



A Study of Orthopaedic Management of Club Foot at Tertiary Care Hospital of Eastern India

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ABSTRACT

Introduction: 1 to 2 out of every thousand live babies are affected by congenital talipes equinovarus (CTEV). Clubfoot is a complicated congenital abnormality that involves the adduction of the forefoot, cavus of the midfoot, varus of the hindfoot, and equines of the ankle. Numerous investigations conducted globally have identified certain obstacles to the application of the Ponseti approach in the treatment of clubfoot.

Aims/ objective: To evaluate the effectiveness of integrated method of Ponseti in the treatment of club foot and to assess the effect of demographic barriers to the compliance with the Ponseti method of clubfoot treatment in tertiary care hospital of eastern India.

Materials and Method: 95 patients presenting with idiopathic clubfoot of any gender or age were included in the study. The Ponseti procedure was used on each of them to treat idiopathic club foot. All of them were ultimately assessed using the Pirani score. Chi-square test was used to determine statistical difference in compliance with respect to demographic variables. Paired t-test was used to compare Pirani score before and after treatment with a p-value of less than 0.05 as marker of statistical significance.

Results: Compliance of the patients to Ponseti treatment were significantly related to age, educational status of parent and distance from the clinic ($p < 0.05$) with the drop-out rate being highest in age greater than 2 years, patients with parent of lower educational status and patients residing at distance greater than 20 km of hospital. There was significant decline in Pirani score ($p < 0.001$) in all age group before and after Ponseti treatment of club foot. However, the decline was greater in patients of age less than 5 year as compared to those of age greater than 5 years.

Conclusion: Ponseti technique was very effective in managing idiopathic club foot. The findings of this study suggest that government-funded clubfoot clinics be set up at the district and village levels. This will benefit both rural and urban areas by lowering travel times and, consequently, treatment times.

Keywords: Club Foot, Ponseti Technique, Pirani Score, Compliance, Dropout.

INTRODUCTION

1 to 2 out of every thousand live babies are affected by congenital talipes equinovarus (CTEV), one of the oldest and most common congenital deformities in human history. ¹ Clubfoot is a complicated congenital abnormality that involves the adduction of the forefoot, cavus of the midfoot, varus of the hindfoot, and equines of the ankle. ² It may be idiopathic or a component of a disease such as multiplex congenita, a congenital condition characterized by joint stiffness in many locations. India has a yearly birth rate of 20.4 births per 1000 inhabitants, according to the 2016 National Institution for Transforming India (NITI) Aayog Report. ³

With India's population, yearly birth rate, and clubfoot occurrence rate of 1/1000 live births, the anticipated annual number of children born with clubfoot is about 27,000. If the deformity is not corrected, it may cause a lifelong physical impairment that will impact the affected person and their family on a social, financial, and psychological level. The first line of defence for clubfoot is generally agreed to be non-operative therapy, which should start as soon as is practical after birth. In 400 BC, Hippocrates recommended splinting as the very first non-

operative therapy, after a little foot massage. In 1836, Guerin created the plaster-of-Paris cast. ⁴

Around the beginning of the 19th century, tools like the Thomas wrench were introduced, which practiced speedy adjustment with powerful manipulation. ⁵ In 1930, Dr. Hiram Kite invented the technique of careful manipulation and casting. The most widely utilized manipulation and serial casting technology was created in 1948 by Dr. Ignacio V. Ponseti. The most extensively used approach is the Ponseti technique, which has been shown in a few studies to be successful both in the short and long term in different settings. ^{6,7}

A review of records from the Centers for Disease Control and Prevention and the Nationwide Inpatient Sample in the USA conducted 47 years after Ponseti published his initial paper on his method, found that the estimated number of surgical releases performed in patients under the age of 12 months reduced from 1,641 discharges in 1996 to 230 discharges in 2006. Additionally, the percentage of club feet that underwent surgical release reduced from 72% in 1996 to 12% in 2006. In a poll conducted among fellows of the Pediatric Orthopaedic Society of North America (POSNA), 96.7% of respondents



said they currently treat idiopathic club foot using the Ponseti technique.⁸

The Ponseti technique is currently regarded as the gold standard for treating clubfeet. Treatment consists primarily of casting and serial manipulation, with a percutaneous tendo Achilles tenotomy and a foot abduction brace added later. In more than 95% of patients, the procedure is able to accomplish full correction.⁹⁻¹¹ Compared to surgery, the treatment is comparatively inexpensive, which makes it a great option for poor nations like India.

Numerous investigations conducted globally have identified certain obstacles to the application of the Ponseti approach in the treatment of clubfoot. These obstacles include, but are not limited to, the parent who is in charge of the treatment, caregiver compliance with the treatment, poverty, and the expense of the treatment and travel.^{10, 12-17}

This study was conducted to evaluate the effectiveness of integrated method of Ponseti in the treatment of club foot and to assess the effect of demographic barriers to the compliance with the Ponseti method of clubfoot treatment in tertiary care hospital of eastern India.

MATERIALS AND METHODS

This was an observational and prospective study carried out in patients of club foot from November 2020 to October 2023 in the department of orthopaedics of SKMCH, Muzaffarpur (a tertiary care hospital in eastern India). We recruited 95 patients after obtaining written informed consent from their legal representative. Right and safety of patients of club foot were taken care of as per principles of good clinical practice and declaration of Helsinki.

Inclusion Criteria: Patients presenting with idiopathic clubfoot of any gender or age were included in the study.

Exclusion Criteria: Patients with trauma or with recurrence after surgery or any other pathology were excluded from the study.

Every patient had a regular investigation performed, including radiological tests like USGs. The Ponseti procedure was used on each of them to treat idiopathic club foot. The Ponseti procedure involves serial manipulation, casting, and tenotomy of the tendon of the Achilles and is divided into two equally significant phases: the correction phase and the maintenance phase.⁸ The use of a foot abduction brace comes next in order to stop relapses. There are two phases to all of these procedures: the first is called the Casting Phase and it includes Tenotomy, Casting, and Manipulation. Using a foot abduction brace throughout the second maintenance phase helps avoid relapses or recurrences.⁸ All of them were ultimately assessed using the Pirani score.¹⁸



Figure 1: Ponseti Method of Clubfoot Correction

[I: Correction before Casting; II-IV: Serial Correction]

Baseline demographic characteristics such as age, gender, parent coming with the patient, educational status of the patient, and distance to clinic were recorded in proforma. Participants were deemed compliant if they finished the course of treatment. If a patient missed three scheduled follow-up appointments in a row while in the casting or bracing phase, they were deemed to have dropped out of treatment.¹⁶

Statistical Analysis

Data collected from the patients of club foot were presented in tabular form using Microsoft Excel 365 and transferred to graph pad version 8.4.3 for further statistical analysis. Descriptive analysis was done to calculate frequency and percentage. Chi-square test was used to determine statistical difference in compliance with respect to demographic variables. Paired t-test was used to compare Pirani score before and after treatment with a p-value of less than 0.05 as marker of statistical significance.

OBSERVATIONS AND RESULTS

Most of patients belonged to 1-2 years of age (49.47%), and were females (61.05%). The parents of most of the patients had either higher secondary (56.84%) or secondary (30.53) educational status. Most of the patients were residing under 20 km from the hospital.

Table 1: Evaluation of baseline demographic characteristics of patients with clubfoot

Parameters	Number of Patients	% of patients (n= 95)
Age		
Less than 1 year	13	13.68
1-2 Year	47	49.47
2-5 Year	32	33.68
Greater than 5 Year	3	3.16
Gender		
Male	37	38.95
Female	58	61.05
Educational status of parent		
Graduate	7	7.37
Higher secondary	54	56.84
Secondary	29	30.53
Primary	1	1.05
Illiterate	4	4.21
Distance to Clinic		
≤ 20 km	56	58.95
>20 km	39	41.05

Table 2: Compliance of patients of club foot with respect to various demographic variables

Parameters	Compliant	Dropout	P-value (Chi-square)
Age			
Less than 1 year	12	1	0.02
1-2 Year	43	4	
2-5 Year	21	11	
Greater than 5 Year	2	1	
Educational status of parent			
Graduate	7	0	0.047
Higher secondary	46	8	
Secondary	24	5	
Primary	0	1	
Illiterate	2	2	
Distance to Clinic			
≤ 20 km	49	7	0.03
>20 km	27	12	

Compliance of the patients to Ponseti treatment were significantly related to age, educational status of parent and distance from the clinic ($p < 0.05$) with the drop-out rate being highest in age greater than 2 years, patients with parent of lower educational status and patients residing at distance greater than 20 km of hospital.

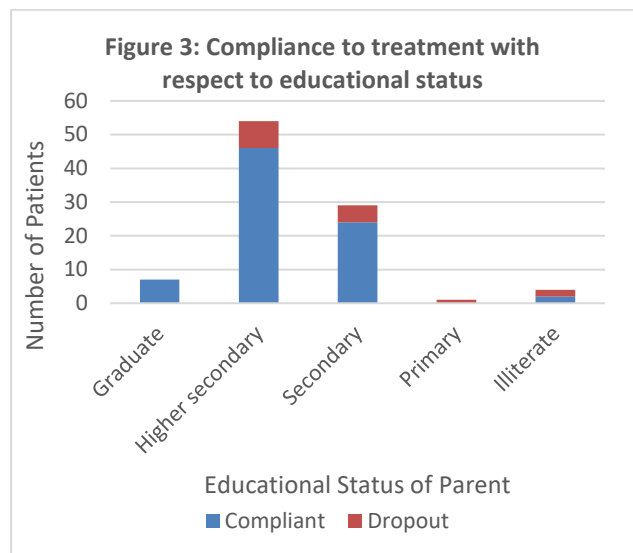
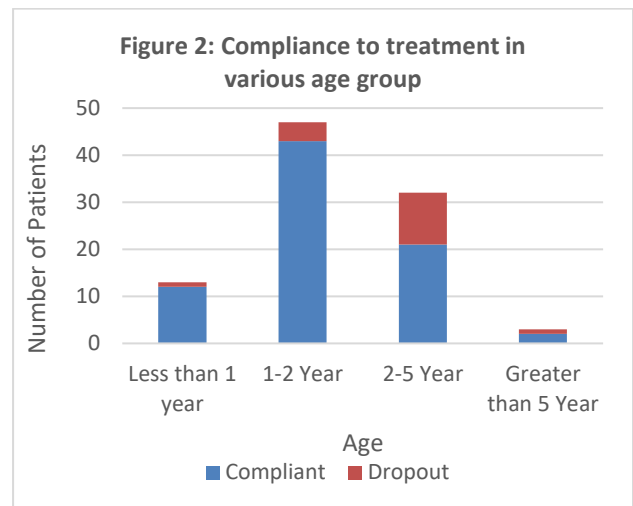


Table 3: Comparison of Pirani score before and after treatment in different age group

Age Group	Pirani Score in Mean ± SD		P-Value (Paired t-test)
	Before Treatment	After Treatment	
Less than 1 year	5.36 ± 1.01	1.76 ± 0.54	<0.001
1-2 Year	5.51 ± 0.96	1.53 ± 0.42	<0.001
2-5 Year	5.82 ± 1.07	1.85 ± 0.49	<0.001
Greater than 5 Year	5.43 ± 1.16	2.23 ± 0.69	<0.001

There was significant decline in Pirani score ($p < 0.001$) in all age group before and after Ponseti treatment of club foot. However, the decline was greater in patients of age less than 5 year as compared to those of age greater than 5 years.

DISCUSSION

Questionnaires have been utilized in a number of studies conducted in low- and middle-income nations, including Malawi, Uganda, China, Bangladesh, and India, to discover obstacles to the successful execution of clubfoot treatment programs.^{10, 12-17} The obstacles found are the same in each of these nations, despite the variations in population, customs, and resources.



Treatment for clubfoot has been found to be hampered by poverty in various developing countries.^{10,12-17} Patients from middle-class and lower-class socioeconomic backgrounds dropped out of our trial at a higher rate.

There was a greater dropout rate among parents who had just completed primary school or were illiterate. In addition, there was a greater dropout rate among parents who held strong cultural ideas about clubfoot. Like the studies in Uganda and Malawi, parents' awareness of clubfoot and its management before to the initiation of treatment did not connect with the dropout rates.^{12,14,15} On the other hand, the dropout rate was considerably lower for parents who were driven to finish treatment and who comprehended the clinician's instructions. Superstitious beliefs and a lack of education may prevent parents from fully comprehending the clinician's recommendations and have an impact on treatment compliance.

The age of the patient was found to be an obstacle to clubfoot therapy in the current investigation, with older children showing higher dropout rates. Extended therapy periods for older patients could have impacted their adherence to the program and raised the dropout rate. Patients who travelled more than 20 kilometres or from rural areas to the hospital also had higher dropout rates. Due to all of these reasons, parents find it challenging to take time off from their jobs and bear the expense of traveling a great distance in order to regularly visit the hospital. Similar results were also noted in China and Uganda.^{10, 15}

The majority of the patients in this study had a strong compliance rate and went to the hospital with both parents. It was noted that the child who was brought to the facility by their father alone had a significant likelihood of not finishing the course of treatment. It has been noted that mothers in Malawi and Uganda have the primary responsibility for treating their children who have clubfoot.^{12,14,15} Similar to our study, the majority of children in China have been accompanied by both of their parents.¹⁰ Upon evaluating the combined impact of all parameters, the patient's companion has a noteworthy influence on treatment compliance, suggesting that both parents play a crucial role in seeing the patient through to the end of the course of treatment.

The findings of this study suggest that government-funded clubfoot clinics be set up at the district and village levels. This will benefit both rural and urban areas by lowering travel times and, consequently, treatment times. These clinics ought to be set up at least twice or three times a week, with doctors skilled in the Ponseti approach, nurses, and counsellors qualified to inform parents about the significance of each stage of treatment and to follow up with them. Establishing a clubfoot clinic also benefits parents by serving as group therapy. New patients' parents can be inspired to finish treatment by witnessing the correction made in other children.

By providing training to ancillary medical personnel working in rural regions, it will be possible to assist in the early detection of the deformity, facilitate prompt referral to the closest clubfoot clinic, educate parents on how to finish treatment, and guarantee consistent follow-up. In cases where parents lack literacy or hold certain cultural views, educating them through images and films may be helpful. These objectives may be met with the assistance of non-governmental groups and government departments working together.

But because it is based on a tiny population group in Eastern India, this study has limitations. The population that visited the clinic helped identify the barriers; it is unknown if these are the same barriers faced by the population that has not gotten treatment. A multicentric analysis can aid in determining the obstacles more precisely.

CONCLUSIONS

The Pirani score for club foot evaluation indicates that the Ponseti technique was very effective in managing idiopathic club foot, and nearly all of the patients responded well to this treatment, according to the findings of our research. The study determined the obstacles to clubfoot therapy, which had a major effect on treatment compliance and dropout rates. The obstacles include the parents' low educational attainment, their lower financial status, the distance to the hospital, their inability to comprehend the advice of the clinician, their lack of drive to finish treatment, and their child's advanced age. The study's findings can be used to create an action plan that will increase the Ponseti method's adherence to clubfoot treatment across India.

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REFERENCES

1. Taneja DK. Soujourn with club foot—35 years experience. *Ind J Orthop.* 2002;36(2):21-26.
2. Ponseti IV. *Congenital clubfoot: Fundamentals for treatment.* London, England: Oxford University Press; 1996.
3. India's fertility rate falls, but the story is different for some states [Internet]. [cited 2023 Dec 9]. Available from: <https://dmeo.gov.in/article/indias-fertility-rate-falls-story-different-some-states>
4. Todase S, Rathod J. A Study of orthopaedic management of club foot at tertiary health care centre. *MedPulse International Journal of Orthopedics.* 2021;20(1):20–2. Available from: <http://dx.doi.org/10.26611/10202015>
5. Preston ET, Fell TW Jr. Congenital idiopathic club foot. *Clin Orthop. Related Res.* 1977;122:102–9.
6. Laaveg SJ, Ponseti IV. Long-term results of treatment of congenital clubfoot. *J Bone Joint Surg Am.* 1980;62(1):23–31.
7. Ponseti IV, Smoley EN. The classic: congenital club foot: the results of treatment. 1963. *Clin Orthop Related Res.* 2009;467(5):1133–45.
8. Radler C. The Ponseti method for the treatment of congenital club foot: review of the current literature and treatment recommendations. *Int Orthop.* 2013 Sep;37(9):1747-53. doi: 10.1007/s00264-013-2031-1. Epub 2013 Aug 9. PMID: 23928728; PMCID: PMC3764299.
9. Laaveg SJ, Ponseti IV. Long-term results of treatment of congenital club foot. *J Bone Joint Surg Am.* 1980;62:23–31.
10. Lu N, Zhao L, Du Q, Liu Y, Oprescu FI, Morcuende JA. From cutting to casting: impact and initial barriers to the Ponseti method of clubfoot treatment in China. *Iowa Orthop J.* 2010;30:1–6.
11. Morcuende JA, Dolan LA, Dietz FR, Ponseti IV. Radical reduction in the rate of extensive corrective surgery for clubfoot using the Ponseti method. *Pediatrics.* 2004;113:376–380.
12. Drew S, Goberman-Hill R, Lavy C. What factors impact on the implementation of clubfoot treatment services in low and middle-income countries?: A narrative synthesis of existing qualitative studies. *BMC Musculoskelet Disord.* 2018;19:72.
13. Gadhok K, Belthur MV, Aroojis AJ, Cook T, Oprescu F, Ranade AS, Morcuende JA. Qualitative assessment of the challenges to the treatment of idiopathic clubfoot by the Ponseti method in urban India. *Iowa Orthop J.* 2012;32:135–140.
14. Johnson RR, Friedman JM, Becker AM, Spiegel DA. The Ponseti method for clubfoot treatment in low and middle-income countries: a systematic review of barriers and solutions to service delivery. *J Pediatr Orthop.* 2017;37:0–9.
15. Kazibwe H, Struthers P. Barriers experienced by parents of children with clubfoot deformity attending specialised clinics in Uganda. *Trop Doct.* 2009;39:15–18.
16. Evans AM, Chowdhury M, Khan S. A community audit of 300 "drop-out" instances in children undergoing Ponseti clubfoot care in Bangladesh—what do the parents say? *Int J Environ Res Public Health.* 2021;18:993.
17. Iqbal MS, Dubey R, Thakur K, Katiyar S, Prasad M. Assessment of awareness and barriers to clubfoot treatment in the Indian scenario. *J Family Med Prim Care.* 2021;10:4229–4235.
18. Lampasi M, Abati CN, Stilli S, Trisolino G. Use of the Pirani score in monitoring progression of correction and in guiding indications for tenotomy in the Ponseti method: Are we coming to the same decisions? *J Orthop Surg (Hong Kong).* 2017 May-Aug;25(2):2309499017713916. doi: 10.1177/2309499017713916. PMID: 28625097.

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