

Original Article

Predisposing Factors for Recurrence Idiopathic Club Foot After Successful Ponseti Treatment at Tikur Anbesa Specialized Hospital

Adamu Belete Genet¹, Biruk Lambisho Wamisho², Birhanu Ayana³

¹Department of Orthopedic and Trauma, Tikur Anbessa Specialized Hospital, AAU, Addis Ababa, Ethiopia.

Corresponding authors*: adambelegene@gmail.com

Abstract

Background: Idiopathic clubfoot is treated with the Ponseti treatment all over the world; yet, the deformity's recurrence is a major complication and not studied in Ethiopia. This research aimed to determine predisposing factors for recurrence of idiopathic club foot after successful ponseti treatment. The objective of this study is to assess predisposing factors for idiopathic club foot recurrence following successful ponseti technique correction.

Method: All children with corrected idiopathic club foot who started abduction brace and on follow up from September 2021 to September 2023 after Ponseti treatment who fulfilled the eligibility criteria were included. From medical and club foot register and telephone call interview, data were collected and analyzed by SPSS version 29 software. Descriptive statistics, bivariable and multivariable analysis were used.

Result: There were 104 patients (136 feet) followed for average of 3.4 years. Thirty-two (31.7%) were right side clubfoot, 38(36.5%) were left side and 33(31.7%) were bilateral. Sixty-six (63.5%) children were males. There were 39(28.7%) feet which had recurrence. Place of residence shows 62(59.6%) were from urban. Chi-square tests found associations between recurrence and, awareness level of treatment ($p=0.0001$), parent's education status ($p=0.002$), job ($p=0.003$), satisfaction of parent with treatment ($p=0.004$), poor compliance ($p<0.001$), discomfort during wearing brace ($p=0.01$), pretreatment Pirani scores ($p<0.001$) and longer follow up age ($p=0.014$). Logistic regression identified pretreatment Pirani score ($p=0.024$), and poor brace compliance ($p=0.022$) had major predictive significance for recurrence.

Conclusion. Pretreatment Pirani score and poor brace compliance are independent significant predictors of recurrence.

Keywords: Club foot, Relapse club foot, Bracing for club foot, Brace compliance, Recurrent club foot.

Citation : Genet AB, Wamisho BL, Ayanna B Predisposing Factors for Recurrence Idiopathic Club Foot After Successful Ponseti Treatment at Tikur Anbesa Specialized Hospital. *Ethio Med J* 62 (supplement 1) 39-- 45

Submission date : 6 November 2023 Accepted: 30 January 2024 Published: April 2024

Introduction

Congenital Talipes Equinovarus (CTEV) is the most prevalent congenital abnormality affecting the musculoskeletal system that requires orthopedic treatment (1). Clubfoot can manifest as either non-idiopathic type or idiopathic type when it occurs in healthy babies (2). It is estimated that Ethiopia sees 3,000–5,000 new CTEV cases annually (3).

The specific etiology is still unknown (4). Prior to the introduction of ponseti treatment, conventional kite manipulation and plastering were used for treating idiopathic clubfoot in Ethiopia(5).The ponseti treat-

ment, which is currently regarded as the gold standard of care, can effectively treat clubfoot in up to 95% of cases without the need for surgery. It is gradually replacing previously used conservative and surgical procedures. In June 2005, the Ponseti treatment started for the first time in Ethiopia at Tikur Anbesa Specialized Hospital (TASH).

It has been progressively accepted in a number of locations by the partnership of TASH and cure international, Ethiopia (3). Currently, around 56 club foot centers are available in Ethiopia. The Ponseti method involves weekly foot manipulation and serial casting, with the

possibility of a percutaneous Achilles tenotomy if necessary. To preserve the correction achieved, a foot abduction brace (FAB) is utilized. Initially, the FAB is worn continuously (23 hours) for the first three months, followed by a gradual decrease to 18-23 hours for another three months. Subsequently, during the maintenance phase, the FAB is worn for 12-18 hours per day until the patient reaches the age of four to five years (6).

Currently, the Ponseti method is widely accepted on a global scale with remarkable success in achieving primary correction rates (7). The objective of clubfoot treatment is to have fully corrected, mobile, plantigrade feet at maturity, capable of walking with shoes without discomfort (8). The substantial problem with the ponseti procedure is a relapsed or recurring deformity, which ranges from 11% to 48% (8).

Predisposing factors for recurrence are still vary and debatable and no consensus except brace compliance as predisposing factor for recurrence According to Dobbs *et al.* there is a substantial risk of noncompliance for the return of clubfoot deformity. Haft *et al.* more recent research, further demonstrated how important it is to follow the post-correction abduction-bracing strategy in order to prevent clubfoot from recurring.(9,13,14). Dobbs and Associate came to the conclusion that the factor most strongly linked with recurrence is failure to comply with brace use.(4). Azipra *et al.* and many other researcher also showed poor compliance as major risk factor for recurrence (7,11,15,16).

The primary trigger of recurrence is brace intolerance, though certain individuals may still experience it even after maintaining braces effectively(10). In Harvard medical school, Boston ,children who experienced recurrence before turning two years old had a substantially greater chance of not wearing their braces as prescribed than those who experienced recurrence after that age in 2017 (12).

Clubfoot and its recurrence is an extremely disabling illness that causes discomfort, hinders moving, and creates marginalization and discrimination from a variety of daily life, including work and education (17). To the best of our knowledge, no research has been done in Ethiopia regarding to predisposing factors for recurrence. The identification of key risk factors could ultimately contribute to improved choice of patients for congenital clubfoot treatments now readily available as well as the possibility of prompt intervention to enhance outcome and compliance. This study intended to assess predisposing factors for recurrence of idiopathic club foot after successful ponseti treatment in our set up. It also aimed to assess sociodemographic factors which affect poor compliance.

Methods and Materials

A retrospective record review was conducted in TASH. All idiopathic club feet children who had a successful ponseti treatment with a minimum of half year follow-up time after the start of brace application and who were on follow up from September 2021 to September 2023 were included in the study.

Eligibility Criteria

Patients were excluded if they had an incomplete medical record, late presenting club foot (>2 year) and those whose parents declined to give verbal consent to participate in the study.

Data collection

Data were collected from clubfoot registry log book, patient's chart, computer follow up, and parents telephone interview conducted to complete the data using a structured questionnaire. Age at first casting and last follow-up, gender, pretreatment Pirani score, number of casts, unilateral or bilateral, tenotomy, address, parent marital status, satisfaction level to treatment, family history, awareness to brace treatment, and education level were recorded. Size of brace fit to feet, discomfort to brace and compliance to brace were also recorded.

Operational definitions

Recurrence was defined as the return of any deformity within the key components of clubfoot that requiring further treatment. Adherence is defined in subjective way as consistent usage most of the time of the foot abduction brace without problem, as reported by the parents or caregivers.

Address is defined as Addis Ababa verses outside Addis Ababa. Adequate income is subjective defined as when it is enough to fulfil their basic needs perceived by the parent.

Statistical analysis

The collected data were coded, and entered to excel. After exporting, the data were cleaned and analyzed using the Statistical Package for Social Science (SPSS) version 29 software. The descriptive data were summarized using descriptive statistics. Tables and graphs were employed appropriately for sharing and presenting data. The chi-square test was employed to examine the association between variables, using the Pearson correlation coefficient. The logistic regression was used to analyze the statistical association between the independent and outcome variables. The 95% confidence interval is derived for crude and adjusted of odds ratios. The original multivariable logistic regression includes those factors that demonstrate a p-value < 0.2. The results of this study were deemed statistically significant if the P-value was less than 0.05.

Ethical Considerations

The study was conducted after getting departmental ethical approval with reference number ERB/ORTH/324/2023. Permission for data collection was

secured from the hospital authorities. The purpose of the study was explained & verbal informed consent was obtained from each participant.

Result

Sociodemographic data

One hundred four patients with idiopathic club foot were included. Male participants were 66 (63.5%). Thirty-two (31.7%) were right side clubfoot, 38 (36.5%) were left and 33(31.7%) were bilateral. Sixty - two (59.6%) came from Addis Ababa. Thirty-one patients with 39(28.7%) feet had recurrent clubfoot. Average Pretreatment Pirani score was 5 with 0.7 SD, and age at initiation was 5 weeks with 2 SD (Figure 1).

Association between independent and outcome variable

Chi-square tests found significant associations between recurrence and lack of awareness of treatment ($p=0.0001$), poor educational status ($p=0.002$), job of parent ($p=0.003$), neutral or dissatisfied with treatment ($p=0.004$), discomfort during wearing brace ($p=0.01$). Whereas sex, place of residence, parent marital status, income level, and laterality had no significant association with recurrence (Table1).

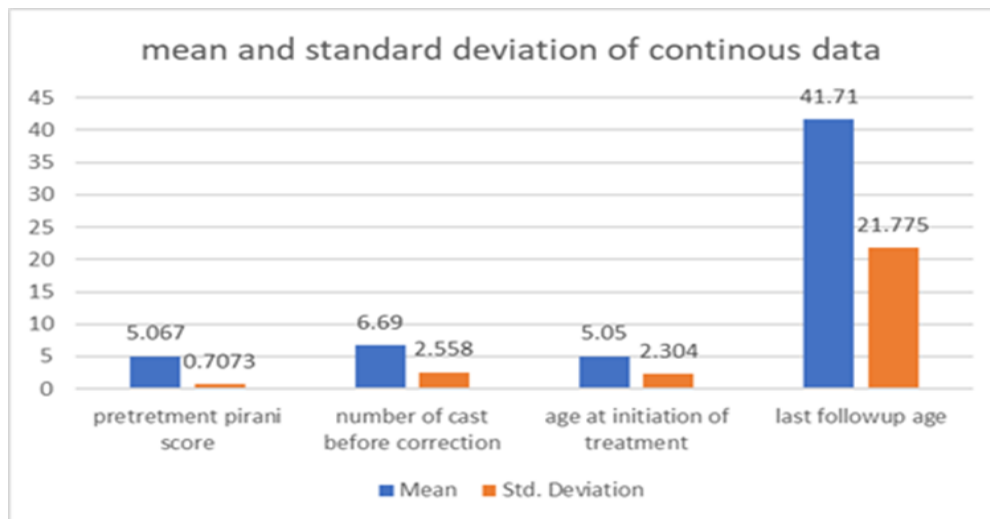


Figure 1. Mean and standard deviation of continuous data

Table 1: chi square analysis of independent and outcome variables, TASH, 2021-23

		Recurrent		P value
		Yes	No	
Sex	Male	17	49	0.234
	Female	14	24	
Awareness	Yes	21	73	0.001
	No	10	0	
Income level	Adequate	23	61	0.268
	Not adequate	8	12	
Education status	University	8	28	0.002
	High school or less	8	34	
	Not able to read and write	15	11	
Poor compliance	Yes	14	6	.00001
	No	17	67	
Job of parent	Government worker	7	27	0.003
	Private worker	15	39	
	Farmer	4	7	
	Jobless	5	0	
Satisfaction level	Very satisfied	3	6	0.004
	Satisfied	14	56	
	Neutral	12	11	
	Dissatisfied	2	0	
Discomfort to brace	Yes	7	2	.001
	No	24	71	

Descriptive statics for continuous data

Mean and standard deviation of continuous variable of recurrent and non-recurrent group (Table 2).

Table 2: descriptive statics for continuous data, TASH, 2021-23

	Recur- rent	Number	Mean	Sd
Number of casts before correction	Yes	31	7.42	2.248
	No	73	6.38	2.633
Pretreatment Pirani score	Yes	31	5.484	0.6517
	No	73	4.89	0.6575
Age at initiation of treatment	Yes	31	4.94	2.366
	No	73	5.1	2.292
Last follow up age	Yes	31	49.68	20.615
	No	73	38.33	21.501

Binary logistic regression,

The variables which had predictive significance were pretreatment Pirani score ($p=0.024$) and poor brace compliance ($p=0.022$) as significant predictors of recurrence after adjusting for other

factors. Last follow up age and discomfort to brace had marginal significance ($p=0.06$) (Table3).

Table 3: Logistic regression analysis with adjusted and crude odd ratio, TASH, 2021-23

	P value	Crude Odd ratio	Adjusted Odd ratio
Sex	0.957	2(0.712-3.972)	
Last follow up age	0.06	0.976(0.956-0.996)	0.982(0.959-1.0009)
Discomfort on brace	0.06	10.354(2.012-53.2810)	6.552(0.559-42.6)
Poor compliance to brace	0.022	9.196(3.078-27.4)	5.582(1.514-20.02)
Pretreatment Pirani score	0.024	0.216(0.095-0.493)	0.355(0.141-0.892)
University level	0.607	1	1
High school or less	0.881	1.214(0.404-3.649)	1.705(0.444-6.552)
Unable to read and write	0.485	0.210(0.069-0.633)	0.425(0.100_1.802)
Parent marital status	0.08	2.191(0.771-6.232)	
Number of casts	0.239	0.854(0.722-1.008)	
Proper information given to the parent	0.031	4.966(0.433-56.9)	
Size of brace fit to shoes most of time	0.437	0.130(0.013-1.299)	
Income	0.28	1.7668(0.641-4.879)	

Factor associated with poor compliance

On logistic regression analysis discomfort to brace with p value 0.002, (AOR 20.639), size of brace with p 0.007, (AOR 46.236) had independent significance on poor compliance. Education status of patient showed marginal significance of 0.065 with odd ratio of 5. The remaining factors had no significance (Table 4).

Table 4: Factors associated with poor compliance, TASH, 2021-23

Variables	P value	COR	AOR
Awareness of parent	0.08	0.514(0.114-3.005)	
Sex of patient	0.164	1.52(0.621_4.35)	
Income of parent	0.466	3.2(0.55-12.6)	
Level of education	0.061	1.004(0.66_1.67)	
Laterality of club foot	0.0771	1.97(0.71_7.430)	
Address of patient	0.138	0.851(0.711_1.06)	
Parent marital status	0.105	0.21(0.01_24)	
Family history of club foot	0.08	0.39((0.22-32)	
Job of parent	0.244	3.51(0.86-52.2)	
Size of brace	0.004	0.09(0.002-0.922)	0.07(0.006-0.797)
Discomfort on brace	0.000	13(5.21-60)	11.39(2.44-53)

Discussion

Our study has retrospectively reviewed 104 children to assess clinical and sociodemographic factors affecting recurrence of club foot. Our study revealed that the relapse rate was 28%, consistent with research done in China 2018 by Zaho et al. (16).

In many studies, it is evident that after Ponseti method, non-adherent to the FAB was thought to be the primary contributing factor of relapse (9,13,14). Consistent to many studies our study found that patients who had poor compliance to wearing the FAB had a significantly higher correlation rate for recurrence and observed that

5.6 times odd of having recurrence relative to those who had good compliance. This is a serious problem because of the cost, the longer brace time, and the social factors that affect compliance, like the stigma associated with wearing an orthosis for an extended period of time.

Patients who had discomfort on brace were odd of **6.55** times more likely to have recurrence of club-foot compared to those who had no discomfort on brace which has marginal significance. In association with this discomfort to Abduction foot brace had major predictive effect on poor compliance ,

it is consistent with Dobs *et al.* 2004 (USA), Zhao *et al.* 2014 (China), and Dobbs *et al.* 2009 (10). This research also found that well fit size of brace had significance predictive effect on poor compliance. According to our finding, the initial Pirani score was major predictive of relapse. The mean pretreatment Pirani score for the recurrent group was 5.5 vs 5 for non-recurrent group, consistent with studies of Hemo *et al.* and Zhao *et al.* and many other research (7,16,18,19). Higher pretreatment Pirani score suggests a more severe initial deformity, which appears to be a significant predictor of recurrence, so it is preferable to closely monitor kids with high initial Pirani scores as this will assist pick up relapses early.

In our study we found that there was a negative correlation of recurrence of clubfoot with regards to level of awareness to brace treatment and higher education level (university level) which is consistent with finding of Dobs *et al.* 2010, Azipra *et al.* and Goksan *et al.* in 2015 and many other researches (2,20–23). Thus, it is vitally necessary to use every chance to educate parents about the significance of wearing FAB.

The mean last follow-up age had positive association for recurrence and marginal predictive significance, Azipira *et al.* Own *et al.* (UK, 2015), Gelfer *et al.* (UK, 2019) associated longer follow up with detecting more relapses, in agreement with this study results (2,24,25). This validates importance of long-term monitoring. Age of initiation and number of casts had no significance association in our study.

Being jobless has positive association but not predictive significance. Recurrence was higher among patients whose parents had neutral or dissatisfied satisfaction levels on treatment compared to those satisfied but no predictive significance.

Our research is novel in a way that it is pioneer and it will serve as baseline for further research for our set up and the country level. The limitation of our study was that it involved only one center which might not lead to generalizability. There was also difficulty in accurately assessing compliance objectively.

Conclusion

Poor compliance to brace and higher Pirani score poses higher recurrence risk, should be considered in treatment plan. Based on the findings, the following recommendations are made: educate parents on importance of brace compliance through simplified counseling tools. Strengthen follow-up systems to regularly monitor recurrence particularly with higher Pirani score. Prioritizing patient comfort through proper sizing and adjustment over time. Conduct further prospective studies to validate the risk factors identified and evaluate interventions to promote brace wear.

Declaration

We hereby certify to the accuracy and completeness of the information given in this paper. We sincerely declare that the information provided in this paper is accurate to the best of our understanding and that all the facts are true.

Acknowledgement

For all of their assistance in carrying out the study, the authors would like to thank the orthopedic and trauma department of Tikur Anbessa Specialized Hospital. Our sincere gratitude extends out to Dr. Suhur Muse, whose skills, direction, and persistent support greatly contributed to the quality and integrity of this study.

Competing of interest

The authors declare that there are no competing interests and all authors approved the manuscript. The study has no outside financial support source.

Reference

1. Chueire AJFG, Carvalho Filho G, Kobayashi OY, Carrenho L. Treatment of congenital clubfoot using Ponseti method. *Rev Bras Ortop* (English Ed. 2016;51(3):313–8.
2. Azarpira MR, Emami MJ, Vosoughi AR, Rahbari K. Factors associated with recurrence of clubfoot treated by the Ponseti method. *World J Clin Cases*. 2016;4(10):318.
3. Ayana B, Klungsøyr PJ. Good results after Ponseti treatment for neglected congenital clubfoot in Ethiopia. *Acta Orthop*. 2014;85(6):641–5.
4. Wallander HM. Congenital clubfoot: Aspects on epidemiology, residual deformity and patient reported outcome. Vol. 81, *Acta Orthopaedica*. 2010. p. 1–25.
5. Mengesha MG, Ayana B, Belay MM, Zewde W, Peter J. MANAGEMENT OF IDIOPATHIC CLUB-FOOT BY PONSETI METHOD: TIKUR ANBESSA SPECIALIZED HOSPITAL FIVE YEAR EXPERIENCE. *Ethiopian Medical Journal*. 2020 Dec 16;58(Supplement 03).
6. Limpaphayom N, Sailohit P. Factors related to early recurrence of idiopathic clubfoot post the ponseti method. *Malaysian Orthop J*. 2019;13(3):28–33.
7. Hemo Y, Yavor A, Kalish M, Segev E, Wientroub S. Ponseti treated idiopathic clubfoot - predictive factors in the test of time: Analysis of 500 feet followed for five to 20 years. *J Child Orthop*. 2021;15(5):426–32.
8. Sobel E, Giorgini R, Velez Z. Surgical correction of adult neglected clubfoot: Three case histories. *J Foot Ankle Surg*. 1996;35(1):27–38.
9. Avilucea FR, Szalay EA, Bosch PP, Sweet KR, Schwend RM. Effect of cultural factors on outcome of ponseti treatment of clubfeet in rural America. *J Bone Jt Surg*. 2009 Mar 1;91(3):530–40.

10. Dobbs MB, Gurnett CA. Update on clubfoot: Etiology and treatment. *Clin Orthop Relat Res.* 2009;467(5):1146–53.
11. Zionts LE, Jew MH, Bauer KL, Ebramzadeh E, Sangiorgio SN. How Many Patients Who Have a Clubfoot Treated Using the Ponseti Method are Likely to Undergo a Tendon Transfer? [Internet]. 2016. Available from: www.pedorthopaedics.com
12. Mahan ST, Spencer SA, May CJ, Prete VI, Kasser JR. Clubfoot relapse: Does presentation differ based on age at initial relapse? *J Child Orthop.* 2017 Oct 1;11(5):367–72.
13. Dobbs MB, Rudzki JR, Purcell DB, Walton T, Porter KR, Louis S. Factors Predictive of Outcome after Use of the Ponseti Method Factors Predictive of Outcome after Use of the Ponseti Method for the Treatment of Idiopathic Clubfeet for the Treatment of Idiopathic Clubfeet [Internet]. Vol. 86, *The Journal of Bone and Joint Surgery.* 2004. Available from: https://digitalcommons.wustl.edu/open_access_pubs/934
14. Haft GF, Walker CG, Grawford HA. Early Clubfoot Recurrence After Use of the Ponseti Method in a New Zealand Population [Internet]. 2007. Available from: www.jbjs.org
15. Van Praag VM, Lysenko M, Harvey B, Yankanah R, Wright JG. Casting is effective for recurrence following Ponseti treatment of clubfoot. *J Bone Jt Surg - Am Vol.* 2018 Jun 1;100(12):1001–8.
16. Zhao D, Li H, Zhao L, Kuo KN, Yang X, Wu Z, et al. Prognosticating Factors of Relapse in Clubfoot Management by Ponseti Method [Internet]. 2016. Available from: www.pedorthopaedics.com
17. Pirani S, Naddumba E, Mathias R, Konde-Lule J, Penny JN, Beyeza T, et al. Towards effective ponseti clubfoot care: The Uganda sustainable clubfoot care project. *Clin Orthop Relat Res.* 2009;467(5):1154–63.
18. Qudsi RA, Selzer F, Hill SC, Lerner A, Hippolyte JW, Jacques E, et al. Clinical outcomes and risk-factor analysis of the ponseti method in a low-resource setting: Clubfoot care in Haiti. *PLoS One.* 2019 Mar 1;14(3).
19. Penny JN. The neglected clubfoot. *Tech Orthop.* 2005;20(2):153–66.
20. Zhao D, Liu J, Zhao L, Wu Z. Relapse of clubfoot after treatment with the ponseti method and the function of the foot abduction orthosis. *CiOS Clin Orthop Surg.* 2014;6(3):245–52.
21. Alves C, Escalda C, Fernandes P, Tavares D, Neves MC. Ponseti method: Does age at the beginning of treatment make a difference? In: *Clinical Orthopaedics and Related Research.* Springer New York; 2009. p. 1271–7.
22. Göksan SB, Bilgili F, Eren I, Bursali A, Koç E. Factors affecting adherence with foot abduction orthosis following Ponseti method. *Acta Orthop Traumatol Turc.* 2015;49(6):620–6.
23. Miller NH, Carry PM, Mark BJ, Engelman GH, Georgopoulos G, Graham S, et al. Does Strict Adherence to the Ponseti Method Improve Isolated Clubfoot Treatment Outcomes? A Two-institution Review. *Clin Orthop Relat Res.* 2016 Jan 1;474(1):237–43.
24. Owen RM, Capper B, Lavy C. Clubfoot treatment in 2015: A global perspective. *BMJ Glob Heal.* 2018;3(4):1–7.
25. A systematic review of relapse as a primary outcome of the ponseti method.