FROM THE ORTHOPÆDISK HOSPITAL, COPENHAGEN

EARLY STABILIZING OPERATION FOR SPASTIC TALIPES EQUINO-VALGUS BY GRICE'S EXTRA-ARTICULAR OSTEOPLASTIC SUBTALAR ARTHRODESIS

By

J. MORTENS, H. MØLLER and L. SALMONSEN

In a previous paper (1) a report was given from the Department for Cerebral Palsy at the Orthopaedic Hospital, Copenhagen, of the results of orthopaedic surgery on the children operated upon within the years 1950 to 1957. In this paper one of the operative procedures used—the Grice operation for stabilizing the severe spastic plano-valgus foot—is analysed in more detail, and results have been compared with the results obtained by the same operation used at department III over the same period for polio-paralytic feet and constitutional plano-valgus feet in children.

In children with cerebral palsy and a moderate- to severe spastic paraplegia, you frequently see the development of a severe talipes equino-valgus. In such cases there is persistent equinus in the ankle joint, and in the attempt on walking to remain plantigrade the foot has broken into abduction and eversion in the midtarsal joints with spurious correction of the equinus. This development may happen in spite of consistent conservative treatment, early bracing and early elongation of the tendo Achillis.

The roentgenogram shows the persistent equinus (Fig. 1), in the lateral view indicated by the steep inclination of the talus in relation to the calcaneus, and in the frontal view by an increased angle between the longitudinal axis of the talus and the calcaneus (the CT angle). The abduction—eversion deformity of the foot is also indicated by this enlarged angle in-so-far as the normal relationship between the os calcis and the anterior part of the foot has not materially altered in contrast to the subluxation of the head of talus in relation to the navicular bone. The steeply placed head of the talus is prominent on the

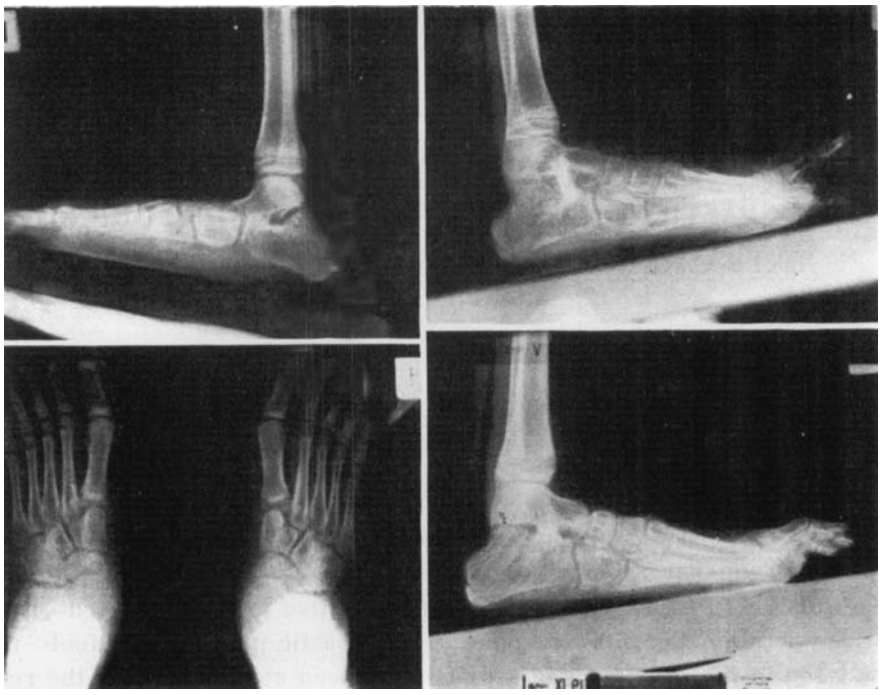

Fig. 1. *Fig. 2.*

Fig. 1. Roentgenograms of a girl with spastic paraplegia and a severe talipes equino-valgus.

Fig. 2. Roentgenograms of the case shown in Fig. 1, 4 months after the Grice operation.

medial side of the foot because of the abduction of the foot in Chopard's joint together with the eversion of the os calcis.

An extra-articular subtalar arthrodesis has been designed by Green and Grice in conjunction with or followed by tendon transplantations for paralytic equino-valgus feet in children before skeletal maturity is reached (2). For spastic talipes equino-valgus we have used this operation without tendon transplantations.

SURGICAL TECHNIQUE

The technique we have used generally follows the principles described by *Grice*. By a lateral incision the sinus tarsi is cleaned up to expose the bone surfaces. The calcaneus is brought into its normal relationship with the talus by adduction of the foot and inversion of the os calcis from its subluxated position. It is necessary to plantar-flex the foot in order to bring the os calcis down and underneath the steep

talus. This position is maintained by locking in place, during dorsi-flexion of the foot to neutral in the ankle joint, the two bone grafts—removed from the upper tibial metaphysis—placed in small grooves made in the two bones. A plaster of Paris bandage is then applied taking care to hold the corrected position of the heel. During setting of the plaster the adducted anterior part of the foot is pronated to restore the longitudinal arch of the foot. A slightly overcorrected position is aimed at, and is corrected to neutral during changing of the plaster for removal of sutures three weeks after operation. Three months after operation the plaster immobilisation is replaced by a molded leather brace to be put inside ordinary shoes and weight bearing is permitted. The leather brace is worn up to one year after operation. In successful cases ordinary shoes can then be used.

CLINICAL MATERIAL

Within the years 1955 to 1959 fourteen children with cerebral palsy—or in total 27 feet—had this extra-articular subtalar arthrodesis performed. The diagnosis (Table 1) was in most of the cases spastic di- or tetraplegia, one case was a hemiplegia with a soft and inbalanced foot, one of the cases had additional ataxia, one had a pure ataxia with a weak foot and postural deformity and two cases were mainly atetoids.

TABLE 1

Type of Cerebral Palsy in 14 children treated with the Grice operation.

	Number of patients	Feet
Spastic di- or tetraplegia	9	18
Spastic hemiplegia	1	1
Ataxia		
	1	2
Combined ataxia and spasticity	1	2
Athetosis		
	2	4
Total	14	27

All fourteen children have been re-examined with a period of observation from one to five years, with an average of two and a half years (Table 2).

TABLE 2

Length of observation period in 14 children with Cerebral Palsy treated by the Grice operation.

Years	1	1–2	2–3	3–4	4–5
Number of patients	3	3	2	5	1

The duration of preoperative conservative treatment will be seen from table 3. Most of the cases were seen by the team when they were between one and three years of age and treated at least one year before operation was undertaken, two of

them in eight years. Further, it will be seen from table 3 that in four cases operation was performed at the age of four, but most of them were operated on at the age of eight to nine. One case was operated at the age of eleven but her somatic development correlated nine years.

TABLE 3

Age at start of conservative treatment, duration of treatment and age at operation in 14 children with Cerebral Palsy treated by the Grice operation.

Years	1	2	3	4	5	6	7	8	9	10	11
Age at start of conservative treatment	7	3	1			1	1		1		
Duration of conservative treatment	1	2	4	1			4	2			
Age at operation				4		1		3	5		1

RESULTS

The asessment of results is based on a general clinical examination. The gait with and without shoes was examined and presence or absence of deformity of feet was noted. An x-ray examination of the feet following a standard technique was done. Further, pictures of motion taken at intervals before and after the operation have been evaluated by at least two members of the team. The relatives and the physiotherapist have been requested to give their asessment of the results of the operation in regard to walking ability: perseverance, walking on stairs and playing. Support used before and after the operation was noted, and on the roentgenograms the condition of the grafts and the position of the talus was examined with measurement of the CT angle.

The results of operation on these fourteen children with cerebral palsy were compared with the results after the same operation performed on eight children with paralytic plano-valgus feet after polio (nine feet) and on eight children with a constitutional plano-valgus foot and a steep talus (fourteen feet). These children were operated on within the same four years-period and the follow-up was performed on similar lines as for the cerebral palsied children (Table 4).

TABLE 4

Results after Grice's extra-articular subtalar arthrodesis in 14 children with Cerebral Palsy, 8 with polio-paralytic—and 8 with constitutional plano-valgus feet.

Number of patients/feet	Cerebral Palsy	Polio	Constitutional plano-valgus
Good	6/8	4/4	5/6
Improved	9/13	3/3	5/5
Unaltered	3/6	1/1	1/1
Overcorrection		1/1	1/2
Total.....	14/27	8/9	8/14

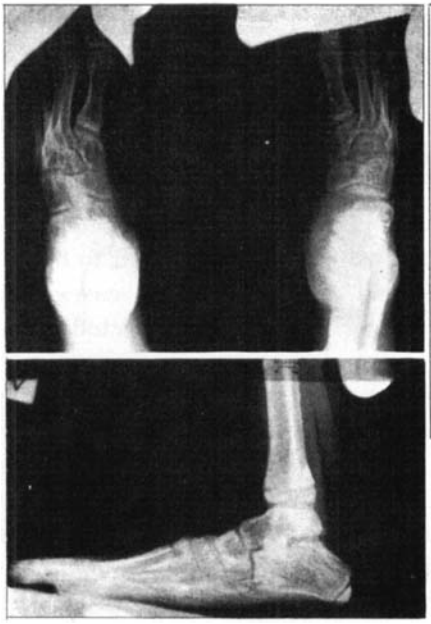

Fig. 3.

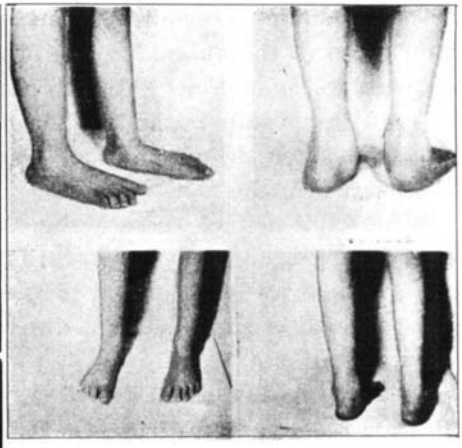

Fig. 4.

Fig. 3. Roentgenograms of the same case as in Fig. 1 and 2, one and a half years after the Grice operation.

Fig. 4. Pre- and postoperative pictures of the case of spastic talipes equino-valgus whose roentgenograms are demonstrated in Figures 1 to 3.

In Figures 1 to 4 pre- and postoperative conditions on the roentgenograms and on clinical examinations can be seen in a girl with a spastic talipes equino-valgus who obtained a good result by the operation.

DISCUSSION

These children with spastic di- or tetraplegia have more or less severe contractures in their hips and knee joints: in the hips flexion, inward rotation and adduction deformities and in the knees flexion deformities. After a successful subtalar arthrodesis you have to expect a gait with the feet inward rotated, and such a gait was also seen more or less marked in all cases as long as the child was wearing its leather brace. But in most cases after removal of the support the postoperative training caused a gait with the feet either straight forward or only a little out- or inward rotated. In two cases, however, the inward rotation was so severe as to indicate a derotation osteotomy on the femur; they are rated as improved in table 4.

The dynamic deformities mentioned above, especially the flexion deformities of the knees, have improved in some cases as judged from the pictures of motion. Naturally, it is rather difficult to exclude the effect of the postoperative training by the physiotherapists although it is felt that the main reason for the improvement of posture is due to the stabilization of the feet.

In four spastic feet we did not get a solid arthrodesis with incorporation of the grafts owing to resorption. Two of these cases had to be reoperated and are now placed in the good group while two cases had such solid fibrosis in the tarsal sinus as to keep the foot corrected without reoperation.

The results rated as unaltered in the spastic group in table 4 may be due to a combination of factors. We may have exceeded the capacity of the operation by interfering with a too spastic inbalanced foot—or the technique may have been faulty. In two of these three cases we feel we did not keep the reduced CT angle immobilised for a sufficiently long time by adequate postoperative splinting. In the third case an adequate lengthening of the Achilles tendon should probably have been performed during operation. He was a boy with a severe spastic diplegia and he had had an elongation of the Achilles tendon years before the operation. This elongation was probably insufficient and should have been repeated—but perhaps we in this case exceeded the capacity of the operation. An ordinary triple arthrodesis was later performed with fair result.

An elongation of the Achilles tendon was performed before or during the Grice operation in five children while in the remaining nine the surgeon did not think it necessary because the foot during operation could be brought in neutral in the ankle joint after the grafts were locked in place. At the follow-up we found, however, three cases—rated as improved—who probably ought to have had a moderate elongation of the Achilles tendon performed at the operation. The spastic pull of the triceps or shortening of the tendon had caused some abduction deformity of the anterior part of the foot in spite of successful incorporation of the grafts and a well reduced CT angle.

CONCLUSIONS

The extra-articular subtalar arthrodesis described by Grice can be of help in correcting the spastic talipes equino-valgus in such cases where an elongation of the Achilles tendon is not sufficient and where

the child is not old enough to be submitted to the ordinary triple arthrodesis. The rate of failures due to resorption or failure of incorporation of the grafts is not very high but reoperation may be necessary in some instances. If spasticity is very marked, failure or some recurrence of the deformity may take place in spite of incorporation of the grafts. In athetosis or ataxia when the child has a plano-valgus deformity due to laxity of the ligaments the same procedure can occasionally be of value.

SUMMARY

27 feet in children with Cerebral Palsy have been operated upon with the Grice extra-articular subtalar arthrodesis. Results are reported and compared with the same operation performed on children with a polio-paralytic foot or a constitutional plano-valgus foot. The technique of the operation is described and the indications for its use discussed.

RESUME

27 pieds chez des enfants souffrant de paralysie cérébrale ont été opérés par arthrodèse sub-talaire extra-articulaire d'après la méthode de Grice. Compte rendu des résultats qui sont comparés à ceux de même opération pratiquée chez des enfants ayant un pied paralysé par la poliomyélite ou un pied plano-valgus constitutionnel. Description de la technique de l'opération et considérations sur ses indications.

ZUSAMMENFASSUNG

27 Füsse von Kindern mit cerebraler Lähmung wurden mittels der extraatikulären subtalaren A throdese nach Grice operiert. Die Ergebnisse werden vorgelegt und mit der gleichen an Kindern mit poliomyelitischem Lähmungsfuss oder einem konstitutionellem pes plano-valgus ausgeführten Operation, verglichen. Die Technik der Operation wird beschrieben und die Anzeigestellung für ihre Anwendung wird besprochen.

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