ORIGINAL ARTICLE OPEN ACCESS

Outcome of Ponseti Technique in Children with Congenital Talipes Equinovarus: A Quasi-Experimental Trial

Pervez Ali[1], Kashif Mehmood[1], Muhammd Aslam Mengal[2], Shazia Soomro[3], Abdul Ghaffar[1], Sharjeel Khan[1], Mehtab Ahmed[1]

[1]Department of Orthopedic Surgery, Jinnah Postgraduate Medical Center, Karachi,[2]Department of Orthopedic Surgery, Sheikh Zaid Hospital, Quetta,[3]Department of Pediatric Medicine, National Institute of Child Health, Karachi, Pakistan.

ABSTRACT

Background: Idiopathic congenital talipes equinovarus (CTEV), also known as clubfoot, is a developmental disorder of the limb. This study was done to determine the outcomes of CTEV following Ponseti technique in terms of change in Pirani score in children presenting at a tertiary care hospital of a developing country.

Methods: This quasi-experimental study was conducted in Jinnah Postgraduate Medical Center, Karachi, Pakistan, from 15th February 2023 to 30th December 2024. A total of 133 children aged 1 week to 2 years, having CTEV (Pirani score 3-6), and undergoing Ponseti treatment were analyzed. Non-probability consecutive sampling technique was employed. All children underwent corrective sequential castings with manipulation as per the Ponseti method. Patients were followed up for 12 weeks, and Pirani score was assessed. Wilcoxon Rank test, Mann-Whitney U test, Kruskal Wallis test, and bivariate correlational analysis were applied (as appropriate), taking $p<0.05$ as significant. Data analysis was performed using IBM-SPSS Statistics, version 26.0.

Results: In a total of 133 children, 101 (75.9%) were male. The median age was 2.00 (1.00-5.00) months. The median number of follow-up visits was 6.00 (6.00-8.00). Age distribution had having significant association with baseline Pirani score ($p=0.002$). The median baseline and final follow-up (12 weeks) Pirani score were 5.00 (4.00-6.00), and 0.50 (0.00-1.00), $p<0.001$. Post-treatment (at 12 weeks) Pirani score was significantly higher among children who underwent percutaneous tenotomy ($p<0.001$). Relatively modest, but significant positive association of final Pirani score with number of follow-up visits ($r=0.238$, $p=0.002$).

Conclusion: The Ponseti technique is an effective and minimally invasive approach for managing CTEV in children, leading to significant improvement in Pirani scores over 12 weeks.

Keywords: Congenital Talipes Equinovarus, Follow-Up, Pirani Score, Ponseti Technique, Tenotomy.

Corresponding Author:
Dr. Pervez Ali,
Department of Orthopedic Surgery,
Jinnah Postgraduate Medical Center, Karachi, Pakistan.
Email: pervez73@hotmail.com
Doi: https://doi.org/10.36283/ziun-pjmd14-3/013

How to cite: Ali P, Mehmood K, Mengal MA, Soomro S, Ghaffar A, Khan S, Ahmed M Outcome of Ponseti Technique in Children with Congenital Talipes Equinovarus: A Quasi-Experimental Trial. Pak J Med Dent. 2025 July ;14(3): 81-87. Doi: https://doi.org/10.36283/ziun-pjmd14-3/013.

Received: Mon, February 17, 2025 **Accepted:** Fri, June 20, 2025 **Published:** Mon, July 21, 2025

INTRODUCTION

Idiopathic congenital talipes equinovarus (CTEV), also known as clubfoot, is a poorly understood development disorder of the limb that affects 0.76 to 3.49 live births[1,2]. CTEV comprises four complex pediatric foot deformities with degrees of variation in rigidity, including forefoot adduct us, hindfoot varus, forefoot equinus, and midfoot cavus[3]. CTEV is estimated to affect 50% cases with both feet[4,5].

Many approaches are opted for the correction of clubfoot, but regardless of its severity, it is usually treated conservatively[6,7]. When compared to conservative therapy, several surgical methods generally have a higher risk of stiffness, pain, avascular necrosis, overcorrection, infection, diminished mechanical strength, poor long-term ankle range of motion, and arthritis[8,9]. Managing CTEV is a significant challenge for orthopedic surgeons, as it tends to relapse despite treatment[10]. The Ponseti technique for the correction of clubfoot using casting and manipulation, on the basis of fundamentals of pathoanatomic and kinematics of the deformity, became widely adopted during 1990s[11]. Global data shows that Ponseti procedure for the correction of clubfoot has a success rate between 90-98%, while around 10% of cases may require further surgery beyond a tenotomy to get good functional outcomes[12].

Various scoring systems like the Dimeglio classification and Ponseti-Laaveg classification have been utilized for evaluating clubfoot over the years, but Shafique Pirani developed a reliable, reproducible, and easy scoring system for grading the severity of this deformity in 2002, known as the Pirani Score[13]. Pirani score is based on the six clinical signs of contracture and may also predict an appropriate treatment. Lack of local data on outcomes of Ponseti technique in patients with CTEV in a relatively young age group motivated the planning behind this study. This research was done to determine the outcomes of CTEV following the Ponseti technique in terms of change in Pirani score in children presenting at a tertiary care hospital of a developing country.

METHODS

This quasi-experimental study was conducted at the orthopaedics department of the Jinnah Postgraduate Medical Center in Karachi, Pakistan, from 15th February 2023 to 30th December 2024. Sample size of 115 was estimated by OpenEpi sample size calculator by taking successful correction of CTEV following Ponseti technique as 95%[14], with 95% confidence level, and 4% margin of error. An addition of 15% sample was made anticipating the loss of follow-up. So, the final sample size turned out to be 133. Children of any gender, aged 1 week to 2 years, having CTEV with Pirani score 3-6, and who underwent correction serial castings with manipulation under Ponseti treatment were included. Patients with neurological disorders, congenital contractures, syndromic feet, or receiving previous conservative/surgical treatment were excluded. Non-probability consecutive sampling technique was employed for sample selection. Ethical clearance was acquired from the Institutional Ethics Committee before commencing this study (No.F.2-81/2023-GENL/21/JPMC, dated: 13-02-2023). Informed and written consents were obtained from parents/guardians.

Patients satisfying eligibility criteria were enrolled. Information including gender, age, and foot involved were noted. Pirani score was calculated at baseline. All patients underwent corrective sequential castings with manipulation as per the Ponseti method. Casts were applied with no anesthesia. Following appropriate management, four to eight long leg casts were put on and replaced every week. The foot was significantly adducted to 70° without pronation and 15° of dorsiflexion without any treatment in the previous cast. A long leg cast was used for an additional 3 weeks. When dorsiflexion could not be achieved, a simple percutaneous Achilles tenotomy was carried out. A consultant who had spent at least 2 years working in the Orthopaedics department conducted the percutaneous tenotomy. Tenotomy was done as an elective treatment in a small operating room while under local anaesthetic. After tenotomy, a long leg cast was applied in 70° of abduction and 15-30° of dorsiflexion under the effect of anesthesia for an additional 3 weeks to allow healing. Patients were followed up for 12 weeks, and Pirani score was assessed.

Data were analyzed using IBMSPSS version 26.0. For categorical variables like age groups, gender, tenotomy, and foot involvement, frequencies and percentages were reported. Pre- and post-treatment Pirani scores were compared using the Wilcoxon Rank test (because distribution of pre- and post-Pirani scores was non-parametric). Effect modifiers were addressed through stratification. Post-treatment Pirani scores were compared using Mann-Whitney U test, or Kruskal-Wallis test. Bivariate analysis was applied to correlate quantitative data. For all inferential statistics, $p<0.05$ was considered significant.

RESULTS

In a total of 133 infants, 101 (75.9%) were males, and 32 (24.1%) females, showing a male-to-female ratio of 3.2:1. The median age was 2.00 (1.00-5.00) months, while 78 (58.6%) infants were aged below 3 months. Bilateral involvement of foot was most frequent, noted in 95 (71.4%). The median number of OPD visits was 6.00 (6.00-8.00).

Table 1: Characteristics of Infants (n=133)

Characteristics		Frequency (%)	Baseline Pirani Score	P-value
Gender	Male	101 (75.9%)	5.00 (3.00-6.00)	
	Female	32 (24.1%)	5.50 (5.00-6.00)	0.082
Age groups (months)	<3	78 (58.6%)	6.00 (5.00-6.00)	
	3-6	10 (7.5%)	4.50 (3.00-5.25)	
	6-12	29 (21.8%)	4.00 (3.00-5.50)	
	13-24	16 (12.0%)	5.00 (5.00-6.00)	0.002
Residence	Urban	81 (60.9%)	5.00 (3.00-6.00)	
	Rural	52 (39.1%)	5.00 (4.00-6.00)	0.265
Monthly family income (PKR)	<30,000	86 (64.7%)	5.00 (4.00-6.00)	
	>30,000 to 60,000	37 (27.8%)	5.00 (3.00-6.00)	
	>60,000	10 (7.5%)	6.00 (3.00-6.00)	0.728
Foot involved	Right	22 (16.5%)	5.00 (4.00-5.25)	
	Left	16 (12.0%)	5.50 (4.00-6.00)	
	Both	95 (71.4%)	5.00 (3.00-6.00)	0.694

Table 1 shows characteristics of infants with respect to baseline Pirani score. It was found that the age distribution. was having significant association with baseline Pirani score (p=0.002).

Table 2: Comparative post-treatment Pirani score with study variables (n=120)

Characteristics		Number (%)	Post-Treatment Pirani Score	P-Value
Gender	Male	88 (73.3%)	0.50 (0.00-1.00)	
	Female	32 (26.7%)	0.50 (0.00-1.00)	0.784
Age (months)	<3	67 (55.8%)	0.50 (0.00-1.00)	
	3-6	8 (6.7%)	0.50 (0.00-1.00)	
	7-12	29 (24.2%)	0.50 (0.00-1.00)	
	13-24	16 (13.3%)	0.75 (0.50-1.00)	0.125
Residence	Urban	75 (62.5%)	0.50 (0.00-1.00)	
	Rural	45 (37.5%)	0.50 (0.00-1.00)	0.705
Monthly family income (PKR)	<30,000	78 (65.0%)	0.50 (0.00-1.00)	
	>30,000 to 60,000	32 (26.7%)	0.50 (0.00-1.00)	
	>60,000	10 (8.3%)	0.50 (0.00-2.25)	0.884
Foot involved	Right	22 (18.3%)	0.50 (0.00-0.50)	
	Left	11 (9.2%)	0.00 (0.00-1.00)	
	Both	87 (72.5%)	0.50 (0.00-1.00)	0.222
Percutaneous tenotomy performed	Yes	40 (33.3%)	1.00 (0.50-2.00)	
	No	80 (66.7%)	0.00 (0.00-0.50)	<0.001

The median baseline Pirani score was 5.00 (4.00-6.00). There were 120 children who completed the mandatory follow-up period of 12 weeks. The median Pirani score at the last follow-up (at 12 weeks) was calculated to be 0.50 (0.00-1.00). The difference between baseline and post-treatment final follow-up Pirani scores was found to be statistically significant (p<0.001). Post-treatment (at 12 weeks) Pirani score was significantly higher among children who underwent percutaneous tenotomy (p<0.001). The details about the association of post-treatment (at 12 weeks) Pirani score with respect to various study variables are shown in **Table 2**.

Bivariate correlation analysis revealed no significant association of final Pirani score with total number of casts (r=-0.019, p=0.832), and details are depicted in scatter-plot shown in **Figure 1**.

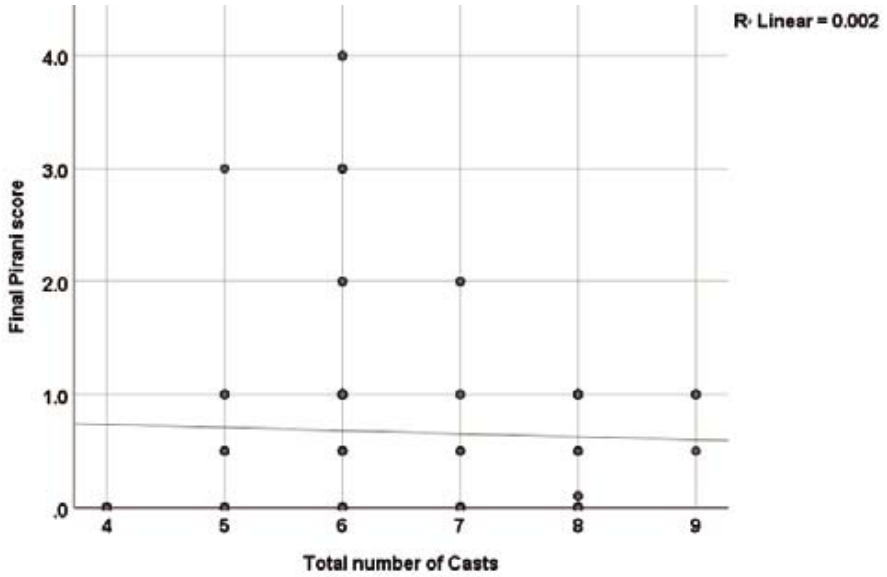

Figure 1: Scatter-Plot Showing Correlation of Total Number of Casts with Final Pirani Score (n=120)

Bivariate correlation analysis revealed relatively modest, but significant positive association of final Pirani score with number of follow-up visits (r=0.238, p=0.002), and details are depicted in scatter-plot shown in **Figure 2**.

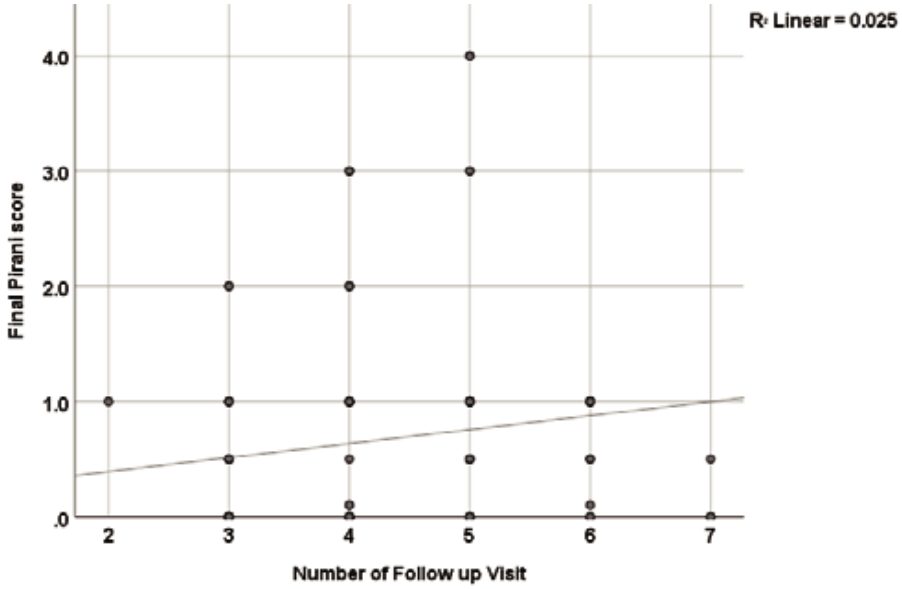

Figure 2: Scatter-Plot Showing Correlation of Number of Follow-Up Visits with Final Pirani Score (n=120)

 DOI: https://doi.org/10.36283/ziun-pjmd 14-3/013

DISCUSSION

This study found that the majority of the children treated were male (75.9%), with a male-to-female ratio of 3.2:1. The higher prevalence of clubfoot among males is well-documented and is likely attributed to genetic predisposition and intrauterine positioning[15,16]. One of the most important findings in this study was the difference in baseline Pirani scores across age groups. Infants younger than three months had significantly higher baseline Pirani scores (6.00 [5.00–6.00]) compared to relatively older children (p=0.002). This is likely due to increased rigidity of the deformity with advancing ages[17]. A study noted that early initiation of treatment leads to better correction, with their study demonstrating a mean pre-treatment Pirani score of 5.4 and post-treatment score of 0.5, similar to the present findings[18]. Other researchers revealed that Pirani score is a highly accurate method in evaluation of clubfoot severity and predicts treatment success[19]. Another study revealed that 85% feet revealed Pirani score below 1 following Ponseti method in clubfoot[20]. The clinical implication of this finding is that early intervention is crucial for optimal correction and should be emphasized in healthcare strategies.

The number of casts required for correction varied among patients. Another study reported that an average of 5.37 casts per patient[21]. A study found that idiopathic clubfoot required fewer casts compared to syndromic or recurrent clubfoot cases[22]. These similarities in the present study further reinforces the reliability of the Ponseti method in managing idiopathic clubfoot effectively.

A major aspect of this research was the role of percutaneous Achilles tenotomy, which was performed in 33.3% of patients. Post-treatment Pirani scores were significantly higher in children who underwent tenotomy (p<0.001), indicating that these cases had more severe deformities requiring additional intervention. This observation is consistent with the findings of Mahmood et al., who reported that 81.1% of their patients required tenotomy, and a study found that patients with higher initial Pirani scores were more likely to undergo the procedure[21]. The need for tenotomy highlights the importance of individualized treatment planning and suggests that children with severe deformities may require additional interventions for optimal correction.

The impact of socioeconomic factors was also analyzed, but no significant association was found between post-treatment Pirani scores and residence (urban vs. rural, p=0.705) or monthly family income (p=0.884). This suggests that despite financial or geographical barriers, the Ponseti method remains an accessible and effective treatment in diverse populations[23,24]. This finding is encouraging and aligns with other studies who reported similar success rates in both urban and rural settings[18,25]. Factors such as parental education, adherence to bracing protocols, and long-term follow-up require further exploration.

This study also documented a modest but significant positive correlation was found between the number of follow-up visits and final Pirani score (r=0.238, p=0.002). This suggests that while the number of casts alone does not necessarily predict final outcomes, frequent follow-up visits might indicate more complex cases requiring additional monitoring and interventions[22]. A local study reported that non-compliance with foot abduction splints was a major factor contributing to relapse[18]. While this study did not assess long-term compliance, the significant improvement in Pirani scores at 12 weeks suggests that short-term adherence to the protocol was well maintained. Future research should focus on long-term outcomes and adherence patterns to better understand factors influencing relapse rates.
The findings of this study have important clinical implications for the management of CTEV in resource-limited settings. The Ponseti method is highly effective in achieving significant correction within a relatively short period, even in tertiary care hospitals of developing countries like Pakistan. The fact that treatment outcomes were not significantly affected by socioeconomic status or residence indicates that the Ponseti method is an equitable and accessible treatment option that can be widely implemented. However, early intervention remains crucial, as higher baseline Pirani scores were observed in older infants, reinforcing the need for prompt diagnosis and treatment initiation[26-28]. The significant improvement in post-treatment Pirani scores underscores the efficacy of the Ponseti method in this population. Given the simplicity and cost-effectiveness of this technique, it should be integrated into standard orthopedic training programs and community healthcare initiatives to improve accessibility[29]. The role of percutaneous Achilles tenotomy should not be overlooked, as it plays a crucial role in achieving optimal dorsiflexion in more severe cases[30].

Despite the strengths of this study, including its prospective design and rigorous statistical analysis, several limitations must be acknowledged. The follow-up duration was limited to 12 weeks, which does not allow for assessment of long-term relapse rates. Future studies should include extended follow-up periods to evaluate sustained correction and the impact of bracing compliance. While non-probability consecutive sampling was employed to ensure an adequate sample size, this may limit the generalizability of findings to other populations. Factors such as parental adherence to bracing and the role of physiotherapy

post-treatment were not assessed, which could have provided additional insights into long-term outcomes.

CONCLUSION

The Ponseti technique is an effective and minimally invasive approach for managing CTEV in children, leading to significant improvement in Pirani scores over 12 weeks. The need for percutaneous tenotomy was associated with higher post-treatment scores, indicating variability in treatment response. Better adherence to follow-up influenced outcomes, reinforcing the importance of regular monitoring.

ACKNOWLEDGMENT

None

CONFLICT OF INTEREST

The authors have no conflict of interest.

ETHICAL APPROVAL

The permission was obtained from the Institutional Review Board of Jinnah Postgraduate Medical Centre, Karachi, Pakistan, with letter number F.2-81/2023-GENL/21/JPMC, dated: 13-02-2023.

AUTHORS' CONTRIBUTIONS

PA: Concept, design, data collection, proofreading, critical revisions, approved for publication. **KM:AG:SK:MA** Drafting, data collection, proofreading, critical revisions, approved for publication. **MAM: SS** Conceived the idea, drafting, data analysis, proofreading, critical revisions, approved for publication.

REFERENCES

1. Mustari MN, Faruk M, Bausat A, Fikry A. Congenital talipes equinovarus: A literature review. Ann Med Surg (Lond). 2022;81:104394. doi: 10.1016/j.amsu.2022.104394

2. Bina S, Pacey V, Barnes EH, Burns J, Gray K. Interventions for congenital talipes equinovarus (clubfoot). Cochrane Database Syst Rev. 2020;5(5):CD008602. doi: 10.1002/14651858.CD008602.pub4

3. Mosca VS. Clubfoot pathoanatomy-biomechanics of deformity correction: a narrative review. Ann Transl Med. 2021;9(13):1096. doi: 10.21037/atm-20-7491

4. Dibello D, Torelli L, Di Carlo V, d'Adamo AP, Faletra F, Mangogna A, et al. Incidence of Congenital Clubfoot: Preliminary Data from Italian CeDAP Registry. Int J Environ Res Public Health. 2022;19(9):5406. doi: 10.3390/ijerph19095406

5. Dibello D, Di Carlo V, Colin G, Barbi E, Galimberti AMC. What a paediatrician should know about congenital clubfoot. Ital J Pediatr. 2020;46(1):78. doi: 10.1186/s13052-020-00842-3

6. Canavese F, Dimeglio A. Idiopathic clubfoot: past, present and future. Ann Transl Med. 2021;9(13):1094. doi: 10.21037/atm-21-2392

7. López-Carrero E, Castillo-López JM, Medina-Alcantara M, Domínguez-Maldonado G, Garcia-Paya I, Jiménez-Cebrián AM. Effectiveness of the Ponseti Method in the Treatment of Clubfoot: A Systematic Review. Int J Environ Res Public Health. 2023;20(4):3714. doi: 10.3390/ijerph20043714

8. Kadhum M, Lee MH, Czernuszka J, Lavy C. An Analysis of the Mechanical Properties of the Ponseti Method in Clubfoot Treatment. Appl Bionics Biomech. 2019;2019:4308462. doi: 10.1155/2019/4308462

9. Gaber K, Mir B, Shehab M, Kishta W. Updates in the Surgical Management of Recurrent Clubfoot Deformity: a Scoping Review. Curr Rev Musculoskelet Med. 2022;15(2):75-81. doi: 10.1007/s12178-022-09739-6

10. Chand S, Mehtani A, Sud A, Prakash J, Sinha A, Agnihotri A. Relapse following use of Ponseti method in idiopathic clubfoot. J Child Orthop. 2018;12(6):566-574. doi: 10.1302/1863-2548.12.180117

11. Zionts LE, Ebramzadeh E, Sangiorgio SN. Objective analysis of intermediate-term outcome of the Ponseti technique: a review of the experience from Los Angeles. Ann Transl Med. 2021;9(13):1101. doi: 10.21037/atm-20-7774

12. Ahmed S, Moosa S, Muhammad AA, Iftikhar S, Khan MA, Chinoy MA, et al. Eight-year Review of a Clubfoot Treatment Program in Pakistan With Assessment of Outcomes Using the Ponseti Technique: A Retrospective Study of 988 Patients (1,458 Clubfeet) Aged 0 to 5 Years at Enrollment. J Am Acad Orthop Surg Glob Res Rev. 2022;6(4):e22.00022. doi: 10.5435/JAAOSGlobal-D-22-00022

13. Dyer PJ, Davis N. The role of the Pirani scoring system in the management of club foot by the Ponseti method. J Bone Joint Surg Br. 2006;88(8):1082-4. doi: 10.1302/0301-620X.88B8.17482

14. Göksan SB. Doğuştan çarpik ayağin Ponseti yöntemi ile tedavisi [Treatment of congenital clubfoot with the Ponseti method]. Acta Orthop Traumatol Turc. 2002;36(4):281-7. Available at: https://pubmed.ncbi.nlm.nih.gov/12510061/

15. Smythe T, Rotenberg S, Lavy C. The global birth prevalence of clubfoot: a systematic review and meta-analysis. EClinicalMedicine. 2023;63:102178. doi: 10.1016/j.eclinm.2023.102178. Erratum in: EClinicalMedicine. 2025;80:103087. doi: 10.1016/j.eclinm.2025.103087

16. Dobbs MB, Gurnett CA. Genetics of clubfoot. J Pediatr Orthop B. 2012;21(1):7-9. doi: 10.1097/BPB.0b013e328349927c

17. El-Sherbini MH, Omran AA. Midterm Follow-Up of Talectomy for Severe Rigid Equinovarus Feet. J Foot Ankle Surg. 2015;54(6):1093-8. doi: 10.1053/j.jfas.2015.07.004

18. Rehman HU, Zaidi SH, Rahman JU, Fraz MO, Aslam M, Safdar CA. Management of congeniital taliipes equiinovarus by the ponsetii method-short-term and iintermediiate effectiiveness of the techniique and factors affectiing outcome. Pak Armed Forces Med J 2016; 66(4):538-42. Available at: https://pafmj.org/index.php/PAFMJ/article/view/761
19. Ahmed HAD, Mohamed AMY, Salih M, Mohamed MMG, Younis A, Hussein SHM, et al. Assessing the Influence of Age, Weight, and Pirani Score on the Number of Casts During the Initial Phase of Clubfoot Treatment Using the Ponseti Method: A Prospective Study. Indian J Orthop. 2024;58(6):687-695. doi: 10.1007/s43465-024-01142-2
20. Smythe T, Chandramohan D, Bruce J, Kuper H, Lavy C, Foster A. Results of clubfoot treatment after manipulation and casting using the Ponseti method: experience in Harare, Zimbabwe. Trop Med Int Health. 2016;21(10):1311-1318. doi: 10.1111/tmi.12750
21. Mahmood T, Zafir MB, Shafee M, Chishti MK, Rasool A, Ahmad MF. casting for idiopathic clubfoot at Nishtar Medical University MF. Outcome of Ponseti method of manipulation and Hospital Multan.J Pak Orthop Assoc. 2022;34(1):35-39. Available at: https://www.jpoa.org.pk/index.php/upload/article/view/620
22. Butt MN, Perveen W, Ciongradi CI, Alexe DI, Marryam M, Khalid L, et al. Outcomes of the Ponseti Technique in Different Types of Clubfoot-A Single Center Retrospective Analysis. Children (Basel). 2023;10(8):1340. doi: 10.3390/children10081340
23. Maghfuri HB, Alshareef AA. The Efficacy of the Ponseti Method in the Management of Clubfoot: A Systematic Review. Cureus. 2024 Jan 18;16(1):e52482. doi: 10.7759/cureus.52482
24. Bor N, Coplan JA, Herzenberg JE. Ponseti treatment for idiopathic clubfoot: minimum 5-year followup. Clin Orthop Relat Res. 2009;467(5):1263-70. doi: 10.1007/s11999-008-0683-8
25. Bitew A, Melesse DY, Admass BA. A 5-years results of the Ponseti method in the treatment of congenital clubfoot: a retrospective study. Eur J Orthop Surg Traumatol. 2023;33(5):1781-1787. doi: 10.1007/s00590-022-03353-5
26. Smythe T, Mudariki D, Gova M, Foster A, Lavy C. Evaluation of a simple tool to assess the results of Ponseti treatment for use by clubfoot therapists: a diagnostic accuracy study. J Foot Ankle Res. 2019;12:14. doi: 10.1186/s13047-019-0323-4
27. Johansson A, Wallander H, Esbjörnsson AC. Initial clubfoot treatment in Sweden from 2016 to 2019: A national register study. PLoS One. 2024;19(6):e0305900. doi: 10.1371/journal.pone.0305900
28. Rastogi P, Agarwal A, Singh S, Meena CP, Gupta N. Correlation of age and severity scores to the number of Ponseti casts in Indian infants with clubfeet. J Clin Orthop Trauma. 2020;11(Suppl 5):S807-S811. doi: 10.1016/j.jcot.2020.06.020
29. Carry PM, Graham S, Whalen K, Burke D, Baschal R, Holmes KS, et al. Implementation of a Ponseti Clubfoot Program Decreases Major Surgery: A Quality Improvement Initiative. Pediatr Qual Saf. 2020;5(6):e362. doi: 10.1097/pq9.0000000000000362
30. Kayondo TK, El-Adwar KL, Abdullah EA, Mosa MM. Reliability of Percutaneous Achilles Tenotomy in the Treatment of Idiopathic Clubfoot. J Pediatr Orthop. 2024;44(6):e566-e569. doi: 10.1097/BPO.0000000000002688.