REVERSE CLUB FOOT

RIGID AND RECALCITRANT TALIPES CALCNEOVALGUS

ELTON R. EDWARDS, MALCOLM B. MENELAUS

From the Royal Children's Hospital, Melbourne

We describe a congenital deformity of the foot which is characterised by calcaneus at the ankle and valgus at the subtalar joint; spontaneous improvement does not occur and serial casting results in incomplete or impermanent correction of the deformities. Experience with five feet in four children indicates that release of the ligaments and tendons anterior and lateral to the ankle and lateral to the subtalar joint is the minimum surgery necessary; subtalar arthrodesis may be required in addition. The foot deformity described may occur as an isolated condition or in association with multiple congenital anomalies. The possibility of a neurological deficit should always be excluded.

This paper is concerned with a foot deformity which is present at birth and is characterised by gross calcaneovalgus which does not improve spontaneously. The deformity occurred in five feet of four patients. Four feet required operative treatment; in the fifth, which was treated by serial casting until 21 months of age, the deformity was not completely corrected. All four patients had weak or absent active inversion of the foot which was noted from an early age. In two there was further evidence of a neurological deficit; one was subsequently found to have a tethered cord and one had sacral agenesis.

Neither the foot deformity nor its management have, as far as we know, been described in the literature. In our department the deformity has been called "reverse club foot"; this term, coined by the late Eric Price, highlights the comparison with congenital talipes equinovarus. The deformities in reverse club foot are the opposite of those in the talipes equinovarus and there is the same rigidity and resistance to treatment in both conditions.

CASE REPORTS

Table I gives the surgical management of the calcaneovalgus deformity but excludes surgery for other deformities.

Case 1. This boy was born in 1974 with severe and rigid right talipes calcaneovalgus and with 30° of lateral tibial torsion, compared with 10° medial torsion of the left tibia. There was also some eversion of the midtarsal joint and abduction of the forefoot. The right foot was

slightly smaller than the left and there was no tibialis posterior function present. Initially it was considered that the deformity was due to a congenital vertical talus; however, radiographs and the course of the condition showed that this was not the case. He was treated by manipulation, strapping and splints up to the age of 15 months. Then an anterolateral soft-tissue release was performed, with excision of aberrant muscle on the lateral border of the foot. Details of this operation and of the postoperative management are listed in Table I. At the end of the operation good correction had been obtained. Bracing was employed for a further two years. At three years the foot was mobile and of good shape though mild abduction deformity persisted. Five years later he presented with moderate heel varus and fixed hyperextension deformity of the metatarsophalangeal joint of the hallux. A valgus-producing osteotomy of the calcaneus was then performed together with surgery to correct the toe deformity. At review his foot was 0.5 cm short but looked normal; it had some stiffness in the ankle and subtalar joints but this was not interfering with function (Figs 1 and 2). Tibialis posterior remained weak.

Case 2. This girl was born in 1981 with severe talipes calcaneovalgus of the right foot. This was initially thought to be of the common postural variety and likely to improve spontaneously. At five weeks of age, however, there had been no spontaneous improvement and it was noted that the foot was small. There was no active inversion of the foot. A series of corrective plasters were applied. At six months there was fixed valgus of the subtalar joint; the calf muscles and tibialis posterior were not functioning. At the age of 18 months there was gross valgus with prominence of the talus medially. Radiographs in full plantarflexion and full dorsiflexion demonstrated fixed calcaneovalgus of the hindfoot. Serial casting over a period of three months resulted in partial correction of the deformities. At review at the age of five years she was found to be an active little girl with a small foot and some fixed hindfoot valgus deformity. Calf muscles were now functioning normally, and tibialis posterior had Grade 4 function.

Case 3. This boy was born in 1974 with gross and rigid talipes calcaneovalgus of the right foot, which was slightly smaller than the left. There was no active inversion of the foot in infancy or later. There were also multiple congenital anomalies, including sacral agenesis and flexion deformities of both hips and knees.

Serial casts were applied starting soon after birth; they included both knees and the right foot. The flexion deformities of both knees were reduced by these means and the foot deformity was slightly reduced in severity. However, there was still abduction and valgus

E. R. Edwards, FRACS, Orthopaedic Registrar
Bristol Royal Infirmary, Marlborough Street, Bristol BS2 8HW.
M. B. Menelaus, MD, FRCS, Chief Orthopaedic Surgeon
The Royal Children's Hospital, Flemington Road, Parkville, Victoria
3052, Australia.

Requests for reprints should be sent to Mr M. B. Menelaus.

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Fig. 1

Fig. 2

Case 1. Photographs of both feet at the age of 12 years. Note the satisfactory posture of the right foot, with the almost invisible scar of an Ollier incision through which the soft-tissue release had been performed and the more obvious and recent scar of the calcaneal osteotomy. There is also a scar on the dorsum of the metatarsophalangeal joint of the right hallux following correction of deformity at this joint.

Table 1. Details of some of the operative procedures and the postoperative management

Case number	Side	Procedure number	Structures divided	Muscle and tendon division or lengthening	Bone procedure	Temporary internal fixation	Postoperative management
1	Right	First procedure	Anterior capsule of ankle; anterior calcaneofibular ligament; bifurcate ligament; ligaments of calcaneocuboid joint; peroneal tendon sheaths; lateral capsule of subtalar joint; dorsal capsule of talonavicular joint	Z-lengthening of peroneus brevis; tenotomy of peroneus tertius; excision of aberrant muscle on lateral border of the foot	—	Single horizontal wire across mid-tarsal joint	Above-knee cast for 12 weeks. Wire removed at 4 weeks
3	Right	First procedure	Anterior capsule of ankle; peroneal tendon sheaths; lateral and interosseous ligaments of subtalar joint	Z-lengthening of peroneus longus and brevis; tenotomy of extensor digitorum longus and peroneus tertius	Subtalar extra-articular arthrodesis using bank bone	Single vertical wire across subtalar joint	Above-knee cast for 10 weeks. Wire removed at 4 weeks
4	Both feet	First procedure	Anterior capsule of ankle; anterior calcaneofibular ligament; anterior inferior tibiofibular ligament; peroneal tendon sheaths; lateral and interosseous ligaments of subtalar joint	Z-lengthening of peroneus longus and brevis; tenotomy of peroneus tertius	—	Single vertical wire across subtalar joint	Above-knee cast for 12 weeks. Wire removed at 3 weeks
4	Left foot	Second procedure	Lateral and posterior capsule of the subtalar joint	Tentomy of peroneus longus and brevis and excision of extensor digitorum brevis	Bank bone graft across subtalar joint to hold heel in neutral position	—	Above-knee cast for 10 weeks
4	Left foot	Third procedure			Oblique osteotomy of tuberosity of calcaneum with medial displacement of tuberosity by 1.5 cm	Single Steinmann pin across osteotomy	Below-knee cast for 6 weeks. Pin removed at 3 weeks

Fig. 3

Fig. 4

Case 4. Photographs of both feet taken standing at the age of 16 months. There is gross planovalgus deformity and the lateral view of the right foot indicates that the lateral metatarsal heads are not bearing weight.

Fig. 5

Case 4. Radiograph of the left foot at the age of 2 years 6 months taken while weight-bearing and before surgical correction. Note the gross valgus position of the calcaneus which is obscured by the talus lying medial to it. A separate centre of ossification can be seen as the most anterior ossification within the calcaneus and lies just beneath the anterior one-third of the lower tibial epiphysis.

Fig. 6

Fig. 7

Case 4. Photographs of both feet at the age of 12 years. The left foot has 10° of fixed valgus of the hindfoot and there is moderate adduction and supination of the forefoot with a small dorsal bunion overlying the metatarsophalangeal joint of the hallux. The right heel is neutral and there is a trace of adduction and supination of the forefoot.

present at the age of six months. Bilateral posterior knee releases were performed at the age of two years, followed by anterior hip releases. By four years of age he was walking but with severe deformity of the right foot and with the peroneal tendons dislocated in front of the lateral malleolus. At this age a soft-tissue release was performed combined with a subtalar fusion (see Table I). This produced a good result in that his gait was markedly improved and his right shoe was no longer deformed. He has not required further foot surgery. At review he was clearly incapacitated severely by his multiple skeletal deformities, for which he wore two long braces, but he was not incapacitated by his foot, which was still 2 cm shorter than the left. The heel was neutral, the forefoot adducted and the ankle and subtalar joints moderately stiff. His foot will certainly meet the restricted demands which will be made on it during adult life.

Case 4. This girl was born in 1974 with severe bilateral talipes calcaneovalgus. No active inversion was noted in either foot until the age of seven years. She had a number of other congenital anomalies including a ventricular septal defect, ureteric reflux and flexion deformities of both elbows.

The feet were treated conservatively with manipulation, strapping, plaster casts and braces. At the age of 16 months the deformities were gross (Figs 3 and 4) and she was referred for a neurological opinion with a tentative diagnosis of spinal dysraphism. However, at that time she was not investigated completely. At the age of 2 years 6 months radiographs of the feet showed a separate centre of ossification for the anterior portion of the calcaneus (Fig. 5) and gross valgus deformity of the subtalar joint. Bilateral soft-tissue release operations were then performed, the details of which are shown in Table I (first procedure). At the age of 3 years 3 months the left foot was still in gross valgus and a further soft-tissue release plus a subtalar fusion was performed on this foot. At the age of 4 years the deformity of the left foot had recurred and there was peroneal spasm; the foot could be controlled reasonably well by bracing which was employed up to the age of 5 years 4 months when an osteotomy of the calcaneus was performed.

At the age of 7 years it was noted that the right foot was deforming into varus and there was overactivity in the previously inactive tibialis posterior which was therefore lengthened surgically. At the age of 11 years the right foot had deformed into cavus and varus and an osteotomy of the calcaneus was performed, displacing the tuberosity into slight valgus. Shortly before this she was once more referred to a neurologist; a myelogram and CT scan disclosed a tethered cord with thickened nerve roots. Lumbar laminectomy was performed and a thickened filum terminale was released. The appearance of the feet at review is illustrated in Figures 6 and 7. Radiographs showed that the two ossific centres in the left calcaneus had coalesced. In the left foot the ankle had no dorsiflexion and 20° of plantarflexion; the subtalar joint was in 10° of fixed valgus. The right foot was 0.5 cm short, had 15° of dorsiflexion and 25° of plantarflexion; the subtalar joint had no eversion but 10° of inversion. There was full power of all muscles.

OPERATIVE TECHNIQUE

An Ollier incision is employed. The anterior capsule of the ankle is then divided throughout its entire length. Attempted plantarflexion will then display that this movement is limited by tightness of the peroneus tertius. On occasion the extensor digitorum longus is also tight (Case 3) and in one child (Case 4, left foot) the extensor digitorum brevis was replaced by fibrous tissue which prevented complete correction. The tendon of peroneus tertius is invariably divided and, should extensor digitorum longus or brevis prevent full plantarflexion, they also are divided or excised. If there is still restriction of plantarflexion it may be necessary to divide the

anterior inferior tibiofibular ligament (as in both feet of Case 4) and the anterior calcaneofibular ligament which was felt as a tight structure, limiting plantarflexion in Case 1.

Correction of valgus deformity of the subtalar joint requires, as a minimum procedure, division of the sheaths of the peroneal tendons, the lateral capsule of the subtalar joint and tenotomy or Z-lengthening of peroneus brevis. If this is inadequate peroneus longus also may require lengthening. In addition the interosseous ligament of the subtalar joint required division in three of our cases. A single vertical wire, introduced through the heel pad and crossing the subtalar joint with the joint held in neutral, ensures that correction will be maintained in the postoperative cast even if this cast needs to be split.

If there is abduction and eversion at the midtarsal joint (as in Case 1) then a midtarsal release is required. This includes division of all the ligaments of the calcaneocuboid joint, division of the bifurcate ligament and of the dorsal capsule of the talonavicular joint. A single longitudinal Kirschner wire, introduced between the second and third metatarsal heads and passing proximally across the midtarsal joint, ensures that correction will be maintained in the postoperative cast.

At the end of the operation an above-knee cast is applied, with the ankle in equinus and the heel neutral. The wires are removed at three to four weeks and the cast retained for a total of 12 weeks.

DISCUSSION

All five feet described in this paper were small and had three other abnormalities: calcaneus deformity at the ankle, valgus deformity at the subtalar joint and weak or absent active inversion of the foot. In addition, other deformities were present in some feet.

Reverse club foot can be differentiated from postural talipes calcaneovalgus by its subsequent course. The deformity at birth may be identical in both but whereas postural talipes calcaneovalgus tends to spontaneous improvement, reverse club foot deformity does not; moreover, it resists conservative methods of correction. Reverse club foot might be mistaken for congenital vertical talus but there is no equinus deformity nor midtarsal dislocation in the former.

The management of reverse club foot presents problems similar to those encountered in the management of congenital talipes equinovarus; the surgeon has to tread the narrow path between incomplete correction and reversal of the deformity. Moreover, recurrence of deformity after surgery may occur.

Varying degrees of deformity occur in reverse club foot, as they do in talipes equinovarus. Whether the surgeon persists with manipulation and casting or corrects the deformity operatively will depend on his ability to correct the deformity fully by conservative

means and by the tendency for the deformity to recur. The one deformed foot that was not operated upon (Case 2) had incomplete correction at review and is likely to require surgery. We cannot give a firm guide as to the most appropriate age for surgery as the number of patients is too small and it is impossible to know which of a number of factors may have influenced the results. We can say that surgical management should be carried out once it is apparent that conservative management has failed to produce a foot which will be trouble-free in later life.

Having decided to operate, the surgeon needs to decide how radical the operation should be. This depends on how much correction he can obtain at each stage of the soft-tissue release; once each deformity can be reversed then further release procedures should not be carried out. Table I lists the ligaments and tendons that have been released, the bone procedures performed and the postoperative management. The ligaments should first be divided, and only if after that the tendons are still preventing full inversion and plantarflexion should they be lengthened.

We cannot give any firm advice as to whether soft-tissue release should be accompanied by subtalar fusion, as was performed at the early age of 3 years 2 months on the left foot of Case 4. Combined subtalar fusion and soft-tissue release did succeed when performed at the age of 4 years in Case 3, and this was the only operation

necessary for this foot. Despite the success in this one foot it seems best to avoid surgery that will lead to a rigid hindfoot. Osteotomy of the calcaneus, with medial displacement of the tuberosity, can be performed for deformity that resists soft-tissue release and was the final operation necessary for the left foot of Case 4.

Patients who present with reverse club foot deformity should have careful neurological assessment including myelography. In Case 4 it is likely that the deformity would have required fewer surgical procedures had the spinal dysraphism been recognised and dealt with at an earlier age. Although James and Lassman (1972) do not describe the deformity of reverse club foot they mention one patient with spinal dysraphism who had unilateral talipes calcaneovalgus. Since Cases 1 and 3 have reached the age of 12 years without progressive deformity it is unlikely that spinal dysraphism is present in these patients. The presence of an aberrant muscle in Case 1 and an abnormal ossific centre for the calcaneus in Case 4 suggests that reverse club foot is not merely a reflection of muscle imbalance in utero secondary to a neurological abnormality.

REFERENCE

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