Section: Orthopedics

Original Research Article

# A STUDY ON EVALUATION OF OUTCOMES OF ACCELERATED PONSETI METHOD FOR CORRECTION OF CONGENITAL TALIPES EQUINOVARUS

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ABSTRACT

**Background:** CTEV is a common congenital condition affecting the lower limbs. Ponseti method is the gold standard line of management. However, due to its lengthy procedure and need for frequent visits, the compliance rate is low. Accelerated Ponseti method has similar efficacy with reduced need for follow-ups. This study evaluates the outcomes of patients treated with accelerated Ponseti method.

**Material and Methods:** A total of 40 patients with CTEV who presented to King George Hospital Visakhapatnam during time period of Aug 2021 to May 2023 were included in this study.

**Results:** A total of 40 patients with CTEV underwent accelerated Ponseti method for correction. Most of the patients had excellent outcomes. There were no poor outcomes. 5 patients had cast related pressure ulcers which subsequently healed.

**Conclusion:** Patients with idiopathic CTEV show better compliance and thereby better outcomes with accelerated Ponseti method.

**Keywords:** CTEV, Ponseti method, deformity, congenital.

## INTRODUCTION

Congenital talipes equinovarus (CTEV) has a complicated origin. It is one of the most prevalent types of birth defects affecting the lower limbs. This condition encompasses multiple deformities, i.e., plantar flexed position of ankle (equines deformity), inversion of hind foot at sub- talar joint (varus deformity) and adduction inversion of mid and forefoot (Cavus deformity). Its incidence is estimated to be about 1-2 in every 1000 live births and male child being more commonly effected than female child (with male: female ratio of 2:1) more commonly being bilateral.[1-3]

CTEV and its management was first described by Hippocrates back in 300 B.C who then suggested tacking the problem right from birth and treating with gentle manipulation. Plaster of pairs in CTEV treatment was first used by Guerin in 1836. Correction of CTEV with the Ponseti approach of weekly manipulation of the deformity followed by long leg cast is successful, minimally intrusive, and affordable.[4]

The Ponseti method consists of a specific technique of manipulation of the clubfoot deformity, followed by the application of a plaster cast with the foot in the corrected position. A percutaneous tenotomy of the Achilles tendon is done prior to the final cast to gain complete correction in most patients. Bracing with foot abduction orthosis is necessary to minimize relapse of the deformity. Bracing at night and during nap time is recommended until the child is 4 to 5 years old. This manipulation allows complete correction of almost all idiopathic clubfeet in 4 to 7 sessions over a long period of time.[5]

Morcuende et al. and Xu created faster and modified protocols that take just 5 days to fix the foot, and they discovered that the outcomes were comparable to the standard technique. Reducing the length of time in correction is necessary to ease the child's and

physical, mental, and financial suffering of families.[6,7]

The purpose of this dissertation is to evaluate the efficacy of the accelerated Ponseti technique for the management of idiopathic CTEV, and the risks and benefits of this procedure.

## MATERIAL AND METHODS

This observational study was conducted at King George Hospital, Visakhapatnam during August 2021 to May 2023. All children under two years who were diagnosed with idiopathic clubfoot and managed with the accelerated Ponseti method in the Department of Orthopedics were included in this group study.

All infants and toddlers below 2 years of age with idiopathic club foot, without other congenital anomalies were included after taking consent from their respective parents.

Patients beyond 2 years of age, or children with congenital or neurological conditions, or children with intermittent r regular club foot or children who had underwent previous conservative or surgical intervention for club foot were excluded from the study.

A detailed history was taken with specific mentions of birth history and consanguinity. Deformity was categorized into different grade using Dimeglio et al system of grading. Pirani clinical scoring was used to determine the outcomes. All patients were followed up for 6 months after end of intervention to assess the outcomes.

Paired 't' test was used to compare the median of the previous Pirani score with the median of the final Pirani score

Ethical committee approval was taken prior to initiation of this study. A written informed consent was taken from the parents of all study participants. All parents were assured of confidentiality.

**Treatment Regimen**

Casting was done according to Ponseti technique on Mondays and Thursdays of every week. Gentle manipulation was used to correct the Cavus deformity initially followed by adductus and Varus and finally equines deformity, in this order along with above knee casting. Achilles Tenotomy was performed, if necessary, under general anesthesia. A foot abduction orthosis with 70o of external-rotation on affected side and 40 o of external rotation on the normal side was worn for 3 weeks. Parents were counseled regarding the need to wear braces for 23 hrs/day for the first three months, and then for the rest of the day and at nap times for the next four years.

**Follow-Up**

Patients were advised to follow-up after 2 weeks of putting the brace. Thereafter, they were told to come to follow-up once a month for the next 3 months; every 3 months from 3-4 years of age and once every 6 months from 4-6 years of age. At each visit, the patient's functional state of foot and any signs of recurrence was assessed.

The outcomes were termed as excellent, good, fair and poor.

| | |
|---|---|
| **EXCELLENT** | • All aspects of the malformation are fixed.<br>• Aesthetically appropriate plantigrade foot<br>• Pliability of the subtalar joint<br>• When there is a bilateral deformity, the degrees of dorsiflexion on both sides must be more than ninety degrees. |
| **GOOD** | • Total deformity correction including all visible signs of improvement<br>• An otherwise normal, mobile, and fully plantigrade foot exhibiting just a little degree of chronic metatarsal adductus. |
| **FAIR** | • Plantigrade and functionally acceptable foot<br>• Cosmetically less acceptable |
| **POOR** | • Loss of correction and recurrence of deformity which requires soft tissue release |

**CASE – 1**

**RIGHT FOOT**

**LEFT FOOT**

**Figure 1,2: At Presentation**

**Figure 3: CASTING**

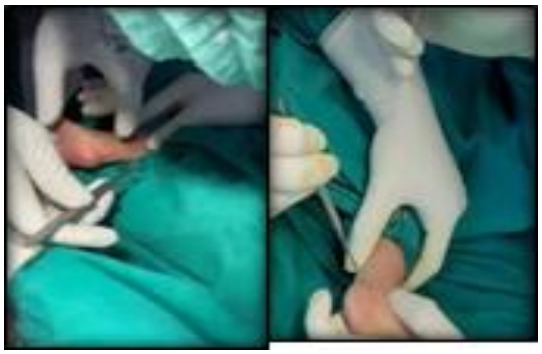


**Figure 4: TENOTOMY**

**RIGHT FOOT**

**Figure 5: Post Correction**

**LEFT FOOT**

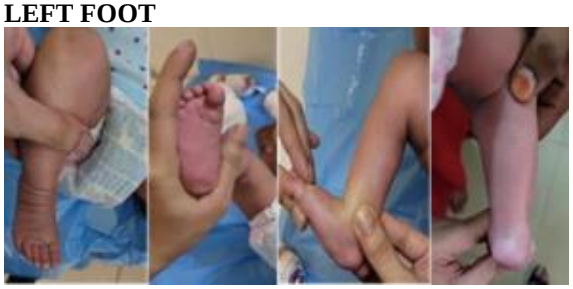


**Figure 6: BRACING**

**CASE – 2**

**RIGHT FOOT**

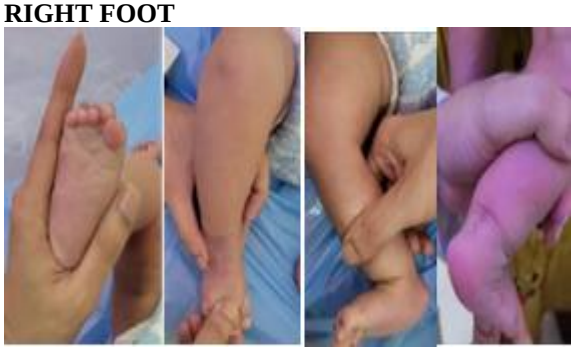
**LEFT FOOT**

**Figure 7,8: At Presentation**

**Figure 9: CASING**

**Figure 10: TENOTOMY**

**RIGHT FOOT**



**LEFT FOOT**

**Figure 11,12: Post Correction**

**Figure 13: BRACING**

**CASE – 3**

**RIGHT FOOT**

**LEFT FOOT**

**Figure 14,15: At Presentation**

**Figure 16: CASING**

**RIGHT FOOT**

**LEFT FOOT**

**Figure 17, 18: Post Correction**

**Figure 19: BRACING**

**CASE – 4**

**RIGHT FOOT**

**Figure 20: At Presentation**

**Figure 21: CASING**

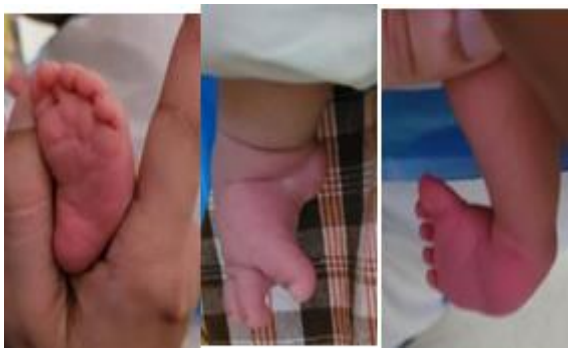
**Figure 22: TENOTOMY**

**Figure 23: Post Correction**

**Figure 24: BRACING**

**CASE – 5**

**RIGHT FOOT**



**LEFT FOOT**

**Figure 25, 26: At Presentation**

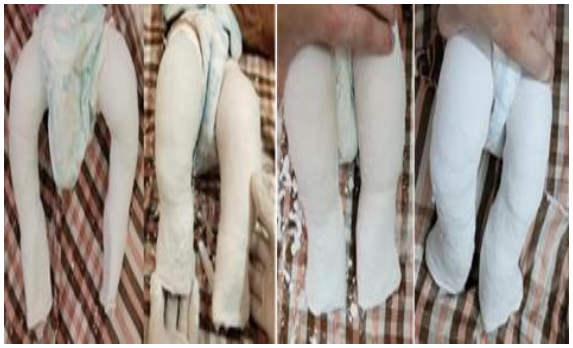


**Figure 27: CASING**

**Figure 28: POST CASING**

**Figure 29: BRACING**

## RESULTS

In this study, we looked at CTEV correction using the accelerated Ponseti approach in 43 individuals diagnosed as idiopathic clubfoot and were less than 2 years old. Three patients could not be located for further evaluation. Hence the study included 40 patients.

In present study, out of 40 patients, 26 were male and 14 were female. 30 patients were less than six months, 7 were between six months and one year, and 3 were older than two years. 21 patients had bilateral deformity, 12 patients had right sided unilateral and 7 had left sided unilateral deformity. A total of 61 feet were included, 33 right and 28 left. 18 patients had Dimeglio grade 4, 13 had Dimeglio grade 3 and 9 had Dimeglio grade 2 deformity. Patient scores at the beginning of the study ranged from 4.59 for those aged 0-6 months, 4.44 for those aged 6-12 months, and 5.25 for those aged 1-2 years.

Average number of casts needed for correction for patients of age between 0-6 months was 4.59, 6-12 months was 4.44 and 1-2 years was 5.25. The average duration for correction for patients of age between 0-6 months was 18.33 days, 6-12 months was 17.2 days and 1-2 years was 31.33 days.

Thirty toddlers had undergone Achilles tenotomy. Tibialis anterior tendon transfers or substantial soft tissue releases were not required on any of the feet. 5 patients had a recurrence of their deformity, 3 with forefoot adduction and 2 with equines deformity. All 5 required more plasters, and 2 required additional Achilles tenotomies. Patients had pressure sores over head of the talus region, which healed subsequently

The results were excellent for 51 feet (85%) and good for 10 feet (15%).

**Table 1: Outcomes**

| Results | No of patients | Percentage |
|---|---|---|
| Excellent | 51 | 85% |
| Good | 10 | 15% |
| Fair | 0 | |

| | | |
|---|---|---|
| poor | 0 | |

**Table 2: Complications**

| Cast complications | 0 |
|---|---|
| Skin allergy or irritation | 0 |
| Cast loosening | 0 |
| Cast related pressure ulcers | 5 |
| Swelling of foot and toes | 0 |
| Circulation problems | 0 |
| Rocker bottom foot | 0 |
| Muscle atrophy | 0 |
| Post Tenotomy complications | 0 |
| Neurovascular damage | 0 |
| Wound infection | 0 |
| Brace related complications | 0 |
| Poor brace compliance | 5 |

## DISCUSSION

Congenital talipes equinovarus (CTEV), often known as 'club-foot', is a common developmental disorder affecting the lower limb. It is defined as fixation of the foot in adduction, in supination and in varus, i.e. inclined inwards, axially rotated outwards and pointing downwards.[8] The goals of therapy are to eliminate the foot abnormalities, restore normal function, and create a plantigrade foot so that the patient may wear conventional footwear and avoid arthritic degenerations later in life.

The good results of Ponseti's clubfoot treatment protocol were first reported in 1963. The Ponseti approach is also useful for fixing the aberrant forms of separate chondro- osseous structures brought on by shifts in the mechanical stress of young, quickly growing tissues.[4] The major drawback in this method in developing countries is the poor compliance to the treatment because of the long duration of the treatment added with lack of education, awareness and poor economic condition of the people.[9]

Morcuende et al,[10] and Xu RJ et al,[11] revealed the findings of a faster and modified procedure that required just 5 days to complete.

Present study included 61 feet of which 51 (85%) had excellent outcome and 10 (15%) had good outcome. The average duration for correction for patients of age between 0-6 months was 18.33 days, 6-12 months was 17.2 days and 1-2 years was 31.33 days, showing a significant decrease in time required for correction particularly in children of age less than 1 year. Achilles Tenotomy was done in 30 out of 40 patients (75%). 5 patients had pressure sores that healed subsequently. 5 patients had relapse of the deformity with 3 having relapse of forefoot adduction and 2 having relapse of equines deformity.

**Table 3: Average initial Pirani scores – Comparison with similar studies**

| Study | Average | |
|---|---|---|
| Present study | 4.63 | |
| Barik et al[12] | 5.02 +/-0.78 (Standard group) | 5.02 +/-0.73 (Accelerated group) |
| Islam et al[13] | 4.67+/- 0.73 (Standard group) | 4.35 +/- 0.76 (Accelerated group) |
| Elgohary et al[14] | 5.17 +/- 0.62 (Standard group) | 5.13 +/- 0.61 (Accelerated group) |

**Table 4: Average No. of casts needed for correction – Comparison with similar studies**

| Study | Average | |
|---|---|---|
| Present study | 5.7 | |
| Barik et al[12] | 5.23 +/-0.59 (Standard group) | 4.72 +/- 0.61 (Accelerated group) |
| Islam et al[13] | 6.3 +/- 1.2 (Standard group) | 6.1 +/- 1.4 (Accelerated group) |
| Elgohary et al[14] | 4.88 +/- 0.88 (Standard group) | 5.16 +/- 0.72 (Accelerated group) |

**Table 5: Average duration needed for correction – Comparison with similar studies**

| Study | Average | |
|---|---|---|
| Present study | 19.67 | |
| Barik et al[12] | 54.38 +/-8 (Standard group) | 33.88 +/- 9.03 (Accelerated group) |
| Islam et al[13] | 58.2 +/- 8.3 (Standard group) | 39.5 +/- 5.2 (Accelerated group) |
| Elgohary et al[14] | 33.36 +/- 6.69 (Standard group) | 18.13 +/- 3.02 (Accelerated group) |

**Table 6: Average final Pirani scores – Comparison with similar studies**

| Study | Average | |
|---|---|---|
| Present study | 0.12 | |
| Barik et al[12] | 1.20 +/-0.46 (Standard group) | 1.50 +/-0.00 (Accelerated group) |
| Islam et al[13] | 0.34 +/- 0.38 (Standard group) | 0.35 +/- 0.31 (Accelerated group) |
| Elgohary et al[14] | 0.49 +/- 0.42 (Standard group) | 0.52 +/- 0.38 (Accelerated group) |

**Table 7: Average final Pirani scores – Comparison with similar studies**

| Study | Tenotomy perfomed | Tenotomy not performed |
|---|---|---|
| Present study | 0.12 | |
| Barik et al[12] | 75% | 25% |
| Islam et al[13] | 84% | 16% |
| Elgohary et al[14] | 84.42% | 15.58% |

**Table 8: Final outcome with accelerated Ponseti method – comparison with other studies.**

| Study | Outcomes | | | |
|---|---|---|---|---|
| | Excellent | Good | Fair | Poor |
| Present study | 83% | 17% | 0% | 0% |
| Barik et al[12] | 78% | 22% | 0% | 0% |
| Islam et al[13] | 66% | 33% | 0% | 0% |
| Elgohary et al[14] | 82% | 18% | 0% | 0% |

**Table 9: Average final Pirani scores – Comparison with similar studies**

| Study | Relapse rate | |
|---|---|---|
| Present study | 12.5% | |
| Barik et al[12] | 15% (Standard group) | 11% (Accelerated group) |
| Islam et al[13] | 12% (Standard group) | 8% (Accelerated group) |
| Elgohary et al[14] | 14.7% (Standard group) | 15.6% (Accelerated group) |

In all 5 cases of relapse it was observed that the cause for relapse has been the poor compliance to the abduction brace. All of the cases of relapse were treated with reapplication of plaster casts until correction of deformity with 2 cases needing second percutaneous Achilles Tenotomy followed by abduction brace application again.

Insufficient brace compliance, a lack of parental education, a severe deformity, and a technical error in the casing all play a role in why the Ponseti brace often fails to correct a deformity.[9,15]

Relapse may be prevented in certain cases by ensuring that patients adhere to the bracing procedure and by following up with them on a frequent basis to check for proper brace fit and make adjustments as necessary. To avoid a recurrence of the deformity, it is crucial to advise and educate the parents about the need of treatment compliance and the various challenges that may arise during the bracing phase.

There were no other complications such as the cast associated skin allergies, cast loosening, swelling of foot and toes, vascular compromise, rocker- bottom foot, post Tenotomy neurovascular damage and wound infections. There was no need for major soft tissue release treatments to rectify the abnormality in any of the youngsters. After treatment, each kid had full range of motion in both legs and their parents reported no complaints about their children's ability to walk normally.

The high degree of compliance can be explained basing upon our modified treatment regimen. When compared to the standard treatment protocol by Ponseti that includes cast change once every week, in present study the casts are changed more frequently, this has decreased the treatment duration of casting phase.

The patients who are travelling from far places particularly the patients from rural areas and patients of low socio-economic status who can't afford to travel multiple times on and off can stay at the hospital for this short duration till the castings are completed. This has greatly decreased the burden on the families which has led to increased compliance to the treatment and the treatment success.

There were also a few drawbacks in present study- the sample size is not large enough and further studies with larger sample sizes are needed to draw conclusive evidence. The period of follow-up in present study is not long enough to detect all the cases of relapse as the clubfoot is known for relapse till the age of 5 years and a total follow-up till age of 5 years is needed to identify all the cases of relapse in the study population.

## CONCLUSION

The accelerated Ponseti method for correction of clubfoot suits our rural population as most of them coming from far off places cannot afford to travel 5 to 6 times. The compliance is better with all the basic principles followed without deviation. With this accelerated version, there was no need for major soft tissue release treatments to rectify the abnormality in any of the youngsters. Parents reported no complaints about their children's ability to walk normally after getting treatment.

There were complications in few cases like pressure sore and relapses in 10% of cases that were tackled effectively with our treatment regimen. There were no other complications such as the cast associated skin allergies, cast loosening, swelling of foot and toes, vascular compromise, rocker-bottom foot, post Tenotomy neurovascular damage and wound infections.

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**Conflicts of interest:** Nil

## REFERENCES


1. Dobbs, Matthew B.; Gurnett, Christina A. (February 18, 2009). "Update on clubfoot: etiology and treatment". Clinical Orthopaedics and Related Research. 467 (5): 1146– 1153. doi:10.1007/s11999-009-0734-9. ISSN 1528- 1132. PMC 2664438. PMID 19224303.
2. Dibello, Daniela; Di Carlo, Valentina; Colin, Giulia; Barbi, Egidio; Galimberti, Anna M. C. (December 2020). "What a paediatrician should know about congenital clubfoot". Italian Journal of Pediatrics. 46 (1): 78. doi:10.1186/s13052-020-00842-3. ISSN 1824- 7288. PMC 7271518. PMID 32498693.
3. PJ; Gray, K (September 2013). "Update on clubfoot". Journal of Paediatrics and Child Health. 49 (9): E434–7. doi:10.1111/jpc.12167. PMID 23586398. S2CID 6185031.
4. Docker CEJ, Lewthwaite S, Kiely NT (2007) Ponseti treatment in the management of clubfoot deformity—a continuing role for paediatric orthopaedic services in secondary care centers. Ann R Coll Surg Engl 89:510–512
5. Dietz FR, Noonan K. Treatment of Clubfoot Using the Ponseti Method. JBJS Essent Surg Tech. 2016 Aug 10;6(3): e28. doi: 10.2106/JBJS.ST.14.00112. PMID: 30233921; PMCID: PMC6135620.
6. Ponseti IV, Smoley EN (1963) Congenital club foot: the results of treatment. J Bone Joint Surg Am 45-A:261–344
7. Halanski MA, Davison JE, Huang J-C, Walker CG, Walsh SJ, Crawford HA (2010) Ponseti method compared with surgical treatment of clubfoot: a prospective comparison. JBJS A92:270–278
8. Miedzybrodzka Z. Congenital talipes equinovarus (clubfoot): a disorder of the foot but not the hand. J Anat. 2003 Jan;202(1):37-42. doi: 10.1046/j.1469-7580.2003.00147. x. PMID: 12587918; PMCID: PMC1571059.
9. Panjavi B, Sharafatvaziri A, Zargarbashi RH, Mehrpour S (2011) Use of the Ponseti method in the iranian population. J Pediatr Orthop 32:11–14.
10. Morcuende JA, Abbasi D, Dolan LA, Ponseti VI (2005) Results of an accelerated Ponseti protocol for clubfoot. J Pediatr Orthop 25:623–626
11. Xu RJ (2011) A modified Ponseti method for the treatment of idiopathic clubfoot: a preliminary report. J Pediatr Orthop 31:317–319
12. Barik S, Nazeer M, Mani BT. Accelerated Ponseti technique: efficacy in the management of CTEV. Eur J Orthop Surg Traumatol. 2019 May;29(4):919-924. doi: 10.1007/s00590-018-2353-1. Epub 2018 Dec 6. PMID: 30523464.
13. Islam M.S., Masood Q.M., Bashir A., Shah F.Y., Halwai M.A. Results of a Standard versus an Accelerated Ponseti Protocol for Clubfoot: A Prospective Randomized Study. Clin. Orthop. Surg. 2020; 12:100. doi: 10.4055/cios.2020.12.1.100.
14. Elgohary HS, Abulsaad M. Traditional and accelerated Ponseti technique: a comparative study. Eur J Orthop Surg Traumatol. 2015 Jul;25(5):949-53. doi: 10.1007/s00590-015-1594-5. Epub 2015 Jan 30. PMID: 25633123.
15. Dobbs MB, Rudzki JR, Purcell DB, Walton T, Porter KR, Gurnett CA (2004) Factors predictive of outcome after use of the Ponseti method for the treatment of idiopathic clubfeet. J Bone Joint Surg Am 86-A:22–27.