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EVALUATION OF THE PONSETI TECHNIQUE TO ASSESS THE EFFICACY OF PONSETI METHOD OF TREATMENT IN CONGENITAL CLUB FOOT BY PIRANI SCORE: AN INTERVENTIONAL STUDY

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Summary

Objectives. Clubfoot has been an unsolved clinical challenge for the orthopedic surgeons and it is one of the congenital deformities in children. Around one lakh (100000) babies born with clubfoot deformity throughout world each year, out of which 80% cases occur in developing countries.

Material and methods. A total of 23 children (32 feet) in children below 2 years of age with unilateral or bilateral idiopathic clubfoot deformity who presented to outpatient department between September 2016 to September 2018 were included in the study and were treated conservatively by use of Ponseti method.

Results. The mean age of presentation was 17.9 weeks, with male to female ratio – 2.28:1. The mean initial Pirani score was 5.26 ± 2.89 . The relationship between number of casts and the respective Pirani score was assessed using the Spearman's rank correlation coefficient and a positive correlation was found. The mean number of casts required was 6.43 and in 68.75% feet Tendo Achilles tenotomy was needed.

Conclusion. Ponseti method is a very effective method to treat idiopathic clubfoot. It avoids the complication of surgery and gives a painless, mobile, normal looking, functional foot and allows fairly good mobility.

Keywords: Clubfoot, Ponseti, Pirani score

Introduction

Clubfoot is one of the most common congenital orthopedic anomalies described by Hippocrates in the year 400 BC. The incidence of clubfoot in India is approximately 0.9 in every 1000 live births. In developing countries, the problem is more severe due to late presentation, a higher rate of dropouts (of treatment), and superstitious beliefs attached to this congenital problem [1]. Although most cases were sporadic occurrences, families have been reported with clubfoot as an autosomal dominant trait with incomplete penetrance. The etiology of clubfoot is unknown. Most infants who have clubfoot have no identifiable genetic, syndrome, or extrinsic cause. However, it continues to challenge the skills of the pediatric orthopedic surgeon as it has a notorious tendency to relapse, irrespective of whether the foot is treated by conservative or operative means. The goal of treatment was to reduce or eliminate all the components of congenital clubfoot deformity so that the patient has a functional, pain-free, normal-looking plantigrade foot with good mobility, without calluses, and no modified shoes. Many different forms of treatment ranging from gentle manipulation and strapping, serial plaster corrections, forcible manipulations, and mechanical devices to surgical correction have been tried. Conservative methods are often targeted at achieving painless plantigrade foot with good mobility and no need for modified or special shoes [2]. In the fifties, Ponseti developed

another conservative method for correcting clubfoot which involved manual manipulation and plaster casting every week. He avoided open surgery in 89% of cases and used his manipulation, casting, and limited surgery [3]. Ponseti's method also includes Achilles tenotomy, which has proven successful in up to 98% of cases with clubfoot deformity. Ponseti cases were reviewed by Cooper and Dietz with an average of 30 years of follow-up and found that 78% of the patients had achieved excellent or good functional and clinical outcomes compared with 85% in a control group without congenital foot deformity [4]. The present study a critical evaluation of the Ponseti technique to assess the efficacy of Ponseti method of treatment in Congenital talipes equinovarus (CTEV) by Pirani score.

Material and methods

This interventional study was conducted in our hospital from September 2016 to September 2018. After obtaining written informed consent, twenty-three cases that fit the inclusion criteria were included in the study. The study population included unilateral or bilateral idiopathic clubfoot patients. Formal ethical committee clearance was undertaken before the study [IEC No: 255/26.07.2015]. The Inclusion Criteria were children with age less than two years having unilateral or bilateral idiopathic clubfoot and those willing to participate in the study. Those who were earlier

treated with other plaster cast application methods or earlier operated for clubfoot or those with a concomitant major illness, with atypical or secondary clubfoot and refusal to consent for the study were excluded.

Patients were evaluated through a detailed history and physical examination. Routine blood and urine investigations were done to rule out any accompanying medical or surgical problems. Every clubfoot taken up for the study was graded according to the Pirani severity score for hind foot, midfoot, and total. The Ponseti technique of manipulation and follow up:

The corrective process utilizing the Ponseti technique can be divided into two phases:

1. Treatment phase: In this phase the deformity was corrected.

2. Maintenance phase: During this phase, a brace was utilized to prevent recurrence.

The treatment phase starts as soon as the child's skin condition permits the use of plaster casts; until that time, the mother's regular corrective manipulation of the foot was carried out. The treatment phase was started with the first cast aiming to align the forefoot with the midfoot and hind foot. This was achieved by:

1. Stabilizing the talus by placing the thumb over the lateral part of its head.

2. Elevating the first ray to achieve supination of the forefoot in respect to the midfoot and hind foot.

3. The treating surgeon then applied a well-padded plaster cast by holding this position and molding it well. In doing so, the cavus was corrected, typically after one cast.

One week later, the first cast was removed, and if the cavus had been corrected, then after a short period of manipulation, the next toe to groin plaster cast was applied by:

1. Stabilizing the talus by placing the thumb over the lateral part of its head.

2. The treating surgeon holds the supinated foot in abduction while applying the cast.

3. He then applies a well-padded plaster by holding the corrected position and molding it well.

4. After one week, the first cast is removed, and if the cavus is corrected, then after a short period of manipulation, the toe to groin plaster cast is applied.

In the Ponseti technique, the heel is never directly manipulated. Heel varus and ankle equinus are corrected simultaneously because of the coupling of tarsal bones. Although, in the Ponseti technique, some amount of equinus deformity persists, and their correction is done by percutaneous surgical release of the tendon. After tenotomy is done, the final cast is applied with the foot in 70 degrees of abduction and 10-15 degrees of dorsiflexion, and the cast is retained for three weeks. When the final cast is removed, an orthosis, i.e., shoes mounted to a bar, is used to maintain a foot in its corrected position.

The data for all the parameters was entered in the word Excel spreadsheet (2007). They were organized and analyzed using the software SPSS - version 21.0 and descriptive statistical analysis was used for the analysis of the data. Correlation was made using Pearson correlation.

Results

In our study, 23 patients with 32 feet of CTEV were treated with the Ponseti method in the Department of Orthopedics. All patients were treated on an outpatient basis. According to the Pirani scoring system, patients were followed up regularly during the study, and the scoring of feet was done each week in between casts. The mean follow-up duration (9 to 23 months) was 16.13.

The mean age of presentation was 17.9 weeks (range of 20 days to 40 weeks). Twelve patients were (52.17%) between 0 to 12 weeks, six patients (26.08%) between 13 to 24 weeks, three patients were (13.04%) between 25 to 36 weeks, two patients (8.6%) were more than 37 weeks at the time of the first presentation. There were 16 males (65.2%) and seven females (34.8%) in our study, and the male: female ratio was calculated to be 2.28:1. Nine (39.13%) patients had bilateral involvement, while seven (30.43%) had each right and left side involvement. The mean $\pm$ standard deviation of the severity is depicted in table 1.

Table 1

Mean, standard deviation and range for the severity score

SEVERITY SCORE	MEAN $\pm$ SD	RANGE
Initial total Pirani score	5.26 $\pm$ 2.89	4.0 – 6.0
Initial Midfoot score	2.50 $\pm$ 4.68	1.6 – 3.0
Initial Hindfoot score	2.76 $\pm$ 2.96	2.0 – 3.0

The total number of casts required in our patients is shown in table 2.

Table 2

Total number of casts required for correction

Number of casts required	Number of feet	Percentage (%)
4 casts	1	4.34
5 casts	2	8.69
6 casts	9	39.13
7 casts	8	34.78
8 casts	3	13.04
Total	32	100

There was a positive correlation of value 0.46 between the severity of the deformity and number of casts which was statistically significant (p value 0.003). Again, the requirement of tenotomy was more in more severe cases as seen in table 3.

Table 3

Association between initial Pirani score and requirement for tenotomy (N = 23)

Initial Pirani Score	Requirement of tenotomy		P value
	Yes	No	
< 5	6	0	< 0.001
$\geq$ 5	3	14	
Total	9	14	

Complications:

There was no major complication with this technique but one patient had developed blister, slight swelling of the toes which delayed next cast by one week. No infection, skin necrosis, neurovascular compromise or post-tenotomy profuse bleeding were observed.

Relapse:

Four feet (in 3 patients) developed relapse, one foot in cavus and three foot in adducts. All three patients were defaulters of Dennis Brown splint. For cavus foot, two corrective casts at weekly interval was required while to correct adduction deformity, two feet required three casts and one foot required two casts.

Treatment Failure:

Full correction was achieved in all 32 (100%) feet. There were no relapses in the two years follow up.

Discussion

The main objective of the treatment for congenital clubfoot is to obtain a pain-free plantigrade foot with good mobility and without calluses. Children who suffer from such deformation undergo surgery to complete the correction. This can range from a percutaneous heel cord lengthening to a wide release of medial, posterior and lateral structures, with or without transfer of anterior tibial tendon [5, 6]. Treatment should be initiated as soon as possible within the first week of life. The majority of the clubfeet can be corrected in infancy, in about 6-8 weeks, with proper, gentle manipulation and plaster cast followed by tenotomy [7].

The mean age of all patients in this study was 17.9 weeks (range of 20 days to 40 weeks). This observation was similar to Agrawal RA, et al. [8], where the mean age of presentation was three months and also similar to Chauhan KM, et al. [7]. However, Sanghvi AV, et al. [9] reported 26 days, Willis RB, et al. [10] reported median age of 2 weeks, and Halanski MA, et al. [11] reported mean age of 24 days. But it was found that there was no difference between the two groups (below six months and above six months of age at the time of presentation) in the number of casts, tenotomies, success in terms of rate of initial correction, rate of recurrence, and rate of tibialis anterior transfer. In our study, the ratio of males and females was 2.28:1. This ratio is similar to Morcuende JA, et al. [12] and Chauhan KM, et al. [7]. Palmer RM [13] explained that females require a higher number of predisposing factors

than males to acquire clubfoot deformity. Dobbs MB, et al. [14] explained that the incidence is higher in males, as females require a more significant genetic load to produce clubfoot deformity.

In our study, 39.13% of total patients had bilateral involvement, which is consistent with Sanghvi AV, et al. [9], whereas Agrawal RA, et al. [8] had bilateral involvement of 46.1%. The mean number of casts required for full correction was 6.43, consistent with Agrawal RA, et al. [8]. The mean initial Pirani score in our study was found to be 5.26 ± 2.89 . The corresponding hind foot score and midfoot scores were 2.76 ± 2.96 and 2.50 ± 4.68 , respectively, which is consistent with Chauhan KM, et al. [7] and Halanski MA, et al. [11].

In our study, out of 32 feet treated by the Ponseti method, the tenotomy was required in 22 feet (68.75%), and the rest 10 feet (31.25%) did not require tenotomy. This finding is consistent with Dyer PJ, et al. and Docker CE, et al. [15, 16]. Chauhan KM, et al. and Agrawal RA, et al. found a higher percentage of cases requiring tenotomy [7, 8].

No major complications were found in our study, except one patient had developed blisters, swelling of toes which delayed the next cast by one week. Lourenco AF, et al. [17] reported 4 out of 178 cases developed complications like erythema, slight swelling of toes, and redness of the skin due to excessive pressure.

In our study, three patients (4 feet) developed relapse; one foot in cavus and 3 feet in adducts. All three were defaulters of Denis Brown's splint. Morcuende JA, et al. reported 10% of cases that developed relapse [12]. Terrazas-Lafargue G, et al. found 22% of cases that developed relapse due to non-compliance of braces [18].

Limitations:

The sample size was small, and the study was hospital-based, for which many CTEV cases lying neglected in the community could not be reached.

Conclusion

Ponseti method has been proved to be very effective in the treatment of idiopathic clubfoot. While it avoids the need for complex surgeries, it also gives a painless, mobile, normal looking, functional foot and allows fairly good mobility. Hence, in all patients with idiopathic clubfoot, Ponseti method of treatment of serial casting should be followed.

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