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Original Research Article

Treatment of idiopathic congenital talipes equinovarus (CTEV) with ponseti method and its short term outcome

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Abstract: Idiopathic clubfoot (CTEV) is the most common congenital complex deformity of foot which is very difficult to correct**.** The resurgence of conservative treatment for clubfoot is because of good results of Ponseti's technique. This method has made the need for surgical procedures very low and thus eliminating the complications associated with extensive surgery. A prospective study of 40 patients with 46 idiopathic clubfoot bilateral in 6 patients, with a minimum 2year after treatment follow-up, we were able to achieve correction in more than 90% of feet and the importance of percutaneous tendoachillis tenotomy in more than 80% of feet. The use of Pirani scoring system is a very useful tool to objectively analyse the results.
Keywords: Idiopathic clubfoot, CTEV, Ponseti method, percutaneous tenotomy, Pirani scoring, short term study.

INTRODUCTION

Congenital Talipes Equino Varus (CTEV) or club foot is the most common congenital deformity. Incidence is about 1-2 cases per 1000 live births [1]. Male to female ratio is about 2:1 to 3:1[1]. It is bilateral in 40% of cases [1]. CTEV has higher incidence with positive family history [1, 2]. CTEV is a complex deformity which consists of 4 deformities forefoot adduction, hindfoot varus, hindfoot equinus and cavus. Different etiologies have been proposed including mechanical factors in utero, neuromuscular defect, primary germ plasm defect and arrested fetal development. Irrespective of the etiology pathoanatomy remains the same and consists of equinus at ankle, equinus and inversion of calcaneum below the talus, talar head prominence at dorsolateral midfoot, navicular placed medial and plantar to talar head, cuboid is medial and in front of calcaneum medially tilting of anterior parts of talus, shortened talar neck. Narrow posterior ankle mortice and talar tilt anterior of ankle mortice. Foot in CTEV is smaller than opposite normal foot when it is unilateral involvement due to small muscle mass and connective tissue fibrosis [3]. CTEV is a complex deformity difficult to treat[4]. The goal of treatment is to reduce or eliminate its four components of deformity in order to give patient a functional, painless, plant grade foot with good mobility and without calluses and avoidance of need for modified shoes. Initial treatment historically has been non-operative and operative treatment only in cases of residual deformity, failed correction, relapse or neglected cases of CTEV. Non-operative treatment consisted of stretching, manipulation and corrective casts. Operative methods vary according to the persistant or residual deformity and wide ranging. The prevalence of both immediate and long-term complications in surgically treated clubfoot has cultivated a renewed interest in nonsurgical treatment [5]. The methods of T.H.Kite [3], Ignacio. V. ponseti [6] and French methods as described by Morse and Bensahal [7] are examples of methods of non-operative correction of CTEV. Ponseti method has gained supremacy and acceptance worldwide. This technique is of gradual and correction of all deformities of CTEV using manipulation and casting at weekly intervals and a possible achillis tendon tenotomy. He differed from others about the interdependent movements of tarsal bones and considered the view that tarsal joints move on a fixed axis of motion to be incorrect and described the Kite's method of correction in which the abduction of calcaneus under the talus was prevented by applying counter pressure over the calcaneocuboid joint as "Kite's error". This is essential in correction of heel varus as calcaneus cannot be everted unless it is fully abducted under the talus [3, 6, 8, 9]. The method has been reported to have short-term success rates approaching 90% and the long-term results have been equally impressive [4]. The need for surgical treatment due to residual deformities or failure of conservative treatment is rare with ponseti technique. Complications occurring as a result of this technique have not been reported [10]. The aim of this study is to

present the author's experience with the Ponseti technique in correcting clubfoot and importance of percutaneous tendoachillis tenotomy using Pirani score [11, 12].

MATERIALS AND METHODS

The study was conducted in Sree Balaji Medical College and Hospital, Chromepet, Chennai (TN) between June 2012 to December 2015. We have treated 40 patients with 46 idiopathic clubfoot deformities using Ponseti method of management. The study is a prospective study. Only patients under the age of 2 years were included in the study. All patients with secondary congenital talipes equino varus were excluded from this study. All the cases were fresh cases and were never treated before. All the patients were followed up for a period of 2years after the completion of treatment regimen. The severity of foot deformity was assessed by Pirani scoring system. All the clubfeet were assessed with Pirani score before treatment, after treatment and at end of 2years of follow up. The results were analysed using SPSS 19 software. T-Test paired samples analysis was done to find out the difference between the means of values (before treatment, after treatment and at follow up).

Table 1: Pirani scoring system

Parameters	Normal	Moderate	Severe
Midfoot			
Curved lateral border	0	0.5	1
Medial crease	0	0.5	1
Talar head coverage	0	0.5	1
Hindfoot			
Posterior crease	0	0.5	1
Rigid equinus	0	0.5	1
Empty heel	0	0.5	1

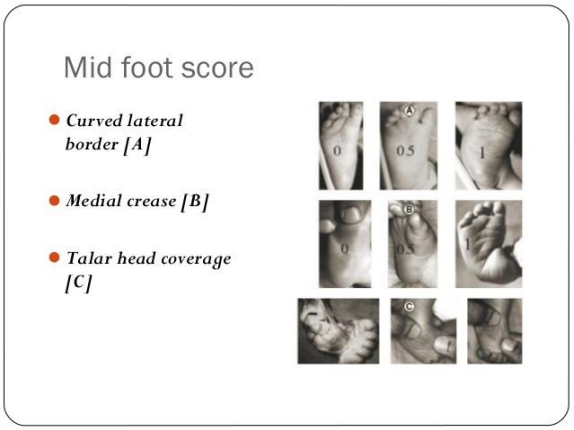

Fig-1: Midfoot score

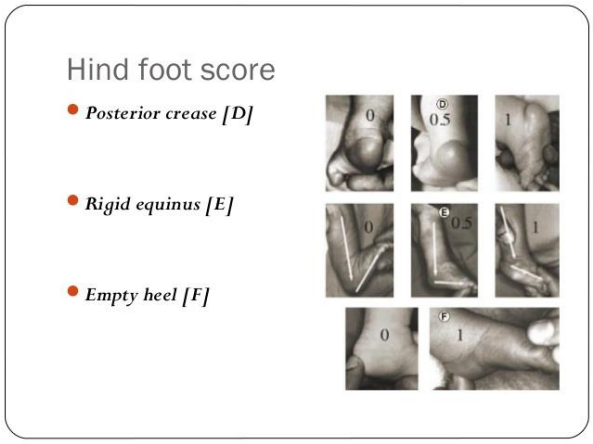

Fig-2: Hind foot score

Ponseti treatment regimen [7]: This consists of gentle manipulation of the foot and serial application of long leg plaster cast without the use of anesthesia, as described by Ponseti. Cavus was corrected first by supinating the forefoot and dorsiflexing the first metatarsal. Failure to supinate the forefoot as the first step ultimately leads to incomplete correction of the clubfoot. To correct the varus and adduction, the foot in supination was abducted while counter presure was applied with the thumb against the head of the talus. Casts were changed weekly after proper manipulation of the foot until good correction is obtained. In the last cast, the foot should be markedly abducted (70°) without pronation. This position was essential in obtaining complete correction and it prevents recurrence.

After correction of the above deformities, passive dorsiflexion of the foot to 15 degree above neutral with the examiner applying a single finger pressure was attempted. If achieved, a final cast was applied in the final corrected dorsiflexed position for three weeks. If dorsiflexion more than 15 degrees was not possible, a simple percutaneous tenotomy of the Achilles tendon was performed under local anesthesia. After tenotomy, a cast was applied and left in place for three weeks to allow for healing of the tendon. After the last cast was removed, correction was maintained by using Dennis-Browne splint. The brace was worn full time (day and night) for the first three months after the last cast was removed. After that, the child should wear the brace for 12 hours at night and 2-4 hours in the middle of the day for a total of 14-16 hours during each 24-hour period. This protocol continues until the child is 5 years of age. Stretching exercises are taught to parents to be done on child during brace free interval. All the children in study were followed up every month for minimum of 2 years.

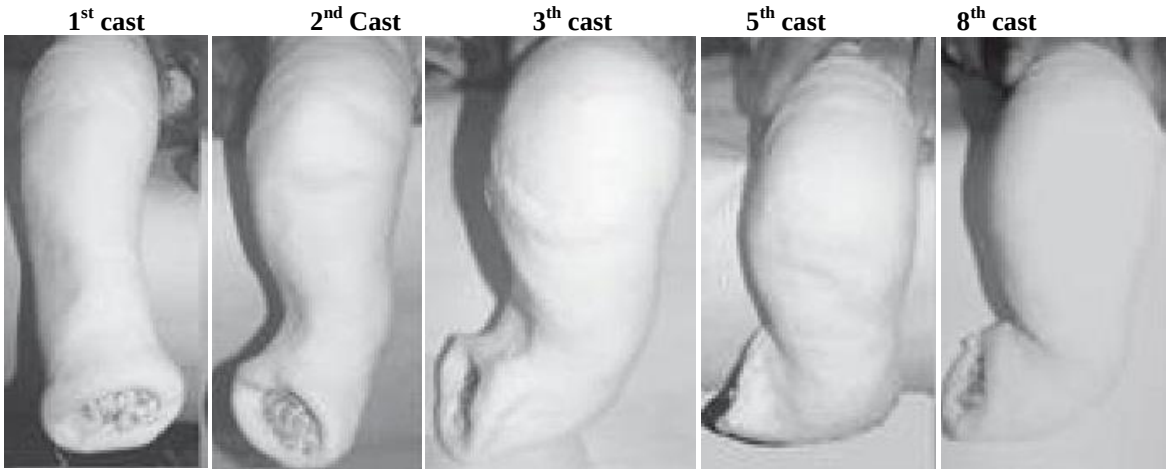

Fig- 3: Serial casts

Fig-4: Denis Brown Splint

Fig-5: Percutaneous tenotomy

RESULTS

We had 40 patients with 46 Clubfoots under study. None of the patients were treated previously. 34(85%) patients had unilateral club foot and 6(15%) patients had bilateral club foot. 28(70%) were male and 12(30%) were female. 4 of 28(14.28%) male patients had bilateral clubfoot and 2 of 12(16.67%) female patients had bilateral clubfoot. 24 of 28(85.71%) male had unilateral involvement and 10 of 12(83.33%) female patients had unilateral club foot. Among unilateral club foot of 34 patients there were 29(85.29%) patients with Right sided club foot and 5(14.71%) patients with left sided club foot. Among male patients 21 of 24(87.5%) club foot were right sided in and 3 of 24(12.5%) clubfoot were left sided. Among female patients 8(80%) were right sided and 2(20%) were left sided. Age of the patients at the onset of treatment ranged from 1day to 660 days (22months). The mean age of the sample 65.7days, however we observed that 37 of 40(92.5%) patients were 0- 6 months of age (range 1 to120days) 1(2.5%) patient was 6-12 months (235days) and 2(5%) patients in 18-24 months (630days and 660days). There was no patient in 12-18months range in our series. Mean age of male patients was 59.25days and female patients was 80.75days however if we removed the 2 samples causing extreme skewing of sample the mean age was 35.76days for patients, 37days for male patients and 31days for female patients.

Deformity was scored with Pirani scores. The mean Pirani score before treatment 4.25(range 3.0 – 5.5)(Table 2). The mean Pirani score after treatment 0.098(range 0 -1.0)(Table 3). The mean Pirani score at follow up of 2years 0.033(range 0-0.5) (Table 4).

We were able to achieve complete correction in 38(82.6%) or 46 feet at end of treatment and near total correction in 8(17.4%) feet after treatment. At 2 years follow up we were able to achieve correction in 43(93.5%) of feet and near normal foot in 3(6.5%) foots. We had accepted only medial crease and no other residual deformity was accepted.

The mean change in Pirani score before and after treatment is 4.15 with p value <0.0005(highly significant). The mean change in Pirani score before treatment and follow-up at 2years is 4.22 with p value <0.0005(highly significant) (Tables 5, 6&7).

Total number of casts required for treatment in study was 340 casts with mean 7.39 median 7, mode 6 and range 6 – 10. The frequency of requirement of 6, 7, 8, 9 and 10 casts were 15, 13, 7, 7 and 4 respectively.

Percutaneous tendoachillis tenotomy was done for 32(80%) patients/38(82.6%) feet. All bilateral cases underwent percutaneous tenotomy. 8patients (20%) / 8(17.4%) feet with unilateral involvement did not require percutaneous tenotomy.

Table 2: Pirani Score before treatment

Pirani Score	Frequency	percentage
3.0	5	10.9
3.5	8	17.4
4.0	11	23.9
4.5	10	21.7
5.0	5	10.9
5.5	7	15.2
Total	46	100.0

Table 3: Pirani Score after treatment

Pirani Score	Frequency	percentage
0	38	82.6
0.5	7	15.2
1.0	1	2.2
Total	46	100.0

Table 4: Pirani Score at follow up

Pirani Score	Frequency	percentage
0	43	93.5
0.5	3	6.5
Total	46	100.0

Table 5: paired samples statistics

Pairs	Pirani score	Mean	N	Std. Deviation	Std. Error Mean
I	Before treatment	4.250	46	.7800	.1150
	After treatment	.098	46	.2266	.0334
II	Before treatment	4.250	46	.7800	.1150
	At follow up	.033	46	.1248	.0184
III	After treatment	.098	46	.2266	.0334
	At follow up	.033	46	.1248	.0184

Table 6: Paired Samples Correlations

Pairs	Pirani score	N	Correlation	Sig.
I	Before treatment &After treatment	46	.487	.001
II	Before treatment & at follow-up	46	.257	.085
III	After treatment &At treatment	46	.671	.000

Table 7: Paired samples test

Pair	Paired Pirani scores	Paired Differences					t	Df (Degree of Freedom)	Sig(2-tailed)
		Mean	Std. Deviation	Std. Error Mean	99% Confidence Interval of the Difference				
					Lower	Upper			
I	Before & after treatment	4.1522	.6982	.1029	3.8753	4.4290	40.336	45	.0000
II	Before treatment & at follow-up	4.2174	.7576	.1117	3.9170	4.5178	37.757	45	.0000
III	After treatment &At treatment	.0652	.1703	.0251	-.0023	.1327	2.598	45	.013

DISCUSSION

The cast treatment for CTEV is not a new concept but all those previously famous methods of cast treatment were with high rates of residual deformity and failure with requirement of subsequent surgeries [7]. Ponseti method was a deviation from all the previous methods in that it did not try to just correct visible deformities rather it gave importance to the anatomical problem underlying. Ponseti proposed reducing the deformity with successive casts. Ponseti's method is based on strict rules established from anatomic evidence. The goal is not to correct the apparent deformation, but on the contrary, to impose a simultaneous supination and abduction of the foot. Once the calcaneopedal block has been derotated, percutaneous tenotomy of the Achilles tendon is performed [13]. Extensive open surgery like postero-medial release is commonly associated with long term stiffness and weakness which is avoided by the Ponseti technique [14]. Ponseti method gives better results compared to other traditional methods of casting which have been proved by comparative studies. Heel varus correction and increased declination angle of the neck of the talus are better with Ponseti method. Three dimensional CT reconstruction of the whole foot also showed that cavus, supination and adduction are corrected much better with Ponseti technique [15]. Previous studies have shown good results (92-98%).

We have successfully treated 43 feet (93.5%) and those who had residual deformity were a soft deformity with medial crease only. We have observed that, the results were good in the children who are treated early. Milder deformities with low Pirani scores were easier to treat. For good results strict adherence to the sequence of correction is a must and a strict regular follow-up and removal of cast just before subsequent cast are essential part of treatment protocol. The necessity of percutaneous tenotomy in majority of feet (82.6%) shows its importance in the treatment protocol. Bleeding complication have been reported with percutaneous tenotomy [10], but we did not encounter any such complications in our study. It is not just the correction but the maintenance of deformity with strict compliance by the parents with brace is critical for good outcomes. Failure of compliance is reported to be the most common cause of failure [4, 5, 14, 16, 17]. The best part of this treatment protocol is the absence of any major complications and requirement of extensive surgical procedures which are fraught with number of complications. This study is a short term study but the patients are still being followed up further for the long term results. The long term results at 5years or 10 years could be a good predictor of the results and need for maintenance of the correction with brace and any late recurrence of deformity. The scope of further long term study would be valuable.

Case1

Fig-6: Before treatment

Fig-7: After treatment

Case 2

Fig-8: Before Treatment

Fig-9: After Treatment

CONCLUSIONS

The Ponseti method is a safe and effective treatment for congenital idiopathic clubfoot and radically decreases the need for extensive corrective surgery like poster medial soft tissue release if started early. Percutaneous tenotomy is a essential part of

treatment in majority of patient. Forefoot adduction with medial crease is the residual deformity seen in this study. Compliance by parents with brace is very important for good results. It is an effective and affordable technique. This technique can be used in children up to 2 years of age. This method can be reproducible even by the orthopaedician in remote and rural places. Longer follow-up will decide whether we can continue to match Ponseti's results. The success of short term gives scope for further follow-up for long term results.

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