EFFECTIVENESS OF PIRANI SCORE IN PREDICTING SELECTION OF ACHILLES TENOTOMY IN IDIOPATHIC CLUBFOOT: A CASE CONTROL STUDY

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ABSTRACT

Objective: To assess the effectiveness of Pirani scoring system in predicting the need of percutaneous Achilles tenotomy in cases of idiopathic club foot.

Study Design: Case control study.

Place and Duration of Study: Orthopaedic department of CMH Kohat, from Mar 2017 to Aug 2018.

Methodology: This study included newborn babies to the age of 3 months with idiopathic club foot. The patients were treated by Ponseti method. The Pirani Score was calculated at initial presentation before starting treatment with casting according to Ponseti method. After three months percutaneous tenotomy was performed based on progression. The data was analyzed by applying unpaired t-test to determine the statistical significance keeping *p*-value <0.05. Binary regression was evaluated to determine the odds ratio.

Results: A total of 39 patients were included in study with 67 club feet. There were 26 (66.6%) males and 13 (33.3%) females. The mean Pirani score of patients who had tenotomy was 4.45 ± 0.74, whereas, it was 3.476 ± 0.48 in patients who did not underwent tenotomy (*p*-value ≤0.001). There were higher odds of tenotomy in patients who have high Pirani score at initial presentation (OR=19.61, *p*-value ≤0.001). The cut off limit of pirani score beyond which tenotomy was essential was 3.95.

Conclusion: Higher Pirani score was associated with higher chances of percutaneous Achilles Tenotomy in cases of Idiopathic Club foot.

Keywords: Idiopathic club foot, Pirani scoring system, Ponseti Method, tenotomy.

INTRODUCTION

Idiopathic Congenital Talipes equinovarus (CTEV) is a birth defect which occurs in 0.6 to 1.5 per 1000 live births[1]. There is no local data available about the prevalence of club foot in Pakistan, however, idiopathic club foot seems to be the most common club foot in region accounting for 85% of all the cases[2]. Although the word "Idiopathic" denotes that no cause can be attributed to its occurrence but latest research has found it to be a complex multifactorial inheritance where environmental and genetics work intricately resulting in its occurance[3]. The natural history of Idiopathic Club foot is progressive and causes lifelong disability with pain and secondary osteoarthritis setting in proximal joints. The risk factors associated with incidence of club foot include smoking prior to and during first trimester, increased consumption of alcohol and coffee[4]. The main aim of treatment in club foot is to achieve an anatomically and functionally acceptable foot. There are many methods documented for treatment of idiopathic club foot ranging from conservative serial casting to extensive soft tissue release and osteotomies. Club foot is governed by four deformities, namely, cavus of mid foot, adduction of forefoot, varus and eqinus of hind foot, leading to pneumonic of CAVE. Ignacio Ponseti developed a treatment protocol for idiopathic clubfoot[8]. In this method serial castings are performed in a manner to correct these deformities in the same manner of pneumonic of CAVE, that is, firstly cavus of mid foot is corrected followed by abduction of forefoot and then valgus of hind foot is achieved, leaving eqinus to be addressed as a last deformity to be corrected. Percutaneous Achilles tenotomy is performed

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if dorsiflexion is <10° of normal. Percutaneous Achilles tenotomy is usually performed under local anesthesia. An above knee cast is applied with 10° of dorsiflexion and 70° of external rotation. This cast is kept in place for 3 weeks. After the cast removal Dennis brown splint is applied. Ponseti method is being followed in many countries. This method has approximate success rate of 98%[9]. Pirani scoring system consists of 6 parameters which are divided in 3 parameters pertaining to hind foot and remaining 3 parameters to midfoot deformities. Each Parameter is scored as 0,0.5 or 1. The best combined score is zero and worst combined score is six[10]. Zero score indicates that deformity is of minor nature and cumulative score of six means that deformity is very severe. Pirani score also plays an important role in identifying the severity and monitors correction of the deformity[8]. This study was undertaken to ascertain the effectiveness of Pirani scoring system in predicting the need of percutaneous Achilles tenotomy in cases of idiopathic clubfoot.

METHODOLOGY

This study was planned as case control study in which patients where tenotomy was performed were taken as cases and other infants who did not undergo any operation were taken as controls. The study was conducted in Combined Military Hospital Kohat, Orthopedic department from 01 March 2017 to 31 August 2018. The sample size was calculated using World Health Organization online calculator. The power of study was kept 80% and alpha error of 5%. The odds ratio from previous study was 4.4 and percentage of exposed in control population was 15%[8]. A total of 39 patients were included in study by non-probability convenient sampling. All newborn babies up to the age of 3 months presenting to Ponseti clinic with idiopathic clubfoot in CMH Kohat, Orthopaedic department were included in this study. All cases of syndromic club foot and those associated with other congenital anomalies like Developmental Dysplastic Hipor urogenital deformities were excluded from this study. Parents were counseled and consented in detail about the treatment modality and duration. Approval of hospital ethics committee was taken. Pirani score was calculated at initial presentation and then corrective castings were applied according ponseti technique. The patients who did not respond to the conservative castings were booked for tenotomy. Percutaneous Achilles tenotomy cases were prepared with preoperative coagulation profile and platelet count. The procedure was performed under local anesthesia. Percutaneous technique was adopted and complete tenotomy was achieved. Acceptable dorsiflexion of more than 20^0 was deemed satisfactory. Firm pressure dressing applied over tenotomy site and hemostasis confirmed. Corrective plaster according to Ponseti teachings were applied for 3 weeks. Plaster was removed after 3 weeks and correction ascertained. Once deformity correction found satisfactory, Dennis brown splint applied in required external rotation.

The various demographic features were recorded through proforma as age, gender, socioeconomic conditions and Pirani score was evaluated at first presentation. The data was analyzed using Statistical Package for the Social Sciences (SPSS) version 21. Means with standard deviation was calculated for all quantitative demographic data. Percentages were calculated for gender and the involvement of foot. The mean pirani score and mean age of patients who underwent tenotomy and who did not have this procedure were compared by independent-t test. *p*-value of <0.05 was taken as significant keeping confidence interval of 95%. Logistic regression was applied to calculate the odds ratio keeping *p*-value <0.05 to be significant. ROC curve was generated to ascertain the cut off limit of pirani score and it was a value which had highest sensi-tivity and lowest 1-specificity. The sensitivity and specificity was calculated using this curve.

RESULTS

A total number of 39 (67 feet) patients were included in study. There were 26 (66.6%) males and 13 (33.3%) females. Twenty eight (71.7%) patients had bilateral feet involvement (56 feet). Eleven (28.3%) patients had unilateral foot with

CTEV out of which right foot CTEV was present in seven (64%) cases and left foot in four (36%) cases. The mean Pirani score and mean age with standard deviation is shown in table-I. A total of 23 (59%) patients underwent tenotomy (case group n=23) and 19 (82.6%) patients had bilateral foot CTEV (38 feet), whereas, four (17.4%) had unilateral foot CTEV. There were 16 (41%) patients who did not have tenotomy (control group n=16). Nine (56.25%) patients had bilateral foot involvement (18 feet) and seven (43.75%) had unilateral foot with CTEV. The mean Pirani score and age of patients who had tenotomy and who did not have operation is shown in table-II. The *p*-value evaluated for mean pirani score by independent t-test was <0.001 making it statistically significant with confidence interval of 95%, whereas, age did not show any statistical significance (*p*-value=0.325)

Table-I: Showing mean Pirani score and age.

	Variable	Mean ± SD
Cumulative (n=39)	Age (days)	8.70 ± 5.73
	Pirani Score	4.08 ± 0.81

Table-II: Comparing mean Pirani scores and age of patients who had tenotomy.

S. No.	Tenotomy Performed	Variables Mean Pirani ± SD	*p*-value (Independent t-test) CI 95%
1	Yes (n=23)	4.45 ± 0.74	<0.001
2	No (n=16)	3.476 ± 0.48	
	Mean age ± SD		
3	Yes (n=23)	8.17 ± 6.05	0.325
4	No (n=16)	9.60 ± 5.13	

Binary logistic regression was applied on Pirani score, gender and involvement of bilateral/unilateral foot and result is shown in table-III. There was statistically significant higher odds of patient to undergo tenotomy who have higher Pirani score at initial presentation (OR=19.61, *p*-value ≤0.001). However, the odds ratio had a wide range so bootstrapping was done with 1000 postulated cases and it revealed an odds ratio range 2.84-24[10]. keeping confidence interval of 95% and *p*-value=0.02. No significant association was seen in terms of gender and involvement of one or both limbs with tenotomy. ROC curve was generated to ascertain the cut off value of pirani score beyond which tenotomy is indicated showing maximum sensitivity and lowest 1-specificity.

Table-III: Showing binary logistic regression predicting need for tenotomy in terms of pirani score, involvement of limb and gender.

S. No.	Variable	Odds Ratio	Confidence Interval 95%		*p*-value
			Upper Limit	Lower Limit	
1	**Pirani Score**	19.61	93.34	4.12	<0.001
	Pirani Score (Bootstrapping)		24.10	2.84	0.02
2	**Involvement**				
	Unilateral	0.26	1.03	0.07	0.055
	Bilateral	3.69	14.26	0.96	0.58
3	**Gender**				
	Male	0.82	2.47	0.27	0.719
	Female	1.06	3.06	0.37	0.911

The limit of pirani score at which tenotomy was recommended in our population was 3.95 with sensitivity of 81.4% and specificity of 71% as shown in figure.

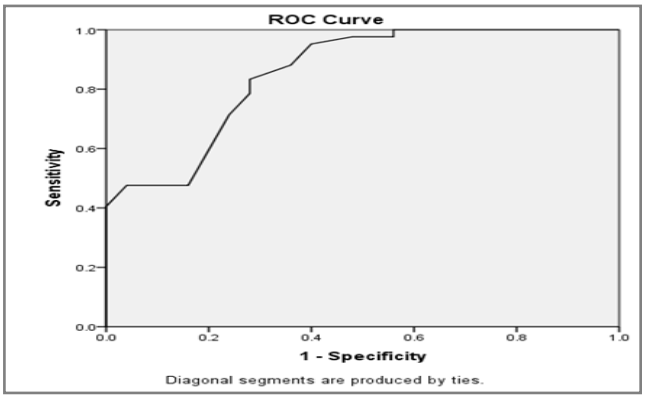

Figure: ROC curve for Pirani score.

DISCUSSION

CTEV is one of the most common congenital structural abnormalities which are faced by most of the orthopaedic surgeons in their clinics[9]. Ponseti corrective casting is a recognized treatment for idiopathic clubfoot in newborn babies[10]. There are many scoring systems for assessment of severity of idiopathic clubfoot, namely Ponseti and Smoley[8], Catterall[11], Dimeglio[12], Harold and Walker[13] and Pirani[14]. Pirani scoring system is easy and quick method with acceptable inter-observer variability[15]. In many cases corrective castings may be followed by percutaneous Achilles tenotomy to achieve acceptable dorsiflexion once all other deformities have been addressed. Tenotomy may be needed in up to 85% of cases[16]. In our study 59% cases needed tenotomy which falls within the range of international publications[16]. Our study showed that CTEV occurs more commonly in males than female population as a ratio of 2:1 was observed. A study done by Khan *et al* also showed a preponderance of male population to have club foot[21]. Although this trend was not observed in international literature[17].

There are many studies which have assessed the requirement of percutaneous Achilles tenotomy in cases of idiopathic clubfoot in light of Pirani score. Mejabi *et al*, in their study demonstrated that feet having Pirani score of 5.1 ± 1.0 required percutaneous Achilles tenotomy[17]. Dyer *et al*, showed that those feet whose hind foot score was 2.5 or 3.0 required percutaneous Achilles tenotomy in 72% of cases[18]. A positive relationship was found between Pirani score and need of Achilles tenotomy by Singh[19]. A study by Scher *et al*, revealed that 85.2% of feet having Pirani score of >5.0 required Achilles tenotomy[20]. In another article by Khalid *et al*, 61.4% feet underwent Achilles tenotomy to achieve acceptable dorsiflexion[21]. In our study 59% of feet required tenotomy and their mean pirani score was 4.45 ± 0.74. This is comparable to the local population studies, however, the mean score is less than international published data. It can be due to late presentation of patients to opd or frequent loss to follow ups leading to treatment failure and hence resulting in operation. No correlation of tenotmy was found with gender or age however weak non-statistically significant association with bilateral presentation was present.

In our study when ROC curve was evaluated to the need for tenotomy. The model showed that a cut off limit of pirani score of 3.95 at initial presentation has a predictive value of 81.4% for tenotomy in future. This was also found in study conducted by David *et al* and his colleagues although their cut off limit was 4.75 with 76% sensitivity[8]. To our knowledge this is the first ever study which is being conducted in region to evaluate in effectiveness of pirani score in predicting tenotomy.

There were some short comings in the study. The sample size was too small and was based on convenience so the results cannot be generalized to whole population. Moreover, there was no blinding so element of observer bias cannot be ruled out. The confounding factors as poor compliance and reluctance of parents to consent for surgery were not evaulated. The author recommends a randomized multi centric control trial for establishing the efficacy of pirani score in predicting tenotomy.

CONCLUSION

Idiopathic Congenital club foot can be managed effectively with Ponseti technique and Pirani score is a useful scoring system which can help predict the need for tenotomy in patients of CTEV with higher values at initial presentation. The cut off limit of Pirani score beyond which tenotmy becomes inevitable is 3.95. This can help the treating doctors to effectively communicate the parents regarding whole management plan at initial presentation.

CONFICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES

1. Ansar A, Rahman AE, Romerol L, Haider MR, Rahman MM, Moinuddin M, et al. Systematic review and meta-analysis of

global birth prevalence of clubfoot: a study protocol. Br Med J Open 2018; 8(3): e019246.
2. Wijayasinghe SR, Abeysekera WY, Dharmaratne TS. Descriptive epidemiology of congenital clubfoot deformity in Sri Lanka. J Coll Physicians Surg Pak 2018; 28(2): 166-8.
3. Basit S, Khoshhal KI. Genetics of clubfoot; recent progress and future perspectives. Eur J Med Genetics 2018; 61(2): 107-13.
4. Werler MM, Yazdy MM, Kasser JR, Mahan ST, Meyer RE. Maternal cigarette, alcohol, and coffee consumption in relation to risk of clubfoot. Paediatr Perinat Epidemiol 2015; 29(1): 3-10.
5. Owen RM, Capper B, Lavy C. Clubfoot treatment in 2015: a global perspective. BMJ Global Health 2018; 3(4): e000852.
6. Morcuende JA, Dolan LA, Dietz FR. Radical reduction in the rate of extensive corrective surgery for clubfoot using Ponseti method. Pediatr 2004; 113(2): 376-80.
7. Hussain FN. The role of Pirani scoring system in the management of club foot with Ponseti method. J Bone Joint Surg Br 2007; 89(4): 561-9.
8. David BH, Olayinka A, Oluwadare E, Ayodele OE, Joseph M, Olujide A. Predictive value of Pirani scoring system for tenotomy in the management of idiopathic clubfoot. J Orthopaed Surg 2017; 25(2): 1–4.
9. Omololu B, Ogunlade SO, Alonge TO. Pattern of congenital orthopaedic malformations in an African teaching hospital. West Afr J Med 2005; 24(2): 92–95.
10. Iltar S, Uysal M, Alemdaroglu KB, AydoganNH, Kara T, Atlihan D. Treatment of clubfoot with the Ponseti method: should we begin casting in the newborn period or later? J Foot Ankle Surg 2010; 49(5): 426-31.
11. Kh TM, Sertakova AV, Kurkin SA, Rubashkin SA, Anisimova EA, Dl A. Talipes equinovarus in children. Saratovskij Naučno-medicinskij Žurnal 2017; 13(3): 514-20.
12. Jochymek J, Turek J, Peterková T. Classification systems to evaluate the clubfoot and their potential use to predict the course and the results of the ponseti method treatment. Acta Chir Orthop Traumatol Cech 2018; 85(5): 331-5.
13. Ganesan B, Luximon A, Al-Jumaily AA, Yip J, Gibbons PJ, Chivers A. Developing a three-dimensional (3D) assessment method for clubfoot - a study protocol. Frontiers Physiol 2018; 8(1): 1098-1106.
14. Pirani S, Outerbridge H, Moran M, Sawatsky BJ. A method of evaluating the virgin clubfoot with substantial interobserver reliability. Pediatr Orthop Soc North Am 1995; 71(1): 99-106.
15. Jain S, Ajmeria A, Solanki M, Verma A. Interobserver variability in Pirani clubfoot severity scoring system among orthopaedic surgeons. Indian J Orthop 2017; 51(1): 81-5.
16. Dobbs MB, Morcuende JA, Gurnett CA, Ponseti IV. Treatment of idiopathic clubfoot: an historical review. IOWA Orthop J 2000; 20(1): 59–64.
17. Mejabi JO, Esan O, Adegbehingbe OO, Orimolade EA, Asuquo J, Badmus HD, Anipole AO. the pirani scoring system is effective in assessing severity and monitoring treatment of clubfeet in children. Br J Med Med Res 2016; 17(4): 1-9.
18. 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 2006; 88(8): 1082-84.
19. Singh A. Analysis of correlation of foot bimalleolar angle and pirani scoring for its predictive value in the management of idiopathic CTEV by Ponseti method. Internet J Orthop Surg 2008; 12(1): 1-9.
20. Scher DM, Feldman DS, van Bosse HJ, Sala DA, Lehman WB. Predicting the need for tenotomy in the Ponseti method for correction of clubfeet. J Pediatr Orthop 2004; 24(4): 349-52.
21. Khan MK, Kabir SK, Khan MS, Iqbal J. Outcome of ponseti technique for idiopathic clubfoot using pirani scoring system. J Med Sci 2013; 21(4): 190-93.