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Original Research Article

Functional Outcome of the Ponseti Method In Patients With Congenital Idiopathic Clubfoot

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Abstract: *Congenital idiopathic clubfoot is one of the most common musculoskeletal deformities in infants and may lead to long-term functional disability if not managed early. The Ponseti method is widely used as a conservative treatment approach due to its effectiveness, safety, and cost-effectiveness.* ***Objective:*** *To evaluate the functional outcome of the Ponseti method in patients with congenital idiopathic clubfoot.* ***Methodology:*** *This study was conducted on 107 children aged up to six months with congenital idiopathic clubfoot from 13-January-2025 to 13-May-2025. The diagnosis was confirmed through clinical evaluation. Children with Ehlers-Danlos syndrome, chromosomal abnormalities and neuromuscular disorders were excluded. All patients underwent the Ponseti technique. Functional outcomes were assessed at twelve weeks using the Bangla Clubfoot Tool categorized as excellent (85-100%), good (70-84%), fair (50-69%), and poor (<50%). Data were analyzed using SPSS 23.* ***Results:*** *The mean age of the 107 children was 3.76±1.70 months. There were 56 (52.3%) males and 51 (47.7%) females. Left foot was involved in 59 (55.1%) cases. Functional outcome assessment showed excellent outcomes in 25 (23.4%) cases, good outcomes in 67 (62.6%), fair outcomes in 11 (10.3%) and poor outcomes in 4 (3.7%) cases. Overall 92 (86.0%) patients achieved good or excellent functional results.* ***Conclusion:*** *Ponseti method achieved 23.4% excellent outcome and 62.6% good outcome in children with congenital idiopathic clubfoot. The treatment proved consistently effective across diverse demographic and clinical subgroups.*

Keywords: Congenital clubfoot, Ponseti method, functional outcome, Bangla Clubfoot Tool

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Introduction

Congenital talipes equinovarus is a complex congenital foot deformity that affects mobility and requires correction. Such a condition is prone to recur, and it involves adduction, cavus, equinus, and varus. Clubfoot is classified by severity, with three primary types recognized: Idiopathic, with an unknown cause; Neurogenic, resulting from the condition affecting the nervous system; and Syndromic, associated with an underlying syndrome. (1, 2) Clubfoot is recognized as a common congenital disability across the globe. Clubfoot is reported among the 1,000 live births, with a higher rate among males and a mainly bilateral presentation. (3) The right foot is found to be more affected compared with the left foot in cases of unilateral clubfoot. From a treatment perspective, clubfoot deformity is managed globally, with the initial approach typically nonsurgical. The clubfoot treatment aims to attain permanent correction of deformity. If not treated in time, it will lead to detrimental effects, pain, and disability. (4, 5)

There are two primary methods used: the Ponseti method and the French functional approach. The Ponseti method is usually regarded as an effective treatment for clubfoot. It offers several benefits, including low cost and fewer complications. (6) The Ponseti method comprises two distinct phases: the corrective phase and the maintenance phase. The corrective phase, as its designation indicates, involves manipulation and serial casting with plaster of Paris. The Ponseti method is widely utilized and leads to optimal functional outcomes. (7) The functional outcome observed following the Ponseti method is highly favorable, resulting in a fully functional foot. Such outcome allows the patient to wear normal shoes, minimizes the need for corrective surgery, and facilitates independent walking (8,9)

The Ponseti method, which involves serial casting followed by Achilles tendon release and bracing, has become the gold standard for treating congenital clubfoot due to its minimally invasive nature and high success rates. As no such study is available locally on this subject, this study aims to determine the functional outcome of the Ponseti method in patients with congenital idiopathic clubfoot at our health facility. The findings of this study will be helpful to our medical professionals in providing valuable information to clinicians to refine treatment protocols and improve patients' quality of life. Additionally, it can identify factors that may influence treatment success, contributing to personalized care for patients with congenital idiopathic clubfoot.

Methodology

This descriptive study was conducted from 13 January 2025 to 13 May 2025 in the Department of Orthopedic Surgery at Lady Reading Hospital, Peshawar. Ethical approval was obtained from the hospital prior to conducting the study. The sample size was 107, which was calculated using the OpenEPI calculator, taking the previous frequency of poor functional outcome 11.3,(9) margin of error 8%, and confidence interval 95%. We used non-probability consecutive sampling for patient selection. Inclusion criteria encompassed children aged up to 6 months of either gender with progressive deformity, cosmetic concerns, and with congenital idiopathic clubfoot. Congenital idiopathic clubfoot was determined through clinical evaluation, observing all of the following features, i.e., rigid and fixed deformity, plantarflexion of the foot, inversion of the heel, forefoot turns inward toward the midline of the body, and high arch in the foot. Patients with Ehlers-Danlos syndrome, chromosomal aberrations, and neuromuscular disorders were excluded.

The benefits, objectives, and risks associated with this study were explicitly conveyed to all participating children's parents/guardians. Then, informed written consent was obtained. Baseline demographics, including age, gender, weight, residential area, and socioeconomic status, were recorded. All children identified with congenital idiopathic clubfoot underwent the Ponseti technique. The treatment commenced once the skin condition allowed for the application of plaster casts. The initial cast was designed to address cavus by coordinating the forefoot, midfoot, and

hindfoot. This alignment was achieved by elevating the initial ray, resulting in the forefoot being supinated relative to the midfoot and hindfoot. During manipulation, the talus was stabilized by positioning the thumb on its lateral aspect and ensuring adequate padding from the groin to the toe. The application of a plaster cast involved maintaining the specified position and ensuring proper molding for effective results. One week later, the initial cast was removed. Following the correction of the cavus, the foot was carefully manipulated for a brief duration. This was achieved by stabilizing the talus with the thumb positioned over its lateral aspect, while the foot was gradually abducted with each subsequent serial cast. Plasters were administered until an abduction angle of 70 degrees was reached. Subsequently, the correction of any residual equinus deformity was performed through a percutaneous surgical release of the Tendo Achillis tendon. Following tenotomy, the definitive cast was positioned with the foot at an angle of 70 degrees in abduction and 10-15 degrees of dorsiflexion. Upon removal of the final cast, a shoe affixed to a bar was used to maintain the foot in the corrected alignment. Functional outcome was assessed using the Bangla Clubfoot Tool, which has a 100-point scale typically divided into four categories (Excellent, Good, Fair, and Poor) after 06 weeks of Treatment. The excellent score range was 85 to 100%, the good score range was 70 to 84%, the fair score range was 50 to 69%, and the poor score range was < 50%. The entire assessment was conducted under the guidance of a consultant with at least 5 years of post-fellowship experience.

SPSS 23 software was used to analyze the data. Mean and SD were calculated for numerical data, such as age and weight. Frequencies and percentages were determined for categorical data such as gender, functional outcome, side (left/right), previous treatment, residence area, and socioeconomic status. Functional outcome was stratified by age, weight, gender, side, previous treatment, residence area, and socioeconomic status to assess effect modifiers. A post-stratification Chi-square test was applied at the 5% significance level.

Results

The mean age of the children was 3.76±1.70 months. The mean weight was 5.74±0.87 kilograms. There were 56 (52.3%) male patients and 51 (47.7%) female patients.

Regarding socioeconomic status, 45 (42.1%) patients had low socioeconomic status, 39 (36.4%) had middle socioeconomic status, and 23 (21.5%) had high socioeconomic status. In terms of residence, 64 (59.8%) children lived in urban areas, while 43 (40.2%) resided in rural areas. The left foot was affected in 59 (55.1%) of the cases, while the right foot was involved in 48 (44.9%) of the cases (Table 1).

The functional outcomes were assessed using the Bangla Clubfoot Tool. The results showed that 25 (23.4%) of the patients achieved an excellent outcome, 67 (62.6%) achieved a good outcome, 11 (10.3%) had a fair outcome, and 4 (3.7%) had a poor outcome (Table 2).

A further analysis was conducted to explore the relationship between various demographic and clinical factors and the functional outcomes. When examining age, it was observed that among those with excellent outcomes, 52.0% were aged between one and three years, while among those with poor outcomes, 100.0% were older than three years. However, this association was not statistically significant, with a p-value of 0.247. Regarding weight, the distribution across outcome categories showed no clear pattern, and the p-value was 0.994, indicating no significant association.

Table 3 presents the stratification of various parameters with functional outcomes; no significant associations were observed.

Table 1: Baseline parameters

Baseline parameters		n	%
Gender	Male	56	52.3%
	Female	51	47.7%
Socioeconomic status	Low	45	42.1%
	Medium	39	36.4%
	High	23	21.5%
Residence	Urban	64	59.8%
	Rural	43	40.2%
Side	Right	48	44.9%
	Left	59	55.1%
Previous treatment	Yes	23	21.5%
	No	84	78.5%

Table 2: Functional outcomes

Functional outcomes	n	%
Excellent	25	23.4%
Good	67	62.6%
Fair	11	10.3%
Poor	4	3.7%

Table 3: Stratification of various parameters with functional outcomes

		Functional outcomes				P value
		Excellent	Good	Fair	Poor	
Age groups (Years)	1 to 3	52.0%	44.8%	54.5%	0.0%	0.247
	> 3	48.0%	55.2%	45.5%	100.0%	
Weight (Kg)	4 to 5.9	56.0%	56.7%	54.5%	50.0%	0.994
	> 5.9	44.0%	43.3%	45.5%	50.0%	
Gender	Male	56.0%	49.3%	63.6%	50.0%	0.811
	Female	44.0%	50.7%	36.4%	50.0%	
Socioeconomic status	Low	36.0%	44.8%	45.5%	25.0%	0.952
	Medium	44.0%	32.8%	36.4%	50.0%	
	High	20.0%	22.4%	18.2%	25.0%	
Residence	Urban	60.0%	62.7%	36.4%	75.0%	0.372

	Rural	40.0%	37.3%	63.6%	25.0%	
Side	Right	52.0%	46.3%	27.3%	25.0%	0.461
	Left	48.0%	53.7%	72.7%	75.0%	
Previous treatment	Yes	32.0%	16.4%	27.3%	25.0%	0.406
	No	68.0%	83.6%	72.7%	75.0%	

Discussion

The management of congenital clubfoot using the Ponseti method has been evaluated across various studies, consistently demonstrating its effectiveness in achieving satisfactory functional outcomes. Jaqueto and colleagues conducted a study in which the Ponseti technique yielded a success rate of 90.2% in 51 treated feet, with the Pirani score showing a mean improvement from a baseline of 5.5 to 3.6 following treatment, a statistically significant change with a p-value of 0.0001. (10) The authors noted that Achilles tenotomy was required in 84% of their patients, with a mean of 5.8 cast changes before tenotomy. Recurrence was observed in 23.1% of cases, with four idiopathic recurrences and two associated with incorrect orthosis use, highlighting the critical role of parental compliance in maintaining correction.

Mussab and colleagues reported a mean Pirani score improvement from 3.77±0.73 at baseline to 1.61±1.38 immediately post-treatment, with excellent outcomes observed in 47.3% of patients immediately after treatment and increasing to 69.2% at four-month follow-up. (11) Their stratified analysis showed that patients requiring four or fewer casts demonstrated significantly superior outcomes at both time points, emphasising the importance of early and effective manipulation protocols. (11)

Rehman and associates reported a complete recovery rate of 73.9% among 88 patients treated with the Ponseti method, with a postoperative Pirani score of 0.16±0.3, and noted that age stratification revealed a statistically significant difference in outcomes between younger and older age groups, with a p-value of 0.001. (12)

The functional dimensions of treatment success have been explored through longitudinal studies. Khan et al. conducted a longitudinal study with repeated follow-up visits and observed that all 93 patients eventually achieved the ability to perform all four fundamental functional tasks of standing, squatting, walking, and running by their final follow-up visit, reflecting a 100% functional outcome rate. (13) This finding underscores the progressive nature of functional recovery following Ponseti treatment, where improvements continue to accrue over time with appropriate bracing and follow-up adherence. The authors noted that the mean age of patients at first consultation was one month in 54.8% of cases, highlighting the principle that early intervention facilitates optimal functional restoration. (13)

The present study evaluated functional outcomes using the Bangla Clubfoot Tool in a cohort of 107 patients with congenital idiopathic clubfoot treated by the Ponseti method. The functional outcomes in the present study showed that 25 (23.4%) patients achieved excellent outcomes, 67 (62.6%) achieved good outcomes, 11 (10.3%) achieved fair outcomes, and 4 (3.7%) achieved poor outcomes. Overall, 92 (86.0%) of patients attained either good or excellent functional outcomes. The proportion of patients achieving excellent outcomes in the present study was comparable to the 20.5% reported by Ishtiaq et al while the good outcome proportion of 62.6% was similar to the 66.7% documented in that same study. (14) The fair and poor outcome rates of 10.3% and 3.7%, respectively, reflect the small proportion of patients who experienced suboptimal results, consistent with the 6.8% no recovery rate reported by Rehman and colleagues. (12)

Conclusion

The present study demonstrated that the Ponseti method achieved excellent outcomes in 23.4% of children with congenital idiopathic clubfoot and good outcomes in 62.6% of children. The present study supports the Ponseti method as a reliable and effective treatment for congenital idiopathic clubfoot across diverse patient populations, with functional outcomes largely independent of demographic characteristics when the protocol is properly implemented.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (Ref-587/LRH/MTI)
Consent for publication
Approved
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Conflict of interest

The authors declared no conflict of interest.

Author Contribution

IU (Trainee Medical Officer)
Data Collection, Data Entry, Study Design, Manuscript drafting
BH (Assistant professor)
Critical Input and Interpretation of results.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the study's integrity.

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