CONGENITAL VERTICAL TALUS

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The term congenital vertical talus is applied to a severe congenital deformity of the foot, which resembles club foot (talipes equino-cavo-varus) in that the heel is elevated, there is dislocation of the talo-navicular joint and the foot is stiff. The displacement of the talo-navicular joint is, however, opposite in the two conditions: in club foot it is downwards and medially, whereas in congenital vertical talus the navicular bone moves upwards and laterally to lie on the dorsum of the head or neck of the talus. A further difference is that the elevated heel in vertical talus is not fixed. Rigidity of the foot is so formidable in congenital vertical talus that most authorities agree that the condition is amenable only to operative treatment.

Lloyd-Roberts and Spence (1958) discussed the differential diagnosis between congenital vertical talus (Figs. 1 to 8) and idiopathic club foot, paralytic flat foot, the flat foot of cerebral palsy, the spuriously corrected club foot (Fig. 9) and the mobile talipes-calcaneo-valgus with the hindfoot in calcaneus. Among the diagnostic features they emphasised the elevated heel, the fixed foot deformity from birth and the characteristic shape of the foot. Radiographs (Figs. 2 to 4) show the vertical talus and the convex contour of the sole of the foot, and also the marked angulation between the axis of the talus and first metatarsal bone in antero-posterior views of the foot. Judging from the cases reported here there is no fixed equinus of the heel; lateral radiographs of the dorsiflexed foot show the calcaneus almost normally related to the tibia.

The purpose of this paper is to illustrate the condition as seen in the infant, to direct attention to the importance in the differential diagnosis of a lateral radiograph taken in fullest plantar-flexion, and to describe a method of operative treatment that has been successful; three patients were followed up for five, six and ten years.

DIAGNOSIS

It is important to note that a diagnosis of vertical talus is established only by a radiograph in which dorsal dislocation of the navicular bone on to the head or neck of the talus is shown.

FIG. 1

Case 1—Photograph of the feet from behind, at age of 9 months. Bilateral severe congenital vertical talus.
Case 1—Right foot before operation.

There may be slight varus at the talo-navicular joint, a tendency to overcorrection.
to be maintained in the position of greatest plantar-flexion. Admittedly, a child’s foot below three years of age may not show an ossified navicular bone, but its situation can easily be identified because it lies between the ossified medial cuneiform and the head of the talus. In all cases of true congenital vertical talus, in full plantar-flexion the navicular will lie on the dorsum of the head of the talus, and it is this persistence of the deformity when the foot is plantar-flexed as far as it will go that is essential for diagnosis.

Figures 10 and 11 show a child of two years and nine months, the lateral radiograph of whose foot in the right-angled position appeared to show a vertical talus; but when radiographs were taken in full plantar-flexion they showed a normal relationship of the talus with the medial cuneiform and therefore with the intervening navicular bone. Such a case can be readily treated by plaster fixation and possibly later by elongation of the tendo calcaneus as advocated by Wainwright (1963). True congenital vertical talus will not respond in this way (Osmond-Clarke 1956, Stone and Lloyd-Roberts 1963).

Of the four patients reported in this paper, three had other congenital abnormalities. Two were mentally retarded, with abnormal facies and various skeletal abnormalities, one being thought to have arthrogryposis. A third had severe scoliosis with two hemivertebrae and a “tuning-fork rib.” In only one case was the foot deformity bilateral.
Fig. 12—Photograph taken of the right foot during operation on Case 1 (Figs. 2 to 8). The navicular bone lies on dorsum of head of vertical talus above the distal end of the cut tibialis posterior. The tight tibialis anterior tendon is seen anteriorly. Figure 13—The talo-navicular dislocation has been reduced but the talus is still lying almost vertically. (The lateral exposure is not seen in this photograph.) The navicular bone is identified by the tibialis posterior tendon; its proximal surface is still unsatisfactorily opposed to the head of talus with foot in full plantar flexion. A wedge of navicular bone has yet to be removed.
TECHNIQUE OF OPERATION

The operation consists in exposing the talo-navicular joint on the medial side through a curved incision with a branch towards the heel. The head of the talus lies in a deep pouch formed by a greatly elongated spring ligament and is exposed by cutting the tibialis posterior tendon and then opening this pouch (Fig. 12). The navicular has always been found lying on the dorsum of the head or neck of the talus, with its proximal articular surface directed downwards and posteriorly. After the dorsal ligament of this dislocated joint has been cut it is still found impossible to reduce the dislocation until the tight extensor tendons are elongated. (In Case 2 division of the dorsal retinaculum with elongation of the peroneal tendons did suffice, but in the others elongation of all the tendons was necessary.) The tibialis anterior and extensor hallucis longus tendon can be elongated from the medial side, but a separate lateral incision is needed for elongation of the tendons of extensor digitorum longus, peroneus tertius and peronei longus and brevis, which last have often become dislocated in front of the lateral malleolus, taking a straight course to the mid-foot. Through this lateral incision in the subtalar and calcaneo-cuboid joints are opened and the ligaments in the sinus tarsi are severed, to assist tarsal mobilisation. When the tendons have been lengthened the navicular bone can be placed opposite the head of the talus, but it is still unstable because its proximal surface is inclined downwards and posteriorly (Fig. 13). Therefore a wedge, based dorsally, is taken from the proximal part of the navicular bone, so that the inclination of the proximal surface is changed to face posteriorly and slightly upwards. A stable reduction is now possible and is supplemented by placing the excised wedge of navicular below the head of the talus; it is secured by suturing the pouch—consisting of the spring ligament—with considerable overlap (Fig. 14).

Removal of the dorsal wedge from the navicular bone not only alters the direction of the proximal surface but also shortens the total length of the skeletal constituents of the medial pillar. The importance of the latter is shown by the radiograph several years later when the head of the talus will be found to be articulating largely with the bases of the cuneiform bones (Figs. 20 to 22 and 26 to 28). The tibialis posterior is shortened before the skin closure which may be difficult because of the altered shape of the foot. A well padded plaster is applied with the foot in full plantar-flexion and slight inversion and is kept on for four to eight weeks, depending on the age of the child. Thereafter mobilisation is allowed. No further treatment has been called for in the three patients followed up for ten, six and five years.

FOUR CASE REPORTS

Case 1—This mentally retarded infant failed to thrive; he had fusion of the second and third cervical vertebrae and a large sacral defect—rather more than a complete spina bifida. He had coarse features, thick lips, a broad nose, widely separated eyes and a left convergent squint. There were large scrotal
herniae. Gargoyleism was excluded by the appropriate chemical tests on the urine. He was first seen at nine months of age with typically stiff and deformed feet (Figs. 1 to 6). Although the child was nine months old when operated upon, he was small for his age in general and had particularly small feet. Much mobilisation was necessary (Figs. 12 and 13) before a reasonable position was obtained (Figs. 7 and 8). Complete subtalar mobilisation was necessary before the reduction was satisfactory. Swelling after operation was considerable but this settled in a few days and healing of the wounds was uneventful. The right foot appears to have been overcorrected and some equinovarus and stiffness gave trouble later. The right calcaneal tendon was elongated four months later, the only one to be so treated in this series. One month later the left foot was dealt with in the same way except that the navicular bone was excised and the position of the talus and the cuneiform bones was maintained by a transfixing wire. The child is still too young to stand on his feet, particularly as he is somewhat retarded mentally, and these have been the most difficult feet to treat in the series. The final result will have to be awaited many years hence.

Case 2—This child was born with a left congenital vertical talus, a diastematomyelia and congenital scoliosis; she was otherwise quite normal. First seen when two weeks old, she was treated by stretching and plaster immobilisation until she was six months old. There was no improvement and operation was done when she was nine months. The condition before operation is shown in Figure 15. Although there was no ossification of the cuneiform or navicular bones, the proximal projection of the axes of the metatarsal bones points to the dorsum of the talus at its head when the foot was plantar-flexed; the navicular bone was found in this position at operation a few days later. After operation the left foot was in plaster for only three weeks and it has had no other treatment since the operation ten years ago. The appearance of the foot is good (Fig. 17) and the radiographs (Fig. 16) show good alignment. The talus is in contact with the medial cuneiform above and the remains of the navicular bone are displaced downward and fused with the head of the talus. The range of plantar-flexion and dorsiflexion is limited to 30 degrees entirely in the ankle joint, and tarsal movement is very restricted.

Case 2. Figure 15—Radiograph of the left foot at age of 9 months, after six months treatment by stretching and plaster immobilisation and before operation. Figure 16—Radiograph of the left foot ten years after operation. The navicular bone appears fused to head of talus and is in correct relationship although the superior portion of the bone is clearly defective.

Case 2—Photographs of the feet 10 years after operation. The scar of the incision can be seen on the left foot.
Case 3—Radiographs of the right foot in full dorsiflexion (Fig. 18) and in full plantar-flexion to show the congenital vertical talus at the age of 11 months.

Case 3—Photograph six and a half years after operation. The right foot is now the better looking of the two because the left foot shows some cavus with claw toes.
Case 4—Pre-operative radiographs of right foot after eight months of stretching and plaster immobilisation. The navicular is not ossified but must lie on the dorsum of the head of the talus between that bone and the ossified cuneiform bone, even in full plantar-flexion.

Case 4—Appearance of the right foot six years after operation. There is slight varus in all views and the scars of both incisions can be seen.
Case 3—This boy had abnormal wrists and fingers with very limited movement; the wrists had ulnar deviation and the fingers were atavistic in their distal parts; he also had a mild scoliosis. He was subnormal mentally, with small pinched features, and was considered to be suffering from arthrogryposis. The right foot had a typical congenital vertical talus, which remained completely unreduced in full plantar-flexion which was just below the right angle. The normal left foot was considerably larger (Figs. 18 and 19). Operation was performed at eleven months, when he was first seen; no conservative treatment was given. The operation resembled that described but reduction was only effected when much of the dorsal part of the navicular bone had been excised, so that some of the proximal surface of the cuneiform bones was in contact with the head of the talus at the end of the operation. The result over six years later is shown in Figures 20 to 22. The antero-posterior radiograph shows excellent alignment of the foot but the only evidence of the navicular bone is a bony fragment lying beneath the head of the talus. The lateral radiograph also shows that only a small fragment of the navicular bone remains beneath the head of the talus. This no doubt represents the displaced portion, which was placed between the front of the calcaneus and the under-surface of the talus, to assist in keeping the latter elevated. The appearance and function were equally satisfactory (Fig. 23); there was no treatment except a period of seven weeks in plaster immediately after operation.

Case 4—This otherwise normal boy was first seen at the age of three weeks. The right foot showed the typical deformity, while the left was normal. Some time was spent in conservative treatment but eight months later there was no fundamental improvement (Figs. 24 and 25), and even in full plantar-flexion the navicular bone lay on the dorsum of the head of the talus between it and the ossified cuneiform bone. Operation was performed; the result over five years later is shown in Figures 26 to 28. The alignment antero-posteriorly is not as good as in Case 3, because there is some varus which is also evident clinically (Fig. 29). The part of the navicular bone that remains is larger than in Case 3 and seems to be the factor preserving the varus. Were the remains of the navicular bone smaller, or absent, a better alignment of the bones in the medial pillar would occur, and the varus or overcorrection would disappear. The child has had no treatment since the operation and the subsequent eight weeks plaster immobilisation, apart from a half-inch outside flare to the heel of his shoe during the last year. He is now a very active schoolboy nearly seven years of age.

DISCUSSION

Three of these children (Cases 2 to 4) were submitted to operation at the ages of nine, eleven and nine months, were retained in plaster for periods of three to eight weeks only and received no other treatment whatsoever. They were followed up for periods of ten, six and five years. The other, Case 1, is recent and was the only bilateral condition. The essential feature of the operation is the removal of a wedge—often almost half—of the navicular bone, which is then placed beneath the head of the talus to help keep it elevated. The late results show that the remainder of the navicular bone plays little part in the medial pillar of the foot in the better aligned cases and supports the contention that, in the more severely deformed feet, it could be completely removed, but with a part of it used to elevate the talus; this wedge must fit neatly between the forepart of the calcaneus and the head of the talus and is held in position by reefing the spring ligament.

There is much to be said for the contention that an important factor in the difficulty of reducing and retaining reduction in the club foot results from the bony constituents of the medial pillar of the foot being too long to lie comfortably in the available interval; the result is that, after effective treatment, the dislocation at the talo-navicular joint will often recur to relax the medial pillar of the foot, between the talus and the big toe. This idea has been championed by Batchelor (1945) who advocated, for children of four to six years of age, an operation to shorten the bony pillar by removing a section from the neck of the talus. I have found this operation very satisfactory. The corrected club foot can, on the other hand, accommodate by reversing the mid-foot displacement, as shown in Figure 9, producing a deformity very similar to a congenital vertical talus.

In the congenital vertical talus there is a similar difficulty in that the bony constituents of the inner pillar are relatively too long. This is supported by the success of the operation described in this paper, in which the depth of the navicular is much reduced; on occasions.
the bone has been almost completely removed (Figs. 20 to 22). Recurrence of the vertical talus deformity has not occurred so far but there has been a tendency to reversal in two children (Cases 2 and 4) who have developed slight varus both clinically and radiologically.

**SUMMARY**

1. Four cases of true congenital vertical talus are described; in three of the four cases there were other major deformities of the skeleton. All were treated by open operation; the operation sacrificed part of the substance of the navicular bone, which was placed between the forepart of the calcaneus and the head of the talus.

2. The results five to ten years after operation show that stable reduction was maintained without any further treatment. They suggest, however, that more of the navicular bone could have been removed or that the whole navicular might be excised, at least in the more severe deformities.

3. Congenital vertical talus resembles club foot (equino-cavo-varus) in that difficulty in reduction and in maintenance of the reduction results from the tension in the medial pillar of the foot. Easing of the tension can result in recurrence of the dislocation or, alternatively, a reversal of the deformity.

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**REFERENCES**


