Original Article

# Influence of Age, Weight, and Pirani Score on the Number of Castings in the Early Phase of Clubfoot Treatment using Ponseti Method

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## Abstract

***Background:*** **The objectives of this study were to investigate whether severity of clubfoot, age, and weight of the patients at initial manipulation and casting influence the total number of castings required.**

***Methods:*** **This prospective study was conducted on 38 idiopathic clubfoot patients undergoing weekly manipulation and casting using the method recommended by Ponseti. The patients' age, weight, and foot Pirani score at the start of manipulation and casting were analysed against the total number of castings required to achieve correction to 60° abduction.**

***Results:*** **Simple linear regression analysis on the influence of weight, age, and Pirani score at the time of cast initiation showed that the Pirani score was the only significant predictor for the total number of castings required.**

***Conclusion:*** **The total number of castings required to treat clubfoot was determined by the severity of clubfoot but not by the weight and age of patients.**

***Keywords:*** *age, clubfoot, plaster cast, weight*

## Introduction

Treatment of idiopathic clubfoot using the Ponseti method involves weekly serial manipulations and castings until the foot can be abducted to 60°. This is followed by Achilles tendon tenotomy and casting, and the patient is then put on foot abduction orthosis to maintain the correction achieved and to prevent recurrence of deformity. Open surgery has been reportedly avoided in 89% of cases when this technique of manipulation, casting, and limited surgery (tenotomy) are used in treatment (1–3). The outcome of treatment greatly depends on the compliance to treatment (4–6). The number of visits to the clinic and the duration of treatment have a direct influence on the cost of treatment, and treatment is recommended to start as early as the first week of life (7,8). However, at this time a number of babies or their mothers may be too weak to travel due to associated medical problems or a difficult delivery process. If treatment has to be delayed, it is important to know the safe period for delaying initiation of treatment. We conducted this study to investigate whether age, weight, or severity of the deformity influence the number of castings needed.

## Materials and Methods

Infants, four months or younger, with untreated idiopathic clubfoot were selected for this study. The following details of patients were collected: age at presentation, weight, sex, unilateral or bilateral involvement, and severity of clubfoot (scoring by the Pirani scoring system). In the first encounter with the patient, the degree of deformity of each foot was graded using the original Pirani score of 10 points (9). The foot was later treated with weekly sequential manipulations and castings as suggested by Ponseti et al. (7–10). Scoring and manipulation were done by either one of two trained paediatric orthopaedic surgeons. The initial stretching was aimed at correction of cavus by supinating the foot to bring the first metatarsal in line with the other metatarsals. The supinated foot was later gradually abducted while applying counterpressure on the head of the talus until abduction of 60°. The hind foot was not manipulated as the calcaneus spontaneously rotates and slides under the talus, thus correcting the heel varus during the manoeuvre. There was no attempt to correct the equinus at this stage. A moulded plaster cast from toes to the proximal part of the thigh with a flexed knee was then

 

applied. The caregivers were educated about possible complications of casting and advised to remove the cast, if necessary, by themselves or at a nearby hospital. Once abduction of 60° was achieved, the ankle dorsiflexion was assessed. If the ankle could not be dorsiflexed beyond 15°, a percutaneous release of the Achilles tendon was done under local anaesthesia in an outpatient setting. The total number of castings to achieve the required correction to 60° abduction was recorded. Its association with age, weight, and severity was then analysed using SPSS version 18.1 for Windows. The required sample size for multiple linear regression analysis was based on the sample sizes by Cohen (11), of which the sample size was 34 patients at a significance level of 0.05 and 80% power for a large-effect size. The final required sample size was 38 after considering a 10% dropout rate.

## Results

Thirty-eight patients for a total of 58 feet (20 patients had bilateral involvement) were included in the study. Eighteen (47.4%) of these patients were female and 20 (52.6%) were male, and all were between 7 days to 120 days old (mean 37.1 days). Their weights were between 2.4 and 7.0 kg (mean 3.6 kg), and the total number of castings required per patient was between two and 10 (mean of 5.2 casts).

Simple linear regression analysis of age, weight, and Pirani score was performed on one foot of each patient (38 feet in total), of which 17 feet were from patients with unilateral involvement. For patients with bilateral involvement, the foot with more severe clubfoot was chosen. The assumptions for model fitness were checked and met based on linearity of each numerical independent variable, normality of residual and equal variance of residual. Results showed that only the Pirani score had a significant influence on the number of castings required (Table 1). Age and weight of patients had a *P* value > 0.25.

## Discussion

Two trained paediatric orthopaedic surgeons were involved in the assessment and casting of the clubfeet. The differences between surgeons were minimised because all patients were randomly assessed and cast every week by either surgeon. Our findings showed that age of initiation of manipulation and casting in patients younger than 120 days did not influence the total number of castings required to achieve a correction to 60° abduction before the clubfoot was considered for tendo-Achilles tenotomy; determining the recommended maximum age for initiation of casting was beyond the objectives of this study. Several researchers recommend that manipulation and casting be started immediately or very soon after birth to guarantee high success rates (8,12). However, overall outcome and success depends greatly on compliance to bracing, which is more difficult in older children. Alves et al. (13) found that the total number of castings required for children who had had their initial treatment before or after 6-months old were similar. Iltar et al. (14), found that the final outcome was better in children who had the Ponseti method beginning after the age of one month compared to those who began before the age of one month because the cuboid, which is still not well ossified in the first month of life, may be compressed during the manipulations rather than corrected.

Large and short lower limbs in an overweight baby are theoretically associated with difficult cast applications and cast dislodgement. However, one limitation of this study was that it did not include the limb length as a variable. We assumed that the patient's weight increased with age, and we found that weight did not influence the total number of castings required.

The third factor analysed in the study was the Pirani score, which indicates severity of the deformity. Simple linear regression analysis showed that of the three factors examined in this study, the Pirani score was the only predictor

**Table 1:** Association of number of casts as the dependent variable with age, weight, and Pirani score

| Variable | Regression coefficient[a] | *t* statistic | *P* value |
|---|---|---|---|
| Age | 0.001 (–0.023, 0.025) | 0.085 | 0.93 |
| Weight | 0.135 (–0.606, 0.877) | 0.37 | 0.71 |
| Pirani score | 0.544 (0.285, 0.803) | 4.26 | < 0.01 |

[a] Simple linear regression.

($P$ < 0.01) of the total number of castings required; consequently multiple linear regression was not carried out. We used 10-point Pirani scoring due to its good inter-observer reliability with correlation coefficients of 0.90 ($P$ = 0.0001) (9). The use of the Pirani score for correlating the severity of clubfoot and the number of castings is supported by Dyer et al. (15) who found a good correlation ($r$ = 0.72) between initial modified Pirani six-point scoring and the number of casts.

Based on this study, the number of castings required can be predicted based on the Pirani 10-point score at presentation as every one unit increase in Pirani score results in an increase of 0.544 units of the total number of required castings. This information can be used to counsel caregivers in treatment planning to ensure good compliance. However, we emphasise that the number is highly variable and needs to be re-evaluated on a weekly basis (16). Dyer et al. (15), using the Pirani six-point version, found that feet scoring 4 and above will likely require four or more times as many castings as feet scoring less than 4.

## Conclusions

The total number of castings required to treat clubfoot was determined by its severity when using Ponseti manipulation but not by the weight and age of patients.

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## Conflict of Interest

None.

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## Authors' Contributions

Conception and design: ARS, MZ
Analysis and interpretation of the data and collection and assembly of data: MZ
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Critical revision of the article for the important intellectual content and provision of study materials or patient: ARS, IM, EFM

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