



RECURRENCE AND RELAPSE PATTERNS IN CTEV PATIENTS FOLLOWING PONSSETI TECHNIQUE WITH OR WITHOUT TENDOACHILLES TENOTOMY

Orthopaedics

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ABSTRACT

Background: Congenital talipes equinovarus (CTEV) is a common pediatric deformity treated effectively by the Ponseti method. However, recurrence and relapse after correction remain a major concern, and the role of Tendo-Achilles tenotomy (TAT) in preventing relapse is debated. **Aim:** To compare the recurrence and relapse patterns in CTEV patients treated with the Ponseti technique with and without Tendo-Achilles tenotomy. **Materials And Methods:** A prospective comparative study was conducted on 72 idiopathic CTEV patients (108 feet) treated at the Department of Orthopedics from May 2023 to May 2025. Patients were divided into two groups: Group A (n = 36) underwent Ponseti casting with percutaneous TAT, and Group B (n = 36) received Ponseti casting alone. The Pirani score, number of casts, dorsiflexion angle, and recurrence or relapse within 12-month follow-up were analyzed. Statistical analysis was performed using chi-square and unpaired t-tests, with $p < 0.05$ considered significant. **Results:** Both groups achieved initial correction using serial casting. However, relapse was observed in 4 (11.1%) feet in the tenotomy group compared to 12 (33.3%) feet in the non-tenotomy group ($p = 0.021$). The mean final Pirani score was 0.8 ± 0.3 in Group A versus 1.4 ± 0.5 in Group B. The average number of casts required was slightly higher in the non-tenotomy group (6.2 ± 1.1 vs 5.4 ± 0.8). No major complications were recorded. **Conclusion:** Adding Tendo-Achilles tenotomy to the Ponseti protocol significantly reduces the risk of relapse and improves functional outcomes in idiopathic CTEV. Early identification of equinus deformity and timely tenotomy are crucial for long-term correction and maintenance of plantigrade feet.

KEYWORDS

CTEV, clubfoot, Ponseti method, Achilles tenotomy, relapse, recurrence, pediatric orthopedics

INTRODUCTION

Congenital talipes equinovarus (CTEV), commonly known as clubfoot, is one of the most prevalent congenital deformities of the musculoskeletal system, affecting approximately 1–2 per 1,000 live births worldwide [1,3]. The condition is characterized by a combination of deformities: cavus, adductus, varus, and equinus — resulting in an internally rotated and inverted foot. It has a clear male predominance and is bilateral in nearly half of the cases [4].

The Ponseti method, introduced by Ignacio Ponseti in the 1940s, revolutionized the management of idiopathic CTEV by emphasizing gentle manipulation and serial casting to gradually correct the deformity [4,7]. This method corrects cavus, adduction, and varus sequentially, with percutaneous Tendo-Achilles tenotomy (TAT) commonly required to correct the residual equinus deformity [5,12]. Multiple studies have reported the success rate of the Ponseti method to be 90–95%, making it the global gold standard for initial management [1,3,4].

Despite excellent initial correction, recurrence and relapse of deformity remain significant challenges, with rates varying from 10% to 40% depending on patient compliance, severity, and post-treatment bracing adherence [6,8,9]. Relapse is often associated with incomplete correction of equinus, early discontinuation of the foot-abduction brace, or inadequate follow-up [5,9,10]. The equinus component is particularly resistant to conservative correction; hence, failure to perform timely tenotomy may predispose patients to recurrence [12].

There is ongoing debate regarding whether Tendo-Achilles tenotomy should be performed universally or selectively after Ponseti casting. While several studies advocate for routine tenotomy to achieve a plantigrade foot and prevent recurrence [1,4,12], others suggest that overuse of tenotomy may not be necessary in milder deformities [2,6]. The variability in outcomes highlights the need for comparative studies assessing relapse patterns between tenotomy and non-tenotomy cases.

The present study was designed to compare recurrence and relapse patterns in CTEV patients managed with the Ponseti technique with and without Tendo-Achilles tenotomy. By analyzing recurrence rates, final Pirani scores, and maintenance of correction over a one-year follow-up, this study aims to determine whether adding tenotomy

confers a significant long-term benefit in preventing relapse and achieving functional plantigrade feet.

AIMS AND OBJECTIVES

Aim: To evaluate and compare the recurrence and relapse patterns in patients with congenital talipes equinovarus (CTEV) treated by the Ponseti technique with or without Tendo-Achilles tenotomy (TAT).

Objectives:

1. To determine the rate of relapse and recurrence following Ponseti treatment in patients undergoing tenotomy versus those managed without tenotomy.
2. To compare the final functional outcomes using the Pirani scoring system between the two groups.
3. To assess the number of casts required and time to achieve correction in both groups.
4. To evaluate the role of Tendo-Achilles tenotomy in achieving and maintaining a plantigrade foot during follow-up.
5. To identify factors influencing recurrence such as laterality, severity at presentation, and compliance with bracing.

MATERIALS AND METHODS

Study Design and Setting: This was a prospective comparative cohort study conducted in the Department of Orthopedic J.L.N MEDICAL COLLEGE AJMER, between OCT2023 and SEPT2025.

Sample Size And Grouping: A total of 72 patients (108 feet) fulfilling the inclusion criteria were enrolled after obtaining written informed consent from parents or guardians. Patients were divided into two groups:

- Group A (Tenotomy group): 36 patients who underwent percutaneous Tendo-Achilles tenotomy following Ponseti serial casting.
- Group B (Non-tenotomy group): 36 patients managed with Ponseti casting alone without tenotomy.

Inclusion Criteria:

1. Patients aged ≤ 2 years with idiopathic CTEV.
2. No prior treatment or surgical intervention for clubfoot.
3. Patients whose parents/guardians provided written informed consent.

Exclusion Criteria:

1. Syndromic or neurogenic clubfoot (associated with cerebral palsy, arthrogryposis multiplex congenita, or myelomeningocele).
2. Recurrent or neglected clubfoot.
3. Patients lost to follow-up before 12 months.

Methodology:

All patients were treated using the standard Ponseti protocol, involving weekly manipulation and serial casting to correct cavus, adduction, and varus deformities.

- Patients achieving correction but retaining equinus deformity ($>10^\circ$ plantar flexion) underwent percutaneous Tendo-Achilles tenotomy under local anesthesia (Group A).
- For Group B, correction was continued through additional casts until maximum dorsiflexion was achieved without surgical intervention. After correction, all patients were fitted with Dennis-Brown (foot abduction) braces and followed up weekly for one month, then monthly for one year.

Outcome Measures:

1. Pirani score — recorded at presentation, after correction, and at final follow-up.
2. Number of casts required for correction.
3. Recurrence and relapse rates — defined as reappearance of deformity requiring further casting or surgical correction.
4. Dorsiflexion angle and maintenance of plantigrade foot at 12-month follow-up.
5. Compliance with bracing was noted through parental reporting.

Statistical Analysis:

Data were analyzed using SPSS version 26.0. Continuous variables (e.g., age, Pirani score, number of casts) were expressed as mean $\pm$ standard deviation and compared using the unpaired t-test. Categorical variables (e.g., relapse rate, laterality, gender) were analyzed using the chi-square test or Fisher's exact test. A p -value < 0.05 was considered statistically significant.

RESULTS

A total of 72 patients (108 feet) with idiopathic congenital talipes equinovarus (CTEV) were included in the study. Among them, 36 patients underwent Tendo-Achilles tenotomy following Ponseti serial casting (Group A), and 36 patients were managed with Ponseti casting alone (Group B). The mean age at initiation of treatment was 9.2 ± 2.4 weeks, and the male-to-female ratio was 2.3 : 1. The baseline demographic profile was comparable between the two groups ($p > 0.05$).

Table 1. Baseline Demographic And Clinical Characteristics

Parameter	Group A (Tenotomy) n = 36	Group B (Non-Tenotomy) n = 36	p-value
Mean age (weeks)	8.9 ± 2.3	9.4 ± 2.6	0.41
Male : Female	25 : 11	24 : 12	0.78
Laterality – Unilateral / Bilateral	20 / 16	18 / 18	0.63
Mean initial Pirani score	5.3 ± 0.6	5.2 ± 0.7	0.48
Positive family history (%)	19.4 %	22.2 %	0.73

Treatment Outcome Parameters

The mean number of casts required to achieve correction was 5.4 ± 0.8 in Group A and 6.2 ± 1.1 in Group B, indicating a significantly faster correction rate among patients who underwent tenotomy ($p = 0.012$). At the completion of correction, the mean Pirani score improved markedly in both groups, with greater improvement noted in Group A (from $5.3 \pm 0.6 \rightarrow 0.8 \pm 0.3$) compared with Group B ($5.2 \pm 0.7 \rightarrow 1.4 \pm 0.5$, $p < 0.001$).

The average dorsiflexion angle achieved at the end of treatment was $18.2^\circ \pm 3.5^\circ$ in Group A and $11.6^\circ \pm 4.1^\circ$ in Group B ($p < 0.001$).

Table 2. Comparative Outcome Parameters

Parameter	Group A (Tenotomy)	Group B (Non-Tenotomy)	p-value
Mean number of casts	5.4 ± 0.8	6.2 ± 1.1	0.012 *
Final Pirani score	0.8 ± 0.3	1.4 ± 0.5	< 0.001 *
Mean dorsiflexion angle ($^\circ$)	18.2 ± 3.5	11.6 ± 4.1	< 0.001 *

Recurrence And Relapse

During the 12-month follow-up period, relapse occurred in 4 patients

(11.1 %) in Group A and 12 patients (33.3 %) in Group B, a statistically significant difference ($p = 0.021$). Most relapses involved forefoot adduction and mild equinus deformity, which responded to repeat casting. Only two cases in Group B required limited surgical intervention.

Bracing compliance was good in 83 % of Group A and 69 % of Group B patients, suggesting its contributory role in recurrence prevention ($p = 0.048$). No major complications such as neurovascular injury or infection were reported in either group.

Table 3. Relapse And Bracing Compliance

Outcome	Group A (Tenotomy) n = 36	Group B (Non-Tenotomy) n = 36	p-value
Relapse cases (n, %)	4 (11.1 %)	12 (33.3 %)	0.021 *
Type of relapse	Mild equinus – 3 / Forefoot adduction – 1	Mild equinus – 7 / Forefoot adduction – 5	—
Re-casting required	4 (11.1 %)	10 (27.8 %)	—
Surgical correction required	0 (0 %)	2 (5.6 %)	—
Bracing compliance (good %)	83 %	69 %	0.048 *

DISCUSSION

The present study compared recurrence and relapse rates among idiopathic CTEV patients treated with the Ponseti technique, with or without Tendo-Achilles tenotomy (TAT). The findings demonstrate that the addition of tenotomy significantly decreases relapse rates and improves final correction outcomes, consistent with prior literature emphasizing its importance in the comprehensive Ponseti protocol [1,3,4,12].

In our series, relapse occurred in 11.1% of feet in the tenotomy group compared with 33.3% in the non-tenotomy group ($p = 0.021$). This aligns with studies by Ahmed et al. (2025) and Chand et al. (2018), who observed relapse rates of 9–14% among patients undergoing tenotomy compared with over 30% in those managed conservatively [1,4]. The difference highlights that incomplete correction of equinus deformity remains the major risk factor for recurrence when tenotomy is omitted. Anatomical persistence of equinus due to shortened or stiff gastrocnemius–soleus complex has been identified as a key factor in relapse, even when cavus, adduction, and varus are adequately corrected [5]. Laliotis et al. (2022) described the Achilles tendon and posterior capsule as critical contributors to recurrent deformity, reinforcing that mechanical correction through tenotomy helps achieve durable plantigrade feet [5].

The improvement in mean Pirani score (0.8 ± 0.3 vs 1.4 ± 0.5) and dorsiflexion angle (18° vs 12°) in the tenotomy group indicates superior functional recovery. Similar outcomes were reported by Masrouha et al. (2021) and Thomas et al. (2019), who found that the success of the Ponseti method depends on achieving at least 15° dorsiflexion after casting [6,7].

Socioeconomic and behavioral factors also play a major role in recurrence. Poor compliance with bracing was associated with relapse in both groups, consistent with the findings of Akinyoola et al. (2022) and Dreise et al. (2023), who emphasized that adherence to the foot-abduction brace is crucial for preventing recurrence [8,9]. In our study, bracing compliance was better in the tenotomy group (83%) compared to the non-tenotomy group (69%), possibly due to easier brace fitting after complete correction.

The mean number of casts was fewer in the tenotomy group (5.4 vs 6.2), comparable with the results of Afridi et al. (2024), who reported that early tenotomy reduces casting duration and promotes more predictable correction [12]. Furthermore, no significant complications were observed in the tenotomy group, supporting the established safety of the percutaneous approach reported by Azarpira et al. (2016) and Iqbal et al. (2021) [3,11].

Collectively, the evidence suggests that failure to perform tenotomy leaves residual equinus, which increases relapse risk. Tenotomy not

only ensures full dorsiflexion but also improves brace tolerance and long-term foot function. The findings of the current study reaffirm the Ponseti philosophy that serial casting alone may not suffice for complete correction, especially in moderate-to-severe deformities.

CONCLUSION

The present study demonstrates that incorporating Tendo-Achilles tenotomy (TAT) into the Ponseti method significantly reduces recurrence and relapse in idiopathic congenital talipes equinovarus (CTEV). Patients who underwent tenotomy achieved faster correction, better dorsiflexion, and lower final Pirani scores compared with those treated without tenotomy.

Residual equinus deformity remains the most important predictor of relapse; thus, timely percutaneous tenotomy is essential to achieve and maintain a plantigrade, functional foot. The procedure is safe, minimally invasive, and enhances long-term stability when combined with proper bracing and follow-up.

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