



Evaluation of outcome in idiopathic clubfoot managed by Ponseti method

Orthopaedic

**Dr Hemeshwar
Harshwardhan**

Associate Professor, Department of Orthopedics, JLN Medical college, Ajmer

**Dr Poonam
Gogania**

Assistant Professor, Department of Physiology, JLN Medical College, Ajmer

ABSTRACT

Introduction: Congenital talipes equinovarus, also known as clubfoot, is a relatively common skeletal deformity characterized by an excessively turned-in foot and a high medial longitudinal arch. Three different forms of this disorder have been identified; positional or postural, idiopathic, and teratogenic or syndromic. The etiopathogenesis of this anomaly is not clearly known. Two genes, PITX-1 and RBM-10, have recently been reported to play direct or indirect roles in the pathogenesis of clubfoot. Clinical diagnosis is at a glance; X-ray analysis is initially unnecessary but should be used after treatment to follow the outcome. Various surgical or nonsurgical methods of treatment have been applied to treat this disorder. Pirani et al has developed a reliable and valid method of clinically assessing the amount of deformity present in unoperated congenital clubfoot of less than 2 years of age. **Material and method:** The subject enrolled in the study were consecutive patients presenting with Idiopathic CTEV, attending Orthopedic OPD from December 2015 to December 2016. **Results :** In total there were 30 children (44feet) presented with idiopathic deformity, treated by Ponseti technique, most of the children were below 6 week of age, when mobility of feet were analyzed with respect to different Pirani Score groups, it was also found that mean Pirani Score of supple and rigid feet were 3.19 and 5.42 respectively. The more severe the initial deformity, higher the Pirani Score, the more casts were required to obtain correction. **Conclusion:** The study clearly shows that, more severe the initial deformity, higher the Pirani Score, the more casts required to obtain correction. Age at initial presentation, quality (mobility) of foot and Pirani Score at presentation, has a direct bearing on final results.

KEYWORDS:

Congenital talipes equinovarus (CTEV), Pirani scoring, Ponseti method

1. INTRODUCTION

Congenital talipes equinovarus (CTEV), also known as congenital clubfoot, is one of the most common congenital skeletal deformities and involves malalignment of the calcaneo-talar-navicular complex. CTEV is characterized by irreducible equinus, varus of the hindfoot, adduction of the forefoot, cavus, and an "empty" heel pad with associated calf muscle atrophy. Most commonly, clubfoot presents as an isolated anomaly (idiopathic CTEV) but can also be associated with different disorders and malformative syndromes, such as distal arthrogryposis, myotonic dystrophy, chromosomal defects, sacral agenesis, spinal muscular atrophy, spina bifida, myelomeningocele and skeletal lower limb abnormalities^{1,2}.

In the clubfoot, the ligaments of the posterior and medial aspect of the ankle and tarsal joints are very thick and taut, thereby severely restraining the foot in equines and the navicular and calcaneus in adduction and inversion.

Most orthopedic surgeons have agreed that initial treatment of clubfoot should be nonsurgical and should started as soon as possible after birth¹. A variety of manipulation, splinting, strapping, bracing and casting techniques have been advocated in an attempt to achieve correction of the deformity^{3,5}, but the results reported in the literature³⁻⁸ suggest that the Ponseti method has become the gold standard of care for treatment of CTEV.

Aim of the study:-

1. To assess the effectiveness of Ponseti technique in management idiopathic club foot deformity.
2. Outcome of the treatment in relation to the initial Pirani scoring.

2. MATERIAL AND METHOD

The subjects enrolled in the study were consecutive patients with idiopathic club foot attending Orthopaedic OPD from December 2015 to December 2016, at JLN Medical college, Ajmer.

Ponseti and Smoley²³ described an assessment, which was purely

subjective and based on the severity of the deformity and flexibility of foot. Pirani et al has developed a reliable and valid method of clinically assessing the amount of deformity present in un-operated congenital clubfoot of less than 2 years of age. It allows the treating practitioner to know how patient is responding to the treatment, to know when tenotomy is indicated, and to reassure the parents regarding progress.

The Pirani severity scoring system registers the deformity of six different components of the clubfoot, comprising of two scores i.e. Mid foot Score and Hind foot Score, scoring six clinical signs, each component is given a score of 0, 0.5 or 1.0

Mid foot Score :- Three signs comprises the Mid foot Score (MS), grading the amount of midfoot deformity between 0 and 3. Curved lateral border, Medial crease, and Talar head coverage.

Hind foot Score :- Three signs comprises the Hind foot Score (HS), grading the amount of hindfoot deformity between 0 and 3. Posterior crease, rigid equinus, and Empty heel.

Consequently, the total Score is from 0 to 6 points, with 6 representing the most severe deformity. In the present study we have used Pirani severity scoring system for assessing clubfoot deformity.

In Ponseti method Correction of clubfoot is accomplished by abducting the foot in supination while counter pressure is applied over the lateral aspect of the head of the talus to prevent rotation of the talus in the ankle. A well-molded plaster cast maintains the foot in an improved position. The ligaments should never be stretched beyond their natural amount of give. After 5 days, the ligaments can be stretched again to further improve the degree of correction of the deformity. Patient was called at weekly interval for repeat corrective casts and Pirani scoring was done at each visit.

Before applying the last plaster cast, the tendo Achillis may have to be percutaneously sectioned to achieve complete correction of the

equinus. The tendo Achillis, unlike the tarsal ligaments that are stretchable, is made of non-stretchable, thick, tight collagen bundles with few cells. The last cast is left in place for 3 weeks while the severed heel-cord tendon regenerates in the proper length with minimal scarring.

Categorization of feet

The feet were classified into three categories with respect to the severity of the deformity on basis of initial Pirani score.

Group 1- feet with a pirani score of 1.5 to 2.5 points.

Group 2- feet with a pirani score of 3 to 4.5 points.

Group 3- feet with a pirani score of 5 points or more.

Treatment Regimen

The ponseti technique^{24,25} was used at our institution, the patients returned in 5 to 7 days and all the casts were removed. The mobilization and casting were continued at each visit, the simultaneous correction of the cavus, Adduction deformity and heel varus was done. The equinus was corrected at last, until all deformity were corrected, and the foot was able to be abducted 50° to 60° on the talus. A simple percutaneous tenotomy of the Achilles tendon was performed, if any residual equinus were observed i.e. after the abduction of the foot and the varus deformity of the heel has been corrected.

After the last cast was removed and once, all deformities were corrected, the patients were given Foot Abduction Brace (FAB). Patients were evaluated every 15 days, until the age of six months and every month after initial completion of treatment to encourage parental compliance to FAB and to evaluate maintenance of correction.

3. Observation and statistical analysis

The present study was carried out in the Department of Orthopedic, JLN Medical College & Hospital, Ajmer, Rajasthan. The subjects included in the study were consecutive patients presenting with Idiopathic CTEV attending Orthopedic OPD from December 2015 to December 2016. In total there were 30 children (44feet) presented with idiopathic clubfoot deformity, treated by Ponseti technique. Most of the children were below 6 weeks of age. The youngest patient in the series was of 3 weeks, while oldest was of 26 weeks. Treatment was initiated at a mean of 9.08 weeks of age (range, 3 to 26 weeks). Treatment begun was, at less than three months of age in 20 patients (80%). In only 3 patients treatment was initiated at more than 18 weeks of age. Male predominated about 72% of the population. The male to female ratio in the series was 2.5: 1. Of the 25 patient 14 (46.6%) had unilateral and 16(53.4%) had bilateral involvement, however right side was found to be more commonly involved (52%) in unilateral cases, when compared to left (48%).

Foot was classified into supple type, if manual reduction was possible and rigid type where manual reduction is not possible. By this method 66% feet were rated as supple and 34% as rigid at the time of initial presentation. Two children (8%) were treated with a cast before initial presentation at our institute, with mean of 7.8 casts (range, 5 -10 casts) have been applied. No patient had any corrective surgery before presentation.

Table 1 : PRE -TREATMENT PIRANI SCORES (According to Pirani)

S.no	Group	Score	No.of feet	Percentage
1	I	1.5-2.5	6	13.6
2	II	3.0-4.5	13	29.5
3	III	5or >	25	56.8
	Total		44	100

The deformity was classified according to Pirani Scoring System into 3 groups. Group I with a score of 1.5- 2.5 points were seen in 6 foot(13.6%), Group II category with a score of 3 to 4.5 points was seen in 13 feet (29.5%) and Group III the most common category with a

score of 5 points or more was seen in 25 feet (56.8%). In the present study majority of the feet (56.8%) were having pretreatment Pirani Score between 5 or more.

Feet classified in Group I, Group II and Group III mean Pirani Score were 2.25, 4.13 and 5.42 respectively. On comparing Pirani score with age at presentation, it was found that patient presenting early after birth were having mild or moderate deformity belonging to group I and group II while patients presenting late belong to group III.

When mobility of feet were analyzed with respect to different Pirani Score groups, it was found that majority of feet in group I and II were belonging to supple variety of feet while in group III majority of feet were belonging to rigid variety of feet. It was found that mean Pirani Score of supple and rigid variety of feet were 3.19 and 5.42 respectively.

In group II with score of 3- 4.5 points, 1 foot (8%) underwent percutaneous tenotomy, while in group III with of 5 points 13 feet (52%) required tenotomy. Total of 14 (32%) of the 44 clubfeet underwent percutaneous Achilles tenotomy to correct a residual equinus deformity. It was also found that mean Pirani Score of tenotomy feet 5.35 was higher than non-tenotomy feet 4.21.

There were 15 complications among all the casting performed, constituting 34% of total feet. Majority of complications were minor, like Erythema and Blisters. No infections, skin necrosis, neurovascular compromise or bleeding were observed, even in post tenotomy period.

4. RESULT

Patients were labeled as having good results if Pirani Score is 1.5 points or less or if deformities get corrected by Ponseti technique alone at final follow up. In present study about 82% of patient had good result and about 4.5% had fair results and 13.6% of patients had poor results showing failure with Ponseti technique. Overall 86.5% of the patient showed satisfactory results. No difference was found when results were compared with respect to sex incidence. In patients classified with group I and II, none of the patients required any extensive surgery to correct clubfoot deformity.

Even patient classified under group I did not require any tenotomy or posterior release to correct the deformity showing 100% results. About 100% of the patients having, Pirani Score less than or equal to 4.5 showed good results with Ponseti technique. However 68 % of the patients under group III also claimed good results with 24% patients having poor result.

Table 2 : Comparison of results with Pirani score at initial presentation

S. no	Foot grade	Good		Fair		Poor		Total	
		Foot	%	Foot	%	Foot	%	Foot	%
1	I	6	100	0	0	0	0	6	100
2	II	13	100	0	0	0	0	13	100
3	III	17	68	2	8	6	24	25	100
	Total	36	81.8	2	4.5	6	13.6	44	100

5. DISCUSSION

The mean age at initial presentation is 10 weeks is in agreement with age incidence observed by Dobbs et al⁷ who reported clubfeet in 51 patient, mean age of 12 weeks, at initial presentation. While in the study of 70 patients Leeveg and Ponseti¹³, the mean age was 6.9 weeks at initial presentation. A mean age of 10.8 weeks was reported by Lehman et al¹⁴ in a series of 30 patients treated by Ponseti technique. However Herzenberg et al⁸ reported a study of 27 patients in which all the patients presented within 3 month of age.

The mean of patients having rigid clubfoot (13 weeks) as compared to supple clubfoot (8 weeks) was definitely higher. The mean pirani score was much higher in patients having late presentation.

The age of initial presentation also had a bearing on, need of tenotomy as showed that only 27% of cases tenotomy was required where age of initial presentation was below 6 weeks, whereas tenotomy was required in 100% of the cases in those presented after 18 weeks of age. However after excluding those feet who had required PMSTR (failure with Ponseti technique) a very statistically significant was obtained, when need tenotomy, was compared with patients presenting at age less than 3 month of age to those presenting at more than 3 months of age.

The above observation clearly showed that presenting age at initial presentation has a direct bearing on quality (mobility) of foot, Pirani Score, the need of tenotomy and final results. In the present study mobility of foot was classified into supple type, if manual reduction was possible and rigid type, where manual reduction was impossible. By this method 43.2% feet were rated as supple and 56.8% as rigid at time of initial presentation. 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 seen in 6 (13.6%), Group-II category, with a Score of 3 to 4.5 was seen in 13 feet (29.5%) and group-III the most common category with a Score of 5 point was seen in 25 feet (56.8%). Majority of the feet (66%) were having pre-treatment Pirani Score between 5.0->5. Overall mean Pirani Score of 5.01 was recorded for all feet. Similarly mean Pirani Score was 2.25 in group I, while in feet classified in group II and Group III mean Pirani Score was 4.13 and 5.42 respectively.

The indication for tenotomy has been clearly described and is reported to be necessary in approximately 32% patients. Tenotomy of the Achilles tendon is an integral part of Ponseti technique^{24,25}. If residual equinus was observed after complete correction of adduction and varus deformity or when 15° of dorsiflexion could not be obtained with the use of casts a simple percutaneous tenotomy of the Achilles tendon was performed which allowed more expeditious correction of the clubfoot deformity, decreasing the number of casts and the overall duration of treatment. In the present study, in group –II with Score 3 to 4.5 points 1 foot (8%) underwent percutaneous tenotomy, while in group-III with Score of 5 or more points 13 feet (52%) required tenotomy. This is showing strong relation between higher Pirani Score at initial presentation and need of tenotomy. The study showed that there is direct correlation between the increased incidence of tenotomy with higher Pirani Score, with increased rigidity of clubfoot and with higher age at presentation.

In the present study the mean number of casts that were applied to obtain correction in group I, II and III were 4.6, 7.4 and 8 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 6.6 (range, 3 to 9 casts), which is quite similar to Laaveg and Ponseti¹³ and Hezenberg et al¹. Lehman et al¹⁴ was able to obtain correction with casting averaged 5.4 (range, 4-9). Similarly scher et al²⁵ reported number of casts as 5.7 (range, 4-7), while dobbs et al⁷ required 4.16±1.23 (range, 3-7 casts) cast for correction.

In the present study, the families of 3 children (12%) admitted that they had not complied with use of the FAB. Similar observation regarding noncompliance of the 29% cases was observed by Lehman et al¹⁴. However in study of Morcuende et al¹⁸ only 10% of the cases showed non-compliance. While high preponderance of noncompliance of 41% was noted by Dobbs et al⁷ in his study.

In the present series 8% of the patients (2 children) reported relapses with pirani score more than 5 after initial successful treatment. Similar observations were reported by Morcuende et al¹⁸, who reported that there were 17 (10%) relapses. While Dobbs et al⁷ reported relapses in 16 infants (31%). Ponseti et al²⁵ has reported a relapse rate of 7% in noncompliant patients. All of the noncompliant patients in Ponseti's series^{24,25} were corrected with recasting. In all 6 relapse in this study, the parents admitted to noncompliance with the FAB. In present study patients were labeled as having good result if Pirani Score reaches 1.5 or less, fair if complete correction was

obtained after open Achilles tendon lengthening or posterior releases and poor if Ponseti technique failed to give complete of foot even once.

Table 3: Summary of outcome management by Ponseti method

1. No. of Patients	30
2. No. of foot	43
3. Bilateral	16(53.4%)
4. Mean number of caste	6.6
5. Tenotomy required	14/44(32%)
6. Good overall result	82%

6. Conclusion : The study clearly shows that, more severe the initial deformity, higher the Pirani score, more casts required to obtain correction. Age at initial presentation, quality (mobility) of foot and Pirani Score at presentation, has a direct bearing on final results.

REFERENCES :

- Aronson J, Pusharich CL : Deformity and disability from treated clubfoot. J. Rediatr. Orthop. 1990; 10: 109-119.
- Bensahel H : Guilanume A, Czukonyi Z, Desgrippes Y: Results of physical therapy for idiopathic clubfoot: a long term follow-up study. J. Pediatr. Orthop. 1990; 10: 189-192.
- Blaleslee TJ : Congenital Idiopathic talipes equinovarus (clubfoot). Current Concept Clin Podiatr Med Surg. 1997; 14: 9-56.
- Colburn M, Williams M: Evaluation of the treatment of idiopathic clubfoot by using the Ponseti Method. J. Foot Ankle Surg. 2003; 42(5):259-67.
- Cooper DM, Dietz FR: Treat of idiopathic clubfoot: a thirty year follow up note. J. Bone Joint Surg (Br) 1995; 77: 1477-89.
- DeValentine SJ, Blackless TJ : Congenital talipes equinovarus. In foot and ankle disorders in children. Editing by SJ DeValentine. New York : Churchill Livingstone, 1992.
- Dobbs MB, Rudzki JR, Purcell DB, Walton T, Porter KR, Gurnett CA : Factors predictive of outcome after use of the Ponseti method for the treatment of idiopathic clubfeet. J. Bone Joint Surg Am 2004; 86A(1) : 22-7.
- Herzenberg JE, Radler C, Bor N : Ponseti versus traditional methods of casting for idiopathic clubfoot. J. Pediatr. Orthop. 2002; 22(4) : 517-521.
- Ippolito E, Farsetti P, Caterini R, Tudisco C: Long term comparative results in patients with congenital clubfoot treated with two different protocols. J. Bone & Joint Surg. 2003; 85A(7) : 1286-1294.
- Karksi T, Wosko I : Experience in the conservative treatment of clubfoot. in newborns and infants. J. Pediatr. Orthop. 1989; 9: 134-136.
- Kite JH : Non operative treatment of congenital clubfoot. Clin. Orthop. 1972; 84: 29-38.
- Kite JH : The clubfoot. Philadelphia : Grune & Stratton, 1964.
- Laaveg SJ, Ponseti IV : Long term results of treatment of congenital clubfoot. J. Bone Joint Surg (Am) 1980; 62: 23-31.
- Lehman WB, Mahaideen A, Madan S, Scher DM, Van Bosse HJ, Iannaccone M, Bazzi JS, Feldman DS: A method for the early evaluation of the Ponseti (Lowa) technique for the treatment of idiopathic clubfoot. J. Pediatr. Orthop. B 2003; 12(2) : 133-140.
- Ikeda k : Conservative treatment of idiopathic clubfoot. J. Pediatric. Orthop. 1992; 12 : 217-223.
- McKay DW : New concept and approach to clubfoot treatment. Section II correction of the clubfoot. J. Pediatr. Orthop. 1983; 3: 10-21.
- Miller JH, Bernstein SM : The roentgenographic appearance of the "corrected clubfoot". Foot Ankle. 1986; 6: 177-183.
- Morcuende JA, Dolan LA, Dietz FR, Ponseti IV : Radical reduction in the rate of extensive corrective surgery for clubfoot using the Ponseti method. J. Pediatr. Orthop. 2003; 23(6):780-7.
- Nutt JJ : Diseases and deformities of the Foot. FB Treat, New York, 1915.
- Pirani S, Outerbridge H, Moran M, Sawatsky B: A method of evaluating the virgin club foot with substantial interobserver reliability. Presented at the annual meeting of Pediatric Orthopedic Society of North America, Miami, 1995.
- Ponseti IV : Congenital Clubfoot. Fundamentals of Treatment. New York Oxford University Press, 1996.
- Ponseti IV : Relapsing clubfoot : causes, prevention and treatment Iowa. Orthop. J. 2002; 22: 55-56.
- Ponseti IV, Smoley EN : Congenital clubfoot : the results of treatment. J. Bone Joint surg. 1963; 45A:261-275.
- Scarpa A : A Memoir on the congenital club feet of children and the mode of correcting that deformity. 1818 Clin Orthop. 1994; 308: 4-7.
- Scher DM, Fieldman DS, van Bosse HJ, Sala DA, Lehman WB : Predicting the need for tenotomy in the Ponseti method for correction of clubfeet. J. Pediatr Orthop. 2004; 24(4):349-52.
- Simons GW : The clubfoot : the present and a view of the future. New York Springer Verlag, 1994.
- Staheli L : Clubfoot: Ponseti Management. 2nd Ed. Global Help Pulication, 2005.
- Turco J : Resistant congenital clubfoot : one stage posteromedial release with internal fixation : a follow up report of a fifteen year experience. J. Bone joint Surg. (Am) 1979; 61 : 805-14.
- Wesely MS, Bernstein PA, Barrent N : Complications of the treatment of clubfoot. Clin. Orthop. 1972; 84: 93-96.