Original Article

Outcome of Syndromic Congenital Talipes Equinovarus in Children Treated by Ponseti Technique at a Tertiary Care Centre of Northeast India

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Abstract

Background: Among congenital abnormalities affecting lower limb, syndromic congenital talipes equinovarus has prevalence rate ranging from 1.1 to 1.6 per 1000 livebirths[1]. Most cases of clubfeet are thought to be idiopathic, meaning they happen randomly at birth. On the other hand, neuromuscular and syndromic diseases constitute most of syndromic congenital talipes equinovarus cases. The aim and objective is to study the incidence and sociodemographic profile of syndromic congenital talipes equinovarus, identifying the clinical profile of syndromic CTEV and to study the efficacy of Ponseti method in management of syndromic CTEV. **Material and Methods:** A hospital based prospective study was done at orthopedics department of a premier tertiary care hospital of North-East India. All clinically diagnosed syndromic CTEV cases were included in the study. **Results:** Most patients were aged 1–5 months at presentation, with a male predominance (male: female ratio 1.35:1). Bilateral involvement was observed in the majority of cases. Arthrogryposis multiplex congenita was the most common associated syndrome. All patients underwent Achilles tendon tenotomy and were treated with a foot abduction brace. Good compliance with treatment was observed in 92.5% of patients, while relapse occurred in only 7.5% of cases. The most common final Pirani score was 0.5/0.5 (47.5%), indicating satisfactory correction. The mean age at first cast application was 6.31 ± 10.26 days, the mean number of casts required was 9.8 ± 1.51, and the mean follow-up duration was 11.28 ± 1.30 months. **Conclusion:** We concluded that Ponseti technique demonstrates favorable outcomes in treating syndromic CTEV, offering high correction rates and improved functional mobility. Ongoing monitoring and individualized treatment adjustments are crucial to managing relapse and optimizing long-term results. Further research is needed to refine protocols tailored to specific syndromic variants and to explore the broader impacts on quality of life and social functioning in affected children.

Keywords: Congenital talipes equinovarus, clubfoot, syndromic, Ponseti technique, systematic review.

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Introduction

Congenital talipes equinovarus (CTEV), commonly known as clubfoot, is one of the most common congenital musculoskeletal deformities, with an incidence of 1.1–1.6 per 1,000 live births worldwide and approximately 0.9 per 1,000 live births in India. ¹The deformity consists of four characteristic components: equinus, varus, adduction, and cavus, resulting in a rigid foot that is turned inward and downward. If left untreated, clubfoot can lead to significant disability, gait abnormalities, and impaired quality of life.

Most cases occur as isolated deformities and are classified as idiopathic clubfoot. However, a smaller proportion is associated with neuromuscular and syndromic conditions such as arthrogryposis multiplex congenita, spina bifida, amniotic band syndrome, and other congenital disorders. These cases are termed syndromic clubfoot and are generally more severe, rigid, and difficult to treat than idiopathic clubfoot.[1]

The exact etiology of clubfoot remains unclear. Several theories including genetic, embryological, neuromuscular, and environmental factors have been proposed. Familial occurrence and twin studies suggest a significant genetic contribution, while environmental factors such as oligohydramnios and maternal exposures during pregnancy may also play a role.[2,3]

The primary goal of treatment is to obtain a painless, plantigrade, flexible, and functional foot. Historically, extensive surgical procedures such as posteromedial release, talectomy, and arthrodesis were commonly used, particularly for syndromic clubfoot. However, these procedures were often associated with stiffness, pain, scarring, and recurrence.[2]

The Ponseti method, which involves serial manipulation, casting, Achilles tendon tenotomy, and bracing, has become the gold standard treatment for clubfoot. It has demonstrated excellent outcomes in idiopathic clubfoot and has significantly reduced the need for extensive surgery. More recently, the Ponseti technique

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has also been applied to syndromic clubfoot with encouraging results. Nevertheless, syndromic feet often require more casts, show greater resistance to correction, and have higher recurrence rates due to the underlying pathology.[3]

Need for the study: Syndromic congenital talipes equinovarus remains a therapeutic challenge because of its severity, rigidity, and increased risk of relapse. Although the Ponseti method is widely accepted as the treatment of choice, limited data are available regarding its effectiveness in syndromic clubfoot, particularly in this Northeastern Indian population. Evaluation of treatment outcomes, recurrence rates, and functional correction is essential to determine the efficacy of this method in syndromic cases. Therefore, the present study was undertaken to assess the clinical profile of patients with syndromic CTEV in this region and to evaluate the effectiveness of the Ponseti technique in achieving and maintaining deformity correction.

Materials and Methods

Study Type: a hospital based prospective cross sectional study

Study setting: Clubfoot clinic, Department of orthopedics at a premier tertiary care hospital of Northeast India

Study period: August 2022 to July 2023

Sample Size: A total of 40 patients was taken up for the study.

Inclusion criteria:

1. All clinically diagnosed cases of syndromic clubfoot.
2. Patients whose guardians give consent for the study

Exclusion criteria:

1. Idiopathic CTEV
2. Non consenting guardians of the patients

Data collection: all clinically diagnosed cases of syndromic clubfoot were examined and history taken from consenting guardian using structured schedule which included patient's clinical profile and information on Ponseti regimen, Achilles tendon tenotomy (ATT), typical number of casts, initial correction, recurrence, effective therapy at final follow-up, and consequences.

Data collection procedure/method:

1. Complete clinical examination
2. Primary and secondary survey to look for any associated congenital abnormalities
3. Radiological examination
4. Pirani scoring to be done before Ponseti casting

Statistical analysis plan:

- Data was entered in Microsoft Excel and analyzed using SPSS software.
- Descriptive statistics such as mean, standard deviation, frequencies, and percentages was used to summarize data.
- Chi-square test used to determine association between categorical variables. A p-value <0.05 considered statistically significant.

Results

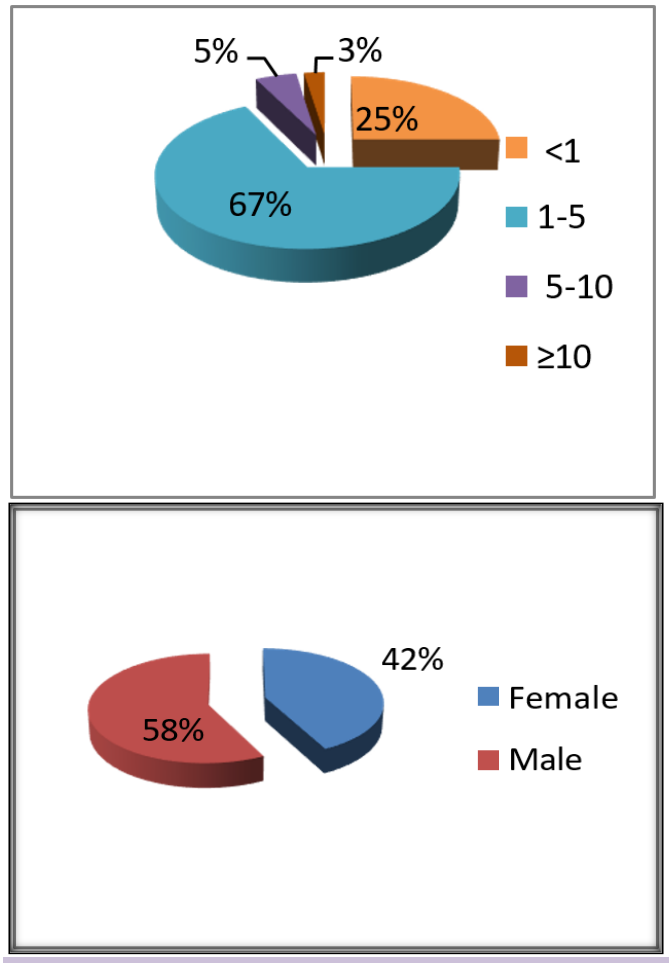


Figure 1: Distribution of Age (in Months) and Sex

The majority of patients presented between 1 and 5 months of age (67.5%), followed by those younger than 1 month (25.0%). The mean age at first cast application was 6.31 ± 10.26 days (range: 0.4–48 days), indicating that most patients received treatment early in life.

There was a male predominance, with 23 (57.5%) males and 17 (42.5%) females, resulting in a male-to-female ratio of 1.35:1. Most patients were first-born children (80.0%), while 20.0% were second-born. Regarding mode of delivery, full-term normal delivery (FTND) was the most common mode of birth, accounting for 65.0% of cases, followed by full-term lower segment caesarean section (22.5%), preterm delivery (7.5%), and full-term breech delivery (5.0%).

Table 1: Sociodemographic Characteristics of Patients with Syndromic CTEV (n=40)

Variable	Category	Frequency (n)	Percentage (%)
Age at Presentation (months)	<1	10	25.0
	1–5	27	67.5
	5–10	2	5.0
	≥10	1	2.5

Sex	Male	23	57.5
	Female	17	42.5
Birth Order	First	32	80.0
	Second	8	20.0
Mode of Delivery	FTND	26	65.0
	LSCS (Full Term)	9	22.5
	Preterm	3	7.5
	Full-Term Breech	2	5.0

Mean age at first cast application: 6.31 ± 10.26 days.

Table 2: Clinical Profile of Syndromic CTEV (n=40)

Variable	Category	Frequency (n)	Percentage (%)
Laterality	Bilateral	27	67.5
	Unilateral	13	32.5
Associated Syndrome	Arthrogryposis Multiplex Congenita (AMC)	30	75.0
	Spina Bifida	7	17.5
	Cleft Palate	2	5.0
	Amniotic Band Syndrome	1	2.5
Previous Treatment	Yes	3	7.5
	No	37	92.5
Initial Pirani Score	6/6	40	100.0

Mean Birth Order: 1.20 ± 0.41

Bilateral involvement was observed in 27 patients (67.5%), whereas unilateral involvement was present in 13 patients (32.5%).

Arthrogryposis multiplex congenita (AMC) was the most common associated syndrome, seen in 30 patients (75.0%). Spina bifida was present in 7 patients (17.5%), while cleft palate and amniotic band syndrome were observed in 2 (5.0%) and 1 (2.5%) patients, respectively.

Only 3 patients (7.5%) had received any previous treatment before presentation, while the remaining 37 patients (92.5%) were treatment-naïve. All patients had severe deformity at presentation, with an initial Pirani score of 6/6.

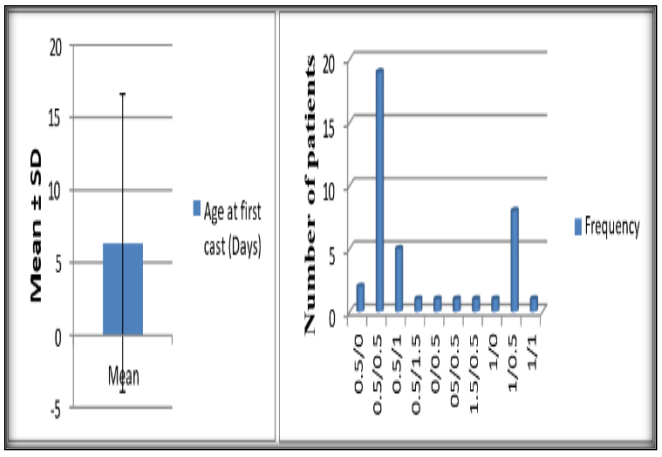
Table 3: Treatment Outcomes and Efficacy of the Ponseti Method (n=40)

Variable	Category	Frequency (n)	Percentage (%)
Achilles Tenotomy	Yes	40	100.0
Foot Abduction Brace (FAB)	Yes	40	100.0
Compliance	Good	37	92.5
	Poor	3	7.5
Relapse	No	37	92.5
	Yes	3	7.5
Most Common Final Pirani Score	0.5 / 0.5	19	47.5

Table 4: Outcome Measures

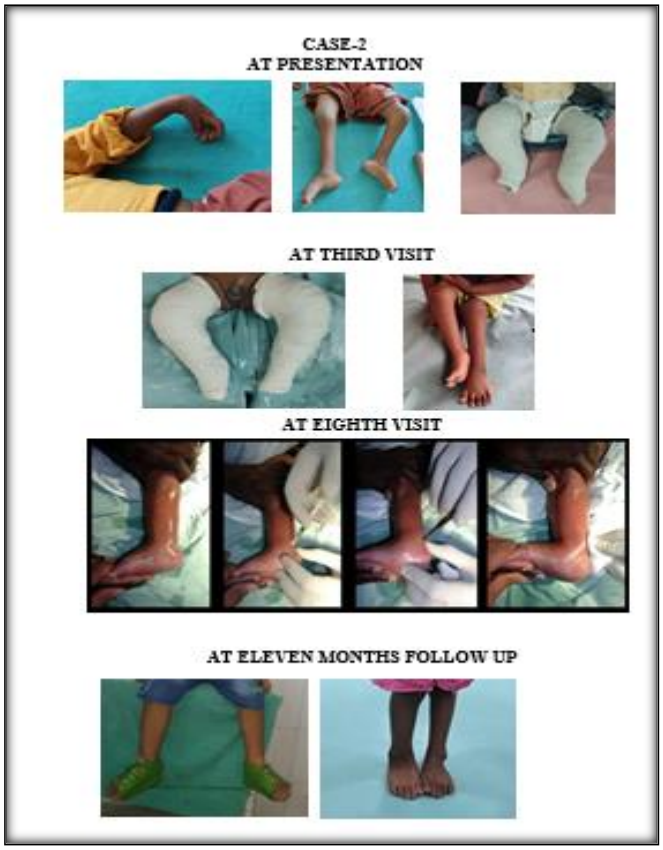
Outcome Measures	Mean ± SD	Range
Number of Casts Required	9.80 ± 1.51	7–12
Follow-up Duration (months)	11.28 ± 1.30	9–14

Correction achieved in all patients, with most attaining a final Pirani score ≤1.



All 40 patients were managed using the Ponseti technique. The mean number of casts required for correction was 9.8 ± 1.51 (range: 7–12 casts), with the majority of patients requiring 10–11 casts. Percutaneous Achilles tenotomy was performed in all patients (100%). Following correction, all patients were prescribed a foot abduction brace (FAB), and good brace compliance was observed in 37 patients (92.5%). Poor compliance was noted in 3 patients (7.5%). At final follow-up, substantial improvement in Pirani scores was observed. While all patients initially had a Pirani score of 6/6, the most common final Pirani score was 0.5/0.5, seen in 19 patients (47.5%). Most patients achieved near-complete correction with final Pirani scores ≤1, indicating excellent clinical outcomes.

The mean follow-up duration was 11.28 ± 1.30 months (range: 9–14 months). Relapse occurred in only 3 patients (7.5%), while 37 patients (92.5%) maintained correction throughout the follow-up period.



Discussion

The present prospective study evaluated the sociodemographic profile, clinical characteristics, and outcomes of the Ponseti method in the management of syndromic congenital talipes equinovarus (CTEV). A total of 40 patients were included and followed for a mean duration of 11.28 ± 1.30 months.[4-6]

Most patients presented between 1 and 5 months of age (67.5%), with a mean age at first cast application of 6.31 ± 10.26 days. Similar early presentation has been reported by Matar HE et al,[5] who observed a mean presentation age of 6.1 weeks in patients with syndromic clubfoot treated by the Ponseti method. Early initiation of treatment is known to improve correction rates and reduce the need for extensive surgical intervention.[7-10]

A male predominance was observed in the present study (57.5%), with a male-to-female ratio of 1.35:1. This finding is consistent with the observations of Butt MN et al,[9] who also reported a higher incidence of clubfoot among males. The majority of patients were first-born children (80%), which is in agreement with epidemiological observations reported by Seravalli V et al.[4]

With regard to clinical profile, bilateral involvement was observed in 67.5% of patients, indicating that syndromic clubfoot frequently affects both feet. Arthrogryposis multiplex congenita (AMC) was the most common associated condition, accounting for 75% of cases, followed by spina bifida (17.5%). These findings are consistent with previous reports identifying AMC and spina bifida as the most frequent causes of syndromic clubfoot.[1]

All patients presented with severe deformity, with an initial Pirani score of 6/6. Only 7.5% had received prior treatment, suggesting that most patients were managed primarily with the Ponseti protocol. Similar findings have been reported by De Mulder T et al,[6] who highlighted the growing role of the Ponseti technique as the primary treatment modality for non-idiopathic clubfoot.

Assessment of treatment outcomes demonstrated the effectiveness of the Ponseti method in syndromic CTEV. The mean number of casts required was 9.8 ± 1.51, which is higher than that generally reported for idiopathic clubfoot and reflects the increased rigidity of syndromic deformities. Comparable observations were reported by Butt MN et al,[9] and Su Y et al,[7] who noted that syndromic clubfeet typically require a greater number of casts to achieve correction.

Percutaneous Achilles tenotomy was required in all patients, and all were subsequently managed with a foot abduction brace. Good brace compliance was observed in 92.5% of patients. Mohsenh WA et al,[10] similarly identified brace compliance as a key determinant of successful treatment outcomes and relapse prevention.

The majority of patients achieved excellent correction, with the most common final Pirani score being 0.5/0.5. Relapse occurred in only 7.5% of patients, which is lower than the relapse rates reported in several previous studies. Parikh K et al,[8] reported a relapse rate of 12.31% following Ponseti treatment, emphasizing the importance of regular follow-up and adherence to bracing protocols.

Overall, the findings of the present study support the effectiveness of the Ponseti method in the management of syndromic CTEV. Although syndromic clubfeet require more casts and closer follow-up than idiopathic cases, satisfactory correction can be achieved with serial casting, Achilles

tenotomy, and strict brace compliance. These results further reinforce the role of the Ponseti technique as the preferred first-line treatment for syndromic clubfoot.

Conclusion

We concluded that Ponseti technique demonstrates favorable outcomes in treating syndromic CTEV, offering high correction rates and improved functional mobility. Ongoing monitoring and individualized treatment adjustments are crucial to managing relapse and optimizing
long-term results. Further research is needed to refine protocols tailored to specific syndromic variants and to explore the broader impacts on quality of life and social functioning in affected children.

Limitations of the study

- The sample size was small.
- Only one location has conducted the study.
- Hospital bias is possible because the study was conducted at a tertiary care facility.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Janicki JA, Narayanan UG, Harvey B, et al.. Treatment of neuromuscular and syndrome-associated (nonidiopathic) clubfeet using the Ponseti method. J Pediatr Orthop 2009;29:393–397.
2. Church C, Coplan JA, Poljak D, et al.. A comprehensive outcome comparison of surgical and Ponseti clubfoot treatments with reference to pediatric norms. J Child Orthop 2012;6:51–59.
3. Gurnett CA, Alaee F, Kruse LM, et al.. Asymmetric lower-limb malformations in individuals with homeobox PITX1 gene mutation. Am J Hum Genet. 2008;83(5):616–622
4. Seravalli V, Pierini A, Bianchi F, Giglio S, Vellucci FL, Cariati E. Prevalence and prenatal ultrasound detection of clubfoot in a non-selected population: an analysis of 549 931 births in Tuscany. The Journal of Maternal-Fetal & Neonatal Medicine. 2015 Nov 22;28(17):2066-9.
5. Matar HE, Makki D, Garg NK. Treatment of syndrome-associated congenital talipes equinovarus using the Ponseti method: 4–12 years of follow-up. Journal of Pediatric Orthopaedics B. 2018 Jan 1;27(1):56-60.
6. De Mulder T, Prinsen S, Van Campenhout A. Treatment of non-idiopathic clubfeet with the Ponseti method: a systematic review. Journal of Children's Orthopaedics. 2018 Dec;12(6):575-81.
7. Su Y, Xie Y, Kang X, Nan G. A polyaxial fixation brace for the treatment of idiopathic congenital talipes equinovarus in newborns. Journal of Orthopaedic Surgery and Research. 2019 Dec;14(1):1-7.
8. Parikh K, Moradiya NP. Outcomes of Congenital Talipes Equinovarus Treated with Ponseti Method.2019
9. Butt MN, Perveen W, Ciongradi CI, Alexe DI, Marryam M, Khalid L, Dobreci DL, Sârbu I. Outcomes of the Ponseti Technique in Different Types of Clubfoot—A Single Center Retrospective Analysis. Children. 2023 Aug 3;10(8):1340.
10. Mohsenh WA, Alqarni MM, Alshehri AK, Asiri AM, Mohsenh OH, Mahmood SE, Alhifzi AI, Mohsenh RH, Zomia AS, Mohsenh W, Alqarni MM. Factors Related to Relapse of Congenital Talipes Equinovarus (CTEV) After the Ponseti Method. Cureus. 2023 Aug 18;15(8).