

CONGENITAL FLAT FOOT : DIFFERENT CLINICAL FORMS

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Using standard lateral x rays of 32 congenital flat feet (CFF) treated in our institutions, we studied the alignment in the sagittal plane of the tarsal and metatarsal bones. All feet presented with a complete dislocation of the talonavicular joint and a vertical talus. In some cases, however, the alignment of the calcaneocuboid joint was abnormal. In these, both the talus and the calcaneus appeared verticalized with no apparent subtalar joint subluxation (type I). Other cases, by contrast, had a normally aligned calcaneus thus implying subluxation of the subtalar joint (type II). Between the two types, a spectrum of clinical forms combining features from both categories exists. Recognition of the different varieties of CFF is of importance when planning surgery. Type I CFF requires reduction and stabilization of the whole midtarsal joint, while in type II CFF attention must be given to both the subtalar and calcaneocuboid joints.

Keywords : congenital flat foot ; vertical talus ; convex pes valgus.

Mots-clés : pied plat congénital ; astragale vertical ; pied plat convexe.

INTRODUCTION

Since first described by Henken (7), congenital flat foot (CFF), also known as congenital vertical talus or congenital pex convex, has received considerable attention from anatomopathological (Patterson, Fitz and Smith (12) ; Drennan and Sharrard (1) ; Rombouts *et al.* (14) ; Seringe *et al.* (16)), clinical (Lamy and Weissman (9) ; Lloyd-Roberts and Spence (10) ; Herndon and Heyman (8) ; Eyre-Brook (3) ; Hamanishi (5)), and therapeutic perspectives (Osmond-Clarke (11) ; Harrold (6) ; Fitton and Nevelös (4) ; Viladot, Viladot and

Ubierna (18) ; Walker, Ghali and Silk (19) ; Seimon (15)).

Despite contributions by Coleman (2) and Rigault (13) in which different clinical forms of CFF are recognized, most of the published series still approach these patients as a single anatomopathological entity (Osmond-Clarke (11) ; Fitton and Nevelös (4) ; Seimon (15)). It is generally accepted that the most important feature in the CFF deformity is a dislocation of the talonavicular joint, with the talus presenting an abnormal verticality, and the subtalar joint being subluxed (Herndon and Heyman (8) ; Eyre-Brook (3)). Some authors, however, believe that the subtalar joint subluxation is not a consistent feature of CFF, but a dislocation or subluxation of both the talonavicular and calcaneocuboid joints (Silk and Wainwright (17) ; Seringe *et al.* (16)).

This study was undertaken to demonstrate that there are in fact different clinical forms of CFF, each having its own features, thus requiring specific treatment modalities.

PATIENTS AND METHODS

The records of 32 cases of CFF (23 patients ; 16 male, 7 female ; 9 bilateral) treated in our institutions were reviewed. At the time of diagnosis the patients

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were an average of 9.8 years old, ranging from 5 months to 32 years. Associated conditions were : arthrogyposis in two patients ; sacral meningocele in two ; and chromosomal aberration (Down syndrome) in one. The remaining 18 patients had no other detectable abnormalities. Referral patients having had previous surgery were not considered in this study.

All patients presented a congenital foot deformity characterized radiologically by a complete loss of a normal relationship between the talus and the navicular bones. Patients with a partial subluxation of the talonavicular joint were not included in this series. Standard lateral projections of both feet at approximately zero degrees plantar flexion and neutral forefoot supination were obtained and utilized in this study. To study the relationship between the talus, the calcaneus, and the metatarsals, three angles between four axes were defined :

1. *First metatarsotalar angle (I-T)* : Formed by the prolongation of the longitudinal axis of the first metatarsal and the long axis of the talus, this angle is an expression of the vertical alignment of the medial longitudinal arch of the foot, and in normal feet ranges from 0° to -10° (plantar concavity).

2. *Fifth metatarsocalcaneal angle (V-C)* : The angle between the prolongation of the longitudinal axis of the fifth metatarsal and the long axis of the calcaneus, represents the vertical alignment of the lateral longitudinal arch of the foot. In normal subjects this angle ranges from -5° to -15° (plantar concavity).

3. *Talocalcaneal angle (T-C)* : Formed by the long axis of both the calcaneus and the talus, it represents the alignment in the sagittal plane of the subtalar joint. In normal subjects the T-C angle ranges from 20° to 30°.

The relationships between the different angles were studied by linear regression analysis. Correlations were considered significant at a p value of less than 0.05.

RESULTS

Because of the verticalization of the talus, all patients in this series were found to have an I-T angle consistently increased by an average of 52°, ranging from 35° to 84°. No relationship could be established between this and the other two angles analyzed.

There was a strong inverse correlation between the T-C and V-C angles (correlation coefficient $R = -0.001$) (fig. 1). Patients with an abnormally

increased V-C angle had an almost normal T-C angle. By contrast, patients with an almost normal V-C angle presented an increased T-C angle.

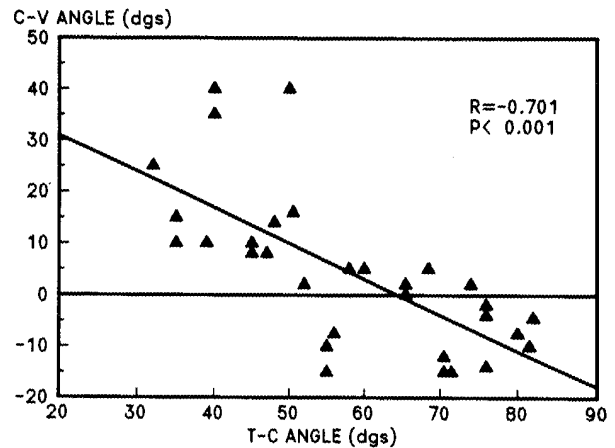


Fig. 1. — Correlation between initial values of the fifth metatarsocalcaneal (C-V) angle and talocalcaneal (T-C) angle. The solid line is given by the equation $X = 61.1 - 0.7 Y$.

The two extremes of this correlation defined two groups of patients : type I, where there was a normal subtalar joint while the whole hindfoot showed an abnormal vertical position (fig. 2) ; and type II, where the calcaneus remained almost normally aligned with respect to the fifth metatarsal and only the talus exhibited an abnormal vertical disposition (fig. 3).

As expected, between the two extremes, a spectrum of clinical forms combining features from both types of deformity was found. By arbitrarily taking + 5° of the V-C angle as a guideline to separate the two groups, 12 feet of this series were considered CFF type I, and 20 feet CFF type II.

DISCUSSION

Only limited conclusions can be drawn from such a study. The use of only planar x rays and standard goniometric techniques to analyze complex 3-dimensional deformities has obvious limitations. Despite these limitations, however, the fact that there are two different radiological types of CFF seems to be reasonably proven. One type can be defined as “congenital vertical talus”, a



Fig. 2. — Idiopathic type I congenital flat foot. Initial lateral x rays showed both the calcaneus and the talus in an abnormal vertical position (first metatarsotalar angle : 70° fifth metatarsocalcaneal angle : 40° , while the subtalar joint maintains an almost normal relationship (talocalcaneal angle : 40°), confirmed by arthrographic exploration.

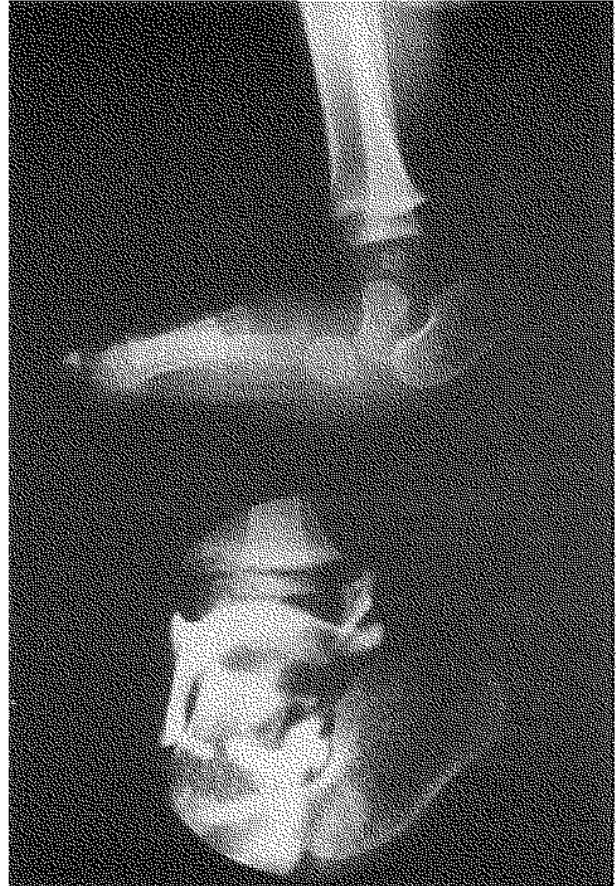


Fig. 3. — A case of an idiopathic type II congenital flat foot. Radiographs and arthrography demonstrate a normal arrangement of the calcaneocuboid joint (fifth metatarsocalcaneal angle : 2°), and a vertical talus with dislocation of both the talonavicular and subtalar joints (talocalcaneal angle : 53°).

deformity implying complete dissociation of the talo-navicular and also the subtalar joint. Another essentially different type of CFF we could define as “congenital vertical hindfoot”, where both the talus and calcaneus bones are abnormally equinized, thereby giving a complete dissociation of both the talonavicular and calcaneo-cuboid joint.

Seringe *et al.* (16), based on dissections of two CFF of a newborn and on their own clinical experience, claimed that the subtalar joint was very seldom affected in these deformities, and that the sometimes important increase in the talocalcaneal angle could be explained by the incidence itself. After reviewing our cases, however, we

certainly disagree with their opinions. Indeed there are cases where the pre-eminence of the transverse dislocation of the tarsus is unquestionable. However, there are also cases in our experience and in that of others (Osmond-Clarke(11); Lloyd-Roberts and Spence (10); Herndon and Heyman (8); Seimon (15)), where both a completely normally aligned calcaneocuboid joint coexists with an obvious subluxed subtalar joint (fig. 3).

It is possible to relate the etiological origin of the deformity to each clinical presentation. In the congenital vertical hindfoot (type I), there may be a retraction of the achilles tendon, which could maintain the hindfoot in its vertical position with

a dislocation of talonavicular and calcaneocuboid joint. On the other hand, in the congenital vertical talus (type II), a paralytic component causing total subtalar joint luxation probably predominates.

Although originally suggested by Coleman, Stelling and Jarret (2) the classification of CFF into two categories has not been adequately emphasized. We strongly believe that it is clinically relevant and very useful when planning surgery for these patients.

In type I CFF (congenital vertical hindfoot), the subtalar joint does not need to be reduced because it is only minimally altered. Efforts in these cases must concentrate on reducing the entire hindfoot from its vertical position. To do this we need to lengthen the achilles tendon and to align the navicular in front of the head of the talus. A temporary stabilization with a Kirschner wire can also be useful.

By contrast, there is no point in reducing the calcaneocuboid joint in type II CFF. These cases need a different approach to solve both the obvious talonavicular luxation and the subtalar dissociation.

We detach the posterior tibial tendon from its insertion in the navicular bone keeping a periosteal flap. With this maneuver we can see the head of the talus and we can reduce the talonavicular luxation. This reduction may be difficult in some cases owing to the excessive length of the talus bone. Among the different published technical solutions to this problem, we favor a partial resection of the head of the talus. Once the reduction is accomplished, a temporary stabilization with a Kirschner wire is advised. The procedure is finished with the repositioning of the posterior tibial tendon flap. In all cases plaster cast is maintained for 8 weeks followed by rehabilitation. Ordinary high-top shoes should be used for walking for 2 to 3 years.

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SAMENVATTING

J. M. SALO, A. VILADOT, M. GARCIA-ELIAS, J. M. SANCHEZ-FREIJO en R. VILADOT. Congenitale platvoet: klinische types.

De auteurs hebben 32 gevallen van congenitale platvoet, met verticale talus, bestudeerd.

De röntgenbeelden toonden in al deze voeten een volledige vertikaliserende van de talus, met dorsale luxatie van het os naviculare tarsi. In sommige gevallen echter was er

een calcaneo-cuboïdale luxatie, met vertikaliseratie van de calcaneus en apparente congruentie van het subtalair gewricht (type 1).

In andere gevallen bevond de calcaneus zich in normale stand, reden van de vertikaliseratie van de talus, met luxatie van het subtalair gewricht (type 2).

Tussen deze 2 extreme beelden bestaat er een waaier van klinische vormen.

De auteurs zijn van oordeel dat de kennis van deze klinische types van groot belang is bij de planificatie van een heelkundige behandeling: in type 1 moet er een repositie en een stabilisatie van het medio-tarsaal gewricht gebeuren, wanneer in type 2 eerst het subtalair gewricht wordt gereponeerd.

RÉSUMÉ

J. M. SALO, A. VILADOT, M. GARCIA-ELIAS, J. M. SANCHEZ-FREIJO et R. VILADOT. Pied plat congénital. Formes cliniques.

Les auteurs ont eu l'occasion d'étudier trente-deux cas de pied plat congénital, avec verticalisation de l'astragale.

L'étude radiologique a montré dans tous les pieds une verticalisation complète de l'astragale accompagnée d'une luxation dorsale du scaphoïde. Dans certains cas cependant, on constate l'existence d'une luxation calcanéocuboïdienne avec verticalisation du calcanéum et apparente congruence de l'articulation sous-astragalienne (type I).

Dans d'autres cas, le calcanéum se trouve en position normale, raison pour laquelle la verticalisation de l'astragale comporte une luxation sous-astragalienne complète (type II).

Entre ces deux extrêmes, il existe un éventail de formes cliniques.

Les auteurs estiment que la connaissance de ces formes cliniques a une grande importance pour la planification du traitement chirurgical: le type I nécessitera une réduction et une stabilisation médio-tarsienne, alors que dans le type II il faudra avant tout réduire l'articulation sous-astragalienne.