

Outcomes of Ponseti Technique for Idiopathic Clubfoot in Children Presenting Up to Three Years of Age

Ponseti
Technique for
Idiopathic
Clubfoot in
Children

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ABSTRACT

Objective: This purpose of this study is to evaluate the outcomes of Ponseti manipulation and casting technique in treating Idiopathic Congenital Clubfoot in children under three years of age.

Study Design: Descriptive study

Place and Duration of Study: This study was conducted at the Department of Orthopaedic Surgery, SKBZ Medical Complex Quetta from 1st September 2021 to 31st August 2022.

Methods: The study included 93 feet of 55 patients with idiopathic club foot deformity, of both genders, age from 1 week to 3 years. The deformities were corrected using the Ponseti manipulation and casting technique. Pirani Scoring System was utilized, while SPSS version 16.0 used to analyse the data.

Results: In this study, we included 55 clubfoot patients, 93 feet, with 37 males and 18 females. 9 cases had right-sided involvement, and 38 were bilateral. The pre-correction Pirani score ranged from 4 to 6, with a mean of 5.7, while post-correction scores ranged from 0 to 1, with a mean of 0.5. The mean age of the patients was 2.2 years, ranging from one week to three years. The Ponseti method resulted in 92.7% excellent outcomes.

Conclusion: We concluded that Ponseti technique was non-invasive, safe and provides efficient, satisfactory outcomes for the management of idiopathic congenital clubfoot in children presenting up to the age of three years.

Key Words: Idiopathic Congenital talipes equinovarus, Pirani scoring, Ponseti technique.

Citation of article: Mengal MA, Mazar S, Taj N, Bari W, Mohib Ullah Durrani, Mohib Ullah Musakhail, Outcomes of Ponseti Technique for Idiopathic Clubfoot in Children Presenting Up to Three Years of Age. Med Forum 2024;35(9):3-7.doi:10.60110/medforum.350901.

INTRODUCTION

Idiopathic Talipes EquinoVarus (CTEV), commonly known as Clubfoot, is among the most prevalent congenital orthopaedic conditions, affecting approximately one in every 1,000 live births globally. This congenital deformity presents as a complex three-dimensional malformation characterized by a combination of four distinct features: ankle equinus (downward pointing of the foot), hind foot varus (inward turning of the heel), forefoot adductus (inward turning of the forefoot), and midfoot cavus (high arch). The exact etiology of CTEV remains idiopathic, although several studies suggest a multifactorial origin,

implicating genetic, environmental, and possibly vascular factors in its development^[1,2].

CTEV is clinically significant not just because of its high prevalence, but also because untreated cases can produce severe and disabling conditions. In the long-run, there are challenges that individuals with CTEV may have to contend with, if the condition is not properly treated, or is well managed. The deformity may progress to chronic pain, restrictions to joint movement and severe functional impairment in even simple daily activities, diminishing the affected person's quality of life. Leaving clubfoot untreated inhibits a person's ability to perform activities of daily living and can lead to social stigma in societies where treatment options are very poor^[3, 4]. In addition, when CTEV is poorly managed, this will also contribute to the significant economic burden on the health care system in the future due to the costs of subsequent management, surgical treatment, rehabilitation and provision of assistive devices as needed^[5].

The main goals of clubfoot treatment are to rehabilitate normal walking function, achieve a painless, plantigrade foot, and ensure functionality of the limb^[1,5]. These goals need to be achieved as quickly as possible, so that the patient and their family do not suffer too much disturbance to their financial and social circumstances. Addressing clubfoot has always been problematic because of the condition owing to the need

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Received: March, 2024

Accepted: June, 2024

Printed: September, 2024

for quick and effective intervention. In the past, extensive surgical releases were the leading treatment approach to this condition. Although these procedures were able to assist in correcting the abnormality, they came with a variety of other several long-term complications as well. This included the recurrence of the treated deformity, stiffness of the joint, and adjacent joint diseases or deformities including the knee and thigh^[6,7]. Such issues were often of such a nature that further treatment could be required which in turn increased the overall morbidity and healthcare costs associated with the disease process.

Over the last two decades, the Ponseti technique has undoubtedly revolutionized the treatment of idiopathic clubfoot becoming the best practice worldwide. The Ponseti method is a non-invasive technique that uses manipulation maintained with plaster of paris casting in order to achieve progressive and gradual correction of the deformity. This pioneering method, developed by Dr. Ignacio Ponseti in the Mid 20th Century, received attention for its effectiveness and successful long-term outcomes with less aggressive procedures^[8]. Many studies demonstrate that longitudinal practices of using the Ponseti method effectively correct the deformity but at the same time decreases the percentage of operations, thus contributing to the reduction of negative effects in the long run^[9,10].

Notwithstanding the good responses to the Ponseti method, the treatment of Clubfoot has its challenges. The deformity is still recurrent after the treatment, especially if the initial severity of the deformity is high or the Ponseti casting system is applied inappropriately^[11]. Brace compliance after treatment, which is a fundamental step of the Ponseti method, was amongst the factors which increased the rate of recurrence. This is especially common where there is lack of sufficient education among the parents or some cultural practices do not allow for the treatment to be followed or adhered through as recommended^[12]. It cannot be overstressed that regular follow up and the facilitation of parents are vital in ensuring that favorable long-term results are achieved.

Additionally, the socio-economic factors and situations strongly influence the success of the Ponseti method where it is implemented^[13, 16]. In low- and middle-income countries, health care resources were not adequate to attend all cases of CTEV using the Ponseti method, with follow-up care, because of general difficulties as the availability of qualified health workers, treatment costs, and logistical problems^[13,17,18]. This requires a multi-modal approach to addressing these challenges which includes: strengthening health systems, access to treatment and keeping the parents informed and supported throughout. Overall, the Ponseti method represents a radical new era in Clubfoot management and is an extremely efficient as well as non-invasive alternative to

conventional surgical procedures. The Ponseti method could greatly benefit course of the disease and mitigate relapse and non-compliance by avoiding reasons to undergo relapsing care, reduce treatment costs with no significant side effect which help make it feasible in our context. Further research and innovation in clubfoot treatment is essential to maximizing the success of the Ponseti method, so that all children can walk without a disability regardless of their demographics and socioeconomic status.

METHODS

A total of 55 individuals were included in the study, of which 93 had affected legs.

Inclusion criteria were patients aged one week to three years, male and female, with idiopathic clubfoot deformity. Severity of deformity was assessed using the Pirani scoring system. We also included recurrent and neglected cases of idiopathic clubfoot.

Patients with non-idiopathic causes of deformity such as neuromuscular disorders or syndromic conditions such as arthrogryposis were excluded. In addition, cases with opposite deformities, acquired equinovarus deformities, and cases of postoperative relapses were not included in the study.

Study data were collected prospectively using a systematic proforma that included demographic information, affected side, severity of deformity, number of casts required, tenotomy requirement, and post-treatment outcomes such as Pirani score. Data on compliance with the brace regimen and follow-up were collected. The obtained data were analysed using SPSS version 16.0. Data were summarized using descriptive statistics such as frequencies, percentages, means and standard deviations. The success of the Ponseti method was measured by comparing Pirani scores before and after treatment.

The management embraced of, all babies underwent the Ponseti method; a non-surgical serial casting that allows correction of clubfoot. The Ponseti method stresses gentle, painless manipulation and gradual corrections on a weekly basis. Correct application of casts by an experienced orthopaedic specialist is accompanied with monitoring for circulation and soft tissue integrity. The casts are made of plaster of Paris, moulded carefully to hold the foot in place, snug but not tight enough to impair circulation. The process is repeated until satisfactory correction of the deformity is achieved.

The major components of the Ponseti Technique are its weekly correction with the help of the casts for 5 to 7 days before change of the cast. These weekly intervals promote the adaptation of soft tissues preventing their overload and allows gradual correction to normal foot alignment. The average amount of casts in the treatment is usually 5-7; although this number can vary depending on the severity of the clubfoot. Correction of the

deformity occurs in stages, starting with the forefoot and midfoot and then the heel, which is usually in an equinovarus position.

In the majority of cases, once the foot is nearly corrected and/or for patients with residual equinus deformity, a minor procedure for Achilles tendon percutaneous tenotomy is performed under local anaesthesia. This procedure helps release the tight Achilles tendon to allow the foot to achieve normal dorsiflexion. A final cast is then applied after tenotomy, usually for about three weeks, to allow the tendon to heal in its lengthened position.

Following the correction, patients are provided with Denis Brown shoes, which are set at 70 degrees of abduction on the corrected side and 45 degrees on the

normal side. This bracing is intended to maintain the correction and prevent recurrence. The bracing protocol requires the shoes to be worn full-time for the first three months, followed by night-time and nap-time use for up to the age of four years.

The Ponseti method used for the correction of club foot treatment, including a cast and a brace, will last about 4 years of age to keep your child's feet in proper alignment and prevent recurrence. Frequent check-ups that begin with every 1-2 weeks and then every 3-6 months, are essential for following treatment progress as well compliance. Parents are taught the full process of seeking and adhering to treatment, as well as early recognition of complications and maintaining proper foot hygiene.

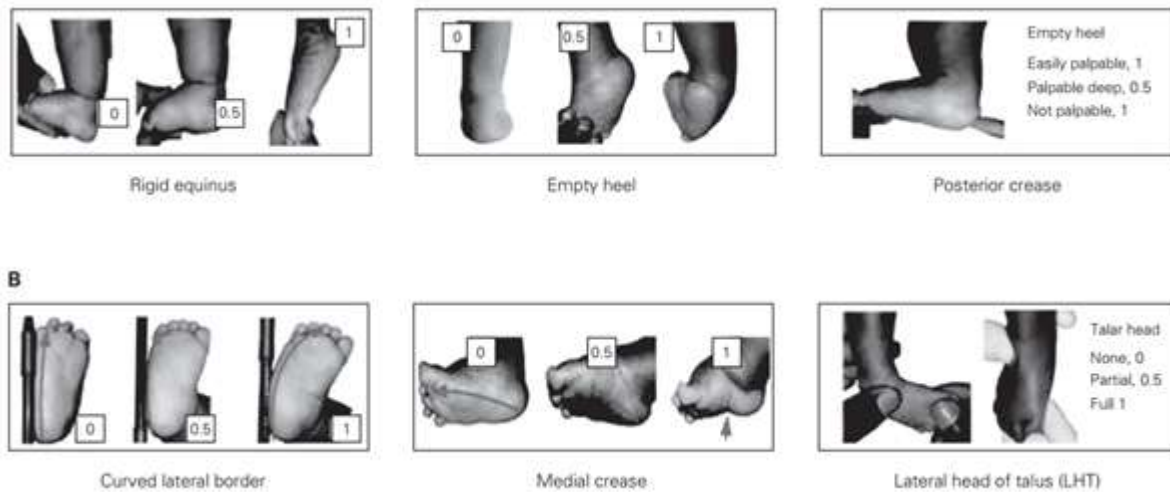


Figure: Pirani scoring system for clubfeet. (A) Hindfoot score (HS); (B) midfoot score (MS). Total score = (HS + MS) ÷ 6.

RESULTS

Table No. 1: Various variables with their values.

Variable	Value	
Total number of patients	55	
Total number of feet	93	
Laterality	Right-sided involvement	9 (16.4%)
	Left-sided involvement	8 (14.5%)
	Bilateral involvement	38 (69.1%)
Case Type	Neglected cases	25 (45.5%)
	Recurrence cases	9 (16.4%)
Patient Age	Mean age	2.2 years
	Age range	1 week to 3 years
Treatment Method	Corrected with Ponseti serial casting alone	11 (20%)
	Required percutaneous tendo achillis tenotomy	44 (80%)
Casting Information	Number of casts (range)	3 to 9
	Average number of casts	5.8

Mean Pirani Scores - Pre and Post Correction

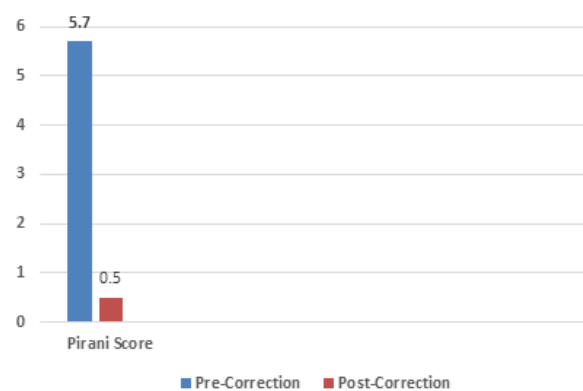


Figure No. 1: Graph demonstrating the Pre correction Pirani score of 4-6 with a mean value of 5.7, and post correction score of 1 to 0 with a mean value of 0.5.

In this study, we included 55 clubfoot patients, totalling 93 feet, with 37 males (67.3%) and 18 females (32.7%). The Ponseti method resulted in 92.7% excellent outcomes, although 5 patients were lost to follow-up, 4

discontinued bracing, and 2 opted for surgery due to recurrence and travel difficulties secondary to low socioeconomic status.

DISCUSSION

In the present study, we aimed to evaluate the outcomes of the Ponseti technique in treating patients with idiopathic clubfoot deformity (CTEV), on a group of 55 patients comprised all together as being with 93 affected legs. There was male preponderance as reported by demographic distribution, in which 67.3% were males and the remaining 32.7% of patients were female. This distribution is evidenced through literature that indicates CTEV occurs more often in men than women^[6]. The majority of cases were bilateral (69.1%), which is also consistent with the known tendency of clubfoot to manifest bilaterally in a significant proportion of patients^[6, 17].

One notable aspect of this study is the inclusion of neglected (45.5%) and recurrent (16.4%) cases, which are often more challenging to treat due to increased rigidity and severity of deformity. Nevertheless, the Ponseti method showed excellent results with a mean post-corrected Pirani score of 0.5 versus pre-corrected (mean) score of 5.7. This identifies the effectiveness of the technique in achieving almost complete correction, considering complex cases of neglected and recurrence CTEV, with after Ponseti management.

The mean age of the patients upon treatment was 2.2 years, with a window between one week and three years old. The presence of patients under three years old is remarkable and shows the flexibility and effectiveness of the Ponseti technique in treatment for older children, where deformity may manifest more evident or resistance to correction. Previous studies demonstrated satisfactory outcomes in older children with the Ponseti method, even when more casts or interventions such as tenotomy are required^[5].

Complete correction was achieved in 80% of patients using a percutaneous Achilles tenotomy, in this study. This is similar to other reports that often tenotomy is required in a significant number of cases for residual equinus correction^[6]. The mean casts applied were 5.8 ranging from 3 to 9 casts. This is consistent with standard Ponseti protocol and usually includes between 4 to 8 casts depending on the severity of deformity and responsiveness to treatment^[7]. After corrective management, patient was given Denis Brown shoes for 70 degrees abduction on corrected side and 45 degrees on normal side. This is a standard brace intended to hold the correction which has been achieved by casting. Although this treatment is successful in general, compliance is the main issue; 5 patients lost to follow-up and 4 patients abandoned the braces. These two factors are the most important in avoiding the relapse. Noncompliance with the brace has been clearly identified as a major risk factor for clubfoot relapse

following Ponseti treatment^[6,7,8]. Two other parents opted for surgical management due to associated recurrence, reasoned with burden from socioeconomic conditions, distance to travel for follow-ups and further demonstrating the persistent struggles surrounding clubfoot management in resource limited settings^[9, 10].

The excellent results obtained in 92.7% cases in this study justifies the Ponseti method as the gold standard of treatment for idiopathic clubfoot. The results are in accordance with the expected findings from other centers indicating high correction rate and low rate of or relapse to clubfoot when managed by Ponseti method^[11,13]. This study is also a reminder and highlights the importance to consider the factors to compliance, socioeconomic conditions and accessibility to health care, which overall ensure the long-term success and adherence to the management^[12].

Controlled trials and multi institutional cohort studies will continue to add weight to the base of evidence existing in literature, that majority children with idiopathic CTEV can be effectively treated by Ponseti technique even at a later age, relapse & recurrence cases as well as neglected/treated cases or when other procedures have failed. The high success rate demonstrated by this study, indicates the reliability of the method and that further controlled interventions will be necessary to follow up on cases with greater compliance within studies aimed at improving adherence rates for treatment protocols.

CONCLUSION

In this study we concluded that Ponseti technique was non invasive, safe and provides efficient, satisfactory outcomes for the management of idiopathic congenital clubfoot in children presenting up to the age of three years.

Limitations: Firstly, the study sample size was relatively small, which may limit the generalizability of the results to larger populations. Additionally, the study was conducted at a single medical center, meaning the outcomes may not fully reflect variations in treatment protocols or expertise across different institutions. Compliance with the bracing protocol was self-reported by caregivers, introducing potential bias or inaccuracies in data collection.

Author's Contribution:

Concept & Design of Study:	Mohammad Aslam Mengal
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Revisiting Critically:	Mohammad Aslam Mengal, Saddam Mazar, Nargis Taj

Final Approval of version: By all above authors

Conflict of Interest: The study has no conflict of interest to declare by any author.

Source of Funding: None

Ethical Approval: No.EC29-1/2021 dated 01.02.2021

REFERENCES

1. Cady R, Hennessey TA, Schwend RM. Diagnosis and treatment of idiopathic congenital clubfoot. *Pediatr* 2022;149(2):e2021055555.
2. Sadler B, Gurnett CA, Dobbs MB. The genetics of isolated and syndromic clubfoot. *J Children's Orthopaedics* 2019;13(3):238-44.
3. Corbu A, Cosma DI, Vasilescu DE, Cristea S. Posteromedial release versus Ponseti treatment of congenital idiopathic clubfoot: a long-term retrospective follow-up study into adolescence. *Therapeutics Clin Risk Management* 2020:813-9.
4. Zhang J, Wang N, Lv H, Liu Z. Magnetic Resonance Imaging of Clubfoot Treated With the Ponseti Method: A Short-Term Outcome Study. *Frontiers Pediatr* 2022;10:924028.
5. Yaqeen A, Sidra H, Ijaz MA, Ijaz MM. Comparison of outcome of Ponseti method with traditional clubfoot treatment in children up to five years of age at tertiary care hospital. *Pak J Med Sci* 2022;38(6):1680.
6. Rieger MA, Dobbs MB. Clubfoot. *Clinics Podiatr Med Surg* 2022;39(1):1-4.
7. Cady R, Hennessey TA, Schwend RM. Diagnosis and treatment of idiopathic congenital clubfoot. *Pediatr* 2022;149(2):e2021055555.
8. Obiegbu HO, Ndukwu CC, Chukwuanukwu TO. Effectiveness of the Ponseti technique in the management of clubfoot. *Orient J Med* 2019;31(3-4):89-93.
9. Rastogi A, Agarwal A. Long-term outcomes of the Ponseti method for treatment of clubfoot: a systematic review. *Int Orthopaed* 2021;45(10):2599-608.
10. Hosseinzadeh P, Kiebzak GM, Dolan L, Zionts LE, Morcuende J. Management of clubfoot relapses with the Ponseti method: results of a survey of the POSNA members. *Journal of Pediatric Orthopaed* 2019;39(1):38-41.
11. Chu A, Labar AS, Sala DA, van Bosse HJ, Lehman WB. Clubfoot classification: correlation with Ponseti cast treatment. *J Pediatr Orthopaed* 2010;30(7):695-9.
12. Thomas HM, Sangiorgio SN, Ebramzadeh E, Zionts LE. Relapse rates in patients with clubfoot treated using the Ponseti method increase with time: a systematic review. *JBJS Reviews* 2019;7(5):e6.
13. Lasebikan OA, Anikwe IA, Onyemaechi NO, Chukwujindu ED, Nwadinigwe CU, Omoke NI. Ponseti clubfoot management method: Initial experience with 273 clubfeet treated in a clubfoot clinic of a Nigerian regional orthopedic hospital. *Nigerian J Clin Pract* 2019;22(9):1266-70.
14. Monforte S, Alberghina F, Paonessa M, Canavese F, Andreacchio A. Synthetic cast material versus plaster of Paris for the treatment of idiopathic clubfoot by the Ponseti protocol: a comparative analysis of 136 feet. *J Pediatr Orthopaed* 2021;41(5):296-300.
15. Al-Mohrej OA, Alshaaan FN, Alhussainan TS. Is the modified Ponseti method effective in treating atypical and complex clubfoot? A systematic review. *Int Orthopaed* 2021;45(10):2589-97.
16. Singh S, Mali HS. Clubfoot: review on assessment, treatment, challenges, and engineering aspects. *JPO: J Prosthet Orthotics* 2022;34(3):e114-30.
17. Ishizuka T, Hung YY, Weintraub MR, Kaiser SP, Williams ML. Ponseti idiopathic and nonidiopathic clubfoot correction with secondary surgeries. *J Foot Ankle Surg* 2021;60(4):742-6.
18. Chu A, Nechamie H, Lehman WB. Management of the complex clubfoot. *Journal of the Pediatric Orthopaed Society North Am* 2019;1(1):39.