

Original Article



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Comparison of Standard and Accelerated Ponseti Technique in the Treatment of Idiopathic Clubfoot at a Regional Orthopaedic Hospital in Nigeria

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Abstract

Introduction: Congenital clubfoot is a developmental deformity of the foot. Management by the Ponseti method has been shown to produce better results with fewer complications than traditional surgical methods. Some studies have shown that shorter intervals of serial manipulation/casting provide similar outcome to standard Ponseti technique. This study compared management outcome using an accelerated twice weekly technique with standard weekly Ponseti casting.

Methodology: A prospective comparative study was conducted involving 62 patients with 90 clubfeet. From the study, 48 clubfeet in 34 patients were managed with standard Ponseti technique (weekly manipulation and casting), while 42 clubfeet in 28 patients were managed with accelerated Ponseti technique (twice weekly manipulation and casting). Pirani score was used for initial assessment and for follow-up.

Results: Children were 1 month to 36 months of age at the time of commencement of treatment. Majority of patients were male (63%). The average number of casts did not differ significantly between the treatment groups ($p = 0.13$). The accelerated Ponseti technique patients were therefore able to complete their treatment within a significantly shorter period than those who went through the standard Ponseti protocol. The standard group had mean duration of correction of 29.65 ± 11.69 days and 12.36 ± 5.45 days for the accelerated group ($p < 0.001$). The episodes of early relapses were 2.1% in the standard group and 2.4% in the accelerated group. The rates of complications were comparable between the groups.

Conclusion: Treatment of congenital clubfeet using the twice weekly casting appears to provide comparable outcomes to the weekly Ponseti casting with a significant reduction in the duration of the casting phase.

Keywords: Clubfoot; Pirani score; Ponseti technique; Accelerated.

Introduction

Congenital clubfoot, also known as congenital talipes equinovarus, is a developmental deformity of the foot [1,2]. It is characterized by equinus of the ankle, varus of the hindfoot, adduction of the midfoot and cavus deformity [3, 4].

The deformity is most often idiopathic but may be associated with other conditions in about 20% of cases [2, 3]. The incidence ranges from 1-2 per 1000 newborns [4, 5, 6]. It is twice as common in boys than girls [4, 7].

Two classification systems have been widely used in the evaluation of clubfoot deformities which include Pirani and Dimeglio systems [3]. Good correlation has been shown between the two systems [3]. Pirani system was used for this study because it is quick, reliable, and easy to use [8].

The management of clubfoot is multidisciplinary, involving paediatric orthopaedic surgeons, physiotherapists, nurses, plaster technicians, orthotists and other allied professionals [5].

Most orthopaedic surgeons agree that the initial treatment of idiopathic clubfoot should be gentle manipulation, with serial casting, splinting or strapping to maintain the correction [9, 10, 11]. The long-term goal of treatment is a functional pain-free, plantigrade foot with good mobility, without calluses and without the need for shoe-wear modification [4, 6, 12].

Clubfoot management with the Ponseti method has been shown to be more effective, producing better results and fewer complications than traditional surgical methods [5, 8]. With this method, the deformity is corrected by weekly manipulation and plaster casting [8, 13]. All the components of the deformity are usually corrected within 4-5 sessions of weekly manipulation and casting for severe deformities, with the exception of equinus [11, 13]. Percutaneous Achilles tenotomy is often required to complete the correction [5, 11, 13]. Alteration in the frequency of casting in the traditional Ponseti technique by casts changed after 5 days instead of 7 days has been shown to shorten the duration of treatment with comparable outcomes [11].

Since the introduction of Ponseti technique in our institution, the caseload has increased steadily leading us to seek ways to shorten the period of correction of clubfoot. The accelerated Ponseti method, involving twice weekly serial manipulation and casting was therefore adopted for some patients. This aim of this study was to compare the

outcomes of the standard (weekly manipulation and casting) and the accelerated (twice weekly manipulation and casting) Ponseti method.

Patients and Methods

The study was undertaken at the National Orthopaedic Hospital, Enugu, Nigeria. The hospital is a regional orthopaedic and trauma centre located along an expressway. It serves the South-East, South-South and part of the North-Central zones of Nigeria. All patients presenting to our clinic with idiopathic clubfoot who met the inclusion criteria were enrolled in the study.

Inclusion criteria were as follows: patients with idiopathic clubfoot, less than 4 years of age at commencement of treatment, and parents' willingness to participate in the study.

Children with prior history of surgical correction and clubfoot due to secondary causes (neural tube defects, tibial deficiency, associated with arthrogryposis, etc.) were excluded.

Ethical clearance was obtained from the hospital ethical committee prior to commencement of the study.

Sixty-four patients with 94 clubfeet were recruited for this study between January 2015 and January 2016. Patients were followed up for a minimum of 3 months, which corresponds to end of the period of 23 hours bracing and commencement of night bracing, after a period of 2 months allowance for manipulation and casting, including tenotomy, if required. Two patients were lost to follow-up, leaving sixty-two patients with 90 feet available for further evaluation.

Patients were allocated to the Standard or Accelerated treatment groups based on their place of residence. Thirty-four patients with 48 clubfeet were allocated to once weekly (on Fridays) manipulation and plaster cast changes (standard Ponseti group) and 28 patients with 42 clubfeet were allocated to twice weekly manipulation and plaster cast changes (accelerated Ponseti group), based on geography alone. Weekly casting was performed for local residents and twice weekly casting for those that resided outside our city. No other variables were taken into account when setting this schedule.

Assessment of patients and documentation through a structured proforma were done during each visit to the clubfoot clinic. The severity of the deformity was scored according to the Pirani system. The sequence of correction and manipulation technique were in accordance with

Ponseti principles. A toe-to-groin plaster cast with the knee in 90 degrees flexion was used to maintain the correction. Once 50-70 degrees of foot abduction was obtained, the residual equinus was corrected. A handheld goniometer was used to measure the passive ankle dorsiflexion and plantarflexion of the foot.

After achieving 60 degrees of foot abduction, when dorsiflexion of the ankle was less than 15 degrees, a percutaneous Achilles tenotomy was performed on an outpatient basis. The last plaster cast following tenotomy was applied in a position of maximum of dorsiflexion with 60-70 degrees of abduction for a period of 3 weeks.

The duration of cast correction was determined from the time of application of the first cast, using the Ponseti method, to a point where at least 60 degrees of foot abduction and 20 degrees of foot dorsiflexion were achieved, irrespective of whether it was achieved with manipulation and casting alone or with percutaneous tenotomy. The angles were measured by one of the authors. After removal of the final cast, the feet were placed in an abduction brace set at 45 degrees for the normal foot and 70 degrees for the clubfoot. In bilateral cases, both feet were set at 70 degrees of abduction. The brace was maintained for 3 months full time (at least 23 hours a day). All patients were followed up at least to the end of the full-time bracing period.

Following the 3 months of bracing, passive dorsiflexion and forefoot abduction were measured with handheld goniometer. Episode of early relapse was determined by loss of foot abduction and dorsiflexion.

The data were presented in tables, figures, and charts. The data were analyzed with electronic computer software, Statistical Package for Social Sciences (SPSS) version 22.0. Descriptive statistics which includes frequency and percentages were used to summarize categorical variables while mean and standard deviations were obtained for continuous variables. Associations between categorical variables were done using Chi square and Fisher's exact tests. Means of continuous variables were compared using t test, ANOVA and Duncan multiple comparison test. The results were considered significant when the p-value was less than 0.05.

Results

The mean age was 11.8 months for standard group and 8.1 months for accelerated group (range 1 month to 3 years). Children less than one year of age comprised 58% of the

standard and 75% of the accelerated treatment group. There was no difference between the 2 groups in terms of age, sex or laterality (Table 1).

Patients required between one and eight casts for correction of the deformity. The average number of casts did not differ significantly between the treatment groups. As expected, a significantly shorter duration was seen in the total treatment duration in the accelerated Ponseti group, regardless of age at presentation (Table 2).

Percutaneous tenotomy was performed in 43% of the accelerated Ponseti group and 59% of the standard Ponseti group. The difference was not statistically significant (Table 3). The progressive reduction in Pirani scores measured during each casting session followed a similar

	Standard Ponseti n (%)	Accelerated n (%)	P value
Age group			
01--12	20 (58.8)	21 (75.0)	0.322
13 - 24	10 (29.4)	6 (21.4)	
25 - 36	4 (11.8)	1 (3.6)	
Sex			
Male	21 (61.8)	18 (64.3)	0.838
Female	13 (38.2)	10 (35.7)	
Side involved			
Right	16 (47.1)	8 (28.6)	0.285
Left	4 (11.8)	6 (21.4)	
Both	14 (41.2)	14 (50.0)	

Age at presentation	Characteristics	Standard	Accelerated	P- value
<1 year	Mean Pirani Score at presentation	4.78 ± 1.19	4.57 ± 1.55	0.576
	Mean Number of casts	4.00 ± 1.49	3.25 ± 1.29	0.106
	Mean Duration of cast correction(days)	28.00 ± 10.47	11.10 ± 4.71	<0.001
≥1 year	Mean Pirani Score at presentation	4.13 ± 1.53	4.08 ± 2.07	0.939
	Mean Number of casts	4.50 ± 1.86	4.50 ± 1.77	1
	Mean Duration of cast correction(days)	31.50 ± 13.03	15.50 ± 6.21	0.004

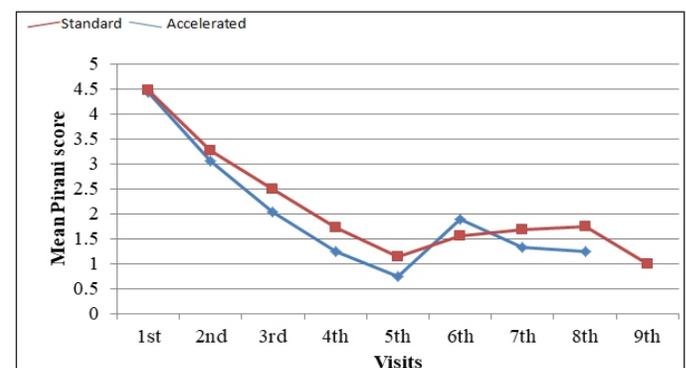


Figure 1: Comparison of mean Pirani scores between standard and accelerated Ponseti groups with respect to visit days.

Achilles tenotomy	Standard n (%)	Accelerated n (%)	P value
Yes	20 (58.8)	12 (42.9)	0.211
No	14 (41.2)	16 (57.1)	

Complications	Standard n(%)	Accelerated n (%)
< 1 year		
Nil	17 (94.4)	19 (95.0)
Pressure sores	1 (5.6)	1 (5.0)
≥ 1 year		
Nil	15 (93.8)	8 (100.0)
Pressure sores	1 (6.3)	0 (0.0)

Relapse	Standard n (%)	Accelerated n (%)
< 1 year		
Yes	0 (0.0)	1 (3.3)
No	25 (100.0)	29 (96.7)
≥ 1 year		
Yes	1 (4.3)	0 (0.0)
No	22 (95.7)	12 (100.0)

pattern in both groups (Fig. 1).

Pressure sores occurred during the casting phase in 2 patients in the standard and 1 child in the accelerated group (Table 4). There was one early relapse in each of the two groups (Table 5).

Discussion

There was a higher preponderance of boys in our study in keeping with findings of other studies of children born with clubfoot [14].

Adewole et al reported that the Pirani score at presentation was 4 or greater in 68% of children with clubfoot [15]. In the present study, a similar proportion of children had Pirani scores greater than 4. The severity of the score did not significantly affect the treatment outcome in this study. The mean Pirani score after correction of the foot deformities, were not significantly different in the accelerated and standard Ponseti groups regardless of age at presentation. This is similar to results reported in other studies [16, 17] supporting our hypothesis that accelerating the casting protocol to a twice-weekly regime does not cause any additional harm whilst providing

similar outcomes.

Additionally, Harnett et al reported an accelerated casting protocol of three times weekly casting. It was found that the Pirani scores at various stages of cast sessions were comparable in the standard Ponseti and the accelerated group [16].

Morcuende et al compared the outcomes between two groups of children who underwent Ponseti casting every 5 days or once weekly [11]. Their patients required between one and seven casts for full correction, with 90% of patients requiring five or fewer casts. This is comparable to our results. In addition, we found that the average number of casts did not differ significantly in the standard or accelerated treatment groups. Age at presentation was not a factor in determining the number of casts required.

Several previous studies have demonstrated significant reductions in treatment time using an accelerated casting protocol as part of Ponseti method [18, 19]. A prospective randomized controlled trial involving forty children who were less than 3 months of age compared biweekly casting in the accelerated group and weekly casts as per the conventional Ponseti method [17]. The average duration of treatment was 15 days in the accelerated group and 35 days in the conventional group.

Harnett et al recruited 40 patients (61 clubfeet) and compared standard weekly plaster to three times per week. Their study showed that the median number of treatment days was 16 in the accelerated Ponseti group and 42 in the standard Ponseti group [16]. They also found no statistically significant difference in the treatment outcome of the two groups.

The rate of Achilles tenotomy was approximately 50% in the present study which is lower than the typical rates of tenotomy in the literature. These include a study done by Changulani et al in which 85% of the patients had Achilles tenotomy [20]. Another study done by Herzenberg et al showed that 91% of patients with clubfeet who were treated with Ponseti underwent tenotomy [9].

None of the children in present study required extensive soft tissue releases for complete correction of deformity. This underscores the effectiveness of Ponseti method even in older children, when strictly adhered to. In contrast, Xu et al compared accelerated Ponseti technique to standard Ponseti technique; 4 clubfeet (10%) in the accelerated group and 3 clubfeet (10%) in the standard Ponseti group, had corrective surgery for complete correction of the deformity [21].

The only complication seen during the course of treatment was pressure sores. Its occurrence was slightly more in the standard Ponseti group, probably due to the relatively longer time in cast before each change. Sharma et al reported no complications due to casting [17].

Early relapse after 3 months of bracing was noted in one foot in each of the groups. In a study by Elgohary and co-workers, the relapse rate was 15.6% in the accelerated and 14.7% in the standard group [18]. The difference in relapse rates may be due to the longer follow-up period (12-48 months) as against 3 months in this study. The rate of relapse was attributed to higher Pirani scores at presentation, delay in the procurement of and non-compliance with foot abduction braces respectively. With longer follow-up, it is conceivable that there will be a certain number of relapses due to similar reasons in our study group.

The limitations of this study include relatively small numbers of patients and short follow-up period. The patients enrolled in this study are under active follow-up and we hope to report on longer term outcomes in due course.

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