

The Role of Paediatrician in Successful Treatment of Congenital Clubfoot with Ponseti Method

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Abstract: *The congenital clubfoot (CCF) treatment is continuously a subject of observations and examinations by many orthopaedic surgeons around the world, mainly because of the large number of failures even today, despite the high level of modern medicine. After mainly surgical treatment approaches, prevailing to about 30 years ago, now comes the time of conservative methods, such as the Ponseti method. Ponseti introduced the conservative approach with plaster casts and subsequent device treatment. Thus, the treatment performed according to his protocol, achieves a total success of 75% only with plaster casts and devices, and with additional surgical minor invasive corrections applied in patients with initial recurrence the treatment success reaches 95% of excellent results. Regardless of the exact postulates which are strictly fulfilled, certain failures, although rare, are developed. The paediatrician is the specialist, who takes care of the child, of its congenital and acquired health problems. It is exactly the paediatrician's assistance in applying the Ponseti method at the CCF treatment, which would increase even more the success in permanent correction of this foot deformity.*

Keywords: Clubfoot, Ponseti treatment, Talipes equinovarus treatment

1. Introduction

CCF is one of the most frequent congenital deformity of musculoskeletal system, which is described as adduction of anterior foot, supination and equinus of the rare foot. Historically, the treatment (in the beginning of 20 century) is documented as mainly achieved by surgical manipulations (5, 10, 12, 15, 15, 16, 26). Even then, the documented results present many unsuccessful results and bad functional results.

During the last decades of the century the Ponseti method was created, based on the theoretical and practical experiences, not only of the author, but of many of his followers (Ponseti 1996). The success of this method is in the exact following of the individual treatment steps performed by a qualified orthopaedist, but also in the important early beginning of the treatment (within 2 weeks after baby's birth) and in adequate continued use of feet device for more than 2 years. Here exactly lies the key role

of the paediatrician, who first determines the equinovarus foot, monitors actively the child and looks for the correct administration of the device treatment.

2. Congenital Clubfoot

The equinovarus foot incidence is 1 of every 1000 deliveries, with prevalence of 2:1 for male to female babies. Both feet are affected in 50% of cases (1, 2, 4). Population variations are determined in frequency, whereas in Caucasian race, including the Bulgarian population, there are 1 to 3 cases in every 1000 children born alive¹.

The equinovarus foot is determined as a congenital deformation, described as a complex disturbed foot position, including soft tissues and bone structures (7, 10). The posterior foot is in equinus and varus (equinovarus), while the mid- and forefoot are in cavus and adduction (Figure 1).



Figure 1: Bilateral equinovarus feet

The equinovarus foot aetiology is still unclear, whereas there are several theories related to internal and external factors. Their main purpose is to determine the reason for development of this deformity. These reasons include: the intrauterine foetus position and increasing intrauterine compression (3, 7, 13, 14, 16); defect in foetus development; viral infections; deficit in blood supply; muscular disorders

; neurology disorders; defect in bone structures development; genetic defect (1, 2, 9, 10, 19, 20, 21, 22, 25).

Presence of fibrous tissue in muscles, fascias, tendons and ligaments posteromedially to the ankle and in the posterior foot segment support the hypothesis for primary nervomuscular deficit, which leads to bone changes (19).

Volume 6 Issue 3, March 2017

www.ijsr.net

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Cytocontractile proteins and myofibroblasts identified in the equinovarus foot are structurally similar to those at palmar fibromatosis and express high levels of type III collagen and some growth factors compared to the non-contractile tissues(8,12). Shortening, fibrosis and retraction of muscles and ligaments is genetically induced, which is related both with primary equinovarus foot and with recurrences observed

after an adequate treatment. In summary, most of the theories regarding idiopathic equinovarus foot aetiology are in contradiction to each other, but they all agree that changes are a consequence of connective tissue defects and not a result of foetal development termination (Figure 2).

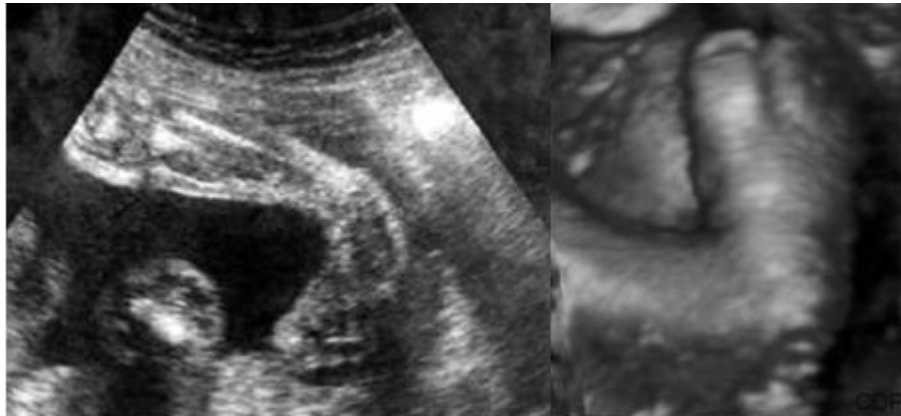


Figure 2: A. Ankle joint deviation of a 21-week old embryo. B. Equinovarus foot with a 3D reconstruction

3. Treatment with Ponseti Method

After a thorough study of the equinovarus foot pathology and results of treatment, Ponseti has developed his own method of treatment, which consists of subsequent plaster casts ending with Achillotenotomy, followed by hypercorrection, supported by an abduction splint. Because of its excellent functional results, the Ponseti method gradually replaced the other surgical and conservative methods of equinovarus treatment. This method could be used not only in idiopathic equinovarus feet but also at equinovarus feet following arthrogryposis, myelomeningocele, complex (atypical) and resistant feet, recurrent cases, as well as at older children with late beginning of treatment(6, 23, 24).

adduction and varus are corrected within the next three or four plaster casts with an opposite pressure over the talus head, with anterior foot segment in abduction and supination. The third deformity is equinism (plantar flexion of the foot), which correction, according to Ponseti, could be successfully performed by achillotomy (in 85% of the cases) (Figure 4).

The correction is achieved by gradual changes of shortened and altered foot elements, which are very elastic in the growing child. Not only remodelling of ligaments, tendons and interosseus ligaments occur, but also bone remodelling because of mechanical stimulation. The treatment per Ponseti method should start in the first days after baby's birth, whereas plaster casts should be changed on every 5 to 7 days. The cast should reach the middle of the thigh, whereas knee joint should be in 60° - 90° of flexion. Firstly, the cavus is corrected by anterior foot supination. The



Figure 3: A plaster cast of a 7-day old child.



Figure 4: Limited dorsal flexion and a line above the heel (A) requiring a percutaneous achillotomy (B)

After performing of this minor surgery, the treatment continues again with the final plaster cast for 20 days. Right after that, the device treatment stage starts and continues at least to the second year. During the first 12 months, the device should be carried 24 hours a day, and when the child begins to walk (after the 12th month of age) - only when the child sleeps (Figure 5).



It turns out, and it is evidenced in many studies, that the unsatisfactory final results after Ponseti treatment, or early recurrence, are due exactly to the incorrect or impermanent use of the device.



Figure 5: A Denis - Broune device for a long-time support of feet abduction

The important paediatrician's role in treatment of equinovarus foot could be determined in several aspects (22, 23, 24):

- Early treatment beginning is determined as a crucial factor for the faster and more successful treatment performance. The best would be to start the treatment on the 10-14 day after delivery. Usually, without the intervention of a paediatrician, who is the first one to see the newborn, treatment begins significantly later.
- Knowing the disease and its features, as well as collaboration between a paediatrician and a hospital with an experience in CCF treatment is crucial for the correct directing of the child for treatment.
- Changes of plaster casts on a weekly basis could be accompanied by some troubles - tightening with possible circulatory disturbances (purple or white toes), which the paediatrician could notice and react by sending the child urgently to the respective orthopaedy centre for a plaster cast correction, or the paediatrician could remove the plaster cast by himself with the available instruments. If this happens, the next day the child should visit the specialist again and the specialist will restart plaster cast treatment.
- It is possible the plaster cast to be wetted when taking a bath or to be broken, which the paediatrician could determine and could send the child for a correction at the specialist.
- It is possible the plaster cast to slip off, especially when, for various reasons, it is not correctly shaped or is too wadded with cotton. In this case the patient again should be sent for a plaster cast replacement.

The last part of treatment according the Ponseti treatment is the abduction foot device period. The paediatrician could look to the correct use of the device according to the instructions given; look to the correct shoes size or if the parents have just decided that the device is no longer necessary because its job is done. Thus, the untimely termination of its use shall lead to lose of the achieved correction and to the deformation recurrence. And under such circumstances, the treatment should be started again according to the so called "Late Ponseti"- again with plaster casts, minor operations and so on. Many authors indicate the

adequate device administration as so important factor as is the initial phase of clubfeet plaster cast correction.

4. Discussion

In a study performed by the authors of this review, including treatment and monitoring of 228 equinovarus feet for a period of 10 years, an analysis is performed of the reasons for treatment difficulties. In this group, there were 31 (14%) recurrences after the successful initial treatment. No significant relation was found between the recurrence appearance and some of the following factors:

- Age of inclusion,
- Previous unsuccessful treatments in other hospitals,
- Number of plaster casts required for correction (used as a measure for severity; $p > .05$).

Recurrences are related to incorrect cooperation during the post hospital period of treatment, and namely in the insufficient or incorrect use of the Denis Broune device ($P = .001$). The data collected indicate that 25 (81%) of feet with developed recurrence were of children with the following social pattern:

- Minority - 12,
- Distant areas and "excessive" transport expenses to the health care establishment, where treatment was performed - 5,
- Raising in children's homes - 8.

This inconsistency, on behalf of the parents or guardians, for use of the Denis Broune device for a long post plaster cast period, turns out to have a 17 times higher significance for recurrence development compared to the cases where the device is correctly used ($P = .0001$).

The paediatrician could not solve these difficulties alone, as some of these difficulties are of social and style-of-life pattern and other are because of the parents low intellectual level. But the paediatrician's firm attitude to the parent regarding the necessary treatment, as well as the timely sending of the child to the orthopaedist would be quite useful for better and sooner results. Knowing the disease and

stages of its treatment should be a prerogative not only of the orthopaedist but of the paediatrician as well.

5. Conclusion

The CCF is a disease, whose treatment is an obligation of the orthopaedist, but the collaboration with a paediatrician will increase the success in performed treatment.

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