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**Dr. Mayank Dutta**  
PG Resident, Post-Graduate  
Department of Orthopaedic  
Surgery, Maharaja Agarsen  
Medical College, Agroha,  
Haryana, India

**Dr. Ashok Kumar**  
Professor, Post-Graduate  
Department of Orthopaedic  
Surgery, Maharaja Agarsen  
Medical College, Agroha,  
Haryana, India

**Dr. Anurag Chhabra**  
Senior Professor and Head of  
Department, Post-Graduate  
Department of Orthopaedic  
Surgery, Maharaja Agarsen  
Medical College, Agroha,  
Haryana, India

**Dr. Vivek Kumar Sahu**  
PG Resident, Post-Graduate  
Department of Orthopaedic  
Surgery, Maharaja Agarsen  
Medical College, Agroha,  
Haryana, India

**Dr. Vivek Yadav**  
PG Resident, Post-Graduate  
Department of Orthopaedic  
Surgery, Maharaja Agarsen  
Medical College, Agroha,  
Haryana, India

#### Correspondence

**Dr. Ashok Kumar**  
Professor, Post-Graduate  
Department of Orthopaedic  
Surgery, Maharaja Agarsen  
Medical College, Agroha,  
Haryana, India

## To study the outcome of congenital talipes equinovarus by ponseti method

**Dr. Mayank Dutta, Dr. Ashok Kumar, Dr. Anurag Chhabra, Dr. Vivek Kumar Sahu and Dr. Vivek Yadav**

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#### Abstract

**Background:** Congenital talipes equinovarus (CTEV) is a common but still not fully understood disorder of the lower limb. It is usually defined as a fixation of the foot in abduction, supination and varus. Different treatment options exist including the Ponseti method.

**Aim:** The aim of the study is to find the effectiveness of Ponseti's technique of plaster cast application in correction of idiopathic congenital talipes equinovarus and to assess the results using Pirani scoring system.

**Patients and Methods:** Thirty six patients (55 clubfeet) were enrolled at the clubfoot clubfoot clinic in the department of Orthopaedics, Maharaja Agrasen Medical College, Agroha, Hisar from August 2015 to 31st October 2017

**Results:** In this study 26 patients (72.2%) were male, the anomaly was bilateral in 19(52.8%) cases, unilateral left side in 7(19.4%) and the right side in 10(27.8%). Mean age of presentation was 4.055 months. Clinical evaluation was performed using the Pirani's scoring system. Mean follow up was 9.16 months: range 6-18 months. An average of 6.69 casts were applied to achieve correction. Only 2 patients (3 feet) required tenotomy which was not corrected by casting. Early starting of casting and longer period of casting helped us decreasing rate of tenotomy. Percentage of cases with relapse at follow up was 9.09% (5 feet) which were treated with recasting again by Ponseti method. In this study mean Pirani's score at the time of presentation was 5.072 and mean Pirani's score after 6 month's follow-up was 0.263. Excellent results were found in 44 feet (80%) i. e. Pirani score of 0.

**Conclusions:** The present study has justified that Ponseti method of manipulation and casting is an effective method to manage congenital talipes equinovarus upto 2 years of age. Ponseti method is capable of achieving painless, plantigrade, normal looking foot. However a longer duration of follow-up and larger sample size is needed to further evaluate the recurrences and to completely justify the effectiveness of Ponseti method.

**Keywords:** CTEV congenital talipes equinovarus, HFCS hind foot contracture score, MFCS mid foot contracture score, D-B splint, denis-browne splint

#### Introduction

Congenital talipes equinovarus (CTEV) or clubfoot is a multidirectional complex foot deformity. Idiopathic clubfoot is one of the most commonly referred problem in pediatric orthopaedics. While secondary clubfoot may be due to muscle imbalance, as in neuromuscular conditions e. g. spina bifida (myelomeningocele), poliomyelitis, cerebral palsy, and fibrosis of soft tissues as seen in arthrogryposis multiplex congenital, Fredrich's ataxia and muscular dystrophies [1, 2].

The true etiology of clubfoot is unknown. Various theories have been associated with the causation of clubfoot such as mechanical factors in utero, neuromuscular defect, primary germ plasm defect, arrested fetal development and various hereditary and environmental factors [3].

The three basic components of clubfoot are equinus, varus and adduction deformity. Equinus occurs at tibio talar joint, inversion at subtalar joint and adduction mainly at mid-tarsal joint (talo-navicular and calcaneo-cuboid joint). The other associated secondary deformities can be cavus and clawing of toes [1].

The goal of treatment of clubfoot is to correct all components of the deformity, to obtain a

normal looking, functional, plantigrade, and supple and pain free foot.

Surgeons have struggled over the years to identify the best method of treatment for the congenital clubfoot deformity. Early attempts at primarily nonoperative strategies relied on forceful manipulations. The first non-operative treatment was proposed by Hippocrates in 400 BC when he recommended gentle manipulation followed by splinting. Plaster casts were used to treat clubfoot when Guerin introduced the plaster of Paris in 1836. Kite was the first to recommend gentle manipulation and cast immobilization. The success rate varies from a high of 90% found by Kite to a low of 19% by Fripp and Shaw [1, 4, 5].

The Ponseti method involves serial manipulation, a specific technique of cast application, and a possible percutaneous tendoachilles tenotomy. It is reported to provide a lower complication rate, less pain and better function as the patient ages as compared to operative treatment [6].

Evaluation of idiopathic clubfoot is essential to assess the initial severity of deformity, to monitor the progress of treatment, to prognosticate and to identify early relapse. Among the several clinical scoring systems described by Ponseti and Smoley [7] (1964), Harrold and Walker [8] (1983), Catterall [9] (1991), Dimeglio [10] (1995) and Pirani [11] (1995) scoring, the Pirani scoring system which incorporates three components in hind-foot and three in mid foot, has gained popular acceptance. The hind foot contracture score (HFCS) and mid foot contracture score (MFCS) will be calculated to define the correction in each component. This system has been found to be user friendly, reliable and predictable. It predicts the number of cast required to correct the deformity and the probability of Achilles tendon tenotomy [12, 13].

This study was undertaken to find the effectiveness of Ponseti method in treatment of congenital talipes equinovarus using Pirani scoring system and to highlight the pitfalls and problems which can compromise a satisfactory clinical outcome.

### Materials and Method

All patients of idiopathic CTEV (unilateral or bilateral) reporting in O.P.D, Department of orthopaedics, in Maharaja Agrasen Medical College, Agroha (Hisar), were included in this study. This study has been done in about 2 years from August 2015 to 31<sup>st</sup> October 2017 including development of study tools, collection of data, analysis and presentation of findings. Patients with idiopathic CTEV up to 24 months of age, were taken as sample for the present study. Thirty six patients with idiopathic congenital talipes equinovarus, 10 were right sided, 07 were left sided and 19 were bilateral thereby accounting for total 55 feet were included in this study.

### Inclusion criteria

Infants and children up to 24 months of age with unilateral or bilateral idiopathic CTEV who attended the hospital for treatment. Children who were untreated or incompletely treated with one or two plaster cast without any significant improvement and parents/relatives gave proper consent for treatment was included in the study.

### Exclusion criteria

- Children older than 24 months of age.
- Atypical or secondary clubfoot.
- CTEV treated by other casting methods or soft tissue release.

- Associated lower limb anomalies affecting casting or scoring.
- Refusal to provide informed consent.

### Method for cast application

In this technique head of talus is used as fulcrum. The foot is manipulated first approximately for 1 to 2 minutes before application of plaster cast. In the first cast correction of cavus deformity was done by elevating 1st metatarsal and supination of forefoot, first below knee POP cast was applied and then extended to upper thigh with knee flexed to 90° and leg in external rotation. After correcting cavus deformity, next casts was used to correct adduction and varus with counter pressure applied on head of talus. POP cast was changed on weekly basis. Last two to three cast to correct equinus deformity by applying cast in maximum dorsiflexion of foot achievable. The residual equinus was corrected by simple percutaneous tenotomy under local/general anaesthesia and applying cast in maximum dorsiflexion and abduction. Post tenotomy cast to be removed at three weeks. To prevent relapse of the deformity, a Denis-Browne bar with shoes (D-B splint) was applied after cast removal. D-B splint (Figure 13) was advised to be used full time (day and night) during the first three months for at least 23 hours each day and then for 2-4 hours a day and for 12 hours at night, a total of 14 to 16 hours per 24 hour period till age of 3 years. CTEV shoes (Figure 14) to be used during the day time for walking child.

Follow up of the patients was done every week during initial stages of treatment till deformity correction and then every monthly for three months after application of D-B splint and after that three monthly. The correction of deformity was assessed by Pirani scoring.



Method Of Cast Application



Denis-Browne splint

**Observation and Results**

In the present study conducted at Maharaja Agrasen Medical College, Agroha on OPD basis, we studied 36 patients with 55 feet presenting with Idiopathic Congenital Talipes Equinovarus, up to 24 months of age. At the initial visit, the mean age of of 36 patients (55 feet) was 4.055 months ranging from 1 day to 20 months. 26 patients (66.6%) patients presented within first 3 months of age. Twenty-six patients were male (72.2%) and 10 were females (27.8%). Male to female ratio was 2.6. Bilateral clubfeet were found in 19 patients (52.8%), left foot in 7(19.4%), right foot in 10(27.8%) patients. Twenty-nine patients (80.60%) presented fresh without any history of previous treatment whereas 7 patients (19.4%) had history of treatment initiated elsewhere in form of 1-3 cast without significant improvement. Mean number of casts applied were 6.96 ranging from 4-12 casts. Three (8.34%) patients had a positive family history of clubfoot.

score of  $\geq 1$  post 6 months follow-up. Almost all cases in the present study were treated by casting alone only 2 patients (3 feet) 5.45% required tenotomy which was not corrected by casting. Usually more number of casts was applied to achieve full correction without tenotomy. Early starting of casting and longer period of casting helped us decreasing rate of tenotomy. Percentage of cases with relapse at follow up was 9.09% (5 feet) which were treated with recasting again by Ponseti method. The main reason of relapse was non-compliance with the D-B splint. 17. Other minor complications like 2 feet (5.45%) presented with complication of pressure sore, 2 feet (3.63%) with swelling and tight Plaster of Paris cast and 6 feet (10.90%) with abrasions due to plaster cast and 2 (3.63%) with contact dermatitis. Mean duration of follow-up was 9.16 months ranging from 6-18 months.

Age in months	Number of cases	Percent
1-3 month	24	66.6%
4-6 month	6	16.6%
7-12 month	3	8.4%
13-24 month	3	8.4%
Total	36	100%
Mean age	4.05 months	

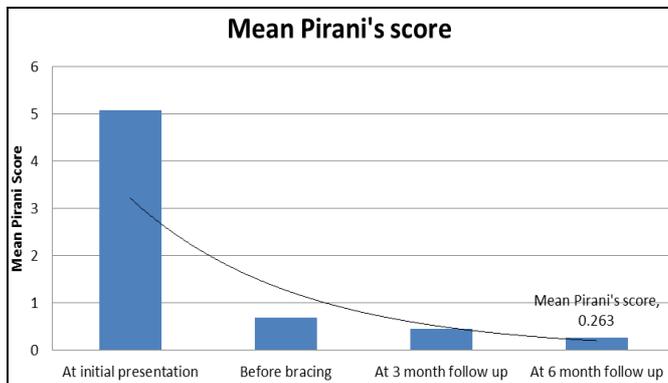
Number of casts	Frequency	Percentage
<b>(Feet)</b>		
4	2	3.64%
5	10	18.18%
6	14	25.46%
7	9	16.36%
8	10	18.18%
9	6	10.90%
>9	4	7.28%
Total	55	100



Minor complication contact dermatitis



Abrasions due to dermatitis



Duration of follow -up	Frequency	Percentage
6 to 8 months	18	50%
9 to 11 months	10	27.78%
12 to 15 months	5	13.88%
16 to 18 months	3	8.34%
Total	36	100%

Clinical grading of deformity was done according to the Pirani scoring systems. Mean Pirani's score at the time of presentation was 5.072, mean Pirani's score before bracing was 0.681, mean Pirani's score after 3 month's follow-up was 0.444, mean Pirani's score after 6 month's follow-up was 0.263. Excellent results were found in 44 feet (80%) i. e. Pirani score of 0, good results in 9 feet (16.36%) i. e. Pirani score of 0.5 and poor results in 2 feet (3.64%) i. e. Pirani



Cast Sequence

**Discussion**

The clubfoot deformity has repeatedly been described for

centuries, which underlines the importance of this handicap. The Clubfoot deformity has been known since time of Hippocrates and is well documented in article “concepts of causation and principles of treatment”. Even today clubfoot is the commonest congenital foot deformity that is seen by orthopaedic surgeons. This study was conducted to evaluate Ponseti method in management of clubfoot which recently has gained popularity worldwide. Correction of deformities was evaluated clinically using Pirani scoring system.

In the present study mean age of child at the time of presentation was 4.05 months. Although, 66% of the patients in the present study presented within 1<sup>st</sup> 3 months of birth because of the good referral institute. In the present study most of the patients were picked up early within first 6 months (83.2%) which resulted in decreased incidence of tenotomy. Several authors have studied whether the initial age of presentation impacts the results of treatment. Abdelgwad *et al.* [14] reported a 6.6% failure rate in patients who presented late for treatment. In our study results were better if this method of treatment was started as early as possible after birth. The earliest cast applied was at 21 day. The maximum age at which the cast was applied was at 20 months.

In the present study male to female ratio were found to be 2.6:1 which is comparable with the other studies of Matuszewski *et al.* [15] (2.5:1) and Pavone *et al.* [16] (2.2:1). Palmer<sup>17</sup> explained this by suggesting that females require a greater number of predisposing factors than males to develop a clubfoot deformity. Social bias and increased attention towards male in our region can also be the reason for the higher incidence of males in our study.

In the present study mean no. of cast required for correction per foot was 7 which is more as compared to Gupta *et al.*<sup>18</sup> (mean 4.9) and Sharma *et al.* [19] (mean 4). The reason behind this is that we achieved full correction of all the deformities by applying more number of casts. Even almost full correction of the equinus was achieved by longer casting only except in few resistant cases. Also more number of casts were required in children in whom treatment were started late due to late age of presentation.

In the present study mean Pirani score at the time of presentation was 5.072 and at around 6 months post treatment it was 0.273 which is consistent with the other studies of Jawadi *et al.* [20] (Initial- 5.8, post treatment-0.5) and Sharma *et al.* [19] (Initial-5.5, post-treatment-0.36). This showed that Pirani’s score reduces significantly post treatment and it also helped in the no of cast required for full correction and also helped in predicting the relapse.

In the present study tenotomy was performed on only 2 patients (3 feet) which is different from all the other studies because we achieved almost full correction in all patients by applying more number of casts which was changed on weekly basis. Tenotomy was performed in only those patients who were not correctable by repeat casting and residual equinus was still present. Early starting of casting and longer period of casting helped us decreasing rate of tenotomy. Our percentage is far much lower than the other studies of Porecha *et al.* [21] performed tenotomy in 97% cases and Pavone *et al.* [16] in 87% cases.

In our study relapse was found in only 3(8.33%) patients which is less as compared to all other studies of Jawadi *et al.* [20] (19.42%) and Porecha *et al.* [21] (28.57%). This can be attributed to the longer duration of follow-up in other studies. The main cause of relapse was non- compliance with the D-B splint and also partly due to application of splint incorrectly at home when parents removed them for bathing. Since most of

the patients in our study are from rural areas, education level is low and thus they fail to understand the importance of proper way to apply the brace to maintain correction. Strict instruction for the brace application, motivation by dedicated personnel and more frequent follow-up had led to increased compliance of the brace for these patients and early detection of any relapse, if any. All the cases of relapse were treated by recasting again as per Ponseti casting technique.

In the present study plaster sore was noticed in 3 feet (5.45%) whereas in a study of Porecha *et al.* [21] it was found in 2 feet (2.98%) which is almost equal to our study. The other minor complications like minor skin abrasions found in 3 feet and contact dermatitis in 2 feet and swelling of toes post casting in 2 feet. The main advantage of Ponseti technique it has only such minor complications which can be managed easily by cast properly with proper padding and with expert hand. Proper observation of the child post casting and guiding the parents properly led to the very less number of these minor complications.

In the present study we only included those patients with minimum follow-up of 6 months post correction. Ponseti had a series with long follow-up. The mean duration of follow-up was 9.16 months. In this study mean duration of follow up is small as compared to all other studies of Porecha *et al.* [21] (5 years) and Pavone *et al.* [16] (4 years) this could be the reason of less number of relapse cases. So, longer duration of follow-up is needed to validate Ponseti casting method.

The Ponseti method of conservative clubfoot treatment is an excellent method of treatment, of which there have been successful results. It avoids the complications of surgery and gives a painless, mobile, normal-looking, functional foot. Results of the clubfoot treatment by Ponseti technique in our study have been very good and rewarding. In a developing country like India where is a dearth of operative facilities in remote, this technique is very safe, easy, result-oriented, economical method of clubfoot management. Pirani scoring is also an excellent scoring system to predict the number of cast required to correct the deformity and predicting the relapse as early as possible if any.

The main short comings of our study are short duration of follow-up and less sample size. So, long term follow-up and large sample size is required to further evaluate recurrences and finding the efficacy of Ponseti casting and compliance of the patients is also essential in maintaining the correction.

The present study has justified that Ponseti method of manipulation and casting is an effective method to manage congenital talipes equinovarus upto 2 years of age. Ponseti method is capable of achieving painless, plantigrade, normal looking foot. However a longer duration of follow-up and larger sample size is needed to further evaluate the recurrences and to completely justify the effectiveness of Ponseti method.



Case 1: pre-treatment



**Before-bracing**



**At 3 months follow-up**



**At 5 months follow-up**



**At 6 months follow-up**



**Case 3: pre-treatment**



**Case 4: pre-treatment**



**Before-bracing**



**Before-bracing**



At 3 months follow-up



At 3 months follow-up



At 6 months follow-up



At 6 months follow-up



Case 12: pre-treatment



Case 16: pre-treatment



Before-bracing



Before-bracing



At 5 months follow-up



At 3 months follow-up



At 9 months follow-up



At 7 months follow-up



Case 22: pre-treatment



Before-bracing

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