



Treatment Outcome of Ponseti Method in the Management of Club Foot at Komfo Anokye Teaching Hospital, Ghana: A Retrospective Study

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Authors' contributions

Authors HB and AN designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author AT managed the literature searches and editing. Author AIB managed the analyses of the study and transform it into intellectual context. All authors read and approved the final manuscript.

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ABSTRACT

Background: Ponseti method is an established conservative treatment for idiopathic clubfoot in children world-wide. Yet, no data are available to quantify its effectiveness for reference in Ghana.

Aim: To explore the effectiveness of Ponseti method in the management of clubfoot at a Tertiary Health Facility in Ghana.

Materials and Methods: The 6-year single arm retrospective cohort study involved a review of clinical folders of babies with club feet. The age range of the children was between 0 and 6 months. They were managed using Ponseti method from 2008 to 2013 at Komfo Anokye Teaching Hospital Clubfoot Clinic. Demographic data and Pirani scores were retrieved from their folders. Pirani scores served as evaluation index through which the treatment outcome of the Ponseti method was

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evaluated. Data were gleaned to descriptive and inferential statistics.

Results: A total of 271 folders of children with club foot were retrieved and reviewed. An average of 5 casts was applied to correct a child's club foot deformity prior to the prescription of Foot Abduction Brace. Pirani score for mid-foot was significantly lower than that of the hind-foot whilst males had significantly higher number of casts than the female. The number of casts required for correction was positively correlated with the age of the children ($r=0.346$) and their Pirani scores ($r= 0.514$, right foot; $r= 0.415$, left foot).

Conclusion: Ponseti method is effective in the management of clubfoot whilst age and initial Pirani scores were the determinants of the number of casts required and indication for tenotomy respectively.

Keywords: Clubfoot; ponseti method; pirani score; treatment outcome.

1. INTRODUCTION

Clubfoot or Congenital Talipes Equinovarus is a complex congenital deformity of the foot [1,2]. It is estimated that more than 100,000 babies are born each year worldwide with congenital clubfoot and 80% are seen in developing nations [3]. The incidence rate of clubfoot per thousand live births in the western world is as follows: USA 1.0 [4]; Australian Caucasian 1.11 [5]; Denmark 1.2 [6]; Sweden 1.4 [7]. The incidence rate of clubfoot per 1000 live births in Africa is comparatively high and they are documented as follows: Uganda 1.2 [8]; Malawi 2 [9]; Papua New Guinea 2.7 [10]; Nigeria 3.4 [11]. In Ghana, it is estimated that 820 babies are born yearly with clubfoot deformities with an incidence of 1.2 to 1000 live births [12]. It clearly shows that clubfoot deformity in Africa including Ghana is a potential source of economic and social burden to the parents and health sector. This view adds credence to the effort to seek most effective method for managing the condition among healthcare professionals and policy makers.

According to Ponseti et al. [3] and Maheshwari [13], classification of clubfoot is based on the cause and the stage of treatment of the deformity. With respect to the cause of the deformity, a clubfoot can be referred to as an idiopathic type when there are no associated neurological conditions such as spina bifida and arthrogryposis [13]. However, when the clubfoot is diagnosed as part of another health condition either neurologic or syndromic, it is referred to as secondary clubfoot [13]. Classification on the basis of treatment stages, categorizes clubfoot as treated, untreated, recurrent, resistant, complex, and neglected clubfoot [3]. Untreated congenital clubfoot is described in children less than two years whilst neglected club foot are those found in children more than two years. Poorly treated club foot will ultimately result in

physical, social, psychological, and financial burdens on patients, families and the society at large [3].

Clubfoot deformity can be managed both conservatively and surgically [1,2]. The Surgical management of clubfoot which became popular from 1980's employed techniques such as Postero-medial release, which is an extensive release of the contracted soft tissues of the clubfoot and the 'a la carte' approach, which focuses on specific components of the deformity based on the presentation of the clubfoot [14]. Surgical correction of clubfoot is often recommended for severe cases, but the lasting effects are generally not desirable, as residual sequela may include weakness, stiffness, and early onset of arthritic changes [14]. According to Dobbs et al. [15], the limitations in the activity of daily living in a thirty-year-follow-up study on patients who had soft tissue release were quite comparable to the disability caused by Parkinsons disease. Additionally, a significant proportion of adults who had surgical treatment for their clubfeet may require additional surgeries on the long term, which are not only expensive but are also associated with several complications [15]. Hence, the consensus among orthopaedic experts suggests conservative management as the first line of approach in the management of clubfoot deformity [1,2,16].

Conservative methods are often targeted at achieving painless plantigrade foot with good mobility and in most cases, with no need for special or modified shoes [16]. Over the years, the conservative methods for managing club foot have evolved and witnessed systematic refinery [17]. In the 50s, Ponseti further developed another conservative method for correcting clubfoot which involved manual manipulation and plaster casting on weekly basis [16]. Often times, Ponseti method also includes percutaneous

Achilles tenotomy which has been proven to be successful in up to 98% of cases with clubfoot deformity [18]. Overall, the method has been shown to be more effective, producing better outcome and fewer complications than traditional surgical methods [18,19]. The effectiveness of Ponseti method is often quantified with Pirani score on the scale of 0 to 1 as follows: 0 as 'no abnormality', 0.5 as 'moderate abnormality' and 1 as 'severe abnormality' [20].

Although the use of this technique is common among the Orthopaedic Specialists and Physiotherapists in Ghana, yet its effectiveness has not been quantified for documentation. The present study thus sought to document the treatment outcome of Ponseti method in the management of clubfoot over a period of five years at a Tertiary Health Facility in Ghana.

2. MATERIALS AND METHODS

2.1 Participants

The 6-year single arm retrospective cohort study was conducted at the Clubfoot Clinic of KomfoAnokye Teaching Hospital (KATH) which is a Tertiary Healthcare Facility in Ghana. It involved data collation from the clinical folders of children with idiopathic club foot who were between the ages of 0 and 6 months. The clinical folders were assessed to retrieve information from the first visit of the children to the Clinic. Records of the children who did not default treatment during the casting period and those seen between January 2008 and April 2013 were included. The study excluded children whose record suggested any other type of management of their clubfoot outside KATH clubfoot clinic and those with neuropathic clubfoot.

2.2 Procedure

Ethical approval was obtained from The Committee on Human Research Publication and Ethics (CHRPE) of The School of Medical Sciences, Kwame Nkrumah University of Science and Technology Kumasi and the KATH, Kumasi. A special permission was obtained from the Heads of the clubfoot Clinic and Record section. Clinical folders of the children with club feet were retrieved from the record section of the department by the Principal Investigator and the Research Assistants. Information regarding demographical data and scores on the Pirani scoring sheet were collected and entered on a spread sheet.

2.3 Data Analysis

All the data were analyzed using Statistical Package for Social Science (SPSS) version 20.0 and Microsoft excel (2010) whilst statistical methods for analysis involved descriptive statistics such as mean, standard deviation and frequencies, and inferential statistics including Spearman's correlation coefficient, independent samples t-test and Chi square test.

3. RESULTS AND DISCUSSION

3.1 Results

A total of 271 clinical folders of the children with clubfoot deformity managed at the club foot Clinic of KATH from 2008 to 2013 were included in the study. Four Hundred and Thirty cases of club feet were reviewed in total. The results indicate that males were more affected 112 (59%). Majority of the cases 237 (88%) were within age range 0-2 months at their first visit to the clubfoot Clinic (Fig. 1). 159 (59%) of the children had bilateral clubfeet (Fig. 2). Two (2) children (1%) had one plaster cast applied to resolve the deformity prior to the prescription of Foot Abduction Brace(FAB) whilst 4 – 6 casts were required in most, 177 (65%), of the children to achieve correction prior to bracing (Fig. 3). The mean number of casts applied was 4.93. Out of the 271 cases, 208 (77%) had tenotomy after which they had one cast before the prescription of FAB.

The number of casts required to correct the deformity was significantly higher in males than the females (Table 1). Similarly, comparison of the recovery rate of Mid-Foot and Hind-Foot showed significant differences ($P<.001$) for both feet. The obtained Pirani score for mid-foot was significantly lower than that for the hind-foot (Table 2). There was a significant difference in the overall initial Pirani scores between children who had tenotomy and those without tenotomy ($P<.001$) Table 3. Number of casts applied is directly and significantly correlated with the age ($r=0.346$) and Pirani scores ($r= 0.514$; $r= 0.415$) for the respective right and feet (Table 4).

Table 1. Comparison of number of casts required between males and females

Gender	Number	Mean	P value
Male	159	5.13±1.65	0.019*
Female	112	4.65±1.66	

Key: *Significant at $p<0.01$

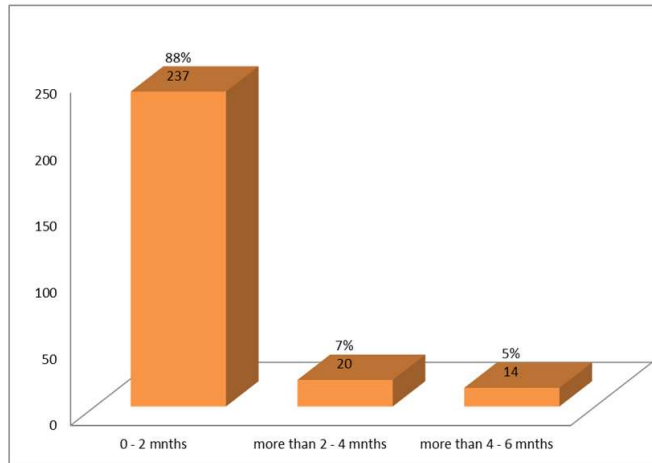


Fig. 1. Frequency of the age groups of the patients

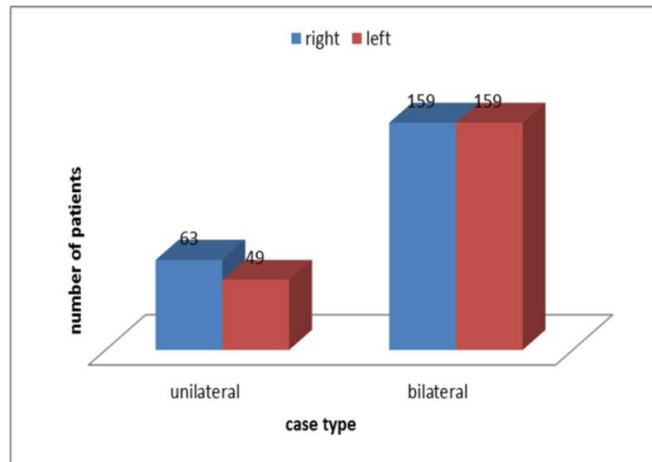


Fig. 2. Frequency of the type of foot affected

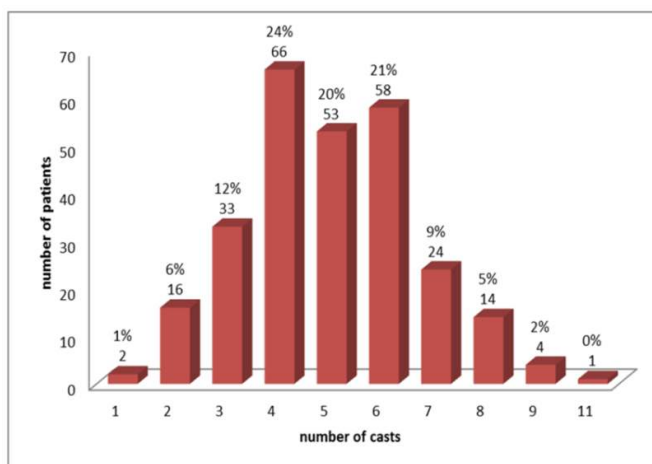


Fig. 3. Frequency of the number of casts worn by the patients

Table 2. Comparison of the Pirani scores recorded between right and left mid-foot and hind-foot

Anatomical site	Number	Mean scores	Chi-square	P value
Right mid-foot	222	0	99.6	<0.001*
Right hind-foot	222	1		
Left mid-foot	208	0	78.5	<0.001*
Left hind-foot	208	1		

Table 3. Comparison of the initial Pirani scores between tenotomy and non tenotomy groups

Tenotomy	N	Mean±SD	p-value
Right foot Yes	169	5.01±1.12	<0.001*
No	53	3.99±1.76	
Left foot Yes	162	5.02±1.17	<0.001*
No	46	4.29±1.59	

3.2 Discussion

The main focus of this study was to document the treatment outcome of Ponseti method in the management of idiopathic clubfoot at a Tertiary Healthcare Facility in Ghana with a view to appraise the outcome of its local population-based application. Considering the number of casts required, findings from our study indicate 4.93 as the mean number of casts applied to correct all the cases of club feet reviewed which conforms to the gold standard postulated by Ponseti in which approximately 5 casts was suggested [3]. Similar results were shown by Dyer and Davis [20] who reported approximately 5 casts and Changulani et al. [16] with approximately 6 casts. The similarity in these outcomes clearly indicates that the recommended application of Ponseti method for managing clubfoot is being adhered to at the KATH Clubfoot Clinic in Ghana.

In this study, males were more affected than females with a ratio of 1.4 to 1. Several previous studies by Carey et al. [5], Wallender et al. [7], Lavy et al. [21], Agarwal and Gupta [22], Miedzybrodzka [23] have also reported similar results in which there were higher numbers of males than females with clubfoot deformity in Africa as well as in the western world. Other studies have also shown a possible increase in the prevalence of clubfoot among females in Africa compared to their male peers in the western world probably because of genetic and/or ethnic factors [23,24]. Our findings also reveal that majority of the cases, 237(88%) upon their first visit to clubfoot Clinic were between 0

and 2 months. This is encouraging as recent literatures suggest that early treatment of clubfoot yields better results [25,26]. Out of the 271 reported cases, 159 (59%) had bilateral clubfoot thereby corroborating the findings of Honein et al. [27]. Contrarily, other studies, Rasit et al. [1], Wallender et al. [7] and Byron-Scott et al. [28] reported a higher number of unilateral cases ascribing divergent reasons for the presentation including prepartum positioning of the feet, genetic and/or ethnic differences. We also found right foot to be more affected in the unilateral cases which remains at par with the studies by Wallender et al. [7], Agarwal and Gupta [22] and Byron-Scott et al. [28]. In contrast, a study by Rasit et al. [1] reported more affection in the left foot.

3.2.1 Pirani scores and number of casts required in relation to gender and components of club foot

Considering the fact that gender could influence the outcome following Ponseti method, the present study showed that males required more casts than females thus suggesting that females recovered faster than their male counterparts even though the underlying causes of the condition were not ascertained. Also, mid-foot was found to correct significantly faster than the hind-foot for both feet. This possibly might have resulted in the higher percentage (80%) of babies who had tenotomy performed on their foot in addition to the casts as equally reported by Changulani et al. [16]. It thus presupposes that hind-foot presents as the most difficult component of club foot to be corrected. Therefore, this finding suggests that the initial Pirani score of hind-foot score can be a good indication for tenotomy [20].

3.2.2 Correlations among Pirani scores, age and number of casts required

Findings in the present study also indicate that the number of casts applied is directly and significantly correlated with the age and Pirani scores for both feet. This implies that the older

Table 4. Correlation matrix for relationships among Pirani scores, age and number of casts applied

	Age	Number of cast	Pirani Score (right)	Pirani score (left)
Age	1.000	0.346*	0.009	0.034
Number of cast		1.000	0.514*	0.415*
Pirani score (right)			1.000	0.967*
Pirani score (left)				1.000

Key: *Significant at $p < 0.01$

the children are the more the number of casts required for correcting the deformity whilst higher Pirani score is indicative of higher number of casts required to be applied for correction. With regard to the effect of age on the number of casts required for correction, Argawal and Gupta [22], Alves et al. [25], and Verna et al. [26] have also reported positive correlation between the two variables. Our findings reveal a strong tie between age and the number of casts required for corrections. This report further buttresses the importance of early intervention in the management of children with club foot as shortened connective tissues are believed to be more pliable at early stage of the deformity. In another dimension, the initial Pirani scores between children who had tenotomy and those without tenotomy were significantly different ($p < 0.001$) which is suggestive of the children who might be indicated for tenotomy on the first contact. Those who underwent tenotomy had an average score of 5 compared to average of 4 for those who did not have tenotomy performed on them. Clinically, this finding postulates that parents' concern could be plausibly addressed during the pre-counseling sessions as to whether their children would require tenotomy or not based on the initial Pirani score.

The complex presentation of congenital talipes equino varus with its attendant high rate of relapses until children attain the age of six to seven years underscores the need for the continued evaluation of its management. The recent global adoption of Ponseti method has brought consensus regarding the preference for conservative method, albeit with its attendant challenges ranging from poor parents' compliance, long duration of casting, incomplete correction, recurrence of the deformity, difficulty associated with neglected cases with severe deformity and parents refusing to give consents for the method. [29,30] In spite of these intervening factors however, Ponsenti method remains the most widely embraced techniques among healthcare professionals including those practicing in low resourced countries where

human and material resources are difficult to come by. [31,32]. Studies have shown better treatment outcome in favour of ponseti method compared to other management strategies. [33,34] Pirani scoring commonly employed to grade the foot prior to and during treatment has been proven to be a good clinical tool as it is reliable, valid and responsive to change. Clinically, the tool can be used to measure the degree of deformity of each element of the affected foot, to assess if the deformity is correcting as envisaged or if there is a problem, and to assist in deciding if and when a tenotomy is indicated [20].

4. LIMITATION

Although the retrospective data indicated that the Ponseti method was effective in this study, data collection was however limited to the last cast. Retrieving information beyond the last cast would have provided more useful information with regard to the rate of success and/or failures as it is always required of any treatment method.

5. CONCLUSIONS

Ponseti method was found to be effective in the management of idiopathic clubfoot as corroborated in this study. Our findings identify age and initial Pirani scores as important determinants for the prognosis which have implication for continuous professional development among physiotherapists and orthopedic specialists as regards its correct application and evaluation.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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