der Methode von Charnley erzielt, indem 36 Fälle unter 3 Monaten und 46 unter 6 Monaten verknöcherten.

Die mittels der verschiedenen Operationsmethoden erhaltenen Ergebnisse wurden analysiert und der Zweck der Nachuntersuchung war herauszufinden bis zu welchem Grade ein steifes Knie die Arbeitsfähigkeit des Patienten behindert hat.

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