Original Article

Result of a Minimum 5-Year Follow-up after Ponseti Serial Casting in Congenital Idiopathic Clubfoot

Chotigavanichaya C, MD[1], Eamsobhana P, MD[1], Ariyawatkul T, MD[1], Wongcharoenwatana J, MD[1], Saelim C, MD[1], Kaewpornsawan K, MD[1]

[1] Department of Orthopaedic Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

Background: Ponseti technique has become a standard treatment for congenital idiopathic clubfoot. Some cases require surgical release to achieve a pain-free, flexible and plantigrade foot.

Objective: To evaluate the result of congenital idiopathic clubfoot with Ponseti serial casting in intermediate-term follow-up.

Materials and Methods: The authors performed a retrospective cohort analysis of congenital idiopathic clubfoot patients who underwent primary treatment by Ponseti serial casting and who were followed-up for at least 5 years between January 2006 and December 2012. Demographic data, age at the beginning of treatment, Functional Rating System (FRS) clubfoot of Laaveg and Ponseti, talocalcaneal angle x-ray, and complication data were collected.

Results: Thirty-three feet from 24 patients (14 males and 10 females) were included, with an average age at beginning of casting treatment of 6.18 weeks (range: 1 to 24). Average follow-up time was 5.94 years (range: 5.07 to 8.35). Mean FRS score was 95.35 (range: 89 to 98). Average talocalcaneal angle of AP and lateral view were 24.89° and 23.46°, respectively. Complications were found in 5 feet and recurrence occurred in 5 feet.

Conclusion: Ponseti serial casting for treatment of congenital idiopathic clubfoot showed satisfactory FRS score at the 5-year follow-up.

Keywords: Congenital idiopathic clubfoot, Complication of clubfoot, Recurrent of clubfoot, Ponseti serial casing

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Congenital idiopathic clubfoot (talipes equinovarus) is a deformity of equinus, hindfoot varus, mid foot cavus and forefoot adduction, that can be successfully treated with Ponseti serial casting technique. The incidence of this disorder is approximately one to six per 1,000 live births depending on race and region[1,2] and it is more common in males[3]. The etiology is still unknown; however, some authors have suggested that this deformity is caused by or related to a genetics[4], fetal development and/or histological abnormalities[3].

The goal of treatment is to obtain a pain-free, flexible, and plantigrade foot. In the past, most cases of congenital idiopathic clubfoot were treated with major surgery, including modified posteromedial release, complete subtalar release, or posterior release at the age of 3 to 12 months to 4 years[5-8]. Some patients may be initially treated with postural casting, with a subsequent waiting period until the patient's foot and weight are appropriately developed so that a major operation can be performed[9]. However, pain, stiffness, and degenerative arthrosis could be found in patients that were followed-up over the long-term[10].

Ponseti technique, which is a recently introduced serial casting method for treating congenital idiopathic clubfoot, has been adopted worldwide[11]. This technique can also be applied to syndromic and neurogenic clubfoot, but the success rates were inferior to those observed in patients with congenital idiopathic clubfoot[12,13]. However, there was no previous literature on intermediate-term result after Ponseti casting evaluating FRS score and radiographic parameters in southeast asia countries.

The objective of the present study was to evaluate the intermediate-term result of treatment of congenital idiopathic clubfoot with Ponseti serial casting at a single institute.

Materials and Methods

After the study protocol was approved by the Institutional Review Board (IRB), we performed a retrospective cohort analysis of children who were diagnosed with congenital idiopathic clubfoot, and who were treated with Ponseti serial casting during 2006 to 2012. All patients were followed-up for at least 5 years. Patients with non-idiopathic clubfoot (e.g., arthrogryposis multiplex congenita),

Correspondence to:
Chotigavanichaya C.
Department of Orthpaedic Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, 2 Wanglang Road, Bangkok Noi, Bangkok 10700, Thailand.
Phone: +66-2-4197968
E-mail: chatuponc@gmail.com

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cerebral palsy, failed previous surgical treatment, recurrent clubfoot, and incomplete medical records were excluded. A retrospective review of medical records was performed. Demographic and clinical data at the beginning of treatment, surgical treatment, complications, and outcomes of treatment were collected, recorded, and analyzed.

Functional Rating System for clubfoot (FRS) was used for assessment at clinical follow-up. The FRS consists of questions that relate to patient satisfaction (maximum 20 points), function (maximum 20 points), and pain (maximum 30 points). The examiner evaluated the foot based on the position of the heel while standing (maximum 10 points), flexibility, such as ankle dorsiflexion, heel varus-valgus, and foot inversion-eversion (maximum 10 points), and gait pattern (maximum 10 points). The total maximum score is 100 points, which reflects the best possible result[14]. We evaluated the FRS score at each follow-up, and all included patients were followed-up for a minimum of 5 years after treatment.

Radiographic analysis was also performed at each follow-up with weightbearing anteroposterior (AP) and lateral radiographs of both feet. Lines were drawn on the AP projection longitudinally through the osseous nucleus of the talus parallel to its medial border, and through the calcaneus parallel to its lateral border to form the AP talocalcaneal angle. In lateral view, lines were drawn longitudinally through the central axis of the talus, and parallel to the lower border of the body of the calcaneus to form the lateral talocalcaneal angle.

The data were analyzed using the Statistical Package for the Social Sciences version 18 for Windows (SPSS Inc., Chicago, IL, USA). Descriptive statistics, including frequencies, percentages, means, ranges, and standard deviations, were used. Statistical significance was defined as a p-value <0.05.

Results

Demographic and clinical data of 33 feet from 24 patients (14 males and 10 females). The mean baseline Pirani score was 5 (range: 2.5 to 6). All cases underwent percutaneous tendoachilles tenotomy under local anesthesia. Cast loosening as a complication of primary treatment was found in 5 feet from 5 patients. Recurrence was found in 5 feet, all of which underwent revision percutaneous tendoachilles tenotomy (Table 1). Two of those 5 feet had history of cast loosening. FRS score and talocalcaneal angle of all feet (excluding 5 surgically revised feet) were shown in Table 2.

Table 1. Demographic data

Characteristics	Mean ± SD (min-max) n (%)
Number of patients	24
Gender	
Male	14 (58.33%)
Female	10 (41.67%)
Number of feet	33
Right	4
Left	11
Bilateral	9
Age of starting cast treatment (week)	6.18±5.08 (1 to 24)
Number of casting	5.68±1.6 (4 to 12)
Age of percutaneous tenotomy (week)	14±5.92 (11 to 30)
Brace time (months)	12.45±5.32
Follow-up time (yrs.)	5.94 (5.07 to 8.35)
Procedure of revision	
Tendo-Achilles tenotomy	3 (9.09%)
Tendo-Achilles tenotomy and TATT	2 (6.06%)
Ponseti serial casting	28 (84.85%)

TATT = Tibialis anterior tendon transfer

Table 2. Functional rating system score (FRS), and talocalcaneous angle

Functional rating system score	Mean ± SD (min-max) (n = 28 feet)
Parent reported outcome	
Satisfaction (best at 20 points)	20
Function (best at 20 points)	19.71±1.04 (16 to 20)
Pain (best at 30 points)	30
Physical examination	
Heel position (best at 10 points)	10
Passive motion (best at 10 points)	5.79±1.37 (3 to 8)
Gait (best at 10 points)	9.86±0.52 (8 to 10)
Total score (best at 100 points)	95.35±2.31 (89 to 98)
AP talocalcaneal angle	24.89±4.83
Lateral talocalcaneal angle	23.46±4.88

Discussion

Functional Rating System (FRS) score in a 5-year follow-up of congenital idiopathic clubfoot treated with Ponseti technique showed a very favorable result in this study. We found an overall complication rate of 15.15% (5 of 33 feet). All of the complications were cast loosening, and all of those complications occurred in patients that were treated during 2006 to 2007. This can likely be attributed to learning curve-related factors that our surgeons encountered when the Ponseti technique was adopted at our center. Many studies reported excellent outcome of Ponseti technique in up to 90% of patients[14,15], and cast-related complication was reported in approximately 5 to 20% of cases[16].

Earlier studies described percutaneous tendoachilles tenotomy during Ponseti technique in 78 to 100% of treated children[14]. However, percutaneous tendoachilles tenotomy was achieved in 100% of cases in the present study. Second surgery success rate in Ponseti technique showed varied results from 0% to more than 23%[17]. In the present study, second tendoachilles tenotomy surgery was performed in 3 feet (9.09%), and 2 of those 3 feet (6.06%) underwent both tendoachilles tenotomy and tibialis anterior tendon transfer. The requirement for these revisions was probably due to brace noncompliance due to the limited availability of a suitable brace, such as a Modified Dennis Brown splint, a Mitchell-Ponseti brace[18], a Markell brace[19], a Steenbeek

Brace[20], a Dobb's dynamic clubfoot bar[21], and a Kessler brace[22]. A low-cost and locally-made brace was used in all cases in this study. This suboptimal alternative may have been uncomfortable to wear, and this may have led to brace noncompliance. However, all patients and families reported being satisfied with their brace, which was applied at least 23 hours/day for the first three months, and then 6 to 8 hours/day at nighttime for at least 9 months. Many authors described an unexpectedly high recurrence rate that ranged from 30 to 45% due to brace noncompliance[18,21-23]. Eamsobhana, et al[24] suggested poor evertor muscle grading as a significant factor in patients with recurrence of idiopathic clubfoot.

Earlier studies evaluated many parameters for the clinical assessment of clubfoot, including Pirani score, Dimeglio score[25], SF-36[26,27], the disease-specific instrument from Roye, et al[28], and FRS[9]. In the present study, the authors used FRS score to evaluate treatment outcome. FRS scoring revealed a very favorable outcome, with a mean score of 95.35±2.31, which is consistent with the result reported by Zwick, et al[9]. Talocalcaneal angle measurement was also within the range described by other authors[14,29,30].

Limitations of this study include its retrospective design, its small sample size, and a wide range of age at the beginning of treatment.

Conclusion

Treating congenital idiopathic clubfoot with Ponseti serial casting showed satisfactory result in 5-year follow-up. Ponseti serial casting technique is still recommended treatment for this disease.

What is already known on this topic?

Ponseti technique has been and continues to be a standard treatment for congenital idiopathic clubfoot.

What this study adds?

Ponseti serial casting was found to be an effective treatment for congenital idiopathic clubfoot with satisfactory FRS score at the 5-year follow-up.

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Potential conflicts of interest

The authors declare no conflict of interest.

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