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Original Research Article

Clinico- Radiological Outcome of Idiopathic Congenital Talipes Equinovarus Following Posteromedial Soft Tissue Release

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Abstract

Introduction: Idiopathic clubfoot or congenital talipesequinovarus is the most common orthopedic congenital deformity. Club foot affects roughly one in every 1000 live births, and it is bilateral in about half of the cases. The four components of a congenital club foot are cavus, adduction, varus, and equinus. The treatment's purpose is to address four abnormalities and keep them corrected so that the patient can have a functional, pain-free plantigrade foot.

Aims: To identify the minimum set of outcomes that should be collected in clinical practice and reported in research related to the care of children with idiopathic congenital talipesequinovarus (CTEV).

Materials and Methods: The present study was an Observational study. This Study was conducted from 03/08/2005 to 02/08/2008 at Ramakrishna Mission Seva Pratishthan, Vivekananda Institute of Medical Sciences. Total 22 patients were included in this study.

Result: We found a relatively low clinical outcome as compared to findings by other authors who have reported excellent or good treatment outcomes that have ranged from 81% to 85.5% and in this study 72% of the patients reported no pain, an evidence of good functional outcomes associated with posteromedial soft tissue release.

Conclusion: The functional outcomes are equally good with the majority of patients reporting no pain, being able to wear shoes of their liking and having no limitation during walking or running. This is a sign of an improved life style and quality of life and correlates with good patient and caregiver satisfaction.

Keywords: Clubfeet, Congenital Talipesequinovarus and Posteromedial Soft Tissue Release.

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Introduction

The most prevalent orthopaedic congenital malformation is idiopathic clubfoot, also known as congenital talipesequinovarus. Club foot impacts approximately one in every 1000 live births and is bilateral in approximately half of the instances.[1] A hereditary club foot has four components: cavus, adduction, varus, and equinus. [2, 3] The treatment's goal is to rectify four abnormalities so that the patient can have a useful, pain-free plantigrade foot. Treatment modalities range from conservative methods such as strapping, serial manipulation and casting by Kite's or Ponseti method, open surgery by soft tissue release like modified Mckay procedure through a transverse Cincinnati incision, complete subtalar release or Turco posteromedial soft tissue release , bony procedures or distraction method by external fixator. Though Ponseti method of serial casting showed excellent to good result ranged from 82.4% to 97% in supple and mildly resistatant cases but it is not very much effective in moderately, severely resistant and recurrent cases of club feet. Turco posteromedial soft tissue release is effective in those cases. Appropriate timed and well performed surgery can restore the normal skeletal alignment in the foot with preservation of the soft tissue anatomy. Idiopathic congenital talipes equinovarus (ICTEV), commonly known as congenital clubfoot, is one of the most common congenital deformities of the musculoskeletal system. It is characterized by a complex three-dimensional deformity of the foot involving equinus, varus, adduction, and cavus components. The deformity results from abnormal development and positioning of the bones, joints, ligaments,

tendons, and muscles of the foot and ankle during fetal life. The condition may occur as an isolated idiopathic deformity or may be associated with neuromuscular and syndromic disorders. Idiopathic congenital talipes equinovarus accounts for the majority of cases and presents a significant challenge in pediatric orthopaedic practice due to its potential impact on gait, function, and quality of life if left untreated.[4]

The incidence of congenital clubfoot varies worldwide and is estimated to be approximately 1–2 per 1000 live births. It shows a male predominance, with bilateral involvement occurring in a significant proportion of affected children. The exact etiology of ICTEV remains unclear; however, genetic, environmental, and developmental factors have been implicated. The primary pathological changes include contracture of the posterior and medial soft tissues, abnormal alignment of the talus and calcaneus, medial displacement of the navicular, and restricted subtalar and ankle movements. These anatomical abnormalities result in the characteristic clinical appearance of a small, inwardly rotated foot with limited dorsiflexion.[5] Early diagnosis and appropriate treatment are essential to achieve a plantigrade, painless, and functional foot. The main objectives of management are correction of deformity, restoration of mobility, prevention of recurrence, and achievement of normal functional development. Conservative treatment, particularly the Ponseti method, has become the preferred initial approach worldwide due to its high success rate. However, in neglected, resistant, or recurrent cases, surgical intervention may be required to correct persistent deformities. [6] Posteromedial soft tissue release (PMSTR) has historically been an important surgical procedure for the correction of rigid congenital clubfoot. The procedure involves releasing contracted medial and posterior structures, including the Achilles tendon, posterior ankle capsule, talocalcaneal and talonavicular capsular structures, and medial soft tissue contractures. The aim is to restore proper alignment of the foot by correcting equinus, varus, and adduction deformities. Although PMSTR provides satisfactory correction in many patients, concerns remain regarding postoperative stiffness, muscle imbalance, recurrence, and long-term functional outcomes. [7] Radiological assessment plays a crucial role in evaluating the severity of deformity and monitoring correction following surgical treatment. Parameters such as the talocalcaneal angle, talo-first metatarsal angle, and calcaneal pitch help in assessing anatomical correction and maintaining alignment. Clinical evaluation combined with radiological assessment provides a comprehensive understanding of treatment outcomes. [8]

Materials and Methods

Study design: The present study was an Observational study.

Study duration: This Study was conducted from 03/08/2005 to 02/08/2008

Study place: Department of Orthopaedics, Rampurhat Government Medical College and Hospital, Rampurhat, Birbhum, West Bengal, India.

Sample size: Total 22 patients with 32 clubfeet were included in this study.

Study variables

- Association of congenital abnormalities
- Pre-treatment mean radiographic angle
- Post treatment mean radiographic angle
- Conservative treatment

Inclusion criteria

- Moderately resistant, severely resistant and recurrent cases with residual deformity after conservative treatment.
- Age of the children: Three month to two year age.

Exclusion criteria

- Supple, mildly resistant, neglected CTEV cases more than two years age.
- Age: Below three months and above two years age.

Classification

Supple: When foot can be passively manipulated to touch the anterolateral aspect of shin.

Resistant: Resistant variety is further sub classified into.

Mildly Resistant: When foot can be passively manipulated beyond 0º (neutral position) but not up to the shin.

Moderately Resistant: When foot can be passively manipulated to 0º (neutral position) but not beyond.

Severely Resistant: When foot cannot be manipulated to 0º (neutral position)

Treatment Modalities: We treated moderately resistant, severely resistant and recurrent cases with residual deformity after conservative treatment clubfeet patients by posteromedial soft tissue release.

Operative procedure: We followed Turco's procedure. Tourniquet was used. Child was placed in lateral position. Skin incision begins distally at the metatarsocuneiform joint and curves along the line of demarcation (pigmentation) between the sole and dorsal skin till below the medial malleolus.

Thereafter it curves proximally in a lazy S pattern till just distal the gastrocnemius (calf). Lengthening

of the tendons were done in the following order tibialis posterior, flexor digitorum longus, flexor hallucis longus and Z plasty of tendoachilles. Mobilization of neurovascular structure. Further structures were released talonavicular capsule/ligament to reposition navicular over head of the talus, spring ligament, posterior capsule of ankle and subtalar joint, interosseous ligament and capsule of naviculocuneiform, cuneio-1st metatarsal joint. Tran section of master knot of Henry. Soft tissue was closed with vicryl(3-0) and skin with monofilament(3-0). Plaster slab was applied in uncorrected position after 14 days slab and stitches were removed and above knee cast was done in fully corrected position. Cast was maintained for 6 weeks then removed. Immediately after cast removal Denis Browne splint or surgical shoe was used according to the age.

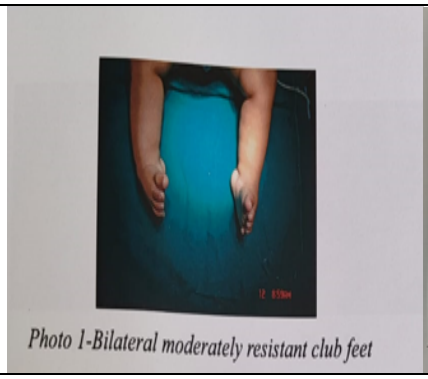

Photo 1-Bilateral moderately resistant club feet

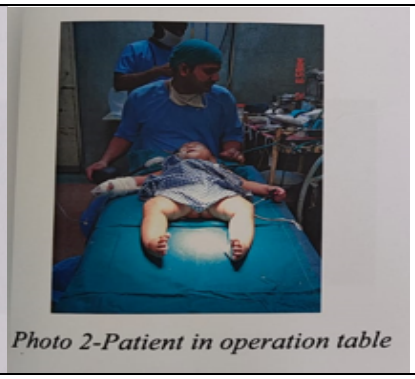

Photo 2-Patient in operation table

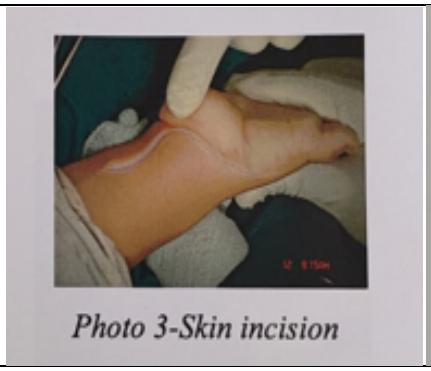

Photo 3-Skin incision

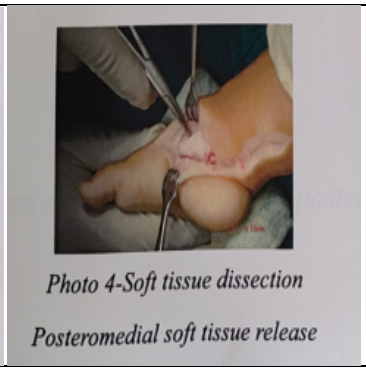

Photo 4-Soft tissue dissection

Posteromedial soft tissue release

Posteromedial soft tissue release

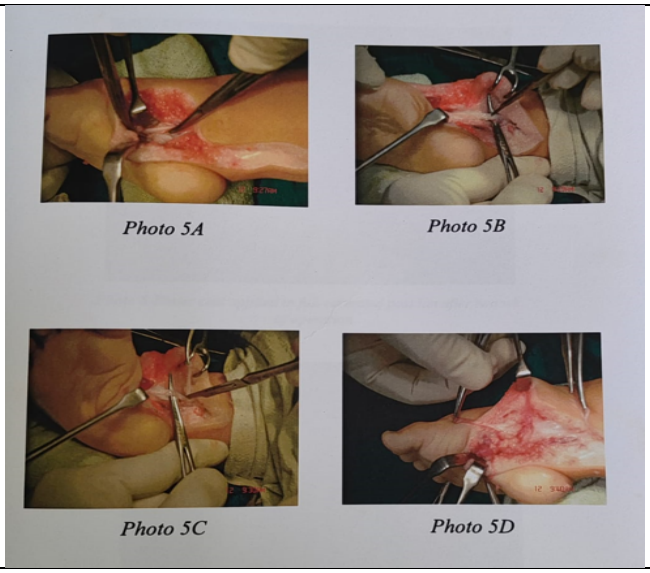

Photo 5A

Photo 5B

Photo 5C

Photo 5D

Important steps of operation posteromedial soft tissue release

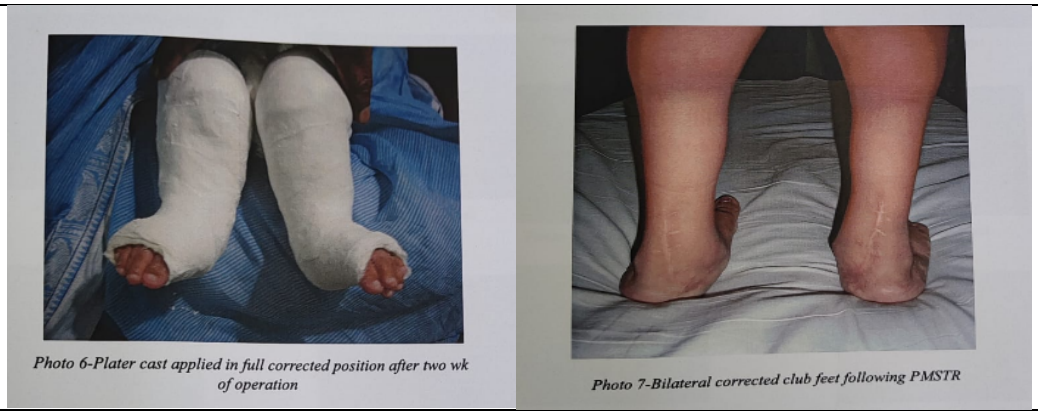

Photo 6-Plater cast applied in full corrected position after two wk of operation

Photo 7-Bilateral corrected club feet following PMSTR

Posteromedial soft tissue release

Figure 1:

Statistical Analysis: For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples. Paired t-tests were a form of blocking and had greater power than unpaired tests. A chi-squared test ($\chi 2$ test) was any statistical hypothesis test wherein the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true. Without other qualification, 'chi-squared test' often is used as short for Pearson's chi-squared test. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate.

Explicit expressions that can be used to carry out various t-tests are given below. In each case, the formula for a test statistic that either exactly follows or closely approximates a t-distribution under the null hypothesis is given. Also, the appropriate degrees of freedom are given in each case. Each of these statistics can be used to carry out either a one-tailed test or a two-tailed test.

Once a t value is determined, a p-value can be found using a table of values from Student's t-distribution .If the calculated p-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level), then the null hypothesis is rejected in favour of the alternative hypothesis.

P-value $\leq$ 0.05 was considered for statistically significant.

Result

Table 1: Demographic Distribution of Study Population (n=22)

Parameter	Category	Number of Patients	Percentage (%)
Age distribution	3 months – 2 years	22	100
	Mean age (10 months 18 days)		—
Sex distribution	Male	16	72.7
	Female	6	27.3
	Sex ratio (M:F)		2.66:1
Laterality	Right side	5	23
	Left side	7	32
	Bilateral	10	45

Table 2: Association of congenital abnormalities

Association of congenital abnormalities		
Number of cases CDH	**Number of cases spina bifida**	**Number of cases of other abnormalities**
2	1	0

Table 3: Pre-treatment mean radiographic angle

Mean radiographic angle			
AP view		**Stress lateral view**	
TC (°)	T-1st MT (°)	TC (°)	Ti-c (°)
10	-13	12	-17.5

Table 4: Post treatment mean radiographic angle

Mean radiographic angle			
AP view		**Stress lateral view**	
TC (°)	T-1stMT (°)	TC (°)	Ti-c (°)
33.7	7.4	26	16.7

Table 5: Operative (PMSTR) treatment

Variety	Results (in number, percentage)				
	Excellent	**Good**	**Fair**	**Poor**	**Failure**
Moderately resistant	8 (45%)	6 (33.3%)	1 (5%)	3 (16.7%)	
Severely resistant	3 (30%)	3 (30%)	1 (10%)	1 (10%)	2 (20%)
Recurrent cases	2 (50%)	1 (25%)			1 (25%)
Total	13(40.6%)	10 (31.25%)	2 (6.25%)	4 (12.5%)	3 (9.4%)

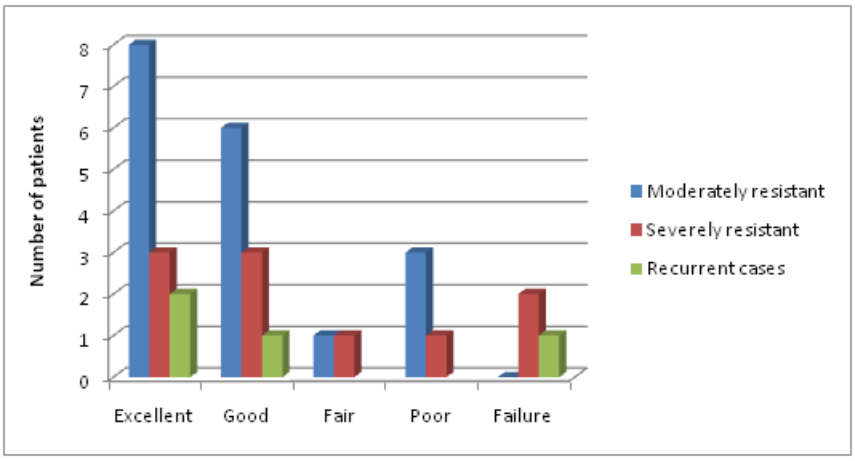

Figure 2: Operative (PMSTR) treatment

Age distribution: In our study, age of presentation 3 months to 2 years and mean age 10months 18 days.

Sex distribution: In our study, out of 22 patientsMale-16, Female-6, Sex Ratio-2.66

Laterality: Right side-5 cases (23%) Left side-7 (32%) Bilateral- 10 cases (45%)

Obstetrics history

Prenatal: In our study, total number of Number of preterm baby-2, Number of term baby– 20 and Number of vertex presentation- 16 cases, Number of breech presentation- 6 cases.

Postnatal: Number of uncomplicated delivery-14, Number of complicated delivery-8 and Average birth of weight of neonates- 2.53Kg

Associated abnormality: In our study, among 22 patient two cases were presented to us with CDH and one case with spina bifida.

Pre-treatment radiographic angle: In AP view: Talocalcaneal angle: 10 º and Talus: 1st metatarsal angle: -13 º

In stress dorsiflex lateral view: Talocalcaneal angle: 12 º and Tibio-calcaneal angle: -17.5 º

Post treatment radiographic angle: In AP view: Talocalcaneal angle: 33.7 º and Talus: 1st metatarsal angle: 7.4 º

In stress dorsiflex lateral view: Talocalcaneal angle: 26 º and Tibio-calcaneal angle: 16.7 º

Results of treatment: Final evaluation was done by Pirani scoring system.

In our study moderately resistant cases, 8(45%) showed excellent, 6 (33.3%) cases good, 1 (5%) case fair and 3 (16.7%) cases poor result.

Among severely resistant cases, 3 (30%) cases showed excellent, 3 (33%) cases – good, 1 (10%) case – fair, 1 (10%) case – poor result and two (20%) cases – failed to correct. Among recurrent cases, 2 (50%) cases showed excellent,1(25%) cases – good and 1 (25%) failure result.

We also observed that results were poor to failure more commonly in older children.

Complications: We faced medial side skin necrosis in three cases following posteromedial soft tissue release operation.

Discussion

In our study, the age of presentation ranged from 3 months to 2 years, with a mean age of 10 months 18

days. Better outcomes were observed in younger children, whereas poor and failed results were more common among older children. Turco et al [9] emphasized that early correction of resistant clubfoot provides better results because soft tissue contractures are less severe and bone remodeling potential is higher in younger patients. He reported that delayed surgical correction is associated with increased stiffness and recurrence. Similar observations were reported by McKay et al [10], who stated that older children develop more rigid deformities due to adaptive changes in bones, joints, and soft tissues, leading to inferior outcomes. Regarding sex distribution, our study showed male predominance, with 16 males and 6 females, giving a male-to-female ratio of 2.66:1. Saran JS et al [11] reported that idiopathic clubfoot has a male predominance and frequently presents with bilateral involvement. They also described genetic and developmental factors contributing to the occurrence of congenital clubfoot. In the present study, bilateral involvement was found in 45% of cases, while unilateral involvement was observed in 55% cases (right side 23% and left side 32%). Simons et al [12] studied the radiographic characteristics of clubfoot and reported that bilateral deformity is common in idiopathic congenital talipes equinovarus. He emphasized the importance of radiological evaluation in assessing correction of hindfoot alignment after treatment. The obstetric history in our study showed 2 preterm and 20 term babies. Vertex presentation was seen in 16 cases, while breech presentation was observed in 6 cases. Fourteen cases had uncomplicated delivery and 8 cases had complicated delivery. The average birth weight was 2.53 kg. Wynne-Davies et al [13] suggested that intrauterine mechanical factors, genetic influences, and developmental abnormalities may contribute to the development of congenital clubfoot.

Associated abnormalities were observed in three patients in our study, including two cases of developmental dysplasia of hip (CDH) and one case of spina bifida. Although idiopathic clubfoot generally occurs as an isolated condition, associated congenital abnormalities may affect prognosis. Jurecka A, et al [14] reported that associated neuromuscular and skeletal abnormalities can influence severity, recurrence, and functional outcomes following correction. Radiological evaluation showed significant improvement following posteromedial soft tissue release. In AP view, the pre-treatment talocalcaneal angle was 10°, which improved to 33.7° postoperatively, and the talus–first metatarsal angle improved from -13° to 7.4°. In stress dorsiflexion lateral view, the talocalcaneal angle improved from 12° to 26°, and the tibio-calcaneal angle improved from -17.5° to 16.7°. These findings indicate satisfactory correction of equinus and hindfoot varus deformity. Functional outcome was assessed using the Pirani scoring system. Among moderately resistant cases, 45% showed excellent results, 33.3% good results, 5% fair results, and 16.7% poor results. Among severely resistant cases, excellent results were obtained in 30%, good results in 33%, fair results in 10%, poor results in 10%, and failure in 20% cases. Among recurrent cases, 50% showed excellent results, 25% good results, and 25% failure. Bensahel et al [15] reported satisfactory correction following surgical release in resistant clubfoot but noted that recurrence and stiffness remain important complications, especially in severe deformities. The present study also observed that poor outcomes were more frequent in older children. McKayet al [10] explained that delayed treatment results in increased soft tissue contracture, altered joint mechanics, and structural changes, which negatively affect correction and long-term function. Therefore, early intervention and proper postoperative follow-up are essential for achieving optimal results. Regarding complications, medial side skin necrosis was observed in three cases after posteromedial soft tissue release. Carroll et al [16] reported that extensive soft tissue dissection and excessive tension during correction may compromise skin vascularity and increase wound complications. Careful surgical technique and preservation of soft tissue blood supply are necessary to minimize these complications.

Conclusion

Clubfoot although a complex deformity, can be treated successfully with proper understanding of the pathoanatomy, biomechanics and selecting the case specific suitable modality of treatment. Success rate increases with early initiation of treatment. Proper Classification of clubfoot at presentation is of paramount importance in selection of treatment modality. In most of the cases results of posteromedial soft tissue release vary from excellent to good in moderately resistant, severely resistant and recurrent clubfeet. Appropriate timed and well performed surgery can restore the normal skeletal alignment in the foot with preservation of the soft tissue anatomy.

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