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Factors Associated with the Number of Casts in the Management of CTEV by using the Ponseti Method: A Retrospective, Analytical Study

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Abstract

The Ponseti method is an effective technique for treating Congenital Talipes Equinovarus (CTEV), which involves serial casting to correct the deformity. We investigated the correlation of the number of casts with patient's age at presentation, initial Pirani score and Dimeglio score. This was an analytic retrospective study of CTEV patients treated with the Ponseti method in Dr. Wahidin Sudirohusodo Hospital from January 2011 to December 2018. Variables of initial Pirani score, Dimeglio score, age at presentation, and the number of casts to achieve correction were collected from the patient's medical record. The data obtained were subjected to statistical analysis using ANOVA test and Spearman correlation test. There were 90 patients included in this study. Male (64 %) are more common than female. Patients with bilateral foot disorders are more often than unilateral. The most common age at the first presentation is under the age of 1 month. Most patients require four circular casts. The initial average of Pirani score is 0.7 and the initial average of Dimiglio score is 13.0. Analysis of each variable with ANOVA test showed that age had a significant relationship ($p < 0.001$), Pirani score ($r = +0.885$), and Dimeglio score ($r = +0.76$) had a significant positive correlation with the number of circular cast.The number of circular casts needed to correct CTEV correlates significantly with the age of first presentation and has a strong positive correlation with both the initial Pirani score and the initial Dimeglio score.

Keywords: CTEV; Ponseti method; Age; Pirani score; Dimeglio score.

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1. Introduction

Congenital Talipes Equinovarus (CTEV) is one of the most common externally visible congenital deformities in worldwide with incidence rate varies between 0,9 and 7 case per live birth [1,2]. Severity of deformity should be recognized for pre-treatment evaluating and monitoring treatment progress. Currently, the Pirani and Dimeglio scoring system have become the most universally adopted classification system [2,3,4]. Most orthopaedic surgeons have agreed that the initial treatment of a CTEV should be nonsurgical. The Ponseti method is widely used for the correction of clubfoot. It is a specific method of casting, serial manipulation and surgery of cutting down the achilles tendon i.e. tenotomy [5,6]. One of the questions that most frequently asked by parents is how many cast will be needed before correcting the deformity [2,6,7]. Several studies have investigated the correlation between initial Pirani score or Dimeglio score with the numbers of casts needed to attain full correction of the deformity, but the result remains controversial [6,7]. Extended application of Ponseti method in older children shown varied results. We retrospectively investigated how the number of casts required for deformity correction differed with (a) the age of the child at initial presentation, (b) gender, (c) initial Pirani score, and (d) initial Dimeglio score.

2. Methods

We retrospectively reviewed 90 consecutive children with idiopathic CTEV treated by Ponseti method from January 2011 to December 2018 in Dr. Wahidin Sudirohusodo Hospital, Indonesia. Data was consecutively obtained from medical database in the institution. The data sheet indicated age at presentation, initial Pirani score, initial Dimeglio score, and number of casting needed. The age groups were divided into : (a) <1 month; (b) 1 – 3 months; (c) 4 – 12 months; dan (d) > 12 months in order to detailed review of Ponseti method. Children with non-idiopathic (neuromuscular, syndromic, arthrogryposis and others), surgical treatment in any form, recurrent clubfoot, noncompliance with serial casting schedule were not included in this study. Approval of the study protocol was received by the Ethics Committee of Dr. Wahidin Sudirohusodo Hospital.

2.1. Statistical analysis

Collected data are reported as descriptive statistics (mean ± standard deviation) for continuous variables and percentages for categorical variables. Correlation between number of casts and age at presentation, Pirani score and Dimeglio score are analyzed used Pearson correlation test and linear regression at 5% significance level to determine if there was a significant correlation between the number of cast need and age at presentation, Pirani score and Dimeglio score. The data analysis was using ANOVA test and Spearman correlation test.

3. Result

3.1. Characteristics

There were a total 90 children that met the inclusion criteria. Bilateral foot was seen in 61 children (68%); 29 (32%) had unilateral CTEV (9 left and 20 right). The sample included more males than females. The most common age group at presentation was < 1 month i.e. 31 cases (34%) (Table 1).

Table 1: Characteristics of the children with CTEV who casting used Ponseti Method

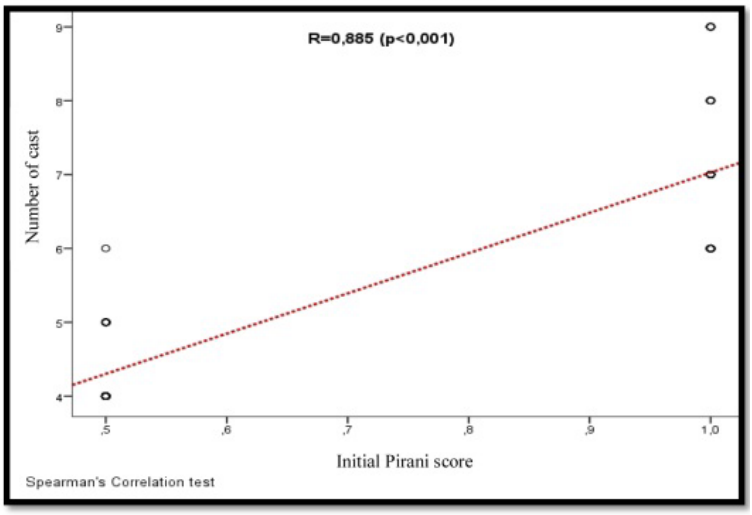
Variable		
Gender n(%)	Boy	58(64)
	Girl	32(36)
Aged at presentation n(%)	< 1 month	31(34)
	1 - 3 months	15(17)
	4 - 12 months	26(29)
	> 12 months	18(20)
Number of cast (mean ± SD)	5.4 ± 1.5	
Pirani score (mean ± SD)	0.7 ± 0.2	
Dimeglio score (mean ± SD)	13.0 ± 3.8	

Tabel 2: Distribution of the number of cast according to gender and presentation age

	Gender			P
Number of Cast	Boy	Girl	Total	
4	28	10	38	
5	8	6	14	
6	9	9	18	
7	6	2	8	
8	4	2	6	
9	3	3	6	
Total	58	32	90	0.503
Presentation Age	N	Mean	SD	P
< 1 month	31	4.0	0.2	<0.001
1-3 months	15	4.8	0.8	
4-12 months	26	5.8	0.7	
>12 months	18	7.7	1.4	

The ANOVA analysis showed that age of first treatment is in better correlation to number of corrective cast than gender.

We calculated the correlation between the number of cast required for correction between Pirani score and Dimeglio score. There was a significant positive correlation between Pirani score and number of cast required (r = 0.885, P < 0.001). Also, number of cast positively correlated with initial Dimeglio score (r = 0.760, P < 0.001) (Figure. 1A and Figure. 1B).



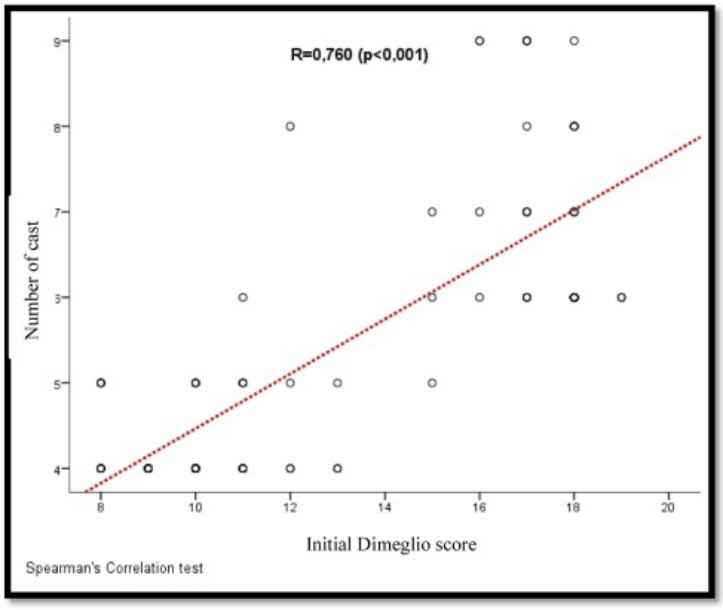


Figure 1: (A) Scatter diagram showing correlation between initial Pirani score and number of cast required; (B) Scatter diagram showing correlation between initial Dimeglio score and number of cast required.

4. Discussion

The Ponseti method has become a gold standard treatment for CTEV.[5] Our study confirmed the strong positive correlation between age and the number of corrective cast ($P < 0.001$). It means that the number of casts required for correction showed an increasing trend with the age. Our results demonstrated that patients aged > 12 months required the most cast and patients aged < 1 months required the least cast. Despite, conflicting reports are present in several studies regarding aged at presentation and it's predictive value for number of cast for correction [8,9,10,11,12]. Agarwal and his colleagues had evaluating 297 children aged 2 weeks to 9 years, they similarly found differences in the number of casts required when comparing the different age groups [11]. While, a contrary result shown in the study by Alaves and his colleagues stated that there are no significant

difference on number of cast between children aged < 6 months and older than 6 months. Nonetheless, the study involved two groups that did not have the matched classification in the severity of CTEV at the baseline, so that it would affect the success of therapy. Additionally, This may be attributed to reduce response of soft tissue to Ponseti maneuver due to the decreased viscoelastic properties of the connective tissue along with the infant's age [10]. We observed no difference in gender with number of corrective cast required. As reported previously, Cosma and his colleagues and Dobbs and his colleagues reported that gender was not associated with outcome [13,14]. In contrast, El Batti and his colleagues found that female gender was significantly associated with a less number of cast [15]. The results suggested that the number of casts is more associated by other factors, such as severity CTEV and side of affected legs. Pirani scores have been frequently used to track treatment progress, number of cast of treatment, and relapse. The present study demonstrated a positive correlation between a Pirani scores and number of cast required. Similarly, Dyer and his colleagues found a positive correlation ($r = 0.72$) between initial Pirani score and number of cast required to correct deformity. But, a few studies also shown no linear relationship between initial Pirani score and number of corrective cast, so it remains controversial. However, there seems to be a cut-off point for feet scoring 4 or more. Of these, a Pirani scoring 4 or more is likely to require at least four cast, and one scoring less than 4 will require three or fewer.this is an easy rule to remember and a useful guide when advising parents [16]. Currently, the Dimeglio scoring system has become the most universally adopted classification systems, and has high intra-observer and inter-observer reliability, clinical relevance and can easily be used in clinical practice. Several studies have investigated the correlation between initial Dimeglio score with the numbers of casts needed to attain full correction of the deformity, but there is no consensus conclusion that has been drawn [17].

Our result demonstrated a positive correlation between Dimeglio score and numbers of corrective casts ($r = +0.760$, $P < 0.001$). A recent study by Gao and his colleagues shown that there are limitations but still has positive correlation between initial Dimeglio score and the number of corrective cast ($r = 0.12$). Despite their excellent intra-observer and inter-observer reliabilities, no consensus has been reach on the correlation between initial Pirani score or Dimeglio score and the number of casts required for deformity correction [17]. This study has a number of limitations. First, although there are specific guidelines according to the Ponseti method, but the decision to discontinue circular casts and start the use of foot-abduction orthosis is entirely determined by the physician, so there will be subjectivity in assessing and making decisions about the number of circular casts used. Second, this study has a small sample size so the results need to be confirmed in larger scale studies. Finally, due to the small number of samples, we cannot analyze the correlations between each component of the Pirani score and the Dimeglio score for the number of circular casts needed, so that the association of each component on the number of circular casts used cannot be determined.

5. Conclusion and Recommendation

The authors concluded that the number of casts for correction in idiopathic CTEV are influenced by several variables, included age of child at presentation, Pirani score, and Dimeglio score. There are no differences between male and female gender in the number of casts. Researchers recommend that CTEV should be classify using a reliable scoring system, include Pirani score and Dimeglio score. Ponseti method still become the mainstay of congenital clubfoot treatment in children presenting at early age

6. Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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