



Management of Idiopathic Clubfoot by Ponseti Technique in Children Presenting After One Year of Age



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ABSTRACT

We conducted a study to determine the effectiveness of the Ponseti technique in the management of idiopathic congenital clubfoot in patients older than 1 year of age. A total of 19 patients with 28 clubfeet (16 males [84.2%], 3 females [15.8%]) were included in the present study. The mean age at presentation was 2.7 (range 1 to 3.5) years. The results of treatment using the Ponseti technique were evaluated using the Pirani and Dimeglio scoring systems. The mean precorrection total Pirani score was 4.84 (range 3.5 to 5.5) and the mean postcorrection Dimeglio score was 12.96 (range 10 to 14). The mean postcorrection total Pirani score was 0.55 (range 0 to 1), and the mean postcorrection Dimeglio score was 2.32 (range 2 to 3). These differences were statistically significant ($p < .001$ and $p < .001$, respectively). In 92.8% of the feet, satisfactory correction of the deformity was achieved. The mean number of casts applied was 8 (range 5 to 12). All but 1 (3.6%) of the clubfeet required tenotomy to achieve correction. The mean follow-up duration was 2.7 (range 1.5 to 3.5) years. We have concluded that the Ponseti technique is an effective method for the management of idiopathic congenital clubfoot, even in toddlers.

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Idiopathic clubfoot is one of the most common congenital abnormalities affecting the lower limbs. The deformity consists of equinus at the ankle, hindfoot varus, forefoot adductus, and cavus. It remains a challenge, not only to understand its genetic origins, but also to provide effective long-term treatment to achieve a functional, painless, mobile, and plantigrade foot. Most surgeons agree that the initial treatment of congenital clubfoot should be nonoperative. Initially, the Ponseti method was used only for idiopathic clubfoot in infancy; however, it has now been used successfully in stiff clubfeet associated with arthrogryposis (1), myelomeningocele, and, even, in older children with neglected clubfoot (2,3). The Ponseti method of clubfoot casting has been shown to be effective even in the treatment of neglected clubfoot in children up to 9 years old (2,4).

The neglected clubfoot deformity is prevalent in poorer, developing countries owing to the lack of awareness, and nonavailability, of appropriate medical facilities. Thus, treatment is either not initiated or incompletely performed, and the affected children often undergo extensive surgeries to correct the deformities, resulting in a stiff and painful foot. To our knowledge, very few published data are available showing satisfactory results with the use of the Ponseti method in older children. Therefore, we conducted a prospective study to evaluate the results of the Ponseti method in the management of idiopathic clubfoot in children older than 1 year of age.

Patients and Methods

The present study was conducted from January 2010 to December 2011 after approval by the institutional review board. A total of 19 patients older than 1 year of age with 28 clubfeet were treated for idiopathic congenital talipes equinovarus in the pediatric orthopedic clinic at our hospital (Table 1). Of the 19 patients, 16 were male (84%) and 3 were female (16%). The mean age at presentation was 2.7 (range 1 to 3.5) years. Patients aged less than

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Table 1
Characteristics of study sample (n = 28 clubfeet in 19 patients)

| Variable | Mean (range) or % |
|-------------|-------------------|
| Age (y) | 2.7 (1 to 3.5) |
| Male gender | 84 |
| Right side | 21 |
| Left side | 32 |
| Bilateral | 47 |

1 year and those with nonidiopathic clubfoot (e.g., neuromuscular disorder or associated with other congenital syndromes) were excluded. A complete examination of the patient, including general, systemic, and local examinations, was performed, and the results were recorded. All the patients were classified according to the Ponseti classification (5):

1. Untreated clubfoot, younger than 2 years old
2. Neglected clubfoot, untreated after 2 years
3. Corrected clubfoot, corrected by Ponseti management
4. Recurrent clubfoot, with supination and equinus having developed after initial satisfactory correction
5. Resistant clubfoot, with stiff deformity seen in association with syndromes such as arthrogyriposis
6. Complex clubfoot, initially treated by a method other than the Ponseti method

Clinical photographs were taken, and all the components of the clubfoot deformity were assessed using the Dimeglio et al (6) and Pirani et al (7) scoring systems. These examinations were performed by 2 of us (M.F., M.A.).

The deformities were treated by manipulation and corrective casting according to the Ponseti method (8), with a few modifications. Before application of each cast, manipulation was performed for 5 minutes twice, with a 1- to 2-minute interval between each round of manipulation. Cavus was corrected by elevating the first metatarsal head and aligning the forefoot with the hindfoot by supinating the forefoot, followed by application of a groin-to-toe cast. Thereafter, gradual correction of adduction and heel varus was performed by abduction of the foot in supination and plantarflexion while maintaining thumb pressure over the lateral aspect of the head of the talus as a fulcrum. The cast was changed weekly, and the equinus deformity was corrected after achieving 50° to 70° of abduction. Percutaneous tenotomy of the Achilles tendon was performed with the patient under local anesthesia if dorsiflexion of <15° was possible. The final cast was applied in full correction for 3 weeks after measurements were made for fabrication of a foot abduction brace. The maximum number of casts was fixed a priori at 12 casts. We maintained the correction in a Steenbeek foot abduction brace 23 hours daily for the first 3 months and then at night only. The brace was an open toe, high-top device with straight medial-side shoes attached to the bar. The bar was of sufficient length to enable the distance between the heels to match the distance between the shoulders. The bar was bent 15°, with the convexity directed away from the child, to hold the feet in dorsiflexion. Foot abduction braces were applied while maintaining the corrected clubfeet in 70° of abduction and 15° of dorsiflexion in bilateral cases. In unilateral cases, the corrected clubfoot was

Table 2
Comparison of pre- and postcorrection scores (n = 28 clubfeet in 19 patients)

| Variable | Pre-correction Score | Postcorrection Score |
|------------------|----------------------|----------------------|
| Pirani score | 4.84 (3.5 to 5.5) | 0.55 (0 to 1) |
| Dimeglio score | 12.96 (10 to 14) | 2.32 (2 to 3) |
| Dorsiflexion (°) | 0 | 16 (13 to 24) |

Data presented as mean (range).

maintained at 70° and the contralateral foot in 45° of abduction, with both feet in 15° of dorsiflexion.

After 12 weeks of bracing, clinical photographs were taken, and the feet were assessed for deformity correction using the Pirani and Dimeglio scores. Additional follow-up of the patients was performed. Recurrence of equinus was treated by repeat tenotomy or open Achilles tendon lengthening. For recurrence of adduction and cavus deformities, repeat casting was performed.

Results

We achieved successful correction that was painless, plantigrade, and functional in 92.8% of the clubfeet using the Ponseti method in patients older than 1 year of age. The mean follow-up period was 2.7 (range 1.5 to 3.5) years. Of the 28 feet, 27 (96.4%) required percutaneous tenotomy to achieve satisfactory correction, and repeat tenotomy was required in 3 feet (10.71%) that had lost correction in the direction of dorsiflexion owing to poor brace compliance. We motivated these patients (their families) to use the brace after the second tenotomy and achieved the desired amount of dorsiflexion through to the final follow-up examination. The mean number of casts required to achieve correction was 8 (range 5 to 12) in our study. The mean Pirani score decreased from a pre-correction value of 4.84 (range 3.5 to 5.5) to a postcorrection score of 0.55 (range 0 to 1). This difference was statistically significant ($p < .001$). The mean pre-correction Dimeglio score in the present study was 12.96 (range 10 to 14, grade 3), and the mean postcorrection Dimeglio score was 2.32 (range 2 to 3, grade 1). This difference was statistically significant ($p < .001$). The mean amount of dorsiflexion after correction was 16° (range 13° to 24°; Table 2). A complication in the form of superficial plaster abrasion developed in 1 of the feet (3.6%) and was treated conservatively by avoiding casting for 1 week. No other complications, such as the development of a rocker-bottom foot, skin necrosis, neurovascular compromise, wound healing problems, excessive bleeding after tenotomy, or gastrocnemius weakness, were observed. However, 3 of the feet (10.7%) required repeat manipulation in the post-tenotomy period to achieve the desired amount of dorsiflexion. This was probably due to poor compliance with the use of abduction bracing. In response to this, we applied 3 more casts to achieve the desired amount of abduction. We then applied the last cast in full correction and obtained the desired amount of dorsiflexion.

Only 2 feet (7.2 %) in our study required minor surgery. An open Achilles tendon lengthening procedure was done in a 1.5-year-old patient (3.6% of the 19 patients) on the left side for recurrence of equinus that could not be corrected by repeat percutaneous Achilles tendon tenotomy, casting, and manipulation. This male patient's right foot had achieved the desired degree of dorsiflexion after the first tenotomy, although recurrence had resulted from a tight Achilles tendon. Tibialis anterior transfer was performed in 1 patient (3.6%), aged 2.5 years, with unilateral idiopathic clubfoot for residual dynamic supination. The dynamic supination had been interfering with gait in this particular patient. None of the patients in the present study required posteromedial (Turco) soft tissue release. Overall, the results we observed showed an excellent response to treatment using the Ponseti method in most of the patients in the present study (Figs. 1 to 6).

Discussion

Congenital clubfoot is the most common congenital problem leading to locomotor disability in children. Approximately 80% of children born with a clubfoot are born in the developing world (9). The incidence of congenital clubfoot is approximately 1 to 2/1000 live births (10). The neglected clubfoot, by definition, is one that has not received any treatment within the first 2 years of life. The neglected

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