

## Original Research Article

# Accelerated versus standard Ponseti cast in the management of idiopathic congenital talipes equinovarus at a tertiary care centre in North India: a comparative study

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## ABSTRACT

**Background:** Congenital talipes equinovarus varus (CTEV) is one of the most common congenital anomalies of foot and ankle. With a male dominance pattern, this deformity is bilateral in around 50% cases. It is characterized across varying degrees and severity of components manifesting with: forefoot adductus, midfoot cavus, hindfoot varus and hindfoot equinus. Severity is assessed using Pirani score (0 to 6). Insights into the basic patho-anatomy of this complex 3-dimensional deformity has helped to correct it using the method given by Ignacio Ponseti, a Spanish orthopaedician, in which serial manipulations of foot are done and weekly casts are applied, followed by a tendoachilles tenotomy in selected cases to correct the equinus component which is then followed by splintage of the feet in foot-ankle orthosis initially for 23 hours day for 3 months and then 12 hours a day for 3 years. Parental counselling regarding the importance of compliance with maintenance braces remains the most important component of treatment.

**Methods:** This was a double blinded randomized prospective study including 40 patients with 61 feet of only idiopathic clubfoot, conducted in the department of orthopaedics, government medical college, Jammu over a period of 01 year.

**Results:** The mean days of plaster duration in accelerated casting group was 18.45 days as compared to 47.25 days in standard casting group (statistically significant,  $p < 0.05$ ). Also, Pirani score at the end of last follow up was comparable in both the groups. Tenotomy rate was slightly higher in accelerated casting group (89.5%) as compared to standard group (85.7%) which may be attributed to higher initial Pirani score in former (5.5) as compared to later (5.0).

**Conclusions:** The clubfoot in developing countries has social stigma, the early and the promising result of the accelerated method of Ponseti casting has a dramatic impact on both parents and the treating orthopaedician. The accelerated Ponseti casting has remarkably reduced the overall duration of the treatment of Ponseti casting without any complication.

**Keywords:** CTEV, Pirani, Accelerated Ponseti

## INTRODUCTION

Congenital talipes equinovarus varus (CTEV), also known as clubfoot is one of the most common pediatric foot deformity with a reported incidence of 0.5-2 cases per 1000 live births.<sup>1</sup> Around 20% of CTEV patients have other associated congenital abnormalities.<sup>3,4</sup> With a male

to female ratio of 2:1, bilateral deformity is seen in around 50% of cases. In unilateral cases, the right foot is the most commonly affected.<sup>5</sup> In parents already having a child affected with CTEV, there is 10% chance of second child to be affected.<sup>6</sup>

Although the exact etiology remains debated, the consensus favors multiple genetic and environmental risk

factors that play varying levels of contributing roles in its clinical manifestations.<sup>7</sup> Environmental factors such as maternal smoking and maternal diabetes have the strongest association with clubfoot.<sup>2,3</sup> Maternal alcohol consumption and in utero positioning has also been cited throughout the literature.<sup>8-10</sup> Genetics likely has a role to the play, although a specific gene alteration remains unclear. Studies of monozygotic twins have shown a concordance of 33% in the comparison to the 3% in dizygotic twins.<sup>11</sup>

CTEV consists of four components: midfoot cavus, forefoot adductus, hindfoot varus and equinus with concurrent soft tissue anomalies. Congenital talipes equinovarus is termed 'syndromic' when it occurs in association with other features as part of a genetic syndrome, or it can occur in isolation in which case it may be termed 'idiopathic'. Syndromic talipes equinovarus arises in many neurological and the neuromuscular disorders, for example spina bifida or spinal muscular atrophy, but the idiopathic form is by far the most common. To achieve a functional, plantigrade foot, enabling the patient to wear usual shoes and to prevent arthritic degenerations in the adulthood has been the primary goal of treatment.<sup>12</sup>

With the advancement in understanding of pathoanatomy of the club foot, Ponseti developed a novel method of correction, which has gained wide acceptance worldwide in the last two decades by producing good long-term results.<sup>13</sup> The standard Ponseti method uses weekly foot and leg plaster changes to gradually correct the deformity, using a strictly defined sequence of moulded plaster changes correcting cavus, adduction, varus and equinus lastly which often requires a percutaneous tendoachilles tenotomy followed by a final plaster for three weeks. Once plastering is finished, children are placed in a foot-abduction brace with all necessary instructions to parents. The participants in our study were usually from far flung areas and parents had to travel long distance carrying their baby and to keep the plaster dry and prevent it from breakage was a challenge, so this study was undertaken to study and compare the correction achieved by standard weekly Ponseti casting and an accelerated Ponseti casting changing plasters twice weekly.

## METHODS

This was a prospective comparative study done at government medical college, Jammu from a period from February 2022 to April 2023 with the aim to compare accelerated Ponseti versus the standard Ponseti method for treatment of idiopathic clubfoot.

### Inclusion criteria

Patients with idiopathic CTEV (unilateral/ bilateral/ male/ female), age <3 months and no other associated congenital anomalies were included in study.

### Exclusion criteria

Patients with age >3 months, previously treated CTEV by any method and atypical CTEV excluded from study.

A thorough general examination of the child was done at the very outset so as to detect any associated congenital anomalies of hip and spine. Parents were educated beforehand about the nature and duration of treatment, expected outcomes, need for tenotomy, chances of recurrence, duration of bracing regime. A verbal consent was obtained in each case and due ethical approval was given by the institutional ethical committee.

Modified Pirani scoring system was used to score the severity of deformity at initial presentation as well as at subsequent visits. Six clinical signs, categorized separately under mid foot contracture score and hind foot contracture score each scored 0 (normal), 0.5 (mildly abnormal) or 1 (severely abnormal) respectively. Thus, each foot can receive a midfoot score between 0-3 and a hindfoot score between 0-3 and a total score between 0-6. Ponseti method of manipulation followed by casting was followed in both standard and accelerated Ponseti groups.

A total of 40 patients (61 feet) were included in our study and were randomized in two groups: group 1 including those treated by accelerated casting (twice weekly) and group 2 including those treated by standard weekly casting. There were 19 patients in group 1 (n=19) and 21 patients in group 2 (n=21). Data was analyzed using STATA software. In order to compare randomized groups for categorical data we used chi-squared tests and Mann-Whitney U tests for continuous variables. P<0.05 was considered statistically significant.

## RESULTS

In our study, out of the total 40 cases, 21 cases were bilateral and 19 were unilateral. The mean age at presentation was 21 days (7 to 48) in group 1 and 29 days (10 to 55) in group 2. There were 10 male patients (53%) and 9 females (47%) in group 1, and 12 male patients (57%) and 9 female patients (43%) in group 2. The mean Pirani score at the beginning was 5.5 (4.5-6) in group 1 and 5.0 (4-6) in group 2. 17 patients (89.5%) in group 1 underwent tenotomy after correction of cavus, adduction and varus, whereas 18 patients (85.7) in group 2 required tenotomy. Mean duration of treatment from the first cast to tenotomy in group 1 was 18.45 days and in group 2 was 47.25 days, which was statistically significant (p<0.0001).

In our study, accelerated group patients needed 6 plasters per foot for correction and standard group 6.35 plasters per foot. The Pirani score at the end of three-week plaster post tenotomy showed no significant difference (Pirani score=0-0.5) between the two groups.

Comparison of characteristics between randomized groups have been shown in Table 1.

Recurrences with different degrees were observed at later follow-up in the form of forefoot adduction, heel varus and equinus, in 3 patients (15.8 %) in the accelerated Ponseti group and 3 patients (14.3) in standard Ponseti group respectively.

These relapsed feet were completely corrected by either accelerated Ponseti or standard method depending on the assigned group. Two patients of the accelerated group and 3 patients of the standard group required tenotomy again (Table 2).

**Table 1: Comparison of characteristics between randomized groups.**

Variables	Accelerated Ponseti group 1, (n=19)	Standard Ponseti group 2, (n=21)	P value from comparative test
Mean age (In days)	21 (7 to 48)	29 (10 to 55)	0.32
Males	10 (53)	12 (57)	0.75
Female	9 (47)	9 (43)	0.69
1 <sup>st</sup> cast to tenotomy interval (Days)	18.45	47.25	0.001
Number of tenotomy	17 (89.5)	18 (85.7)	0.115
Pirani score precast	5.5 (4.5 to 6.0)	5.0 (4.0 to 6.0)	0.143
Pirani score at tenotomy/ end of treatment	0.5 (0.5 to 1.0)	0.5 (0 to 1.0)	0.299
Pirani score at 12 months follow up	0 (0 to 1.0)	0 (0 to 0.5)	0.630

**Table 2: Relapse rate in both groups and need of second tenotomy.**

Casting group	Relapse (%)	2 <sup>nd</sup> tenotomy
<b>Group 1 (Accelerated Ponseti), (n=19)</b>	3 (15.8)	2
<b>Group 2, (Conventional Ponseti), (n=21)</b>	3 (14.3)	3

The results were graded as excellent if Pirani score reduced to below 1, good if score was between 1 and 2, and poor if score was >2 at the final follow up. Accelerated group had excellent results in 17 patients and good results in 2 patients. In the standard group, excellent results were observed in 18 patients and good in 3 patients. None of the patients had poor results (Table 3).

**Table 3: Grading as per Pirani score at 12 month follow up.**

Grading	Accelerated group 1	Conventional group 2
Excellent	17 (89.5)	18 (85.7)
Good	2 (10.5)	3 (14.3)
Poor	Nil	Nil
Total	19	2

## DISCUSSION

The standard Ponseti method, which emphasizes manipulation of the foot with serial weekly casting and tenotomy of the tendo-achilles, is currently the method of choice for conservative treatment of clubfoot as has already been proven by many studies.<sup>9</sup> For the normal development of the foot in the patients with CTEV an early

correction of all aspects of the deformity is essential.<sup>21</sup> The ponseti technique is a specific method of manipulation, with head of talus as fulcrum to stretch the contracted ligaments and hold the stretch with serial casting followed by Achilles tendon tenotomy and Bracing-foot abduction brace.<sup>14,15</sup> The largest comprehensive study was undertaken over an 11 year period by Morcuende et al by performing serial manipulations by changing the cast every 5 days to obtain a successful correction with or without minimal side effects.<sup>18</sup> In our study there was a slight higher male predominance in our study in both the groups. This is also the result of study done by Solanki et al and Ullah et al.<sup>16,17</sup> There was a slightly higher rate of tenotomy in accelerated group (89.5%) as compared to conventional group (85.7%) but this was not statistically significant (p=0.115). This can be attributed to higher initial mean Pirani score in accelerated group (5.5) as compared to conventional group (5.0). This characteristic was identified by Scher et al who related higher Pirani scores to the need for a tenotomy.<sup>13</sup> The number of days required for the correction in plaster were 18.45 days in case of accelerated group and 47.25 days in case of conventional group, this was a statistically significant difference (p=0.001). Same was the result obtained by various studies (Table 4). However, Pirani score at the end of follow up in both the groups showed almost similar results in terms of plantigrade, functional and cosmetically accepted foot.

Relapse following correction usually occur in the order of hindfoot equinus, heel varus, forefoot adduction and cavus occurs at last. There were 3 cases of relapse in both the groups following correction. The most significant factor with regard to recurrence during follow-up is compliance with the abduction brace.<sup>18</sup> Haft, Walker and Crawford reported a five times greater chance of recurrence in patients whose parents were noncompliant with bracing.<sup>19</sup> Such relapses can be decreased by parental counselling at

each successive visit and explaining them the need to wear abduction brace. The strengths of our study are that it's a prospective study with minimum 12 months follow up and no patient was lost during follow up period. The limitations are that it's a non-randomized study with a small sample size. Our study compared the clinical outcomes of idiopathic clubfoot in child <3 months age using accelerated (biweekly) casting and standard weekly casting, and showed the efficacy of accelerated casting over standard casting in terms of shorter days to correction with a comparable Pirani score at the end of follow up.

**Table 4: Various studies comparing the average number of days in plaster for accelerated versus conventional Ponseti method.**

Studies	Accelerated group (Days)	Conventional group (Days)	P value
Morcuende et al <sup>14</sup>	16	24	<0.05
Xu <sup>15</sup>	20.61	35.35	<0.05
Harnett et al <sup>16</sup>	16	42	<0.05
Sharma et al <sup>17</sup>	15	35	<0.05
Present study	18.45	47.25	<0.05

## CONCLUSION

In a country like India, where parents have to travel long distances to bring their children for serial casting, there are several financial and social issues. Keeping in view the psychological and economic burden over the family of the patient with club foot travelling long distances to the location of treatment centre it has become a necessity to shorten the time required for deformity correction. Using accelerated Ponseti casting, there is significant reduction in duration of treatment days with similar results at the end of follow up when compared to conventional casting. Accelerated casting can significantly reduce the overall economic burden on the poor patients by reducing the number of days of work lost as well as the total expenditure on the travel.

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