Foot disorders in childhood

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Abstract

Childhood foot problems are common within a paediatric orthopaedic practice. A wide spectrum is seen from conditions which resolve spontaneously to those which cause progressive deformity and functional limitation. In this article clubfoot, metatarsus adductus, vertical talus, flatfeet and pes cavus are discussed.

Keywords Cavus; clubfoot; pes planus

Clubfoot

Clubfoot (congenital talipes equinovarus (CTEV)) is a congenital foot deformity that includes **C**avus (plantarflexion of the forefoot on the hindfoot), **A**dduction of the forefoot on the midfoot, **V**arus (or inversion of the subtalar joint) and **E**quinus of the hindfoot (Figure 1). The exact cause is unknown but is thought to be multifactorial. Various theories have been proposed including primary muscle, bone, nerve or vascular pathology, developmental arrest and retracting fibrosis. The incidence varies with race. In Europe the incidence is 1 in 1000 live births with boys twice as commonly affected as girls. In affected families the likelihood of clubfoot occurring in the offspring is 30 times more than in the general population.

Abnormalities are present in multiple tissues, including the bones, muscles, tendons and ligaments. The talus is deformed and the navicular articulates with the medial aspect of the neck of the talus. The talus and calcaneus are parallel in all three planes (sagittal, coronal and axial).[1] The gastrocnemius and long toe flexors are hypoplastic and the foot and calf are smaller than the contralateral normal side. In addition prominent medial and posterior skin creases are observed.

Diagnosis: the diagnosis is often made prenatally by ultrasonography.[2] In the absence of a prenatal diagnosis the diagnosis is made at birth by clinical examination. Minimal ossification of the bones in the foot of a newborn limits the usefulness of radiographs. Clubfeet may be positional, idiopathic or teratogenic. The idiopathic and positional types are seen in an otherwise normal infant. The teratogenic clubfoot is associated with conditions such as arthrogryposis and myelomeningocele, and a thorough clinical examination is required to determine whether a child presenting with clubfoot has a broader disease syndrome.

Management: the aim of treatment is to create a mobile, pain-free and functional foot. Most orthopaedic surgeons would agree that the initial treatment is non-operative. The Ponseti method of manipulation, serial casting and bracing is the technique most commonly favoured.[3] Treatment commences soon after birth with gentle manipulation of the foot and application of a moulded long leg cast in the improved position. The cast is changed every 5–7 days and five or six cast changes are usually required. An equinus deformity is treated by a percutaneous Achilles tenotomy, which is performed only after the other deformities have been corrected. After removing the last cast a foot abduction orthosis (Denis Browne bar and shoes) is applied and worn full time for 3 months and then only at night and nap times for 2–4 years. This is required to facilitate remodelling and to prevent recurrence.[4]

Metatarsus adductus

Metatarsus adductus is a common foot deformity characterized by medial deviation of the forefoot relative to the hindfoot. The incidence is 1 in 1000 live births. The cause is unknown although in-utero positioning may contribute.

Diagnosis: the diagnosis is clinical and the deformity is usually noted at birth although it may present at a later age. The foot has concave medial and convex lateral borders and when viewed from the sole assumes the shape of a bean. Internal tibial torsion may be present. Bleck classified metatarsus adductus into mild, moderate and severe using the heel bisector line (Figure 2). Normally this line passes between the second and third toes.[5]

Management: most cases (86%) resolve without active treatment.[6] Serial casting is recommended for severe deformities or deformities that do not resolve as the child gets older. Surgery is rarely required and only if the deformity does not resolve after serial casting.

Vertical talus

Congenital vertical talus (convex pes valgus) is an irreducible dorsal dislocation of the navicular on the talus and the foot assumes a rocker bottom shape. The incidence is 1 in 15,000 live births with no sex predilection and it is bilateral in 50% of cases. The aetiology is unknown but muscle imbalance, intrauterine compression and growth arrest during fetal development have been suggested. It may occur as an isolated congenital foot anomaly or in association with other conditions like myelomeningocele and arthrogryposis.[7]

Diagnosis: the diagnosis is made by clinical examination and lateral radiographs of the foot.

Examination reveals the sole of the foot is convex, the talar head is prominent medially, the midfoot is dorsiflexed and abducted on the hindfoot and the hindfoot is in equinovalgus giving the appearance of the Persian slipper. In addition the Achilles, tibialis anterior and peroneal tendons are contracted.

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Figure 1 Clinical picture of a bilateral clubfoot deformity.

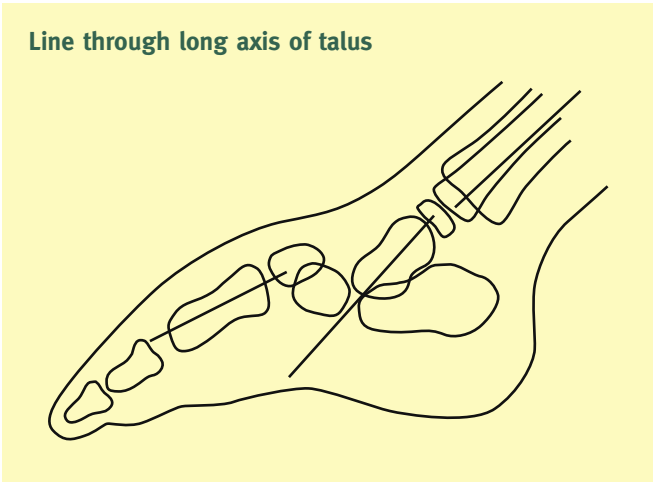

Figure 3 Schematic diagram of congenital vertical talus showing metatarsal–cuneiform axis, talar axis and tibial axis on the lateral view.

On the lateral radiograph taken with the foot in maximal plantar flexion the hallmarks of vertical talus is that a line drawn along the long axis of the talus appears vertical (almost parallel to the tibia) and also passes below a line drawn along the first metatarsal/cuneiform axis (Figure 3).[8]

Management: the initial treatment involves manipulation and serial casting with the corrective forces applied opposite to that required during Ponseti casting for CTEV (often termed reversed Ponseti). Manipulation and serial casting may not fully correct the deformity and surgery is required. Surgery involves soft tissue release, that is, Achilles tendon lengthening, reduction of the talo-navicular joint with or without a tibialis anterior tendon transfer. In the older child excision of the navicular, subtalar or triple arthrodesis may be necessary. Untreated the deformity persists and causes disability.

Flatfoot

A flatfoot is a foot with a large plantar contact area and an abnormally low or absent longitudinal arch. Flatfeet may be flexible (physiological) or rigid. The rigid type is pathological and should be investigated and treated appropriately. The cause of flexible flatfoot (pes planus) is unknown though it is more common in children with features of generalized ligamentous laxity. It also runs in families. Flexible flatfoot is present in nearly all infants and many children but the exact incidence is unknown. In the infant foot the longitudinal arch is usually obscured by subcutaneous fat. As the infant grows the fat atrophies and the longitudinal arch develops.[9] The development of the arch is independent of the use of insoles.

Diagnosis: the diagnosis is clinical and examination of the child whilst standing reveals an absent or low longitudinal arch, the hindfoot is in valgus and the forefoot is abducted. The medial longitudinal arch reappears on tip toeing or on passive dorsiflexion of the great toe with the child seated.[10] In addition subtalar joint motion is full.

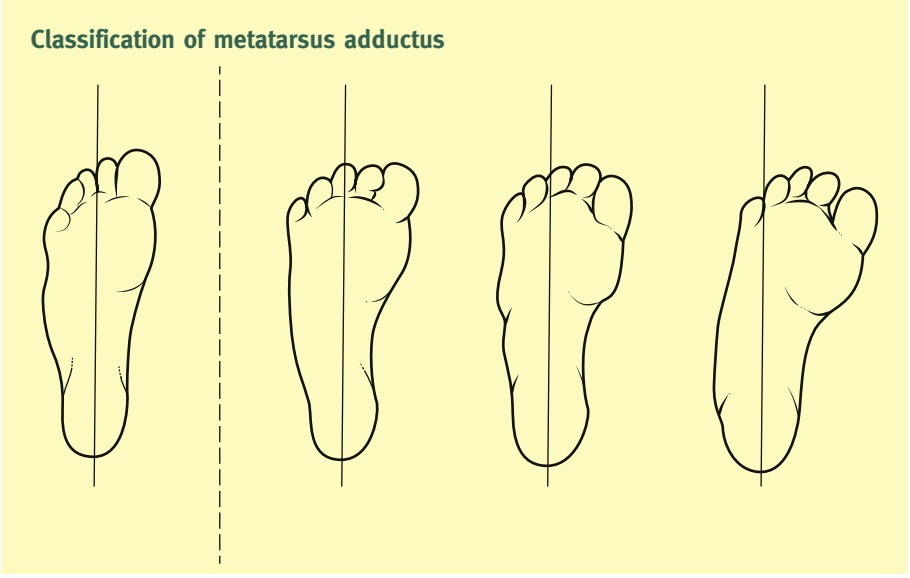

Figure 2 Schematic diagram of the severity of metatarsus adductus. Adapted from Bleck. Metatarsus adductus: classification and relationship to outcomes of treatment. *J Pediat Orthopaedics*. 1983; **3**: 2–9.