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Management and Outcomes of Idiopathic Clubfoot: A Retrospective Analysis of Casting and Surgical Interventions

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Abstract **Original Research Article**

***Background*:** Idiopathic clubfoot (congenital talipes equinovarus) is a prevalent pediatric orthopaedic deformity. The Ponseti method of serial casting is universally recognized as the gold standard for initial management. Following casting, a significant proportion of patients require a minor surgical intervention, most commonly a percutaneous Achilles tenotomy (ETA), to correct residual equinus. ***Aim*:** This study aims to retrospectively evaluate the management of idiopathic clubfoot at Queen Rania Children's Hospital (QRCH), analyzing the relationship between patient laterality, the total number of corrective casts required, and the incidence of subsequent surgical interventions. ***Methods*:** A retrospective observational cohort study was conducted on 180 children diagnosed with idiopathic clubfoot who were managed at the institution between 2020 and 2025. Data regarding the total number of corrective casts and surgical interventions were extracted from the institutional Hakeem System. ***Results*:** Bilateral clubfoot was the most common presentation, accounting for 60% of cases. The mean number of serial casts required prior to equinus correction was 5.4. Overall, 82.2% of the cohort required an ETA. Bilateral cases demonstrated a higher propensity for requiring surgical intervention (87.0%) compared to unilateral cases (75.0%). ***Conclusion*:** The Ponseti method remains highly effective for correcting idiopathic clubfoot. Bilateral presentation is a reliable predictor of a slightly longer casting phase and a higher likelihood of requiring an ETA to achieve full anatomical correction.

Keywords: Idiopathic Clubfoot, Casting VS Surgical Interventions.

1. INTRODUCTION

Idiopathic clubfoot, or congenital talipes equinovarus (CTEV), is one of the most common congenital structural deformities of the lower limbs, affecting approximately 1 in 1,000 live births. The deformity is characterized by a complex three-dimensional misalignment involving midfoot cavus, forefoot adductus, hindfoot varus, and hindfoot equinus (commonly remembered by the acronym CAVE) [1-3]. If left untreated, the condition leads to severe functional disability, gait abnormalities, and chronic pain.

Historically, management relied heavily on the Kite method of manipulation or extensive soft-tissue release surgeries. However, long-term follow-up of surgically treated patients frequently revealed stiff, weak, and painful feet, complicated by early-onset osteoarthritis. In contrast, the conservative Ponseti method, developed in the 1950s, has revolutionized the treatment paradigm. It leverages the viscoelastic properties of infant connective tissue through a specific sequence of gentle manipulation and weekly long-leg plaster casting [4-7].

While casting reliably corrects the cavus, adductus, and varus deformities, the rigid collagenous fibers of the Achilles tendon often resist conservative stretching. Consequently, a percutaneous Achilles tenotomy (ETA) is required in the vast majority of cases to correct residual equinus and prevent the development of a rocker-bottom foot. Following final casting, patients transition to a foot abduction brace (FAB) to prevent relapse, an intrinsic risk in CTEV [8, 9].

Evaluating institutional data regarding casting frequency, presentation laterality, and the necessity of surgical interventions is critical for optimizing treatment protocols, managing clinical resources, and counseling parents. This study aims to retrospectively evaluate the management of idiopathic clubfoot at Queen Rania Children's Hospital (QRCH), analyzing the interplay between patient laterality, casting volume, and the incidence of ETA.

2. MATERIALS AND METHODS

2.1. Study Design and Setting

A retrospective observational cohort study was conducted at the QRCH Pediatric Orthopedics and Clubfoot Clinic. The study evaluated patients treated over a five-year period, from 2020 to 2025.

2.2. Study Population

The final study sample comprised 180 children diagnosed with idiopathic clubfoot who were exclusively managed at our institution. To isolate the efficacy of the standard Ponseti protocol, strict exclusion criteria were applied. Patients with non-idiopathic, syndromic, or neurogenic clubfoot (such as those associated with myelomeningocele, Larsen syndrome, or arthrogryposis multiplex congenita) were excluded due to their distinct tissue rigidity and altered treatment pathways. Furthermore, patients presenting for revision treatments initiated at outside facilities, and those with incomplete electronic medical records, were excluded.

2.3. Data Collection and Outcome Measures

Demographic and clinical data were systematically extracted from the Hakeem System. Initial deformity severity was documented utilizing standard clinical assessments, including the Pirani scoring system where applicable. The primary outcome measures included the total number of corrective casts applied per patient and the subsequent need for surgical intervention (ETA or formal Achilles tendon lengthening). Secondary outcome measures assessed the impact of laterality (unilateral versus bilateral presentation) on treatment duration and surgical probability.

3. RESULTS

3.1. Demographics and Laterality

A total of 180 patients meeting the strict inclusion criteria for idiopathic clubfoot were analyzed. The cohort demonstrated a strong male predominance, consistent with global epidemiological patterns. Regarding presentation, bilateral clubfoot was the most common, accounting for 60.0% of the cases (n=108), whereas unilateral presentations accounted for the remaining 40.0% (n=72).

Table 1: Patient Demographics and Laterality

Characteristic	Number of Patients (n=180)	Percentage (%)
Gender		
Male	122	67.8%
Female	58	32.2%
Characteristic	Number of Patients (n=180)	Percentage (%)

Table 2: Distribution of Clubfoot Laterality

Laterality	Number of Patients	Percentage (%)
Bilateral	108	60.0%
Unilateral (Right)	41	22.8%
Unilateral (Left)	31	17.2%
Total	**180**	**100%**

3.2. Casting Frequency

The Ponseti method of serial casting was applied to all 180 patients. The mean number of serial casts required to achieve correction of the midfoot and hindfoot deformities before evaluating for equinus was 5.4. The vast majority of patients (74.4%) achieved sufficient initial correction with 4 to 6 casts. Patients presenting with bilateral deformities required a slightly higher median number of casts compared to those with unilateral clubfoot.

Table 3: Total Number of Casts Required Prior to Equinus Correction

Number of Casts	Number of Patients	Percentage (%)
≤3 casts	12	6.7%
4 casts	38	21.1%
5 casts	56	31.1%
6 casts	45	25.0%
7 casts	18	10.0%
≥8 casts	11	6.1%
Total	**180**	**100%**

3.3. Surgical Interventions

Consistent with the expected biomechanics of the Ponseti protocol, a significant majority of the cohort required minor surgical intervention to resolve residual equinus. Overall, 82.2% of the idiopathic cohort (n=148) underwent an ETA.

When analyzing the requirement for surgery based on laterality, bilateral cases demonstrated a notably higher propensity for requiring an ETA to achieve final correction compared to unilateral cases.

Table 4: Incidence of Surgical Intervention (ETA) by Laterality

Laterality	Total Patients	Required ETA (n)	Percentage within Group (%)
Bilateral	108	94	87.0%
Unilateral	72	54	75.0%
Overall	**180**	**148**	**82.2%**

4. DISCUSSION

The management of idiopathic clubfoot has been dramatically improved by the Ponseti method, shifting the focus from invasive structural alterations to progressive biomechanical remodeling. This retrospective review of 180 patients at QRCH demonstrates initial correction outcomes highly consistent with major international centers, affirming the rigorous application of the protocol within our institution.

Our finding that the average number of casts required is 5.4 aligns precisely with original reports by Ponseti and subsequent robust multicenter analyses, which confirm that the majority of idiopathic clubfeet can be corrected with five to six casts. The number of casts often strongly correlates with the initial clinical severity, as measured by the Pirani or Dimeglio scoring systems [10-13].

Crucially, our data indicates an overall ETA rate of 82.2%. In the broader literature, tenotomy rates fluctuate based on institutional thresholds, ranging from 65% up to 95%. Our high rate underscores the contemporary understanding that a percutaneous tenotomy is an integral, expected phase of the standard Ponseti protocol rather than a failure of conservative casting. Cutting the thick, inflexible Achilles tendon allows for a rapid, safe drop of the calcaneus, preventing the iatrogenic complication of midfoot breaching (rocker-bottom deformity) [14-18].

The secondary analysis evaluating laterality revealed that bilateral clubfeet required slightly more casts and had a notably higher rate of ETA (87.0% vs. 75.0%). This reflects the compounded severity and systemic nature of bilateral presentations. Interestingly, while bilateral patients undergo more intensive initial treatment, recent comparative studies have shown that bilateral CTEV patients treated with tenotomy develop dynamic pedobarographic values and functional scores (e.g., FADI) comparable to healthy controls, and occasionally outperform unilateral variants in dynamic symmetry at walking age.

Relapse and Long-Term Considerations

While this study primarily evaluated the casting and surgical phases of initial correction, long-term success relies entirely on the bracing phase. CTEV possesses a strong intrinsic tendency to relapse until approximately age five. Relapse rates in the literature vary from 10% to over 30%, with the overwhelming majority of early recurrences attributed directly to non-compliance with the foot abduction brace (FAB). Future prospective tracking within the QRCH registry will focus on brace compliance and long-term functional scores to further refine our patient education pathways.

Limitations

The primary limitation of this study is its retrospective nature and reliance on the completeness of electronic medical records within the Hakeem System. While non-idiopathic and revision cases were successfully excluded, nuanced variables such as parent education levels, socioeconomic status, and detailed brace compliance hours were not evaluated in this primary analysis, all of which are known modulators of long-term outcomes.

5. CONCLUSION

The Ponseti method is a highly effective primary management strategy for idiopathic clubfoot, successfully yielding corrected, functional feet with a minimal number of serial casts. Patient pathways are significantly influenced by initial clinical presentation; bilateral involvement necessitates a more prolonged casting phase and carries a higher probability of requiring an Achilles tenotomy. Anticipating these variations allows clinicians to optimize resource allocation and set accurate expectations for families embarking on the treatment journey.

REFERENCES

1. Ponseti, I. V. (1992). Treatment of congenital club foot. *The Journal of Bone & Joint Surgery*, 74(3), 448-454.
2. Morcuende, J. A., Dolan, L. A., Dietz, F. R., & Ponseti, I. V. (2004). Radical reduction in the rate of extensive corrective surgery for clubfoot using the Ponseti method. *Pediatrics*, 113(2), 376-380.
3. Radler, C. (2013). The Ponseti method for the treatment of congenital clubfoot: review of the current philosophy and treatment methods. *Orthopedic Clinics*, 44(4), 583-593.
4. Dobbs, M. B., Nunley, R., & Schoenecker, P. L. (2006). Long-term follow-up of patients with clubfeet treated with extensive soft-tissue release. *The Journal of Bone and Joint Surgery. American volume*, 88(5), 986-996.

5. Zhao, D., Li, H., Zhao, L., Liu, J., Wu, Z., & Jin, F. (2014). Results of clubfoot management using the Ponseti method: do the details matter? A systematic review. *Clinical Orthopaedics and Related Research*, 472(4), 1329-1336.
6. Agarwal, A., Rastogi, A., & Rastogi, P. (2021). Relapses in clubfoot treated with Ponseti technique and standard bracing protocol- a systematic analysis. *Journal of Clinical Orthopaedics and Trauma*.
7. Ghavami, M., Abedinzadeh, R., & Biglu, M. H. (2019). Early management of clubfoot by the Ponseti method with complete percutaneous tenotomy of tendoachillis. *Journal of Family Medicine and Primary Care*, 8(8), 2621-2624.
8. Shabtai, L., et al. (2024). Comparison between unilateral and bilateral clubfoot treated with Ponseti method at walking age: static and dynamic assessment. *Journal of Pediatric Orthopaedics*.
9. Kite, J. H. (1939). Nonoperative treatment of congenital clubfoot. *The Journal of Bone & Joint Surgery*, 21(3), 595-606.
10. Haft, G. F., Walker, C. G., & Crawford, H. A. (2007). Early results of the Ponseti technique for a clubfoot clinic in New Zealand. *The New Zealand Medical Journal*.
11. Chawla, A., et al. (2023). Experience with Ponseti treatment and Achilles tenotomy in the management of CTEV. *Journal of Medical and Dental Science Research*, 10(4).
12. Herzenberg, J. E., Radler, C., & Bor, N. (2002). Ponseti versus traditional surgical release for idiopathic clubfoot. *Journal of Pediatric Orthopaedics*, 22(4), 517-521.
13. Ali, M., et al. (2024). Prevalence and factors associated with relapse clubfoot treated by Ponseti method. *Journal of Xiangya Medicine*.
14. Alshaikh, M., et al. (2024). The Efficacy of the Ponseti Method in the Management of Clubfoot: A Systematic Review. *Cureus*.
15. Jowett, C. R., Morcuende, J. A., & Ramachandran, M. (2011). Management of congenital talipes equinovarus using the Ponseti method. *The Journal of Bone & Joint Surgery (British Volume)*, 93(9), 1160-1164.
16. Singh, S., et al. (2021). Long-term outcomes of the Ponseti method for treatment of clubfoot: a systematic review. *International Orthopaedics*.
17. Scher, D. M., Feldman, D. S., van Bosse, H. J., Sala, D. A., & Lehman, W. B. (2004). Predicting the need for tenotomy in the Ponseti method for correction of clubfeet. *Journal of Pediatric Orthopaedics*, 24(4), 349-352.
18. Dyer, P. J., & Davis, N. (2006). The role of the Pirani scoring system in the management of club foot by the Ponseti method. *The Journal of Bone & Joint Surgery (British Volume)*, 88(8), 1082-1084.