

Predicting the Need for Tenotomy in the Management of Idiopathic Clubfoot by the Ponseti Method

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Abstract

Purpose: The aim of this study was to determine the role of Pirani scoring system for predicting the treatment of idiopathic clubfoot with the Ponseti technique. **Materials and Methods:** A retrospective study was conducted. The records of 132 idiopathic clubfeet of patients treated by the Ponseti method and scored by the Pirani system between May 2007 and September 2015 were analyzed. **Result:** Of the 132 feet, 101 (76.5%) feet of the patients required tenotomy. The mean number of casts required was significantly higher ($P=0.033$) for the group that required tenotomy (5.53 ± 1.6 casts) than the group that did not require tenotomy (4.87 ± 0.9 casts). **Conclusion:** The initial Pirani score is predictive of the number of casts that may be required and the need for a tenotomy of the Achilles tendon.

Keywords: Casting, clubfoot, congenital talipes equinovarus, pirani scoring, ponseti, tenotomy

INTRODUCTION

The Ponseti serial corrective cast management is universally accepted as an effective and economical method for the management of idiopathic clubfoot.^[1-7] The Ponseti method involves serial corrective manipulation, a specific technique of the cast application, and a percutaneous tendoachilles tenotomy when required.^[8] The method has been reported to have a success rate approaching 98% in recent studies.^[5]

The severity of the clubfoot deformity can vary, and, consequently, the response to nonoperative treatment may vary from foot to foot. Pirani *et al.*^[9] devised a simple scoring system to document the severity of the components of clubfoot deformity. Each of the six components of the deformity is scored as 0 if there is no deformity, 0.5 if there is moderate deformity, and 1 if the deformity component is severe. Three of these six clinical signs are related to the hindfoot, and three are related to the midfoot. Thus, each foot can have a hindfoot score (HFS) between 0 and 3, a midfoot score (MFS) between 0 and 3, and a total score between 0 and 6. The interobserver reliability of the Pirani scoring system has been shown to be good.^[9,10]

This study was undertaken to determine whether the Pirani score could predict the need for performing a tenotomy of the

Achilles tendon during the course of treatment of idiopathic clubfeet by the Ponseti technique.

MATERIALS AND METHODS

After obtaining approval from the ethical committee at our institution, the authors retrospectively reviewed the records of 132 idiopathic clubfeet in 89 children. These children were treated by a single surgeon using the Ponseti method at our institution between May 2007 and September 2015. Each foot was rated according to the Pirani scoring system at each visit by the same surgeon. Scores for each foot were obtained at each visit prior to cast application and following the removal of the final cast. Patients with syndromic clubfoot, as well as any other associated congenital anomalies of the lower limbs and spine, were excluded from the study. Corrective serial casts were applied after manipulation according to the Ponseti method.^[6,7,11] Manipulation and casting were continued weekly for the next 2–3 weeks to abduct the foot gradually around the head of the talus. The final cast was applied with the foot in the 70° abducted position and

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dorsiflexed 15°. A percutaneous Achilles tenotomy was performed when a dorsiflexion of 15° was not possible at final cast. Post-tenotomy, the foot was cast in the final position of 70° of abduction and 15° of dorsiflexion for 3 weeks to allow the healing of the tendon.

The records were studied to evaluate the association between the initial total Pirani score and the number of weekly casts required. HFS and MFS were measured separately, and correlation between the initial total Pirani score and the need for tenotomy was calculated.

The analysis was performed using the Statistical Package for the Social Sciences version 20.0 software (SPSS Inc., Chicago, Illinois, USA) for Windows. The means of each group were used for comparison. The association between the number of casts and the respective Pirani score was assessed using the Spearman's rank correlation coefficient, with the level of significance set at $P \leq 0.05$. The association between the Pirani score and the need for tenotomy was investigated using chi-square test, with $P \leq 0.05$ considered as significant. Odds ratio was calculated by using logistic regression analysis.

RESULTS

One hundred and thirty-two idiopathic clubfeet in 89 children were selected, as they fulfilled the inclusion criteria and were, therefore, enrolled in this study. Demographic characteristics of the participants are shown in Table 1. Of the 132 feet, 101 (76.5%) feet of the patients required tenotomy. The mean number of casts required was significantly higher ($P < 0.05$) for the group that required

tenotomy (5.53 ± 1.6 casts) (range 2–11) than the group that did not require tenotomy (4.87 ± 0.9 casts) (range 3–7). We found a positive correlation between the initial Pirani score and the number of casts ($r = 0.441$, $P < 0.0005$), the midfoot component and the number of casts ($r = 0.409$, $P < 0.0005$), and the hindfoot component and the number of casts ($r = 0.387$, $P < 0.0005$).

In the non-tenotomy group, we observed a significant association between the initial Pirani score and the number of casts ($r = 0.513$, $P = 0.003$). In addition, hindfoot components showed a significant association ($r = 0.698$, $P < 0.005$) with the number of casts required. We did not find a significant association between the midfoot component and the number of casts required.

In the tenotomy group, we observed a significant association and positive correlation between the initial Pirani score and the number of casts required ($r = 0.381$, $P < 0.005$). Similarly, there was a significant association and positive correlation between the hindfoot component and the number of casts required ($r = 0.238$, $P = 0.017$) as well as the midfoot component and the number of casts ($r = 0.402$, $P < 0.0005$).

By means of the Student's independent *t*-test, we observed significant difference between the mean initial scores for tenotomy and non-tenotomy groups. Although there was significant differences in the mean scores of hindfoot component for both the groups, no significant difference was found between the midfoot component scores (shown in Table 2).

By logistic regression analysis, we found that the odds of requirements for the number of casts ≥ 5 is 2.20 times higher among patients with initial Pirani score ≥ 5 than patients with initial Pirani score < 5 [odds ratio (OR) = 2.20, 95% confidence interval (C.I.) 1.07–4.5] ($P = 0.030$). In addition, the need for tenotomy was 2.6 times more among patients requiring ≥ 5 number of casts as compared to those requiring 4 or less. (OR = 2.5, 95% C.I. 1.1–6.1) ($P = 0.029$). However, we found that the odds of the need for tenotomy is 3.2 times higher among patients with initial Pirani score ≥ 5 than patients with Pirani score < 5 (OR = 3.2, 95% C.I. 1.2–8.5) ($P = 0.019$). This suggests that if patients have an initial Pirani score ≥ 5 , then the need for tenotomy is 3.2 times more.

DISCUSSION

The management of congenital clubfoot has developed over the past few decades. The Ponseti method has become the

Table 1: Demographic characteristics of the patients

Characteristics	Number (%)
Sex ($n = 89$)	
Male	72 (80.9%)
Female	17 (19.1%)
Side ($n = 132$)	
Right side	72 (54.5%)
Left side	60 (45.5%)
Family history ($n = 132$)	
Yes	15 (11.4%)
No	117 (88.6%)
Tenotomy	
Yes	101 (76.5%)
No	31 (23.5%)

Table 2: Association between the components of Pirani scores (mean \pm SD) among patients belonging to the tenotomy and non-tenotomy groups

Component	Tenotomy group ($N = 101$)	Non-tenotomy group ($N = 31$)	<i>P</i> value
Initial Pirani score	4.86 ± 1.04	4.27 ± 1.21	0.010
Hindfoot score	2.77 ± 0.32	2.44 ± 0.68	0.013
Midfoot score	2.09 ± 0.8	1.84 ± 0.72	0.115

gold standard for clubfoot treatment.^[12] Around 70–80% of the patients require tenotomy while treating clubfoot by the Ponseti method.^[6,8,11] Pirani scores have been commonly used to follow treatment progress, predict tenotomy requirements,^[13,14] the number of casts for treatment,^[15] and relapse rates.^[16]

Bhaskar and Patni^[17] devised a classification of the relapse pattern in clubfoot treated with the Ponseti technique. They assessed 164 relapsed feet. The mean Pirani score in these relapsed feet was 5.6 in bilateral and 5.5 in unilateral groups. This high score seemed to be associated with late relapse, as noted by Goriainov *et al.*^[16]

The predictive value of this score would help to guide anxious parents regarding the requirement of a tenotomy as well as the number of casts required to achieve complete correction of the deformity.

In a recent study, Chandrakant *et al.*^[18] in their attempt to define prognostic indicators in tarsal dysplasia found a negative correlation between tarsal dysplasia and the number of casts required. However, the limitation of their study, as mentioned by them, was the small study population. They did not correlate this dysplasia with the initial Pirani score, which they considered to be more subjective as compared to ultrasonography (USG) of the tarsal bones. They have, however, also mentioned the subjective nature of USG measurement of the tarsal bones, which is also a limitation of their study. Hence, they concluded that further studies would be required to validate the use of tarsal dysplasia as a prognostic tool.

Dyer and Davis reported the predictive value of Pirani scoring on 70 idiopathic clubfeet.^[13] They found a positive correlation ($r=0.72$) between the initial Pirani score and the number of casts required to correct the deformity. A foot scoring of 4 or more is likely to require at least four casts, and one scoring <4 will require three or fewer. Chu *et al.*^[19] (185 feet; mean age 15.3 days) determined that the mean number of casts required was 5.1. The initial Pirani scores correlated poorly ($r=0.33$) with the number of casts required for clubfoot correction. Agarwal and Gupta^[20] also found that there was a positive correlation by regression analysis in both Pirani score and age at onset of treatment with the number of casts. They also reported that Pirani scoring correlated ten times more than age to the number of casts required.

In this study, there is a positive correlation between the initial Pirani score and the number of casts required by Spearman's rank correlation coefficient, which is in accordance with that reported by Dyer and Davis^[13] By logistic regression analysis, we found that a foot scoring 5 or more is likely to require at least five casts, and those scoring <5 may required four or less. In addition, a foot with an initial score of 5 or more has a 3.2 times higher risk of requiring a tenotomy. This is a helpful guideline when counseling parents. Even though parents may be given an estimate about the average number of casts at counseling, it must be reemphasized that the number of casts is extremely variable.

There were a few limitations in this study. It is a retrospective study with a heterogeneous age at the onset of treatment.

CONCLUSION

We conclude that the Pirani scoring system can be used to explain the need for tenotomy and to help us to estimate the number of weekly plaster requirement. A foot scoring 5 or more is likely to require at least five casts, and those scoring <5 are likely to require four or fewer casts. In addition, a foot with an initial score of 5 or more is 3.2 times more likely to require a tenotomy than a foot with a lower initial Pirani score.

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Conflicts of interest

There are no conflicts of interest.

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