Acta Orthopaedica et Traumatologica Turcica xxx (2017) 1–5

Contents lists available at ScienceDirect

Acta Orthopaedica et Traumatologica Turcica

journal homepage: https://www.elsevier.com/locate/aott

The ultrasonography evaluation of talar dysplasia as a potential prognostic factor for predicting the course and outcomes of clubfoot deformity treatment using Ponseti technique

Jiří Jochymek*, Jakub Turek

Department of Paediatric Surgery, Orthopaedics and Traumatology (DPSOT) of the Children's Medical Centre (CMC), Faculty Hospital in Brno, Medical Faculty of the Masaryk University in Brno, Brno, Czech Republic

ARTICLE INFO

Article history:
Received 18 July 2016
Received in revised form
15 May 2017
Accepted 24 November 2017
Available online xxx

Keywords:
Ultrasonography
Clubfoot
Achilles tendon
Ponseti method
Tarsal bone
Talar dysplasia

ABSTRACT

Objective: The aim of this study was to assess the role of sonographic evaluation of Talar dysplasia in predicting the outcome of standard Ponseti method in the treatment of clubfoot deformity.
Methods: A total 23 children (15 boys and 8 girls; mean age: 18.2 ± 5.4 days (8–32)) who underwent Ponseti treatment were included in the study. Before the treatment, maximal talus length of affected and non-affected feet were measured by US and relative talar dysplasia ratio (RTDR) was calculated. The patients were categorized 2 groups according to RTDR: group A – mild and group B – severe deformity. Pirani score was used for clinical evaluation. The groups were compared in terms of number of the applied casts, need of percutaneous tenotomy of Achilles tendon (AchT) and frequency of deformity recurrence.
Results: Pirani score was 4.46 for population (4.33 for group A; 4.54 for group B). Number of casts significantly differed between groups ($p < 0.001$) and positive correlation was found ($r = 0.851$, $p < 0.001$). AchT was performed in 56% cases for group A and in 86% cases for group B; no statistically significant difference was obtained ($p = 0.162$). Recurrence occurred in 2 patients belonging to group B without significant difference compared to group A ($p = 0.502$).
Conclusion: Talar dysplasia assessment appeared as a promising prognostic factor for predicting the outcome of the Ponseti technique in treatment of clubfoot deformity. Level of evidence: Level IV, diagnostic study

Introduction

Pes equinovarus congenitus (PEC, clubfoot, talipes) is the most frequent congenital structural defect of the feet with an incidence of 1–2/1000 among newborns.[1] It has already been more than 15 years since conservative Ponseti technique became a gold standard treatment method[2] with effectiveness estimated to approximately 90%.[3–5] Nevertheless, the clinical follow-ups showed that not every clubfoot deformity responds to this method in a similar way; there is a different degree of resistance to the treatment and many seemingly cured deformities have the tendency to reoccur. Up to date, there is no method which could predict when the affected feet will be responding worse to Ponseti plaster casting, eventually when the possible recurrence should be taken into account.

Nowadays, certain predictions and assessments could be stated based on the clinical examination of the feet before and during treatment. Although there are sophisticated scoring systems commonly used, especially the ones described by Dimeglio[6] and Pirani,[7] they represent a clinical evaluation based on the subjective assessment, which could be accompanied with a risk of possible examiners' errors or a bigger interobserver variability. Moreover, there has not been accepted unified opinion concerning clear correlation between clinical examination prior to treatment obtained by scoring systems and the outcomes of the treatment in published papers.[8,9]

* Corresponding author. Department of Paediatric Surgery, Orthopaedics and Traumatology (DPSOT), Faculty Hospital in Brno, Jihlavská 20, 625 00 Brno, Czech Republic. Tel.: +420 532 23 1111.
E-mail address: jochymek@fnbrno.cz (J. Jochymek).
Peer review under responsibility of Turkish Association of Orthopaedics and Traumatology.

https://doi.org/10.1016/j.aott.2017.11.007

One of the possibilities how to objectively assess certain parameters of the deformity is a radiographic examination. Considering age of the patients when the treatment is initiated, we face the problem of incomplete ossification of the feet bones and the eccentric placement of ossification centres that usually appear later compared to the foot without deformity.[10,11] Furthermore, a radiation dose in repeated radiographic examinations in children must be taken into account. The same situation occurs when considering CT examination, which, additionally, needs to be performed under general anesthesia in newborn patients. Although magnetic resonance imaging (MRI) is not burdened by the radiation dose, there is also the necessity of general anesthesia in regard to obtain the images of satisfactory quality. Additionally, the cost of this examination plays an important role as well.

Considering limitations of the different modalities mentioned above, the ultrasound (US) imaging of children feet appears to be perspective and optimal. It is widely available, even in routine orthopaedic clinics, relatively simple after training, easily reproducible and inexpensive. The recent literature already described US examination for clubfoot deformity.[12–15] The authors often described extensive evaluation and measurements of complex parameters of deformity, which are not suitable for a daily routine orthopaedic practice. Furthermore, the US examination is often performed by radiologist and orthopaedists evaluate the deformity only in a clinical way and take care of the treatment. Yet, even these findings in most cases do not clarify the issue of US parameters of clubfoot deformity that would be suitable for the possible prediction of a course and outcomes of the treatment. Moreover, some findings appeared very often contradictory.

Thus, when searching for a suitable parameter which could be easily examined by a clinician, we worked on the presumption that tarsal bones dysplasia is accompanied with clubfoot deformity. In this respect, the most affected bone is talus[16] as it is suggested by the term of the deformity - talipes equinovarus. Therefore, we focused on US examination of talus and we tried to find relationships between the talar dysplasia and (1) number of casts required for deformity correction, (2) necessity of percutaneous tenotomy of Achilles tendon (AchT) and (3) the possibility of the recurrence of the deformity. These 3 criteria were set as indicators of successfulness of the course and treatment of PEC deformity.

Materials and methods

Between January 2014 and March 2015, 23 patients (15 boys and 8 girls) with unilateral PEC deformity treated with Ponseti method in our institution were included in the prospective study. All children were treated and followed by one orthopaedic surgeon from the institution (JJ). Only children with idiopathic and unilateral deformity were enrolled in the study in regard to directly compare affected feet and their dimensions with the healthy feet without clubfoot deformity. The children with different aetiology of the deformity were excluded. None of the children was treated in a different institution prior to inclusion in our study.

Parents of all included children were fully informed and signed informed consent drawn from the authorities of our hospital and formally agreed to participate in the prospective study. Parents could have left the study anytime voluntarily without any consequences but this situation didn't occur.

Clinical evaluation

Patients were clinically examined and categorized based on the Pirani scoring system which represents clinically effective tool to assess each of the components of the deformity[7] prior to treatment. The six components were divided into three ones related to the hindfoot (severity of the posterior crease, emptiness of the heel and rigidity of the equinus), and the rest of them were related to the midfoot (curvature of the lateral border of the foot, severity of the medial crease and position of the lateral part of the head of the talus). Each of the components was scored as follows: 0 – no abnormality; 0,5 – mild abnormality and 1 – severe abnormality. Thus, total score could range from 0 up to 6 and Pirani score of 6 represented clinically the most severe form of clubfoot abnormality.

Ultrasound measurements

All ultrasound measurements were obtained by US machine Aloka Prosound 2 (Aloka Holding Europe, Steinhausertrasse, Switzerland) or Mindray (Shenzhen, China) DP-50 using 7,5 MHz linear probes. The examination was performed by one orthopaedic surgeon experienced in US imaging and intraobserver variability was calculated.

From all different projections already presented in literature, the dorsal projection described by Aurel et al[18] for measurement of maximal talar length was applied. Using this projection, the probe has to be placed in the sagittal position on the dorsum of the examined foot following the direction of the talar axis. For examination of the feet with PEC, the probe should be placed more laterally in order to capture the talar axis properly. Images were recorded in the habitual position of the affected foot as well as in the position when the foot was held in maximal correction.

The healthy foot was assessed first in regard to keep children calm for further measurements. The talar length was measured in millimetres (mm) (Fig. 1). The ratio of the maximal talar length of

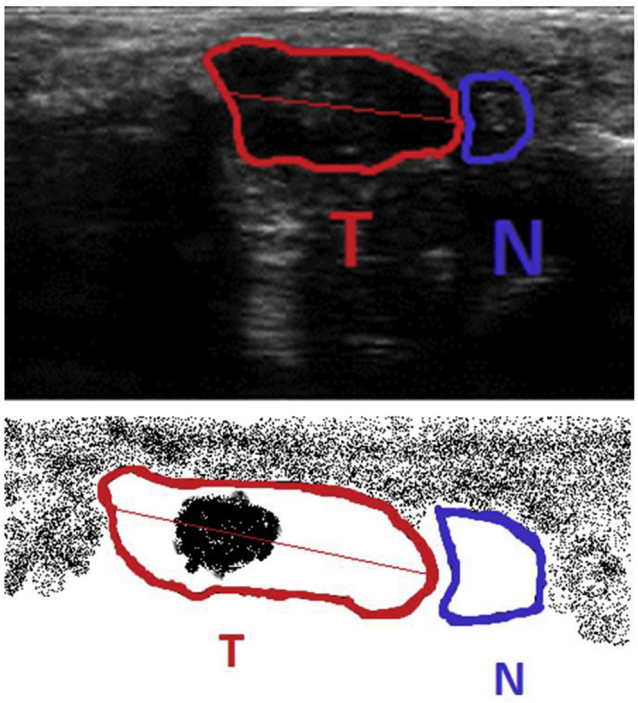

Fig. 1. Schematic demonstration of the ultrasonography examination and measurements when the dorsal projection is used (T – talus, N – navicular bone).

Please cite this article in press as: Jochymek J, Turek J, The ultrasonography evaluation of talar dysplasia as a potential prognostic factor for predicting the course and outcomes of clubfoot deformity treatment using Ponseti technique, Acta Orthop Traumatol Turc (2017), https://doi.org/10.1016/j.aott.2017.11.007