OPERATION FOR CALCANEUS DEFORMITY
AFTER SURGERY FOR CLUB FOOT
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We describe three patients who developed gross calcaneus deformity following surgery for talipes equinovarus. One also had an associated valgus deformity and another had supination of the forefoot; all had intractable problems with footwear.

Operation for transfer of the tibialis anterior to the heel, with correction of the associated deformities, was successful and improved both their gait and the shoe problems.

“Despite meticulous care and attention to detail, occasional untoward results are inevitable even with the most conscientious treatment of some congenital club feet” (Coleman 1983). Major overcorrection at operation for congenital club foot may lead to poor gait and footwear problems, especially if it results in fixed calcaneus with or without fixed valgus. Even functional calcaneus deformity without a fixed element, but with gross valgus, may cause problems which cannot be managed conservatively.

We report our experience with three patients born with club feet, all of whom developed severe overcorrection after surgery. All three had some ill-defined neurological or joint disorder which may have contributed to the problem by muscle imbalance. We can find no previous account of the surgical management of this condition. Weseley, Barenfeld and Barrett (1972), describing the management of over 300 congenital club feet, reported only one case with overcorrection severe enough to require surgery but gave no details of the operation performed.

PATIENTS AND METHODS

Primary operation. All three children had had posteromedial release of the posterior ligaments of the ankle and subtalar joints, the medial ligaments of the subtalar joints, the superficial fibres of the deltoid ligament and the ligaments of the talonavicular joint, with Z-lengthening of the tendons of tibialis posterior, flexor hallucis longus and flexor digitorum communis. Each child also had Z-lengthening of the calcaneal tendon, with the longitudinal limb of the Z in the sagittal plane, so as to allow 10° of ankle extension at the end of the operation. The talonavicular joint was held in a reduced position with a Kirschner wire which was retained for three weeks. For Case 2 the operation was performed as two separate procedures.

Case 1. A boy born in 1972 with a right club foot was recognised at two years of age as being retarded with a minor degree of spastic diplegia. At 11 years of age he developed a thoracolumbar scoliosis which required operative correction at the age of 15 years.

His right foot had been treated from birth with serial plasters for three months and then with a night splint. By the age of five years, the foot had relapsed into cavo-equino-varus, and a posteromedial release was performed. One year later, the foot was noted to be in a calcaneo-cavus position; 10 years after this, at the time of his scoliosis surgery, he had a calcaneo-supinatus deformity with an elevated first metatarsal (Fig. 1). Tibialis anterior showed normal power but the calf muscles were not functioning and there was a fixed calcaneus deformity of 20°. Shoes were deformed so rapidly that he required a new pair every four weeks. An overriding second toe caused no problems. He wore a short double iron and posterior sandwich strap for three months but it was unsatisfactory because of the fixed calcaneus deformity.

At the age of 15 years, operation was performed for anterior ankle release, transfer of tibialis anterior to the heel and fusion of the medial cuneiform to the first metatarsal, with the metatarsal depressed so that its head lay in the same plane as that of the four lateral heads.

 Twelve months after this operation, the patient walked well with neither a calcaneus gait nor foot drop, and his shoes were lasting for two to three months. The weight-bearing area of the sole had increased because the first metatarsal head was now taking some weight.
(Fig. 2), and the heel was less prominent. The ankle could be voluntarily dorsiflexed to 90° and plantarflexed to 30°, both at MRC power 4. There was a small range of subtalar movement, but none at the midtarsal joints. Case 2. A girl born in 1978 with bilateral club feet and camptodactyly of both hands had serial plasters for two months. These corrected the left foot adequately, but the right foot remained in equinus and a posterior release was performed at the age of three months. Two years after this the right foot showed a cavus-deformity, so further plantar and medial releases were performed, which resulted in pes planus. This was managed with arch supports, but there was increasing calcaneo-cavus deformity and shoe wear was rapid because of her calcaneus gait. Tibialis anterior showed normal power but there was only a flicker of activity in the calf. She had a prominent “pistol grip” heel with 15° of fixed valgus deformity (Fig. 3).

At operation at eight years of age, the tibialis anterior was transferred to the heel with calcaneal osteotomy and shortening of the calcaneal tendon. Two years later the patient walked well, with neither a calcaneus gait nor foot drop. The os calcis was more horizontal (Figs 4 and 5) and her shoes lasted longer. She had a normal weight-bearing area, 10° of flexion and of extension at the ankle and about 20° of subtalar movement centred on the neutral position. The transferred tendon was functioning at MRC power 4. Case 3. A boy born in 1984 with bilateral club feet was subsequently diagnosed as a case of geleophysic dysplasia (Spranger et al. 1984). This is a rare hereditary disorder of glycoprotein metabolism affecting the mesenchymal tissues; only five cases have been described in the literature. Increasing rigidity of the joints is one feature, and progressive extracellular accumulation of collagenous material may affect the skeleton and the heart valves. Treatment with serial plasters for three months secured incomplete correction of equinus and varus deformities, bilateral posteromedial releases were then
performed. Six months after these operations, calcaneus deformity was first seen, with, again, normal tibialis anterior power and very weak calf muscles. On the right, the deformity could not be controlled by a short double iron and posterior sandwich strap, so at two-and-a-half years of age (22 months after the first operation), anterior ankle release, transfer of tibialis anterior and shortening of the calcaneal tendon were performed.

One year after the second operation the child was able to walk without calcaneus or foot drop, but with rigid ankles, knees and hips. The right foot was plantigrade, with a reasonable arch, though there was gross limitation of movement as a result of the dysplasia. **Operative technique.** The operation was performed at one stage and in the sequence given below:

**Anterior ankle release.** This was necessary in patients with fixed calcaneus deformity (Cases 1 and 3) and was performed via a lazy-S midline dorsal incision. The anterior capsule of the ankle was exposed and completely divided, as were the long toe extensors and peroneus tertius, so that the ankle could be placed in approximately 20° of equinus.

**Tibialis anterior tendon transfer.** This was performed in all three patients using a technique similar to that originally described by Herndon, Strong and Heyman (1956).

**Shortening of the calcaneal tendon.** This was necessary where this tendon was excessively slack when the foot was placed in maximum equinus (Cases 2 and 3). It was performed by making a Z incision and shortening each tongue by 2 cm before suturing with 2/0 Dexon.

**Arthrodesis of the medial cuneiform-metatarsal joint.** This was indicated when the forefoot was supinated with elevation of the first metatarsal (Case 1). A plantar based wedge of bone was excised from the joint, the surfaces apposed and held with a single Kirschner wire.

**Osteotomy of the os calcis.** This was used when needed to correct excessive valgus of the heel where there was also a vertical tuberosity of the os calcis (Case 2). A dorsally based wedge was excised from lateral aspect of the os calcis, the tuberosity was then displaced and angulated medially to restore its normal relationship to the body of the bone.

**Postoperative management.** A below-knee plaster was applied to hold the ankle in as much equinus as possible for six weeks.

**DISCUSSION**

The development of severe calcaneus deformity after the surgical correction of club foot is not a common problem. In the 16 years since the oldest of our patients received his primary treatment, approximately 500 club feet have been managed in this department; only three children have required an operation for overcorrection.

Although the feet of all of our three patients were initially well corrected, with time they became increasingly deformed. Overlengthening of the calcaneal tendon is a possible cause of progressive calcaneus deformity, but the initial release had been performed by an experienced surgeon who had lengthened the tendon by the minimum amount necessary to correct the equinus deformity. The late calcaneus deformities may have been contributed to by the generalised abnormality in each patient: spasticity associated with mental retardation and scoliosis in Case 1, weakness and wasting of undetermined cause in Case 2, and geleophysic dysplasia in Case 3. The relative influence of general and of local factors is uncertain, since the deformity occurred unilaterally in two of the patients (Cases 2 and 3) who had undergone seemingly identical bilateral operations by the same surgeon.

In our patients, the main indications for further surgery were major footwear problems which did not respond to the wearing of an orthosis, and the progression of deformity. For the calcaneus foot with little or no calf muscle function, transfer of the tendon of tibialis anterior is logical since it is the strongest available motor unit which is expendable. Its loss does not result in a foot drop gait in these patients because of the invariably associated ankle stiffness. Some ankle dorsiflexion may be retained through the action of extensor digitorum communis and peroneus tertius. Clearly, fixed calcaneus deformity must first be corrected and about 20° of plantar flexion be made available before the tendon is transferred. This was achieved by anterior ankle release.

Another rigid deformity is the vertical alignment of the tuberosity of the calcaneum ("pistol grip heel") which in Case 2 was associated with valgus deformity of the heel. A mobile deformity might have been correctable with an ankle-foot orthesis or by the Grice-Green operation but, being fixed, both deformities needed correction by calcaneal osteotomy. At review, the three feet were admittedly less than perfect, with limited passive and very weak active movement of ankle, subtalar and midtarsal joints. Nevertheless all the patients were improved by the revision operation: they had plantigrade feet, footwear problems were lessened, and their gait had improved. There was no tendency to relapse into calcaneus deformity: this is unlikely since muscle balance has been restored.

Mr S. S. Wijesinha was supported by an AMI Travelling Surgical Fellowship.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

**REFERENCES**


THE JOURNAL OF BONE AND JOINT SURGERY