CONGENITAL VERTICAL TALUS IN INFANCY

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Lamy and Weissman (1939) in the earliest important paper on this rare deformity described the clinical characteristics of congenital vertical talus as convexity of the sole, deviation into valgus of the posterior part of the foot and abduction of the forefoot. Radiographically it is distinguished by the vertical or oblique position of the talus. They preferred the title congenital convex pes valgus, as descriptive of the appearances, particularly in the older children they were treating. The rigidity of the foot was emphasised, both ankle and tarsal movements being restricted, particularly plantar-flexion. Excision of the talus was advocated. Hark (1950) described a method of open correction. His twelve patients included four with arthrogryposis, one with spina bifida, three with other severe congenital deformities and two patients in whom maltreatment of talipes equinovarus had produced a rocker foot. Osmond-Clarke (1956) described experience with five patients, in two of whom he had successfully held correction after open reduction by a peroneus brevis tendon transfer into the neck of the talus. Lloyd-Roberts and Spence (1958) reviewed the combined experience of the Royal National Orthopaedic Hospital and the Hospital for Sick Children, Great Ormond Street, over twenty-seven and eighteen years respectively and found twenty-two cases. Ten of these patients had arthrogryposis, two had spina bifida and one had neurofibromatosis. Differentiation was described from idiopathic and paralytic flat foot, from the foot of cerebral palsy and from spurious correction of a club foot. The possibility of confusion with talipes calcaneo-valgus was mentioned. No benefit came from either non-operative treatment or tenotomy of the tibialis anterior in these cases. Hughes (1957) thought that the treatment of the late neglected case was so difficult and unsatisfactory as to warrant drastic measures at the earliest stage. Heyman (1959) gave the opinion that satisfactory function may be obtained without complete correction; yet Stone (1963) advocated excision of the navicular to help secure open reduction in older children. Herndon and Heyman (1963) in a detailed review of eighteen otherwise normal patients concluded that if a child is seen before irreversible changes have developed the preferable approach is open reduction. Four of their patients had this treatment but only one was under one year old. Two of the six feet so treated had an excellent result. Wainwright (1964) was able to report the success of essentially conservative treatment started soon after birth, splinting being combined with open elongation of the tendo calcaneus and posterior capsulotomy of the ankle.

This paper is based on personal experience with eight cases, all seen in infancy and all without other severe abnormality.

MATERIAL

Details of the patients are summarised in Table I.

Seven of the children were boys, which agrees with the observation of Lamy and Weissman (1939) that the deformity is more common in boys. Three cases were bilateral, three involved the right foot only, two the left. Four were first born, one was the second, two the third and one the fourth of the family. In Case 8, the only girl in the series, the child was retarded and underweight, with features suggestive of trisomy. No such abnormality was demonstrable however on chromosome examination. Detailed obstetric records were available in four cases and showed no abnormality or obvious common factor. Two of the unilateral cases showed in the opposite foot a benign talipes calcaneo-valgus deformity and a third
showed a reciprocal adduction of the metatarsals. The diagnosis was confirmed radiographically in all patients except for one foot of a presumed bilateral case (Case 1). In this patient, although the feet were indistinguishable under treatment during the first four months of life, radiographic confirmation was neither sought nor obtained until the age of seven months, by which time the right talus was no longer vertical.

**DIAGNOSIS**

Most earlier reports have described this condition in children at the time of walking or later when it presents as one variety of rigid flat foot. The scarcity of reports on the condition in infancy reflects the ease with which the diagnosis may then be overlooked. The foot is plantigrade throughout and its shape is to a degree disguised by the thick layer of subcutaneous fat. Confusion with the common benign talipes calcaneo-valgus often causes an over-optimistic assessment.

The outstanding differential diagnosis in the first few months is from talipes calcaneo-valgus. In seven of these eight cases this was the initial clinical diagnosis by the orthopaedic surgeon first seeing the baby. In both conditions the foot lies dorsiflexed and everted, and plantar-flexion and inversion are restricted (Figs. 1 and 2). In the newborn simple treatment by stretching or splints produces improvement in either condition. Rigidity of the foot in congenital vertical talus is usually not a feature in infancy. Inversion occurs at least to neutral and plantar-flexion may be practically full (Figs. 4 to 6). Eversion and dorsiflexion are unrestricted. Other of the stigmata of vertical talus seen in older children may be absent. Prominence of the head of the talus in the sole is often not conspicuous, in fact some concavity of the longitudinal arch may still remain (Fig. 3). Similarly the upward tilt to the point of

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**TABLE 1**

**DETAILS OF THE EIGHT CHILDREN WITH CONGENITAL VERTICAL TALUS**

<table>
<thead>
<tr>
<th>Case number</th>
<th>Sex</th>
<th>Side</th>
<th>Age at diagnosis (months)</th>
<th>Other lesions</th>
<th>Treatment</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Boy</td>
<td>Right</td>
<td>7</td>
<td></td>
<td>Plasters until 4 months</td>
<td>Satisfactory at 5 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Left talipes calcaneo-valgus</td>
<td>Manipulation under anaesthesia failed. Open reduction at 4 months</td>
<td>Satisfactory at 13 months</td>
</tr>
<tr>
<td>3</td>
<td>Boy</td>
<td>Right</td>
<td>6</td>
<td>Absent tibialis posterior tendon</td>
<td>Open reduction at 7 months. Repeated at 16 months</td>
<td>Persistent deformity of both feet</td>
</tr>
<tr>
<td>5</td>
<td>Boy</td>
<td>Right</td>
<td>3</td>
<td>Left talipes calcaneo-valgus</td>
<td>Open reduction at 16 months</td>
<td>Satisfactory at 4 years</td>
</tr>
<tr>
<td>6</td>
<td>Boy</td>
<td>Right</td>
<td>Birth</td>
<td>Reciprocal adduction of left foot</td>
<td>Plasters for 2 months</td>
<td>Satisfactory at 1 year</td>
</tr>
<tr>
<td>7</td>
<td>Boy</td>
<td>Left</td>
<td>8</td>
<td></td>
<td>Open reduction at 8 months</td>
<td>Satisfactory at 18 months</td>
</tr>
<tr>
<td>8</td>
<td>Girl</td>
<td>Right</td>
<td>3</td>
<td>Delayed development</td>
<td>Open reduction at 6 months</td>
<td>Satisfactory Poor correction</td>
</tr>
</tbody>
</table>
FIG. 1—Case 1 at birth. There is a bilateral vertical talus. Note the dorsiflexed everted position of the feet and the hollow in front of the lateral malleolus. Figure 2—Case 2 aged three months. Right vertical talus. The foot is dorsiflexed, everted and laterally rotated on the leg. There is an upward concavity of the outer border of the foot.

FIG. 3
Case 3 at 6 months. There is a bilateral vertical talus. Plantar-flexion and inversion were limited but the longitudinal arches appeared to be preserved.

FIG. 4
Case 6 at birth, with a right vertical talus to show the range of plantar-flexion.

FIG. 5
Case 6 at birth. There is a right vertical talus. These figures show the range of inversion present.

FIG. 6

the heel may not be obvious. The most helpful sign, although even this is not invariably present, is obtained by looking at the outer border of the foot where a very typical angulation, concave upwards, is visible at the level of the midtarsal joint (Fig. 1). Abduction of the metatarsals may be a further conspicuous and suggestive feature. A pressure dimple on the point of the heel is sometimes evident (Fig. 6).

Benign talipes calcaneo-valgus usually corrects readily with simple treatment during the first few months of life. In any case where this deformity fails to improve rapidly the possibility of congenital vertical talus should be considered. The diagnosis once suspected is easily confirmed by radiography. Lateral films with the foot in a weight-bearing posture show the long axis of the talus to be vertical or nearly so, with a lesser degree of equinus of
the calcaneus (Figs. 10 and 11). Antero-posterior views centred on the talus show its long axis to be strongly deviated medially or, to look at it more accurately, the calcaneus and foot are laterally rotated on the leg, a point also evident clinically. The bony outlines are recognisable at birth but are more easily studied when the child is a few months old.

PATHOLOGY

The literature contains much speculation on the etiology of this deformity. It is well known in association with other congenital abnormalities. Its frequent occurrence in patients with arthrogryposis was emphasised by Lloyd-Roberts and Spence (1958). It has recently been recognised as one of the numerous defects associated with autosomal trisomy, occurring both with trisomy 13-15 and with trisomy 18 (Townes, DeHart, Hecht and Manning 1962; German, Rankin, Harrison, Donovan, Hogan and Bearn 1962; Uchida, Lewis, Bowman and Wang 1962). It is not, however, a feature of trisomy 21 or Downs syndrome. A familial incidence was noted by Lamy and Weissman (1939) who recorded an example of a mother and child with the same deformity. It is, however, most frequently seen as an isolated abnormality in otherwise normal children, particularly boys.

Exploration of the talus at operation shows it to lie vertically, with the navicular against the front of its neck. The upper articular surface of the talus is exposed anteriorly and extends medially as a narrow strip towards the head of the bone. It is to be noted how in infancy the neck of the talus is very short, there being a gap of only two or three millimetres between the upper joint surface and that for the navicular. The plantar calcaneo-navicular ligament is stretched and the sustentaculum tali displaced backwards and laterally. In one patient in this series repeated exploration failed to reveal the presence of the tibialis posterior tendon, but it was identified in all the other feet operated upon.

Careful dissection behind the ankle failed to show anything pulling or holding the talus into equinus. Its posture did not appear to be caused by tightness of posterior structures. This finding was confirmed radiographically in one patient before treatment, in whom forced dorsiflexion of the foot restored an almost normal relation between the talus and the tibia (Fig. 12).

These observations indicate that the talus lies in equinus because it is pushed there by the navicular which is displaced on to the front of its neck. The vertical position of the talus pushes the sustentaculum tali and calcaneus into a lesser degree of equinus and into eversion.
Case 6 at birth. There is a right vertical talus. Abduction of the forefoot is associated with reciprocal adduction of the left foot.

Figures 9 and 10—The right talus points vertically and inwards.
FIG. 11
Case 4 at 2 months. There is a left vertical talus with equinus of the calcaneus.

FIG. 12
Case 7 at 8 months. On forced dorsiflexion the left talus and calcaneus assume a normal relation to the tibia. Note how the foot "breaks" at the midtarsal joint.

FIG. 13
Radiographs of a dissected specimen from a normal full-term foetus. In Figure 14 the navicular bone has been stitched to the front of the neck of the talus, pushing the talus into the vertical position. Downward displacement of the head of the talus has pushed the calcaneus into equinus.

FIG. 14
Radiographs of a dissected specimen from a normal full-term foetus. In Figure 14 the navicular bone has been stitched to the front of the neck of the talus, pushing the talus into the vertical position. Downward displacement of the head of the talus has pushed the calcaneus into equinus.
It was possible to reproduce these features in a dissected normal foot by displacing the navicular dorsally on to the neck of the talus by forced dorsiflexion, the foot then being brought down to the right angle (Figs. 13 and 14).

The association with talipes calcaneo-valgus in two cases and with the striking reciprocal deformity of the opposite foot in Case 6 (Fig. 8) suggests that the dorsal dislocation of the navicular on the talus arises at least in part as a result of pressure on the foot from the uterine wall. Other factors, as yet unrecognised, determine why the moulding effect causes displacement at the talo-navicular joint rather than, for example, the ankle. One such factor may be a longitudinal compression of the foot associated with the dorsiflexing force.

**TREATMENT**

The talo-navicular dislocation should be reduced as soon as possible. Reduction can be achieved by closed methods if they are begun at birth (Cases 1 and 6). By serial plaster-of-Paris splints the foot is moved into full equinovarus and is held there for two months. On removing the splints the foot returns to a normal posture carrying the talus with it. If this treatment fails, or if it is not applied through delay in diagnosis, operative treatment is indicated. The uncorrected deformity in a child over three months old should be treated by immediate open reduction.

The technique is much as described by Herndon and Heyman (1963). Through a medial incision the talo-navicular joint is freely dissected, the plantar calcaneo-navicular ligament and tibialis posterior tendon being divided. The medial capsule of the talo-calcaneal joint is cut. Through a second, lateral incision the talo-calcaneal joints are again widely opened and the calcaneo-cuboid joint freed on its dorsal aspect. Care should be taken to avoid dissection close to the talus that may damage its blood supply. Thorough mobilisation of the triple joint allows the navicular with the forefoot and calcaneus to be swung downwards and medially rotated to restore correct relationship with the talus. The peroneal tendons usually need elongation. Internal fixation with two Kirschner wires is important (Fig. 15). The stretched plantar calcaneo-navicular ligament is plicated and repaired and the tibialis posterior tendon reattached with shortening. The foot is immobilised in plaster in the equinovarus position for six weeks. The wires and plaster are then removed and the foot returns to the normal posture. In none of the cases here described was elongation of the calcaneal tendon or posterior capsulotomy of the ankle needed.

**RESULTS**

The results are illustrated in Figures 16 to 25.

Complete or nearly complete reduction of the talo-navicular dislocation was obtained in eight of the eleven feet treated. The failures were both feet of Case 3 (Figs. 18 and 19)
Case 1 at 2 years. Partial correction was obtained in the left foot but the right foot was satisfactory.

Case 3—The feet two years after the failure of repeated open reductions on each side.

Case 5—The right foot at 3 months in Figure 20 and at 3 years in Figure 21.

Case 4 at 1 year, after open reduction at 4 months of age.

Case 6 at 10 months. The right foot after conservative treatment from birth.
initially operated upon when seven months old and subjected to repeat operation at sixteen months, and one foot of another bilateral case (Case 8) operated upon at six months (Figs. 24 and 25). The longest follow-up is five years (Case 1). There has been little evidence in any patient of a tendency to relapse after adequate initial correction. The failure of reduction in Case 3 was evident throughout. In Case 6, treated by plasters alone, abduction of the forefoot was a persistent problem and required a further course of plasters later.

Some of the feet were more difficult to correct than others. The severity of the deformity was variable, with difficulties independent of those arising from delay in diagnosis and treatment although these are important. Thus in Case 5 (Figs. 20 and 21) operation was delayed until the age of sixteen months but good correction was quite easily obtained. The bilateral cases in contrast presented considerable difficulty even at an early age.

Even in the favourable cases full inversion of the foot has not been recovered in the relatively short period of follow-up so far experienced. The eventual fate of the subtalar joint must be a source of anxiety. Restoration of the proper anatomy at the earliest possible moment offers the best hope for its preservation.

SUMMARY

1. Eight cases of congenital vertical talus in infancy are reported. The principal differential diagnosis at this age is from talipes calcaneo-valgus.
2. The deformity is primarily a dorsal dislocation of the talo-navicular joint.
3. Closed reduction can be achieved if treatment begins at birth. Open reduction is indicated for the deformity uncorrected by the age of three months.

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REFERENCES


