Efficacy of Ponseti Casting in Syndromic Clubfoot Cases in Children: A Quasi-Experimental Study

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Abstract

Objective: This study aimed to assess the efficacy of Ponseti casting in the management of syndromic clubfoot deformities. Study design: A quasi-experimental study. Place and **Duration:** This study was conducted in Liaquat College of Medicine and Dentistry, Darul Sehat Hospital Karachi from December 2022 to December 2023. **Methodology:** Children under one year of age, regardless of gender, with syndromic clubfoot and without prior casting or surgical interventions, were included. Exclusion criteria comprised prior treatment, parental reluctance, or specified conditions. Initial assessments included photographic documentation and Pirani scoring before casting initiation. Weekly casting sessions were documented, with selective TA tenotomies performed when necessary prior to the final cast. Post-treatment documentation and Pirani scoring were conducted, with follow-up assessments at 3 and 6 months to monitor recurrence and surgical requirements. Data analysis was conducted using SPSS version 26. **Results:** The study enrolled 100 children (70 males, 30 females) with 80 bilateral and 20 unilateral clubfeet. Initial Pirani scores indicated significant deformity, necessitating varying numbers of casts and occasional tenotomies. Despite challenges, notable improvement was observed, although syndromic cases required a greater number of casts compared to idiopathic clubfeet. The mean pre-Ponseti Pirani score was 4.1±0.83, demonstrating a significant reduction to 2.1±0.6 post-treatment ($p < 0.001$). Recurrence occurred in 40 (40%) children, with 20 (20%) requiring surgical intervention. **Conclusion:** Ponseti casting demonstrates utility in correcting syndromic clubfoot deformities, albeit with increased casting requirements. Despite the challenges, the method effectively corrects deformity to a considerable extent. Therefore, it is recommended for use in children.

Keywords: **Clubfoot, Syndrome, Children, Ponseti Casting.**

Introduction

Clubfoot deformity, characterized by abnormal positioning of the foot and ankle, is one of the most common musculoskeletal congenital anomalies, affecting approximately 1 in every 1000 live births worldwide [1]. While the majority of clubfoot cases are idiopathic in nature, occurring without any underlying genetic or syndromic associations, a subset of patients present with syndromic clubfoot, where the deformity is accompanied by various genetic syndromes or congenital anomalies [2]. Syndromic clubfoot represents a distinct clinical entity, often presenting unique challenges in management and treatment outcomes compared to idiopathic cases.

The Ponseti method, introduced by Dr. Ignacio Ponseti in the 20th century, has revolutionized the non-operative management of clubfoot deformity [3]. This technique involves a series of gentle manipulations followed by the application of plaster casts to gradually correct the foot position over several weeks [4]. Despite its widespread acceptance and success in idiopathic clubfoot cases, the efficacy of the Ponseti method in syndromic clubfoot remains a subject of debate and ongoing research [5].

Several studies have investigated the outcomes of Ponseti casting specifically in syndromic clubfoot cases, aiming to assess its effectiveness, complications, and long-term results [6, 7]. However, the literature on this topic is relatively limited, and findings are often heterogeneous due to variations in study designs,

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patient populations, and follow-up protocols [8]. Understanding the unique challenges and outcomes associated with Ponseti casting in syndromic clubfoot is essential for optimizing treatment strategies and improving patient care in children [9].

Simple clubfeet typically respond well to Ponseti casting, often achieving correction rates exceeding 90% within a few casting sessions [10]. However, challenges arise with difficult or syndromic feet, which tend to be more rigid, severely deformed, and associated with additional abnormalities. These cases present difficulties in correction, often requiring a higher number of casting sessions and a higher rate of TA tenotomy [11]. Success rates are lower, recurrence rates are higher, and additional surgical procedures may be necessary shortly after casting or later to achieve significant correction [12]. Compliance with treatment protocols, both by the child and their parents, is often more challenging in these complex cases, impacting the overall outcome of management [13].

This study aims to contribute to the existing body of literature by evaluating the efficacy of Ponseti casting in syndromic clubfoot deformities. Through a comprehensive review of relevant literature and analysis of our own clinical data, we seek to elucidate the effectiveness, challenges, and long-term implications of this treatment modality in syndromic clubfoot management. By addressing these gaps in knowledge, we aim to provide valuable insights that can inform clinical decision-making and enhance the quality of care for patients with syndromic clubfoot.

Methodology

The inclusion criteria comprised children of either sex, aged less than one year, presenting with clubfoot and other congenital abnormalities, who had not undergone previous casting or surgical interventions. Exclusion criteria included prior casting or surgical history, parental unwillingness, or other specified conditions. Ethical approval was obtained from the hospital ethics review committee. All children with clubfoot who attended the outpatient department were screened, and those with syndromic clubfeet were selected for participation.

Each eligible child underwent evaluation at a specialized Ponseti clinic. Before initiating Ponseti casting, photographs were taken, and Pirani scoring was performed on each foot to assess the extent of deformity. Individual files were created for each child, containing their history, examination findings, and photographs, with a unique identifier assigned to each.

Ponseti casting commenced on a weekly basis at the outpatient Ponseti clinic. Pirani scoring and photographic documentation were performed weekly before the application of the next cast, with all records meticulously maintained in the individual files. In cases where residual equinus persisted despite casting, TA tenotomy was performed before the final cast.

Following the removal of the final cast, Pirani scoring was repeated to assess the degree of correction achieved. The number of casts required for each child, TA tenotomies performed, and the percentage of final correction were recorded using Pirani Scoring. All children were provided with Dennis Brown shoes after Ponseti casting and completion of any necessary TA tenotomy procedures.

Follow-up evaluations were conducted at 3 months and 6 months post-Ponseti casting to monitor recurrence rates and the need for additional surgical procedures to achieve further correction. Data entry and analysis were performed using SPSS version 26, with a significance level set at $p < 0.05$ using a paired t-test to compare pre- and post-Ponseti Pirani scores.

Results

The study included a total of 100 children, comprising 70 males and 30 females, with 80 bilateral and 20 unilateral clubfeet. Upon initial assessment, all participants exhibited significant deformities as indicated by their Pirani scores, necessitating individualized treatment approaches involving varying numbers of casts and occasional TA tenotomies. Despite the complexities inherent in treating clubfeet, considerable improvement was observed across the cohort, reflecting the effectiveness of the Ponseti casting method. Notably, syndromic clubfoot cases required a greater number of casts compared to idiopathic cases, highlighting the challenges associated with correcting deformities in this subgroup.

The mean pre-Ponseti Pirani score was 4.1±0.83, indicating the severity of deformity at the onset of treatment. Following Ponseti casting, there was a significant reduction in the Pirani scores, with the mean post-treatment score decreasing to 2.1±0.6 ($p < 0.001$). This substantial improvement underscores the efficacy of the Ponseti method in achieving correction and realignment of clubfeet deformities.

Despite the positive outcomes observed, recurrence of deformity occurred in 40% of the children during the follow-up period. Additionally, 20% of the participants required surgical intervention to address persistent or recurrent deformities. These findings highlight the importance of long-term monitoring and the potential need for additional interventions beyond Ponseti casting to ensure optimal outcomes in the management of clubfeet, particularly in cases of syndromic clubfoot where complexities may predispose to higher rates of recurrence and surgical intervention.

Table 1: Demographic Characteristics of Participants.

Total Participants	Gender (Males/Females)	Clubfoot Type (Bilateral/Unilateral)
100	70/30	80/20

Table 2: Pre- and Post-Ponseti Pirani Scores.	
Treatment Stage	Mean Pirani Score
Pre-Ponseti	4.1±0.83
Post-Ponseti	2.1±0.6

Table 3: Recurrence and Surgical Intervention Rates.		
Outcome	Number of Children	Percentage
Recurrence	40	40
Surgical Intervention	20	20

Discussion

The findings of our study highlight the effectiveness and challenges of utilizing Ponseti casting in the management of syndromic clubfoot deformities. Our results demonstrate significant improvements in deformity correction, albeit with notable complexities and variations in treatment outcomes compared to idiopathic clubfoot cases. In this discussion, we will compare our findings with those of five other relevant studies in the literature.

Dobbs et al. conducted a study evaluating the outcomes of Ponseti casting in idiopathic clubfeet and reported a mean pre-treatment Pirani score of 4.0, which reduced to 1.2 post-treatment. While our study focused on syndromic clubfeet, we observed a comparable mean pre-Ponseti Pirani score of 4.1, indicating similar initial deformity severity. However, our post-treatment Pirani score of 2.1 suggests a slightly less favourable outcome compared to idiopathic cases [14].

Morcuende et al. conducted a longitudinal study evaluating the long-term outcomes of Ponseti casting in idiopathic clubfoot and reported a recurrence rate of 32% over a five-year follow-up period. In our study, we observed a higher recurrence rate of 40% in syndromic clubfeet, indicating a greater risk of deformity relapse in this subgroup despite treatment [15].

Zionts and Dietz investigated the effectiveness of bracing following Ponseti correction in idiopathic clubfoot and reported a recurrence rate of 10%. While our study did not specifically address the role of bracing in syndromic clubfoot, our findings suggest a higher recurrence rate of 40%, underscoring the challenges in achieving long-term stability in children [16].

Andriesse et al. conducted a systematic review assessing the outcomes of Ponseti casting in children with congenital idiopathic clubfoot. While our study focused on syndromic cases, our findings regarding the efficacy of Ponseti casting in achieving deformity correction align with the results reported in their review, highlighting the general applicability of the Ponseti method across different etiology of clubfoot [17].

Laaveg and Ponseti pioneered the use of the Ponseti method in the treatment of congenital clubfoot and reported a mean correction rate of 93% with serial casting. While our study did not achieve comparable correction rates in syndromic clubfeet, our findings suggest that the Ponseti method remains a valuable tool in the management of these challenging cases, despite the need for additional interventions and the higher risk of recurrence [18].

Conclusion

In conclusion, our study contributes to the growing body of literature on the use of Ponseti casting in syndromic clubfoot deformities. While our findings indicate significant improvements in deformity correction, challenges such as higher recurrence rates and the need for additional interventions underscore the complexities inherent in treating syndromic clubfeet. Further research is warranted to optimize treatment strategies and improve long-term outcomes in children.

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Permission

Taken from the ethical committee.

Conflict of interest

None

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