

Does age and start of Ponseti treatment affect the functional outcome in club foot: A comparative study



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ABSTRACT

Background: Idiopathic clubfoot is one of the most common and complex congenital deformities which are difficult to correct. **Aims and Objectives:** The present study was designed to assess the effectiveness and results of the Ponseti method's early use in the treatment of idiopathic congenital talipes equinovarus (CTEV). **Materials and Methods:** Seventy-six feet in 50 patients of CTEV during the period of May 2019–May 2020 were studied. All the cases were treated by Ponseti technique. Children with idiopathic CTEV and age < 1 year were included in our study. The severity of deformity was graded according to Pirani scoring system both at the beginning and at the end of treatment. **Results:** The mean age at presentation was 2.77 months. The mean initial Pirani score at time of presentation was 4.07, and at last follow-up was 0.13. We observed that 63 feet (82.89%) out of 76 feet required a percutaneous TA tenotomy along with plaster casting to correct the equines deformity. The mean total number of casts required to correct the deformity was 6.4. The mean duration of treatment from 1st plaster cast to cast for equinus correction was 8.4 weeks. About 94% of cases had a good outcome at last follow-up which was evaluated on the basis of Pirani score. The association of duration of treatment (weeks) with age and total number of cast with age has $P=0.002$ which was found to be significant. **Conclusion:** The Ponseti technique is a very safe, efficient, and acceptable economical treatment for the correction of CTEV that gives excellent results on conservative treatment and in most of the cases avoid surgical intervention if protocol followed as prescribed. If the age of the patient is higher at time of presentation, it requires a longer casting period and more number of casts to correct the deformity compared to younger children with the early presentation.

Key words: Ponseti; Idiopathic; CTEV; Casting; Club foot

INTRODUCTION

Idiopathic clubfoot is one of the most common and complex congenital deformity which is difficult to correct.¹ Children with clubfoot walk on the sides and tops of their feet, which causes callus formation, the possibility of skin and bone infections, the inability to wear regular shoes, significant mobility limits, and limited employment options when left untreated.² Patients, their families, and society as a

whole are burdened by neglected clubfoot in terms of their physical, social, psychological, and economic well-being.³ The incidence of idiopathic congenital talipes equinovarus (CTEV) is approximately 1/1000 live births with a male predominance of 2:1 and bilateral in 50% of cases.

The CTEV, also referred to as “club-foot,” is a common congenital orthopedic foot deformity in children characterized by four foot deformities: forefoot adduction,

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midfoot cavus, hindfoot equinus, and hindfoot varus. Therefore, the goal of clubfoot care is to provide a pain-free, supple, plantigrade foot, and an acceptable physical look while minimizing disruption to the socioeconomic lives of the parent and kid.^{4,5}

To stretch tight ligaments using the Ponseti technique, serial long leg casting should be initiated as soon as possible and done once per week for a period of 4–8 weeks. Our study's goal is to assess the effectiveness and results of the Ponseti method's early use in the treatment of idiopathic CTEV.

Aims and objectives

The present study was designed to assess the effectiveness and results of the Ponseti method's early use in the treatment of idiopathic congenital talipes equinovarus (CTEV).

MATERIALS AND METHODS

We studied a total of 76 feet in 50 patients of CTEV during the period of May 2019–May 2020, attended in the Orthopedic Department of Dr. Baba Saheb Ambedkar Medical College and Hospital, New Delhi. The study was pre-approved by the Institutional Ethics Committee (IEC) for the final permission. After obtaining the permission of IEC, the study was conducted. All the cases of the study were treated by Ponseti technique. Parents were educated about the condition, prognosis complications, various methods of management, and more importantly the course of Ponseti technique. Children with idiopathic CTEV and age <1 year were included in our study. The severity of deformity was graded according to Pirani scoring system both at the beginning and at the end of treatment.

The procedure involved weekly serial casting to rectify the deformity and bracing to maintain that correction. Casting got started as soon as possible after delivery, ideally within the 1st week. Pirani scoring was used to evaluate the first severity in each baby. First, the cavus deformity was rectified by elevating the first metatarsal and supinating the forefoot to line it with the hindfoot. For 7 days, a long leg cast (from the toe to the groin) was worn to preserve the correction. If the cavus was not sufficiently corrected at the second appointment, a plaster cast was applied again using the standard accelerated Ponseti approach, and the parents were requested to return after 7 days. After 7 days, the cast was taken off, and the deformity's severity was determined using Pirani scoring. Over the course of the following three to four visits, the foot was serially abducted to effect over correction, and casting was applied as Ponseti suggested. Sometimes more casting would be required. When the midfoot score was <1 but the hindfoot score was still >1, a tenotomy was performed.

Then, by bracing infants in a Dennis Browne splint for 14 h a day for 3 years after the first 3 months, they were moved into the Maintenance phase. During the early phases of bracing, weekly follow-up was conducted to ensure compliance and to occasionally reassure and inform the parents. The patients were observed for a total of 6 months and later monthly follow-up was indicated.

Continuous variables were reported as mean SD and median, whereas categorical variables were presented as number and percentage (%). Kolmogorov–Smirnov test was used to determine the data's normality. Non-parametric test was employed if normality was refused. $P < 0.05$ was considered statistically significant. The data were entered in Microsoft EXCEL spreadsheet and analysis was done using the Statistical Package for the Social Sciences version 21.0.

RESULTS

We studied a total of 76 feet in 50 patients of idiopathic CTEV during the period of May 2019–May 2020. All the subjects of the study were treated by Ponseti technique of manipulation and casting.

The mean age at presentation was 2.77 months, ranging from 0.1 to 10 months. The most common age group at presentation was ≤ 1 months, that is, 26 patients (52.00%), 15 patients (30.00%) were between the age of 1–5 months, and nine patients (18.00%) were more than 5 months and <12 months of age. Thirty patients (60.00%) were male and 20 patients (40.00%) were female. Male-to-female ratio in our study was found out to be 1.5:1. Twenty-four patients (48.00%) had unilateral clubfoot and 26 patients (52.00%) had bilateral clubfoot.

The mean total number of casts required to correct the deformity was 6.4. The mean duration of treatment from 1st plaster cast to cast for equinus correction was 8.4 weeks, ranging from 6 to 12 weeks (Table 1). Sixty-three feet (82.89%) required a percutaneous TA tenotomy to correct the equinus deformity, whereas 13 feet (17.11%) did not require tenotomy.

In our study, the Mean \pm SD initial Pirani score was 4.07 ± 1.32 , the Mean \pm SD Pirani score after last plaster was 0.08 ± 0.18 and at last follow-up at 6 months was 0.13 ± 0.28 . The Mean \pm SD initial Pirani score in the age group of <1 months was 4.11 ± 1.16 , Mean \pm SD Pirani score after last plaster was 0.07 ± 0.18 and at last follow-up at 6 months was 0.14 ± 0.3 . The Mean \pm SD initial Pirani score in the age group of 1–5 months was 4.05 ± 1.56 , Mean \pm SD Pirani score after last plaster was 0.08 ± 0.18 , and at last follow-up at 6 months was 0.08 ± 0.18 . The Mean \pm SD initial Pirani score in the age group of >5 months was 4 ± 1.48 ,

Mean±SD Pirani score after last plaster was 0.11±0.21, and at last follow-up at 6 months was 0.18±0.32.

The association of duration of treatment (weeks) with age and total number of cast with age has P=0.002 which was found to be significant (Figures 1 and 2).

In our study, seven patients (14.00%) had these complications, out of which four patients (8.00%) had plaster sore, and three patients (6.00%) had equinus recurrence.

In our study, functional outcome based on Pirani scoring, overall 47 patients (94%) had good functional outcome. In the age group of <1 month, 24 patients (92.31%) had

a good functional outcome, whereas two patients (7.69%) had a fair functional outcome and no patients had poor functional outcome. In the age group of 1–5 months, 15 patients (100%) had a good functional outcome. In the age group of >5 months, eight patients (88.89%) had a good functional outcome, whereas one patient (11.11%) had a fair functional outcome and no patients had poor functional outcome (Table 2).

DISCUSSION

The etiology of CTEV, also known as clubfoot, has been known since the time of Hippocrates; however, it is still not fully understood. The problem is a complicated, three-dimensional foot deformity made up of four parts: Equinus, varus, adductus, and cavus deformities. It is not just a single foot deformity.

Now, the majority of orthopedic surgeons concur that the first course of care should be non-surgical and initiated as soon as feasible after birth.⁶ Dr. Ignacio Ponseti created a method for treating clubfoot in 1950 that involves casting and serial manipulation. He corrected his foot in 85–90% of the cases, resulting in a plantigrade foot that could function without posteromedial release.⁶ The Ponseti approach has revealed a decreased rate of residual deformity and recurrence.

In our analysis, 26 patients (52.0%) were under 1 month old at the time of presentation, 15 patients (30.00%) were 1–5 months old, and nine patients (18.00%) were over 5 months but under 12 months old. About 48% of babies came to us at a late age, which reflects a poor referral mechanism in the area and parental misinformation. Lehman et al., found a mean of 10.8 weeks (0.5–40 weeks) in a series of 30 patients with a total of 45 clubfeet treated with the Ponseti procedure.⁷ Changulani et al., used the Ponseti technique to treat 66 patients with 100 idiopathic clubfeet. They reported that the mean age at presentation was 12 weeks or 3 months (1–60 weeks).⁶ Abbas assessed the initial outcomes of the Ponseti approach for the treatment of idiopathic CTEV in 100 patients with 156 feet, with an average age of 4.5 months at presentation.⁹

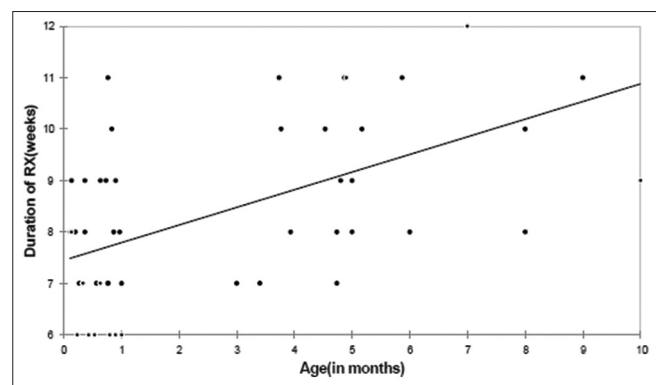


Figure 1: Correlation of age with duration of treatment

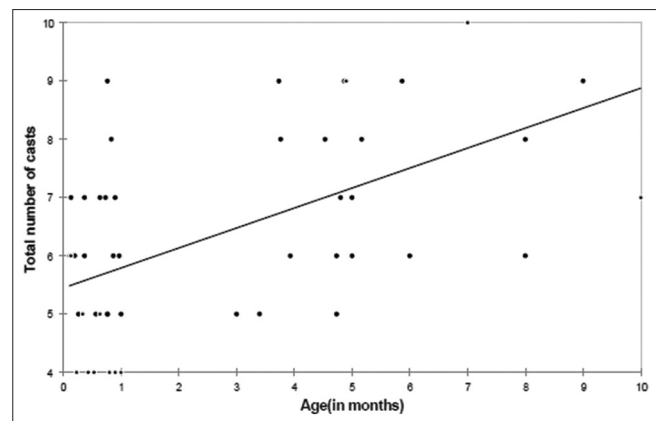


Figure 2: Correlation of age with total number of casts

Table 1: Duration of treatment (weeks) and total number of cast applied in study subjects			
Variable	Mean±SD	Median (interquartile range)	Range
Duration of treatment (weeks)	8.4±1.7	8 (7–9.75)	6–12
Total number of casts	6.4±1.7	6 (5–7.75)	4–10

Table 2: Comparison of results with Pirani score at presentation			
Age (months)	Good (%)	Fair (%)	Poor (%)
<1	24 (92.31)	2 (7.69)	0
1–5	15 (100)	0	0
>5	8 (88.89)	1 (11.11)	0

In our study, the mean initial Pirani score at presentation was 4.07 ± 1.32 which ranged from 2 to 6. We found similar findings in studies conducted by Lehman et al., Changulani et al., Brewster et al., Abbas et al., Halanski et al., Sætersdal et al., and Pavone et al.^{6,7,9,10-13,15}

In our study, the Mean \pm SD initial Pirani score was 4.07 ± 1.32 , the Mean \pm SD Pirani score after last plaster was 0.08 ± 0.18 , and at last follow-up at 6 months was 0.13 ± 0.28 . The Mean \pm SD initial Pirani score in the age group of <1 months was 4.11 ± 1.16 , Mean \pm SD Pirani score after last plaster was 0.07 ± 0.18 , and at last follow-up was 0.14 ± 0.3 . The Mean \pm SD initial Pirani score in the age group of 1–5 months was 4.05 ± 1.56 , Mean \pm SD Pirani score after last plaster was 0.08 ± 0.18 , and at last follow-up was 0.08 ± 0.18 . The Mean \pm SD initial Pirani score in the age group of >5 months was 4 ± 1.48 , Mean \pm SD Pirani score after last plaster was 0.11 ± 0.21 , and at last follow-up was 0.18 ± 0.32 . Pirani scoring system was found to be practical, reproducible, and helpful in the management of idiopathic clubfeet by Ponseti technique. In our study, 63 feet (82.89%) required a percutaneous TA tenotomy to correct the equinus deformity, whereas 13 feet (17.11%) required only casting to the equinus deformity which is comparable to studies by Changulani et al., Lehman et al., Brewster et al., Nagaraju KD, and Sætersdal et al.^{6,7,8,11,13}

In our study, we noted that feet requiring tenotomy was equally well corrected clinically at the end of casting as those that did not require tenotomies. Hence, even a severe idiopathic clubfoot can be successfully treated using proper application of Ponseti technique and the need for tenotomy does not suggest a poorer result. The mean total number of casts that we applied up to the final follow-up to correct the deformity were 6.4 (ranged from 4 to 10) which was comparable to similar studies done by Lehman et al., Changulani et al., Nagaraju KD, and Sætersdal et al.^{6,7,8,13}

In the age group of <1 months, Mean \pm SD total number of casts required were 5.69 ± 1.32 . In the age group of 1–5 months, Mean \pm SD total number of casts required were 6.6 ± 1.68 . In the age group of >5 months, Mean \pm SD total number of casts required were 8.11 ± 1.54 .

The above findings suggest that with increasing age at presentation, the more number of plaster casts required to correct the deformity. A positive correlation ($r=0.508$ and $P<0.002$) was also noted between initial Pirani score and number of casts required which means as the Pirani score increases, number of plaster casts required to correct the deformity increased. In our study, the mean duration of treatment from 1st plaster cast to cast for equinus correction was 8.4 weeks (range 6–12 weeks). In our study, seven patients (14.00%) had these complications out of which four patients

(8.00%) had plaster sore, and three patients (6.00%) had equinus recurrence. There was no major complication such as infection, skin necrosis, and neurovascular compromise.

Based on the Pirani scoring system, we found that the Mean Pirani score in our study group at initial presentation was 4.07 and the Mean Pirani score after last plaster cast was 0.08. The above findings were comparable to the study conducted by Ullah et al., in which the Mean initial Pirani score was 5.2 and the Mean Pirani score after last plaster cast was ≤ 1 .¹⁴

In our study, the follow-up was of short duration. A true functional outcome cannot be determined until the child has completed growth. Still, the results of treatment of clubfoot by Ponseti technique can be assessed by validated Pirani scoring systems which allow an accurate assessment of the ability of casting and need for TA tenotomy to correct the clubfoot to a supple, plantigrade position.

Limitations of the study

The duration of follow-up (1 year) period is short as long-term follow-up is required to assess further effectiveness of Ponseti technique and relapse of CTEV. This study does not include clubfoot children with more than 1-year old, neglected clubfoot, syndromic clubfoot.

CONCLUSION

The Ponseti technique is a very safe, efficient, and acceptable economical treatment for the correction of CTEV that gives excellent results on conservative treatment and in most of the cases avoid surgical intervention if protocol followed as prescribed. If the age of the patient is higher at time of presentation, it requires a longer casting period and more number of casts to correct the deformity compared to younger children with the early presentation.

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RM, AKS, MBA- Concept and design of the study, prepared first draft of manuscript; **NSK, DK-** Interpreted the results; reviewed the literature and manuscript preparation; **AS, SS-** Concept, coordination, statistical analysis and interpretation, preparation of manuscript and revision of the manuscript.

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