

# A Retrospective Study on the Treatment of Clubfoot Using the Ponseti Method

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## 1. Introduction

Congenital anomalies are one of the leading causes of disability in children<sup>1</sup>. Clubfoot also known as congenital talipes equinovarus (CTEV), is one of the most common congenital defect that beget mobility impairment<sup>2</sup>. The structure and position of the foot are affected, and if left untreated leads to pain and reduced mobility, and hence results in restrictions and activity limitation<sup>3</sup>. Clubfoot forms in the early weeks of gestational development, and this may be part of specific syndromes or secondary to systemic or neurological disease. However, the majority of cases occur in isolation and are termed 'idiopathic', and cause of which is not understood well.<sup>4</sup>

Clubfoot has four components: Ankle equinus, hindfoot varus, forefoot adductus, and midfoot cavus.<sup>5, 6</sup> Even though a variety of conservative and non - conservative methods have been employed to rectify clubfoot, the most severe cases of clubfoot are still difficult to treat. The procedures utilised to cure clubfoot have been debatable for the past 150 years<sup>7</sup>. Because frequent soft tissue releases during lengthy surgeries to treat clubfoot can result in arthritic issues, low quality of life, and foot stiffness<sup>8</sup>. Following that, several conservative procedures are suggested to treat the clubfoot deformity, including various manipulation techniques, orthoses, splinting, bracing, casting, and strapping.<sup>9-11</sup>

### Classification of C. T. E. V

Classification according to treatment stage:

- 1) Untreated clubfoot: Affected child under 2 years of age and has not been treated till date.
- 2) Neglected clubfoot: affected child more than 2 yrs and has not been treated till date.
- 3) Treated clubfoot: Club feet that have completed the casting phase of Ponseti method.
- 4) Recurrent clubfoot: recurrence of deformities (equines and supination) after initial good correction.
- 5) Resistant Clubfoot: Previously untreated club foot that does not correct with ponseti technique.
- 6) Complex clubfoot: any club foot that has received any form of treatment other than ponseti.<sup>12</sup>

The Ponseti procedure was created by Ponseti in 1963 and consists of manipulation, casting, Achilles tenotomy, and bracing<sup>13, 14</sup>. It takes around four to five weeks to fully treat all four aspects of the clubfoot deformity. In this procedure,

the Achilles tenotomy is utilised to cure the clubfoot deformity and remove bracing for keeping the corrected clubfoot<sup>15, 16</sup>. It also aids in achieving the plantigrade foot<sup>17</sup>, which is flexible, functional, and pain - free. Although orthopaedic surgeons agreed that initial treatment for clubfoot should be a conservative method to correct the clubfoot successfully<sup>13, 18 - 23</sup>, the relapses, partial correction of clubfoot and rocker bottom foot is still not avoidable<sup>24, 25</sup>.

### Pirani Scoring System<sup>26, 27</sup>

In a recent clubfoot case involving a child under the age of two, Dr. Pirani has created a reliable and convincing method for clinically assessing the magnitude of foot and ankle morphological changes. The treating surgeon can evaluate where they are on the management roadmap, determine whether a tenotomy is necessary, and inform and reassure parents about management progress by documenting the extent of involvement. It enables accurate results comparison. Six clinical parameters are measured by the Pirani method. These variables are given a score of 0, 0.5, or 1 depending on how normal, moderately aberrant, or severely abnormal they are classified as.

#### Hindfoot score

The following three components are included in the Hind Foot Score (HFS), for grading the extent of involvement

1. Posterior crease
  2. Rigid equinus
  3. Empty heel
- Possible HFS between 0 and 3  
Midfoot score

The following three components are included in the Mid Foot Score (MFS), for grading the extent of involvement

1. Curved lateral border
2. Medial crease
3. Coverage of the talar head

Possible MFS between 0 and 3

#### Bracing Protocol

Babies shifted to Maintenance phase, 3 weeks after tenotomy by bracing them in dennisebrowne splint; The splint is to be used 23 hours a day for the first 3 months and then at least 14 hours a day for 3 years.

Common errors in correction of clubfoot according to Ponseti<sup>5</sup>:

- The foot pronates, causing the cavus to enlarge and the adducted calcaneus to become locked under the talus while the midfoot and forefoot twist into eversion.
- External foot rotation when the calcaneus is still invarus to correct forefoot adduction. By externally rotating the talus in the ankle mortise, this causes the lateral malleolus to move posteriorly. Poorly managed clubfoot can result in the posteriorly displaced lateral malleolus, an iatrogenic deformity.

Complications<sup>5</sup>:

The following are the complications to be expected and looked for,

- a) Skin allergy
- b) Slipping of cast
- c) Pressure Ulcers
- d) Circulation problems
- e) Rocker bottom foot
- f) Muscle atrophy

**Keywords:** Clubfoot, Ponseti method, Congenital anomalies, Retrospective study, Treatment.

### Study Technique

## 2. Materials and Methods

This Retrospective Study examines the treatment of clubfoot using the Ponseti method. Conducted at Department of Orthopedics, Mayo Institute of Medical Sciences, Barabanki, from August 2021 to January 2023, the study includes 19 cases of untreated clubfoot in children under 12 months.

### Study design:

The study is a Retrospective study.

### Source of Data:

All the children from birth to 12 months of age with congenital idiopathic clubfoot attending the CTEV Clinic from August 2021 to January 2023 at our hospital and who are willing to undergo treatment.

### Inclusion criteria: –

- 1) Infant from birth to 12 months of age with clubfoot deformity
- 2) Infants with idiopathic clubfoot.

### Exclusion criteria: –

- 1) Infants with Non - idiopathic clubfoot like myelodysplasia, complex idiopathic clubfoot, paralytic clubfoot.
- 2) Previously operated for clubfoot.
- 3) Age more than 12 months.

19 cases were selected from the registered patients with untreated deformed foot and age at presentation less than 12 months.

Each patient was registered and detailed personal history was recorded including the age, sex, father's & mother's name, address, date of first reporting, age of reporting, detailed history of previous treatment, etc. A thorough general & local examination was carried out & the deformity was scored according to Pirani's classification at each visit before applying cast. The score was plotted against the time and the trend of score was noted with reference to effect of manipulations or other interventions on deformity.

Manipulations were done by Ponseti's method followed by corrective casts at weekly interval without anaesthesia. Depending upon the response of the deformity to serial casting as evident by improvement in Pirani Scoring since institution of treatment, the treatment was either continued or modifications were recommended. Patients were followed up weekly for corrective casting till tenotomy and corrective cast was applied for 3 weeks after final correction or percutaneous Tendoachilles tenotomy. We performed the tenotomy under anaesthesia. Then the patients were advised regarding bracing with Dennis Browne splints for 3 months and followed - up to instruct regarding night time bracing for 3 - 4 years. Modified CTEV shoes in children who had started bearing weight on lower limbs were given.

### Statistical software used:

- 1) Microsoft Excel Sheet 2019.
- 2) 17<sup>th</sup> version of SPSS Software



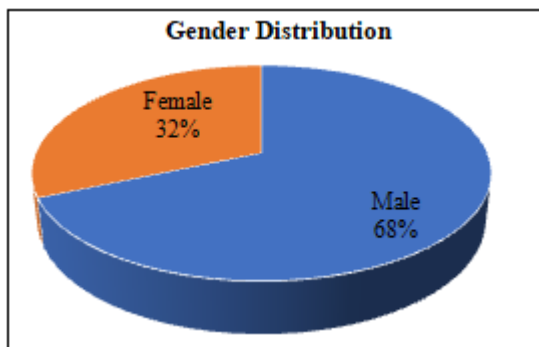


### 3. Results

All 19 patients were managed by serial cast correction by ponseti technique using the Pirani scoring for assessing the results. The following were the observations made during the study.

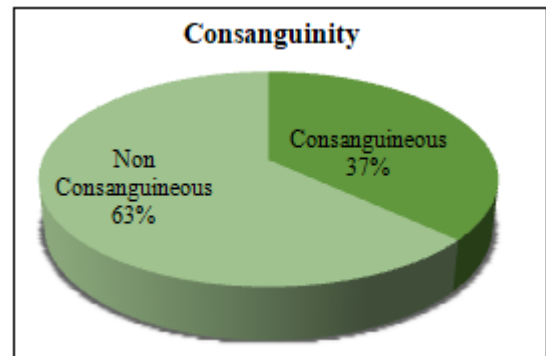
#### Gender Distribution:

Male	Female
13	6



#### Consanguinity:

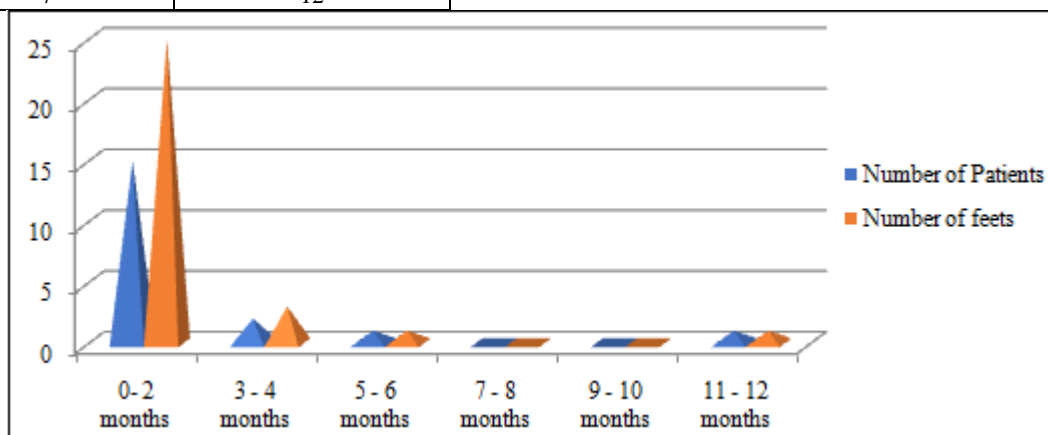
Consanguineous	Non Consanguineous
7	12



Of the 19 cases thirty seven percent were born out of consanguineous marriage.

#### Age Distribution:

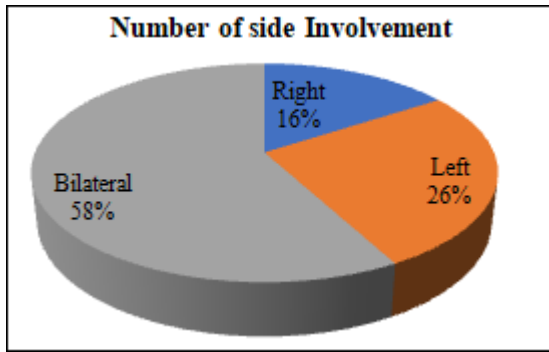
Age at Presentation (In months)	Number of Patients	Number of Feet
0 – 2	15	25
3 – 4	2	3
5 – 6	1	1
7 – 8	0	0
9 – 10	0	0
11 – 12	1	1



The age at presentation has significance with respect to outcome. Those children who presented less than 2 months had good results manifested by the difference between initial and final Pirani score.

#### Side of involvement:

Side	Right	Left	Bilateral
Number of Cases	3	5	11



In our study predominance of bilateral involvement was seen in 58% of cases. 16% were right sided and 26% were left sided.

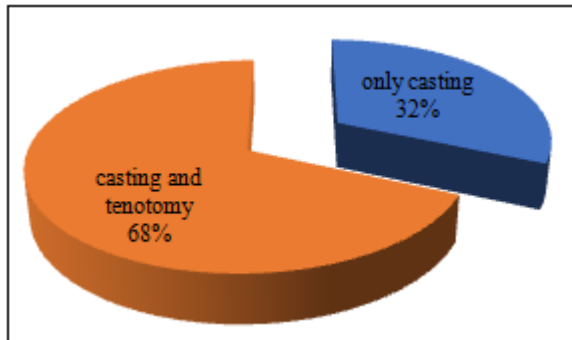
**Relationship between age at presentation and final result:**

Age at Presentation (In months)	Mean Initial Pirani Score	Mean Final Pirani Score
0 – 2	4.098	0.88
3 – 4	3.6	0.40
5 – 6	12	0.25
7 – 8	0	0
9 – 10	0	0
11 - 12	6	0.5

The younger age (<2month) group fared better in terms of results on comparing the mean initial pirani score and the mean final pirani score.

**Percutaneous Tenotomy:**

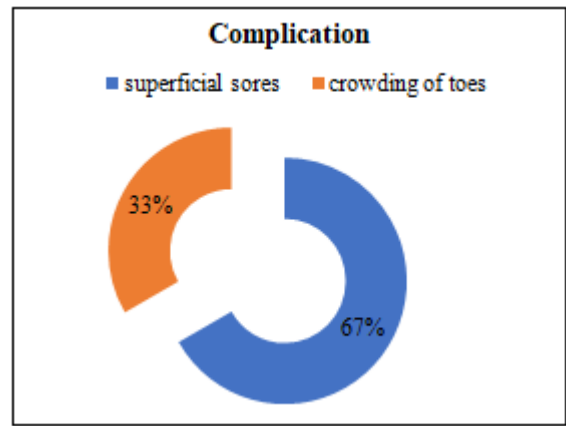
Treatment	No of cases	Percentage
Only Casting	6	31.57%
Casting & Tenotomy	13	68.4%



In our study we were able to achieve correction in 31.57% of the cases without resorting to tendoachilles tenotomy.

**Complications:**

Complication	No of patients
Superficial sores	2
Crowding of toes	1



Minor complications were noted in 13.15% of our cases. The superficial sores were managed with further castings with adequate soft padding and allowing the skin to heal. The crowding of toes was managed but allowing enough space for the toes especially the dorsum for free toe movements.

**4. Discussion**

Ignacio Ponseti, MD, at the University of Iowa in the 1950s introduced and perfected the serial cast correction procedure for club foot. With the intention of achieving a plantigrade, flexible, functional foot by non - surgical means, it was used to newborns with congenital clubfoot deformity. Satisfactory functional results have been documented in 85–90% of the cases receiving serial cast correction as per schedule. Other institutions' nonsurgical treatment plans of manipulation and casting have had less success and have been linked to complications like a flattening of the talar dome, increased cavus deformity, false modification with mid tarsal breach and rocker - bottom deformity, pressure sores from casts, and perhaps even fractures brought on by using too much force during manipulation.

In our series, we have used the Ponseti technique and serial casting to treat 19 infants with idiopathic clubfoot. Of the 19 infants, 11 had bilateral affection and 8 unilateral affection. There were 13 male and 6 female infants.

19 babies were born; 15 of them had 25 feet when they were 2 months old, 2 had 3 feet when they were 3 and 4 months old, and 1 had unilateral CTEV when they were 5 and 6 months and 11 and 12 months old, respectively.

In contrast to Yamamoto’s<sup>28</sup> and Chesney D et al.<sup>29</sup> dataset, where the male to female ratio is 3: 1 and 2.2: 1, respectively, whereas in our series it was found to be (2: 1). Palmer et al.<sup>30</sup> determined that the sex connection was not significant. The higher frequency of males in Indian settings can be attributed to ignorance, social prejudice, and more attention to male babies in our area.

Relapse rates of 78% in patients who did not adhere to the straight - last shoe and abduction bar regimen and 7% in those who did were reported by Ponseti. Recasting was used to treat all of Ponseti's series' noncompliant patients. In 2 of our patients (10.53%), forefoot adduction recurred, most likely due to increased brace compliance. In their

investigation, Porsche et al.<sup>3</sup> reported a 28% relapse rate. Further casts were needed for the relapsing feet, but eventually all of the feet were flexible and suitably sized for the Dennise Browne splint.

In our investigation, there were four to seven castings each foot (average 6.15 casts per foot). The average number of casts used during their therapy was seven in a different study by Laaveg et al.<sup>6</sup> 90% of the patients, according to Morcuende et al.<sup>4</sup>, needed five or fewer casts. As a result of the learning curve, people have started changing plaster casts more frequently over time, and studies show that using fewer castings per foot produces positive outcomes. At the beginning of treatment, the feet in our study that required the most casts had a high Pirani score. Also, we discovered a connection between late presentation and a greater cast rate.

79% (15 out of 19 babies) of the children who came to us were under the age of two months, and 21% were older, indicating both a likely inadequate referral mechanism in our area and parental ignorance.

68.4% of the cases required a tenotomy (13 out of 19 patients). Almost 90% of the patients Pirani treated for clubfoot had tenotomy. Laaveg et al.<sup>6</sup> performed tenotomies in 78% of patients. In the Dobbs et al.<sup>8</sup> study, 91% of patients required tenotomies.

## 5. Conclusion

- The Ponseti approach significantly reduces the need for extensive corrective procedures and is a very safe, effective, and cost - effective treatment for club foot rectification.
- Because it is efficient and affordable, the Ponseti method of cast repair is crucial, particularly in developing nations like India.
- The sooner the youngster presents, the quicker the repair will be made and the better the outcome.
- Less severe kinds with lower Pirani scores can be corrected more quickly and with fewer castings.
- Ponseti technique - initiated correction that is followed by a regular weekly casting routine typically yields greater functional and cosmetic benefits.
- Even relapses can be controlled with additional castings by themselves.

### Ethical Issues

No ethical issues have been found to be occurring in this study.

### Financial Support and Sponsorship

No financial support. Sponsorship has been obtained.

### Conflicts of Interests

No conflicts of interests have been found to be occurring.

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