IS THE PRE-TREATMENT PIRANI SCORE OF ANY PREDICTIVE VALUE IN THE MANAGEMENT OF CLUBFOOT WITH THE PONSETI TECHNIQUE?

H.O. Obiegbu, MBBS, FWACS,FMC Ortho, FAOSpine, Department of Orthopaedic Surgery, Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra state, Nigeria. Email: obinnaobiegbu@yahoo.com

ABSTRACT

Background: Clubfoot is a common developmental anomaly of the musculoskeletal system and the Pirani scoring system a tool for assessing both the severity of the deformity and the progress of treatment. The Ponseti method of clubfoot correction is a conservative procedure that uses specific manipulation and casting technique, in addition to a limited surgical intervention (percutaneous tenotomy) done on an outpatient basis.

Objectives: This study was done to determine if the Pirani score (total, midfoot and hindfoot) had any predictive value in the management of clubfoot using the Ponseti technique of manipulation and casting.

Design: This was a prospective study.

Methods: The study was carried out in a tertiary hospital following ethical clearance. A total of 50 patients (64 clubfeet) were recruited into this study. The pre-treatment Pirani score was obtained using the Ponseti technique of serial manipulation and casting was begun.

Results: The age range of patients for this study was 2-17 months, with a mean age of 1.42 months. Thirty seven feet (57.8%) had tenotomy. The mean pre-treatment total Pirani score was 4.33 ± 1.56, while the pre-treatment midfoot and hindfoot scores were 2.1 ± 0.94 and 2.2 ± 0.94 respectively. A post treatment Pirani score of 0 was achieved in 90.6% of clubfeet. There was a positive correlation between the pre-treatment Pirani score (including midfoot/ hindfoot scores) with tenotomy and number of casts used.

Conclusion: This study confirms the predictive value of both the pre-treatment Pirani scores and its independent components (midfoot and hindfoot scores). They predict the need to do a tenotomy and the number of casts required for correction of clubfoot using the Ponseti technique.

Key words: Ponseti, Clubfoot, Tenotomy, Casts, Pirani score

INTRODUCTION

Clubfoot, one of the most common congenital orthopaedic anomalies has a spectrum of severity, with regards to both its gradation and flexibility of the foot (1). There is no agreed method for grading the severity of clubfoot, but there is a reported need for its classification to be reliable, reproducible and feasible in a clinical setting and also be able to act as a guide to appropriate treatment (2). Several scoring systems for grading clubfoot exist including the Pirani scoring system (3) and the Dimeglio-Bensahel scoring system (4). The Dimeglio-Bensahel scoring system (4) incorporates eight components including: equinus, varus, position of the talo-calcaneal forefoot unit (supination/ pronation), forefoot adduction, the presence of abnormal musculature, cavus, a medial crease and a posterior crease. A total of 20 points is possible; the higher the number, the more severe and rigid the clubfoot is. However, the Pirani scoring system (3) has been shown to have better clinical correlation than the Dimeglio-Bensahel scoring system (4) with the Pirani system having an excellent inter-observer reliability (5).

Pirani *et al* (3) devised a simple scoring system based on six clinical signs of contracture, thus: scored 0- when there is no abnormality; 0.5- when there is moderate abnormality and 1- when there is severe abnormality. The six signs are separated into three, which are related to the hindfoot (severity of the posterior crease, emptiness of the heel and rigidity of the equinus) and three, related to the midfoot (curvature of the lateral border of the foot, severity of the medial crease and position of the lateral part of the head of talus). The Pirani score is simple and reliable, and has shown inter-observer reliability much better than any of the previous scoring systems (5).

Although operative treatment initially formed the cornerstone of management of clubfoot, the

currently most accepted mode of treatment is serial manipulation and casting as described by Ponseti, and has become both widely used and is efficacious in clubfoot management.

The Ponseti technique aims at eliminating all components of clubfoot which includes forefoot varus and adductus, midfoot cavus, hindfoot varus/ ankle equinus. The objective of this study was to determine if the Pirani score (midfoot and hindfoot scores) has any predictive value; and thus determine if there is correlation between the Pirani score, number of casts used, and the need for a tenotomy.

MATERIALS AND METHODS

This was a prospective study done from July 2016 to June 2018. Patients attending the outpatient clinic in a tertiary care hospital diagnosed of clubfoot who met the inclusion criteria were recruited into this study.

The inclusion criteria were all patients less than 2 years of age at enrolment (with parental consent), while exclusion criteria were patients presenting with neglected clubfoot, patients with prior treatment of their clubfoot (non-operative or operative), patients with syndromic congenital talipes equinovarus and in cases where consent was refused by caregivers. The caregivers of the patients who were enrolled into the study were given information about the nature of treatment.

Diagnosis of clubfoot was made after clinical examination (for the pathological features of clubfoot), and the pre-treatment Pirani score of the affected foot (feet) was obtained, before the Ponseti technique of weekly serial manipulation and casting was begun. Tenotomy was performed if after a midfoot score of 0, there was a residual equinus (ankle cannot be dorsiflexed beyond the neutral position). Pirani scores were obtained weekly until correction was achieved.

The sample size was calculated based on the statistical formula (Daniel, 1999) (6) as shown below.

$n= Z^2P(1-P)/d^2$

Where n= sample size

Z= Statistic for level of confidence; at 95% level of confidence which is conventional, Z value is 1.96

P= Expected prevalence or proportion. Value of 3.4% was chosen for this study (from a background of prevalence rates ranging from 1 to 3.8%) (7,8)

d= Absolute precision i.e the value required (in percentage points) which in actual term describes the maximum difference between the population rate and the sample rate that can be tolerated. 5% (0.05) was taken for this study.

Therefore,

$n= (1.96)^2\ 0.034(1-0.034)/\ (0.05)^2$

= 50.03 which is approximately 50

Fifty patients were recruited into this study.

Data was analyzed using the Statistical Package for Social Sciences (SPSS) for Windows (Version 22.0). One-way Analysis of Variance (ANOVA), Chi-Square test and T-test analysis were done. The level of significance was taken as $p<0.05$.

RESULTS

A total of 50 patients (64 clubfeet) were recruited into this study and analyzed. Fourteen of the patients (28%) had bilateral clubfeet. The age range of the patients was 2- 17 months, with a mean age of 1.42 months.

Table 1

Age distribution of the patients

Age (months)	Frequency	(%)
0-60	33	66
7-12	11	22
13-18	6	12
Total	50	100.0

Table 1 shows that the most common age group at presentation is 0- 6 months.

Table 2

Mean of test variables (midfoot/ hindfoot and total Pirani score)

Variables	Mean (Standard deviation)
Midfoot score at presentation	2.1 (±0.94)
Hindfoot score at presentation	2.2 (±0.75)
Pirani score at presentation	4.33 (±1.56)

Table 3

Correlation between Pirani score and tenotomy

	Tenotomy	
	Done	Not Done
	Mean ± SD	Mean ± SD
Pirani score	4.99 ± 1.26	3.43 ± 1.49
P< 0.001		

Table 3 shows that the mean Pirani score of patients who had tenotomy were higher than those who had no tenotomy, and this difference was statistically significant. Thus there is a positive correlation between Pirani score and tenotomy.

Table 4

Correlation between midfoot Pirani score and tenotomy

Midfoot score	Tenotomy	
	Done	Not Done
	Mean ± SD	Mean ± SD
	2.43 ± 0.92	1.69 ± 0.79
P< 0.001		

Table 4 shows that there is statistically significant correlation between midfoot score and tenotomy, and this is statistically significant.

Table 5

Correlation between hind foot score Pirani and tenotomy

Hind foot score	Tenotomy	
	Done	Not Done
	Mean ± SD	Mean ± SD
	2.55 ±0.48	1.70 ± 0.78
Fischer's Exact test= 0.001, P=0.001		

Table 5 shows that there is a positive correlation between hindfoot scores and tenotomy, and this correlation is statistically significant.

Table 6

Correlation between Pirani score and number of casts applied

Pirani score	Number of casts	
	Done	Not done
	≤5 casts	≤5 casts
	n (%)	n (%)
<4	17 (77.3)	5 (22.7)
≥4	1 (2.4)	41 (97.6)

Table 7

Correlation between midfoot Pirani score score and number of casts applied

Midfoot score	Number of casts	
	Done	Not done
	≤5 casts	≤5 casts
	n (%)	n (%)
<2.5	18 (58.1)	13 (41.9)
<2.5	0 (0)	33 (100)

P<0.001

Table 7 shows that all subjects with a midfoot score ≥2.5 had more than 5 casts applied for clubfoot correction. This difference is statistically significant (p<0.001).

Table 8

Correlation between midfoot Pirani score score and number of casts applied

Hind foot score	Number of casts	
	Done	Not done
	≤5 casts	≤5 casts
	n (%)	n (%)
<2.5	17 (56.7)	13 (43.3)
<2.5	1 (2.9)	33 (97.1)

P<0.001

Table 8 shows that subjects with hind foot scores of ≥2.5 had more casts applied for clubfoot correction. There is a positive correlation (statistically significant) between the hind foot score and number of casts used for correction.

Figure 1
Sex distribution of the patients

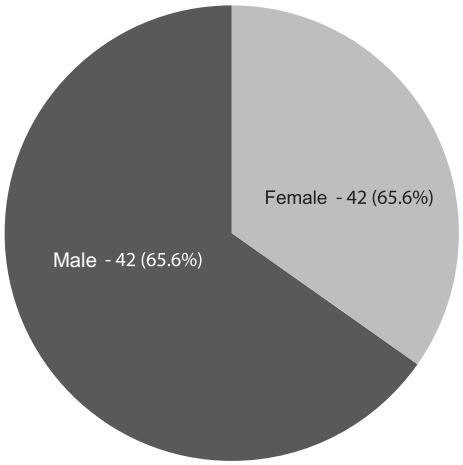
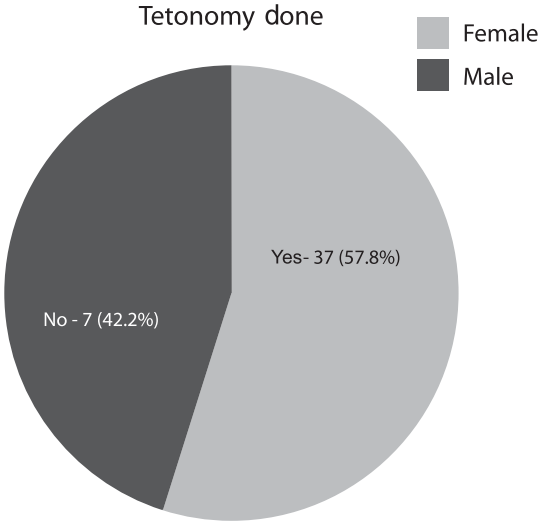


Figure 2
Clubfeet that had tenotomy



DISCUSSION

Non- surgical management of clubfoot using the Ponseti method of serial manipulation and casting has become widely accepted in the management of clubfoot and the Pirani scoring system is widely used to follow up treatment progress. In this study, the prognostic importance and the predictive value of the individual components of the Pirani score (midfoot/ hindfoot score) were assessed with regards to the need for a tenotomy, the number of casts required to achieve correction and the relationship with clubfoot correction.

In this study, there was a positive correlation between the pre-treatment Pirani score and the number of casts used. Both the midfoot and hindfoot scores independently had a positive correlation to the number of casts used. In a similar study, Dyer and Davis (9) reported also on the predictive value of Pirani scoring on 70 cases of idiopathic clubfoot. They found a positive correlation (r=0.72) between the initial Pirani score and the number of casts required to correct the deformity. In a similar study by Sharma *et al.* (10), the Spearman's rank coefficient was significant and confirmed a positive correlation between the initial Pirani score and the number of casts required to correct the deformity (r=0.93, p<0.0001). In a study by Deshmukh *et al.* (11), the initial (pre-treatment) midfoot and hindfoot components of the Pirani score independently showed a positive correlation to the number of casts used.

In this present study, of 64 clubfeet, 37 feet (57.8%) had a tenotomy and there was a positive correlation between the Pirani score and the need for a tenotomy. In the study by Sharma *et al*. (10), although the number of feet that had tenotomy done were higher (76.8%), there was also a positive correlation between the Pirani score and tenotomy. In a similar study by David *et al*. (12), 38 (45%) out of 84 clubfeet had tenotomies, and the initial total Pirani and hindfoot scores were found to predict the need for a tenotomy, with a higher Pirani score associated with higher odds of requiring tenotomy (OR= 4.402, P<0.001). Ayahualem *et al*. (13) who carried out a study on 424 clubfeet in Ethiopia also found similar outcomes, with Pirani score predicting the need for a tenotomy. The findings from this study would also come in handy in predicting the cost and duration of treatment, and also act as a useful tool for cost estimation for both health insurance companies and patients who pay out of pocket.

CONCLUSIONS

The findings in this study confirm the predictive value of both initial total Pirani score and the initial midfoot/ hindfoot scores with regards to number of casts and the need for a tenotomy. This information can be relayed to caregivers of affected patients, as a tool in determining both duration of treatment (number of casts) and the need for tenotomy.

Conflict of interest/supports: None to declare.

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