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The outcome of Ponseti technique for idiopathic clubfoot

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Abstract

Aims and objectives: Idiopathic congenital talipes equinovarus is a complex deformity that is difficult to correct. The treatment of clubfoot is controversial and continues to be one of the biggest challenges in paediatric orthopaedics. Most orthopedists agree that the initial treatment should be non-surgical and should be started soon after birth.

Methodology: 30 patients underwent the Ponseti method at the Department of Orthopaedics, and patients were followed up regularly at monthly intervals. The severity of foot deformities were graded as per Pirani's scoring system.

Results: Good results were obtained in 28 patients. 2 Patients developed recurrence of the deformity due to non-compliance of the use of Orthotics.

Conclusion: The Ponseti method is a safe and cost effective treatment for congenital idiopathic clubfoot and radically decreases the need for extensive corrective surgery. Non-compliance with orthotics has been widely reported to be the main factor causing failure of the technique.

Keywords: idiopathic clubfoot; CTEV; ponseti

Introduction

Idiopathic clubfoot or CTEV is the commonest orthopaedic congenital condition which has been treated since the times of Hippocrates with unsatisfactory results. The results have improved over time owing to the increasing knowledge about the etiology and pathoanatomy of the club foot. The treatment methods also have changed over time. Clubfoot occurs in one in 1000 live births and is one of the most common birth defects involving the musculoskeletal system^[1]. CTEV results in an equinus deformity characterized by ankle plantar flexion, subtalar inversion and adduction of the hind and forefoot. The foot itself is usually short and broad in appearance. The muscles of the lower leg are often small in diameter and do not fully develop. The incidence among different races ranges from 0.39 per 1000 among the Chinese population to 1.2 per 1000 among Caucasian to 6.8 per 1000 among Polynesians^[2]. Lochmiller 1998 reported a male to female ratio of 2.5:1 and 24.4% of the affected individuals have a family history of idiopathic talipes equinovarus^[3].

Treatment of this deformity dates back to fifty century B.C, by Hippocrates and has since undergone tremendous changes largely due to a better understanding of the deformity. Over the years may different forms of treatment ranging from gentle manipulation and strapping, serial plaster corrections, forcible manipulations including the use of mechanical devices to surgical correction have been tried.

Although some success with non surgical treatment has been reported in the literature, results have often been less than optimal, with partial corrections, recurrence, and other complications^[4]. This had led to a trend toward surgical intervention, usually within the first year of life⁵ however, surgical treatment also carries significant risks, and the potential for complications is great.

There has been much debate in the past as to whether a conservative or operative treatment was more effective in the treatment of clubfoot. Those feet usually which have had numerous manipulations, operations and neglected are stiff, deformed and rigid due to scar tissue formation.

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The Ponseti treatment for clubfoot deformity was introduced in North America in the late 1940s and has become a primary treatment option in many countries more recently. Ignacio Ponseti, MD, at the University of Iowa, developed an inexpensive and effective method of treating clubfoot by serial manipulation, a specific technique of cast application, and a possible percutaneous Achilles tenotomy. The clinical correction achieved by using this method has produced a functional, plantigrade foot without requiring posteromedial release in 85% to 90% of cases [6].

Long-term follow-up studies show that feet treated by Ponseti management are strong, flexible, and pain free. These studies prove that Ponseti management of clubfoot is best for all countries and cultures.

Higher number of patients coming to our center from nearby districts, the unsatisfactory results associated with complete soft tissue releases at ten to fifteen years of follow up and good to excellent results by Ponseti technique reported by many authors encouraged us to study the subject.

Methodology

This study includes 30 patients from outpatient section of Department of Orthopaedics.

Inclusion criteria

- Children between 7 days to 2 year of age with idiopathic clubfoot.

Exclusion criteria

- Patients aged more than 2 year of age.
- Clubfoot secondary to syndromic involvement, polio, CP.
- Patients that have undergone prior surgical intervention for clubfoot.

1. Demographics

Demographic data (name, age, sex and date of birth of the child, educational level, and income of the parents etc) were obtained from the parents during their visits.

2. History

A complete and detailed history was taken in every case. Antenatal, natal and postnatal history of mother was taken to find any eventful condition during or after pregnancy. Family history for clubfoot and other congenital diseases was also inquired. Each patient was subjected through general, physical and systemic examination including spine, hip and extremities.

3. Pre-treatment assessment

After taking complete history, mobility of foot was assess gentle corrective manipulation. Foot was classified into supple type if reduction was possible; and rigid type, where manual reduction was impossible.

Children were evaluated and graded for severity of clubfoot by Pirani severity scoring system [78, 79, 93], which registers the deformity of six different components of the clubfoot.

The congenital clubfoot undergoing treatment was assessed at

each visit and assigned.

- a) A Mid foot Score (MS) of up to 3 (0=normal, 3=severe deformity)
- b) A Hind foot Score (HS) of up to 3 (0=normal, 3=severe deformity)
- c) A Total Score (TS) of up to 6 (0=normal, 6=severe deformity)

Consequently, the total Score was from 0 to 6 points, with 6 representing the most severe deformity.

Use of Pirani Score

Every clubfoot under Ponseti management was “Scored” at each week for HS, MS ad TS (Total Score).

The Scores were plotted on a graph to know how the foot was recovering on the roadmap of treatment.

Tenotomy was indicated when HS>1, MS<1 and the head of the talus was covered.

After calculating Pirani Severity Score at initial presentation and at weekly interval during follow up, it was noted in proforma specially made for it.

Results

Table 1: Age distribution

Age	Number of cases	Percentage
0-6 month	23	77%
0.6-1 year	3	10%
1-2 year	4	13%

Most of the children were below 6 months of age. The youngest in the series was of 8 days, while oldest was of 1 year 10 months.

Treatment was begun at less than six months of age in 23 cases (77%). In rest of the cases, treatment was initiated at more than 6 months of age.

Table 2: Pre-treatment pirani scores (According to pirani)

Group	Score	No. of Feet	Percentage
I	1.5-2.5	0	-
II	3.0-4.5	16	40%
III	>5	24	60%
Total		40	100%

The deformity was classified, according to the Pirani scoring system into 3 groups. Group-I with a Score of 1.5 to 2.5 points ABSENT, Group-II with a Score of 3 to 4.5 points was seen in sixteen feet (40%) and group-III the most common category with a Score of >5 points was seen in 24 feet (60%). In present study, majority of the feet (60%) were having pre-treatment Pirani Score between >5.

Table 3: Initial pirani score versus no. of casts required

Group	Score	No. of Cast		
		4-6	7-9	>10
0-6 month	1.5-2.5	---	---	---
0.6-1 year	3.0-4.5	4	1	3
1-2 year	>5	13	6	4

Table 4: Need for tenotomy among different groups

Group	Tenotomy done		Tenotomy not done		Total No. of feet	
	Foot	%	Foot	%	Foot	%
I	---	---	---	---	---	---
II	14	88%	2	12%	16	100%
III	24	100%	---	---	24	100%

In group-II with Score of 3 to 4.5 points, 14 feet (88%) underwent percutaneous tenotomy, while in group-III with Score of 5 points; all feet (100%) required the tenotomy.

Table 5: Number of casts

Group	No of Feet	Total No. of Casts	Mean No. of casts
I	0	---	---
II	16	96	6.0
III	24	173	7.2
Total	40	269	6.6

The mean number of casts that were applied to obtain correction was 6.6 (Range-4 to 14 casts). The more severe the initial deformity (Higher Pirani Score), the more casts were required to obtain correction.

Table 6: Compliance with steenbeek brace

Compliance with treatment	No. of patient	Percentage
Yes	28	93%
No	2	7%

Table 7: Showing relapse of treated foot

Relapse	No. of patient	Percentage
Yes	2	7%
No	28	93%

Table 8: Complications

Complications	No of feet	Percentage
Abrasion	2	6%
Loosening of cast	1	3%
Blister	1	3%

Table 9: Result of treatment at final follow up

Result	No. of patient	Percentage
Good	28	93%
Fair	2	7%

Discussion

When the feet were divided on the basis of the age at first reporting, it was seen that a large proportion of patients were seen very early in life. The youngest patient who was included in the study was less than 8 days old. The mean age at initial presentation of 10.2 weeks is in agreement with age incidence observed by

Dobbs *et al.* [7] who reported clubfeet in 51 patients at mean age of 12 weeks, at initial presentation. While in the study of 70 patients, by Laaveg and Ponseti [8], the mean age was 6.9 weeks at initial presentation.

A mean age of 10.8 weeks was reported by Lehman *et al.* in a series of 30 patients treated by Ponseti technique. In the present study clubfoot deformity was classified, according to the Pirani scoring system into 3 groups Group-I with a Score of 1.5 to 2.5 points was absent, Group-II, with a Score of 3 to 4.5 points was seen in sixteen feet (40%) and group-III the most common category with a Score of 5 points was seen in twenty four feet (60%). Overall mean Pirani Score of 4.8 was recorded for all feet. Similarly mean Pirani Score of 4.6 was noted by Lehman *et al.*

We found that those feet belonging to Group II were more amenable to correction and responded relatively early when compared to those belonging to Group III.

In the Morcuende *et al.* series, no assessment regarding the security of the deformity was available before the initiation of the castings. They used number of casts needed for correction of CTEV as a marker of severity of the deformity [3].

Raju Rijal *et al.* Showed in their series, faster rates of decrease in Pirani score (Improvement) treated by Ponseti technique, regardless of side, mean Pirani scores improved

much faster similar to our study [9].

Noam Bor *et al.* in their series had mean total Pirani score 4.7 (2 to 6) and the end Pirani score 1.2 (0 to 3.75) and mean number of cast required was 6 similar to our study [10].

In our study, number of casts required for full correction ranged from 4 to 6 and most patients requiring mean number of 5.8 casts.

In our study we used Pirani scoring system which is in accordance with Lehman *et al.* series, which shows Pirani scoring is easy to use and simple and fairly reproducible.

In our study 28(90%) patients required percutaneous tenotomy of Tendoachilles. In Morcuende *et al.* study (n=256) tendoachilles tenotomy was done in 86% of the cases [3].

In M Changulani *et al.* study, 85% (n100) patients required percutaneous tenotomy of tendoachilles. In Noam Bor *et al.* study 97% (n=36%) patients required percutaneous tenotomy of tendoachilles [10].

Colburn *et al* and Scher *et al.* requiring percutaneous tenotomy in 67% and 72% feet respectively. On the other hand Lehman *et al.* required as low as 25(55%) tenotomies in 45 clubfeet in 30 patients.

Most important observation noted from this study is the recognition that feet requiring tenotomies were equally well corrected clinically at the end of casting as those that did not require tenotomies. This conclusion reinforces the notion that even severe idiopathic clubfeet can be successfully treated using proper application of the Ponseti technique and the need for a tenotomy does not suggest a poorer result.

In the present study the mean number of casts that were applied to obtain correction in group I, II and III were 0.6 and 7.2 respectively. The more severe the initial deformity, the more casts were required to obtain correction.

However overall mean number of cast for all groups was 7.3 (Range, 4-14casts), which is quite similar to Laaveg and Ponseti [14] and Herzenberg *et al.* [22] who reported mean number of cast as 7.

In Morcuende *et al.* [3] series, number of casts ranged from 1 to 7, 90% of the patients required <5 casts for correction.

Lehman *et al.* was able to obtain correction with casting averaged 5.4(range being 4-9).

Similarly Scher *et al.* [11] reported mean number of casts as 5.7 (Range 4-9), while Dobbs *et al.* required 4.16±1.23 (Range 3-7 casts) cast for correction.

In present study minimum duration of plaster cast application was five weeks, maximum being fourteen weeks. Average duration was 7.3 weeks. It is quite similar with Herzenberg *et al.* [12] who reported casting for average of 8 weeks, range being 4-12 weeks.

While Morcuende *et al.* [3] reported that average time from first cast to tendoachilles tenotomy (Full correction of deformity) was 20 days which is lower than present study.

In the present series 6% of the patients (2 children) reported relapses after initial successful treatment. Similar observations were reported by Marcuende *et al.* [3] who reported that there were 17 (10%) relapse. While Dobbs *et al.* reported relapses in sixteen infants (31%, twenty-seven feet) at a mean age of six months (range, 3-18 months), when there was >5° of hind foot varus and/or <15° of ankle dorsiflexion. These relapses were significantly associated with non compliance with the Steenbeek Foot Abduction Brace (p<0.02). Relapses were treated with a second series of sequential manipulation and casting, followed by the strict usage of the orthotic.

Conclusion

- Ponseti Method is an excellent conservative method for treatment of Congenital Talipes Equino Varus (CTEV) deformity.
- Treatment must be started as earlier as possible.
- The patients who have lower Pirani score at initial visit (i.e., less severe deformity) respond better and faster to the treatment as compared to those who have higher Pirani score at initial visit (i.e. more severe deformity).
- Good casting technique helps in successful correction and to minimize complications.

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