

## A RETROSPECTIVE ANALYSIS OF THE FUNCTIONAL OUTCOMES OF PONSETI TECHNIQUE IN THE CORRECTION OF CTEV

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### Abstract

**Background:** Congenital Talipes Equino Varus (CTEV) being the most common congenital musculoskeletal anomaly is complex in nature, making it difficult to correct. Though noninvasive treatments remained the mainstay line of management, surgical techniques like Achilles tenotomy and tendon transfers were also practiced by many surgeons simultaneously worldwide. The Ponseti technique currently is the most promising and accepted treatment technique across the globe due to its less failure and recurrence rates. The main objective of this study is to evaluate the mid-term effectiveness of the Ponseti technique in the treatment of club foot. In this retrospective analysis, a total of 34 babies were included. Out of which, 23 babies had bilateral clubfoot and 11 babies had unilateral clubfoot (57 club feet), treated and documented during the period of October 2014 to July 2018. The Ponseti scoring system was applied at the 1st, 3rd and 5th year of life for assessing the functional outcomes. At the 5th year, the Ponseti scoring system was applied and was found to be Excellent in 44 feet; good in 8 feet; fair in 4 feet. The Ponseti technique proves to be an efficient one in the non-invasive management of idiopathic CTEV. An early initiation of treatment with regular follow-up and precise manipulation are very essential in the deformity correction.

## INTRODUCTION

CTEV being the most common congenital musculoskeletal anomaly is complex in nature, making it difficult to correct. The deformities include - Equinus at ankle; Varus at hindfoot; cavus at midfoot and adductus at forefoot.<sup>[1]</sup> Commonly called as clubfoot due to its appearance.

The history of treatment of CTEV dates back as early as 1000 BC in Egyptian and Indian civilizations. However it was in 300 BC when Hippocrates,<sup>[2]</sup> first described manipulation and bandaging to correct the mechanical pressure, which he believed to be the reason behind it.

Later in the 18th century, came into use the Wrench devised by Thomas, which were used to forcibly change the position of the foot. But this resulted in damage to the deformed foot, thus making it lose its significance over the days.

In 1930, Kite, who strongly believed that a non-invasive method of serial manipulation and casting followed by night splinting was able to attain good outcomes with his technique.<sup>[3]</sup> His principle was to correct the deformity by abducting the foot at mid-tarsal joint. However, the need for more number of casts even upto 2 years and recurrence rates made this method less significant.

Though noninvasive treatments remained the mainstay line of management, surgical techniques like Achilles tenotomy and tendon transfers were also practiced by many surgeons simultaneously worldwide.

It was in the late 90's when Dr. Ignacio Ponseti from the USA started his own method of deformity correction by combining both non-invasive and surgical techniques.<sup>[4]</sup> by serial manipulation, casting and percutaneous Achilles tenotomy after correcting the cavus, adductus and varus this was followed by use of Dennis brown splint.

The Ponseti technique currently is the most promising and accepted treatment technique across the globe due to its less failure and recurrence rates. However, surgical techniques are indicated for resistant and refractory cases.

The ultimate aim of all these treatment modalities is to give the baby a cosmetically as well as a functionally plantigrade foot.

We, in this study plan to evaluate the mid-term effectiveness of the Ponseti technique in the treatment of club foot.

## MATERIALS AND METHODS

A retrospective analysis on a total of 34 babies out of which 23 babies had bilateral clubfeet and 11 babies had unilateral clubfoot (57 club feet), treated by the same orthopaedic surgeon at Trichy SRM medical college hospital and research centre during the period of October 2014 to July 2018. Infants with idiopathic CTEV from birth up to 6 months of age were included after getting informed written consent from the parents of the babies. Infants presenting above 6 months of age, Babies with syndromic CTEV and babies with associated hip disorders were excluded.

The study population were screened for any associated anomalies and co-morbidities. The severity of the deformity were assessed by using the Pirani score. Correction of the deformity was started at the first consultation by using the Ponseti technique. Serial weekly castings were done followed by equinus correction by performing a percutaneous TendoAchilles tenotomy. Then the babies were subjected to Dennis brown splint up to 3 years.

All babies were followed up every week until Equinus correction followed by bi monthly visits till 1st year (2nd,4th,6th,8th months),then yearly once till 5 years(1st,2nd,3rd,4th,5th year).

The babies were followed up till July 2021, the mean follow-up period being 5 years and the minimum follow-up period being 3 years.

### Correction Technique

The order of correction as described by Ponseti was: Forefoot cavus and adductus followed by mid foot varus and finally the hind foot equinus.

The Pirani Score at time of presentation was recorded.

Adequate padding is essential and a below knee cast is applied which is then extended up to the groin. The castings are done with 90° flexion at the hip and knee. The parents are educated about genitals hygiene and POP care.

The first cast targets the correction of fore foot cavus which is done by palpating the head of the 1st metatarsal and applying an upward pressure in order to dorsiflex it. This aligns the forefoot to the hind foot and the cast was applied.

The patients were followed up 1 week later and the Pirani score was assessed. If the cavus remains uncorrected, then the 1st cast technique is repeated until cavus is corrected.

The next cast involves correction of fore foot adductus and mid foot Varus. This is done by gentle abduction of the foot by using the talus head as the lever. The head of talus is palpated using the thumb and gentle abduction is done and the cast is applied. Serial weekly castings are done by using the same technique until the adductus and varus are corrected. The next step involves correction of the hind foot equinus, which required a percutaneous Achilles tenotomy in operation theatre, under sterile aseptic

precautions, under local anaesthesia/sedation using surgical knife, followed by casting in maximum dorsiflexion. If the equinus was passively correctable, then casting was applied with ankle in maximum dorsiflexion.

This cast was continued for the next 3 weeks. Then cast was removed and Pirani score was reassessed. Corrected deformities were then subjected for splinting in a Dennis brown splint for nearly 23 hours for next 3 months; followed by night splinting for the next 3 years.

Parents were taught to perform gentle passive ankle and foot stretch and motion exercises during the non-splinting time. A strict adherence to splinting was advised and the babies were followed up yearly once from the 1st year to final year.

The Ponseti scoring system.<sup>[7]</sup> was applied at the 1st year, 3rd year and 5th year for assessing the functional outcomes.

FUNCTIONAL SCORING SYSTEM ACCORDING TO DR.PONSETI:	
<p><b>SATISFACTION:</b></p> <ul style="list-style-type: none"> <li>➤ VERY SATISFIED – 20</li> <li>➤ SATISFIED – 16</li> <li>➤ NEITHER SATISFIED/UNSATISFIED -12</li> <li>➤ UNSATISFIED – 08</li> <li>➤ VERY UNSATISFIED - 04</li> </ul>	<p><b>FUNCTION:</b></p> <ul style="list-style-type: none"> <li>➤ NOT LIMITED – 20</li> <li>➤ OCCASIONALLY LIMITS STERNUOUS ACTIVITY-16</li> <li>➤ USUALLY LIMITS STERNUOUS ACTIVITY-12</li> <li>➤ OCCASIONALLY LIMITS ROUTINE ACTIVITY – 08</li> <li>➤ LIMITS WALKING - 04</li> </ul>
<p><b>PAIN:</b></p> <ul style="list-style-type: none"> <li>➤ NEVER PAINFUL – 30</li> <li>➤ OCCASIONALLY MILD PAIN ON STERNUOUS ACTIVITY – 24</li> <li>➤ USUALLY PAINFUL ON STERNUOUS ACTIVITY -18</li> <li>➤ OCCASIONALLY PAINFUL ON ROUTINE ACTIVITY-12</li> <li>➤ PAINFUL DURING WALKING -06</li> </ul>	<p><b>POSITION OF HEEL ON STANDING:</b></p> <ul style="list-style-type: none"> <li>➤ HEEL VARUS 0° OR SOME HEEL VALGUS – 10</li> <li>➤ HEEL VARUS 1° TO 5° – 5</li> <li>➤ HEEL VARUS 6° TO 10° - 3</li> <li>➤ HEEL VARUS &gt;10° - 0</li> </ul>
<p><b>PASSIVE MOTION:</b></p> <ul style="list-style-type: none"> <li>➤ DORSIFLEXION – 1 POINT FOR EVERY 5° (MAX- 5)</li> <li>➤ TOTAL VARUS-VALGUS MOTION OF HEEL – 1 POINT PER EVERY 10° (MAX- 3)</li> <li>➤ TOTAL INVERSION - EVERSION OF FOOT - 1 POINT PER EVERY 50° (MAX – 2)</li> </ul>	<p><b>GAIT :</b></p> <ul style="list-style-type: none"> <li>➤ NORMAL – 6</li> <li>➤ CAN TOE WALK – 2</li> <li>➤ CAN HEEL WALK – 2</li> <li>➤ LIMP - -2</li> <li>➤ NO HEEL STRIKE - -2</li> </ul>

Figure 1: Image showing the Ponseti scoring system and its interpretation

- Excellent - 90-100 points
- Good - 80-89 points
- Fair - 70-79 points
- Poor - less than 70 points

## RESULTS

The study population included a total of 57 club feet in 34 babies, who were treated and followed up for a mean period of 5 years, out of which 2 babies lost follow-up.

In our study population, 20 were male and 14 were female, the Male: Female ratio being 1.42:1.

Out of 34 babies, 23 had bilateral clubfeet and 11 had unilateral clubfeet (6 right and 5 left).

Only 1 baby with unilateral clubfoot had an associated Tibia vara deformity.

Mode of birth in our study population was normal vaginal delivery in 25 babies and LSCS in 9 babies. All babies presented to us within 4 weeks of birth, the earliest being 2 days post-delivery and the late being at the end of 4 weeks.

The Pirani scoring at the initiation of treatment was 6 in 10 clubfeet, 5.5 in 15 clubfeet, 5 in 20 clubfeet and 4.5 in 8 clubfeet.

The number of casts applied for correction ranged from 6 to 10 and the mean number of casts was 8.

45 feet needed percutaneous tenotomy and the time at which the tenotomy done ranged between 8 to 10 weeks. The mean time at tenotomy was 9 weeks.

The mean time at the initiation of splint usage was 12 weeks and the range was 11 to 13 weeks.

The splinting was continued for 23 hours a day for the next 3 months followed by night splinting for the next 3 years. Then all the babies were advised Club foot shoes until 5 years of age.

The Ponseti scoring system was applied at the 1st year of life and was found to be Excellent in 35 feet; good in 15 feet; fair in 5 feet and poor in 1 feet

One child developed relapse due to poor compliance to splinting. Repeat ponseti casting was initiated and at the end of 1st year the child had a residual deformity for which surgical management in the form of posteromedial soft tissue release was done. Therefore, was excluded from the study thereafter.

At the 3rd year, the Ponseti scoring system was applied and was found to be Excellent in 40 feet; good in 10 feet; fair in 6 feet.

At the 5th year, the Ponseti scoring system was applied and was found to be Excellent in 44 feet; good in 8 feet; fair in 4 feet.



**Figure 1: Unilateral Clubfoot – right side 1st consultation**



**Figure 2: Images showing serial casting done once weekly until correction of Cavus, Adductus and Varus deformities**



**Figure 3: Image showing corrected deformity at end of serial casting**



**Figure 4 and 5: Outcome at the end of 1 year**



**Figure 6 and 7: Outcome at the end of 3rd year**

### Case Illustration 3



**Figure 1 and 2 showing Relapsed Ctev with residual deformity**



**Figure 3, 4 and 5 showing Outcomes after posteromedial soft tissue release**



## DISCUSSION

Idiopathic CTEV, being the most commonly encountered congenital anomaly,<sup>[8]</sup> demands an effective treatment protocol in order to attain a functionally as well as cosmetically acceptable foot. The Ponseti technique that involves correction of the deformities by series of manipulative castings stands out to be an effective method in CTEV correction. An effectively implemented Ponseti technique along with a good compliance to treatment has proved to reduce the need for surgical management in CTEV correction.<sup>[9]</sup>

Our 5 year follow-up study aimed at assessing the midterm effectiveness of the Ponseti technique in the management of idiopathic CTEV.

Our study population had a male child predominance which was comparable to Porecha et al study.<sup>[12]</sup>

In this study the Pirani scoring at time of initiation of casting was 6 in 17.5% of babies, which was very less compared to Almag Bitew.<sup>[14]</sup> et al study.

The mean number of casts before equinus correction in our study was 8, which was similar to Porecha et al study. 78% of our study population required a percutaneous tendoachilles tenotomy, which was comparable to Bitew et al study. The mean time at initiation of splint usage was 12 weeks, which was comparable to Porecha et al study.

The ponseti scoring at end of 5 years was Excellent in 77% of the study population, which was similar to Porecha et al study.

## CONCLUSION

The Ponseti technique proves to be an efficient one in the non-invasive management of idiopathic CTEV. An early initiation of treatment with regular follow-up and precise manipulation are very essential in the deformity correction. The use of appropriate sized splints and proper compliance to them is a must to prevent the relapse or recurrence of the deformities.

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