Treatment of congenital idiopathic talipes equinovarus with the Ponseti method

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Introduction
Congenital idiopathic talipes equinovarus (clubfoot) is a complex deformity that can always be treated conservatively if the right technique is followed. The aim of treatment is to correct its five components so that the patient has a functional, pain-free, plantigrade foot, with good mobility and without calluses, and does not need to wear modified shoes.

Aim of the work
The aim of this study is to present the authors' experience with the Ponseti technique in correcting clubfoot and to stress the importance of percutaneous tenotomy in management.

Patients and methods
We treated 21 feet in 15 patients with clubfoot deformity using the Ponseti technique in Aljedaani Hospital, Ibn Sina College for Medical Science, KSA, and El Hussein University Hospital, Alazhar University, Cairo, Egypt, between August 2006 and August 2009. The severity of the initial clubfoot deformity was classified according to the system of Dimeglio and colleagues. Age at the initiation of the treatment, severity of the initial deformity, total duration of the treatment, the details of tenotomy, Denis-Browne splint, and modified shoes were all studied in relation to the recurrence of the deformity.

Results
The mean number of casts that were applied to achieve correction was six (range 4–9 casts). Tenotomy was performed in 17 feet. In 19 feet, good results were achieved. Two patients developed recurrence of the deformity because of noncompliance of the parents on the use of orthoses.

Conclusion
The Ponseti method is a safe and effective treatment for congenital idiopathic clubfoot and markedly decreases the need for extensive corrective surgery. The percutaneous tenotomy of tendo-Achilles is an important step in the management. Noncompliance with orthotics has widely been reported to be the main factor leading to failure of the technique. The outcome has no relation with the severity of the deformity, but the younger the age, the less the number of casts needed. The total duration of the treatment is about 2 months and we found almost normal range of motion at the average 2-year follow-up. Parents of 13 patients (87%) found the final appearance of the foot acceptable.

Keywords:
congenital idiopathic talipes, equinovarus, Ponseti

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Introduction

Clubfoot is a complex deformity that can always be treated conservatively if the right technique is followed. The deformity has five components: ankle equinus, hindfoot varus, forefoot adduction, and midfoot cavus. The aim of the treatment is to correct all the components of the deformity to achieve a painless, plantigrade, pliable, and cosmetically and functionally acceptable foot within the minimum time duration and with least interruption of the socioeconomical life of the parents and child.

There is almost universal agreement that the initial treatment of clubfoot should be nonoperative irrespective of the severity of the deformity. Historically, the treatment consisted of forceful serial manipulation by correcting all the deformities simultaneously with a fulcrum at the calcaneocuboid joint as described by the Kite [1]. If the deformity does not respond, most surgeons proceed to posteromedial release of soft tissue. Although all of these methods have the potential to be successful when applied correctly, most of the authors have reported a success rate of only 15–50% [1]. A notable exception is the Ponseti method [2], which

involves serial corrective manipulation with the index finger on the medial malleolus, the thumb on the head talus, and no touching of the calcaneous, and a possible percutaneous tendo-Achilles stenotomy.

The method has been reported to have a short-term success rate of almost 90% and long-term results have been equally impressive [2]. Cooper and Dietz [3], in a review of the cases of 45 patients who had been treated by the Ponseti method and followed for a mean of 30 years, found that, with the use of pain and functional limitation as the outcome criteria, 35 patients (78%) had achieved an excellent or a good outcome.

The unsatisfactory results associated with complete soft tissue release at 10–15 years of follow-up [4] and the long-term success reported with the Ponseti method have led to a renewed interest in this method among pediatric orthopedic surgeons.

Despite this interest, success with the Ponseti method when used by other orthopedic surgeons has not been reported until recently [5].

Patients and methods

We treated 21 feet in 15 patients with clubfeet deformities using the Ponseti method of management. All patients with secondary congenital talipes equino-varus were excluded from this study. The severity of the foot deformity was classified according to the grading system of Dimeglio *et al*. [6].

Patient demographic results

A total of 21 feet in 15 patients with clubfoot were treated. 12 patients (80%) had unilateral involvement. Six patients (40%) had bilateral involvement. The average age of the patients at the beginning of treatment was 90 days (range 0–300 days). None of the patients had received any previous treatment, either surgical or conservative.

Three feet had moderate deformity, 11 feet had severe deformity, and seven feet had very severe deformity. The mean number of casts applied to obtain correction was six (range 4–9 casts). In severe deformity, more casts were required to achieve correction. Seventeen of the 21 clubfeet required percutaneous tendo-Achilles tenotomy to correct the residual equinus deformity. The average follow-up was for 2 years (range 1–3 years).

All clubfoot deformities were graded according to Dimeglio *et al.* [6] before and after treatment. Any residual deformities or complications during treatment were recorded. The number of casts required to obtain correction and the need for tenotomy were also recorded. Demographic data including age, sex, and bilateral deformity were determined.

Treatment protocol

The Ponseti technique was used in our study according to the following protocol: treatment is started as soon as possible after referral, preferably shortly after birth, as soon as the skin permits, and consists of gentle manipulation of the foot and the serial application of a long leg plaster cast without the use of anesthesia, as described by Dr Ponseti [4] (Figs 1 and 2a and b).

If residual equinus is observed after the adduction of the foot and the varus deformity of the heel has been corrected, a simple percutaneous tenotomy of the Achilles tendon was performed under local anesthesia. After tenotomy, a cast was applied and left in place for 3 weeks to allow for healing of the tendon (Fig. 3).

An orthosis was used to prevent relapse of the deformity; the brace was fitted on the same day as the last POP cast was removed to prevent relapse and/or recurrence of the deformity.

Well-fitted, open-toed, high-top straight-last shoes attached to a Denis-Browne bar of approximately the length between the child's shoulders were used (Fig. 4).

Figure 1

Schematic presentation of the weekly interval corrective cast.

Figure 2

(a) The first cast at the beginning of correction. (b) Almost complete correction in the cast. (c) After removal of the cast.

Figure 3

Percutaneous tenotomy of the tendo-Achilles with complete correction of the equinus.

The splint maintains the corrected foot in 70° of external rotation to prevent recurrence of the varus deformity of the heel, adduction of the foot, and toeing-in. The ankle should be in dorsiflexion in an attempt to prevent equinus, and this is accomplished by bending the bar with the convexity of the bar distally directed. If the deformity is unilateral, the normal foot is placed in 40° of external rotation. The orthosis is worn full time (23 h/day) for the first 3 months and then at night for 3 years with day-time congenital talipes equino varus shoes to prevent further relapse [2]. The parents were instructed to perform range of motion exercises for the ankle and foot when it was out of the brace. In the exercise, the parent stabilized the leg with one hand while using the other hand to grasp the foot. The lateral border of the foot was then approximated toward the shin of the leg. These exercises were repeated 20 times at each sitting.

The exercises were performed twice a day for the first 3 months (when the brace was applied for 23 h/day) and five times daily for the next 3 years (when the brace was applied for 12 h at night).

After the orthosis was applied, the child was seen on a monthly basis for 3 months and then once every 3 months till the patient was 3 years of age.

Results

The patients were evaluated according to the measurement of the following four parameters [6]:

(1) Equinus in the sagittal plane.
(2) Varus deviation in the frontal plane.
(3) Derotation around the talus of the calcaneo forefoot block.
(4) Adduction of the forefoot on the hindfoot in the horizontal plane.

Figure 4

The baby with a Denis-Browne splint.

The scale includes four additional points for the presence of medial crease, a posterior crease, cavus, and poor calf musculature. From the score, which has a maximum of 20 points, the deformity can be graded as mild (benign), moderate, severe, and very severe (Table 1).

Nineteen feet were treated successfully using the Ponseti method (Figs 5 and 6). These patients achieved complete correction of the deformity with dorsiflexion of the ankle between 15 and 20° and plantar flexion of the ankle between 25 and 35°; 11 patients needed six casts, five patients needed nine casts, three patients needed five casts, and two patients needed four casts to achieve full correction. In the two patients with a poor result, they were very severe; although the deformity was corrected after six casts and tenotomy of the tendo-Achilles, the deformity recurred. The average time from correction to relapse was 2 months. The families of both patients had not complied with the use of orthosis. These two patients were treated again by the Ponseti technique of manipulation and the use of six casts.

Discussion

Although the Ponseti group represented our learning curve with this method, we are very satisfied with the initial results. The major concern in the operative treatment of clubfoot is the functional outcome. Open surgical release often leads to scarring and stiffening of the ankle, with resulting limitation of motion and strength [4]. Dobbs *et al.* [7] studied the disability associated with various clubfoot treatment options. Their results showed that patients who underwent casting only and patients who had additional heel cord lengthening had the least deformity and disability [7]. However,

Table 1 The grading of idiopathic talipes equinovarus according to the Dimeglio *et al.* [6] scoring system

Grades	Type	Score	Reducibility
I	Mild (benign)	<5	>90% soft–soft resolving
II	Moderate	5 to <10	>50% soft–stiff, reducible partly resistant
III	Severe	10 to <15	>50% stiff–soft, resistant, partly reducible
IV	Very severe	15 to <20	>10% stiff–stiff, resistant

Figure 5

(a) A 2-day-old girl with bilateral talipes. (b, c) Complete correction at 30 months of age.

Figure 6

(a) A 2-month-old girl with bilateral talipes. (b, c) Complete correction at 3.5 years of age.

patients who had undergone posterior medial release had reduced ankle plantar-flexion motion and decreased push-off strength. Our patients who were treated with the Ponseti method had much better ankle range of motion, both in dorsiflexion and in plantar flexion [8].

Percutaneous tenotomy performed during the first few months of life has been shown by Cooper and Dietz [3] to be a benign procedure, with no negative long-term effect on muscle strength. Ponseti reported partial relapse in 35% of his patients older than 3 years, metatarsus adductus, which required tibialis anterior tendon transfer [9]. In this study, we did not require tibialis anterior transfer and the relapse was treated by serial casts only. The Ponseti technique has been reported to yield 92–98% success in the treatment of idiopathic clubfoot [10]. We successfully corrected 19 (90.4%) of the 21 clubfoot deformities using the Ponseti method. Two patients developed recurrence of the deformity because of noncompliance with the use of orthotics [11]. This reason has been widely reported to be the main factor causing failure of the technique. Serious bleeding complications have been reported following percutaneous tendo-Achilles tenotomy [12]. However, we did not encounter any complication and found it very helpful for achieving full correction.

The Ponseti method and traditional casting methods involve similar amounts of casting, but the traditional casting method invariably leads to an incomplete correction, necessitating an extensive surgical procedure with the possibility of foot stiffness.

Conclusion

From this study of 21 feet, Ponseti serial corrective cast management is an easy, effective, and economical method of clubfoot correction when applied in idiopathic clubfoot. The result of the method is excellent when applied within a golden period of congenital talipes equino varus, that is, in the initial 3 weeks of the newborn. Radiological correction of the deformity has no relationship with the functional outcome of the result; thus, radiograph is not essential. Tenotomy of the tendo-Achilles is an important step in the Ponseti technique to correct residual equinus deformity of the ankle.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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