

Evaluation of Percutaneous needle Tendoachilles Tenotomy as an Outpatient Procedure in Clubfoot Treatment by Ponseti Method

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ABSTRACT

Background: Clubfoot is a relatively common congenital foot deformity. Ponseti demonstrated correction of clubfoot in infants using manipulation followed by application of well-molded, long-leg plaster casts. In the current study, we evaluated the efficacy and safety of percutaneous achilles tenotomy as an office procedure during ponseti technique in correction of CTEV deformity of foot. **Patients and Methods:** This randomized clinical trial study was conducted in Orthopedic outpatient clinic of Zagazig University hospitals on 12 patient with idiopathic clubfoot managed with ponseti technique during the period from April 2020 to September 2020. **Results:** in this study showed, 13 feet had favorable outcome (8 cases (53.3%) excellent and 5 cases good 33.3%) and 2 feet had fair outcome (13.3); these 2 feet had relapse (13.3%), one foot relapsed equinus deformity and one adductus foot deformity, The equinus deformity patient responded to repeated tendo-achilles tenotomy and further Ponseti casting and adductus foot deformity responded to adductor tenotomy and cast. Both two cases obtained satisfactory outcome after completion of treatment. **Conclusion:** Achilles tenotomy as an out-patient procedure using topical and/or local anesthesia is a safe procedure and is an important step in successful treatment of congenital clubfoot.

Keywords: Clubfoot , Ponseti method , Achilles tenotomy

INTRODUCTION

Clubfoot, also known as congenital talipes equinovarus (CTEV), is a frequent foot anomaly in which the foot points downward (equinus) and inward (metatarsus adductus) and the hind foot inward (varus) and the mid foot inward (metatarsus adductus) (cavus). The disorder is present from birth. It affects roughly one in every 1000 live births^[1].

Clubfoot deformity can be caused by myelodysplasia, arthrogryposis, or a combination of congenital abnormalities, however it is most usually an independent birth abnormality that is considered idiopathic^[2]. The prevalence of other congenital defects or chromosomal abnormalities in clubfoot patients varies greatly depending on the demographic and ranges from 24 percent to 50 percent^[3].

Clubfoot is a congenital defect. During the second trimester of pregnancy, a typically developing foot develops into a clubfoot. Turco describes the pathophysiology as the talus being driven into equinus by the underlying calcaneus and navicular, with the head and neck of the talus displaced medially. The calcaneus is inverted beneath the talus, with the posterior end shifted upward and laterally and the anterior end displaced downward and medially^[4].

In the recent two decades, the care of clubfoot deformity has shifted from surgical correction (posterior medial release) to the non-surgical Ponseti approach^[5]. The aim of this study was to evaluate the efficacy and safety of percutaneous achilles tenotomy as an office procedure during ponseti technique in correction of CTEV deformity of foot.

PATIENTS AND METHODS

This randomized clinical trial study was conducted in Orthopedic outpatient clinic of Zagazig University hospitals on 12 patient with idiopathic clubfoot managed with ponseti technique during the period from April 2020 to September 2020. We performed the procedure on 12 patients with idiopathic (15 feet) were included in this prospective study, syndromatic cases, recurrent or residual cases were excluded.

Inclusion criteria: Idiopathic clubfoot managed with ponseti technique. Age: below 1 year. **Exclusion criteria:** Syndromic cases such as arthrogryposis multiplex congenita, spina bifida, cerebral palsy, and poliomyelitis. Residual talipes equinovarus after ponseti technique. Recurrent cases after surgical correction.

Written informed consent was obtained from all participants parents and the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Pre-operative:

All patients underwent full history taking, clinical picture, Each patient was subjected thorough general, physical, and systemic examination including Spine, hip and extremities. After taking complete history, mobility of foot was assessed by applying gentle corrective manipulation. Foot was classified into supple type if manual reduction is possible and rigid type, where manual reduction is impossible.

Surgical technique:

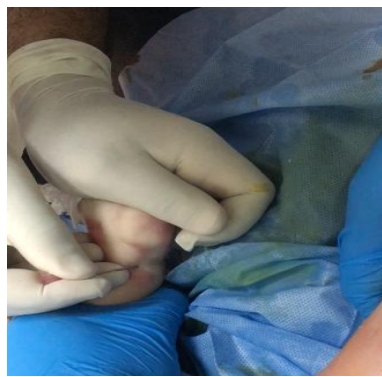
Babies underwent serial manipulation and casting according to the Ponseti method. The Catterall Pirani score was routinely used for ascertainment of progression. Tenotomy was indicated while the mid-foot is corrected (mid-foot score = 0) and if equinus deformity is still present (ankle dorsiflexion <10 degrees). The procedure was performed during routine outpatient clinic activity.

A topical anesthetic cream was applied 30 minutes before the procedure, an oral/rectal analgesic was given, and the baby is fed. A local anesthetic was injected subcutaneously immediately before the procedure. The tendon was completely sectioned by needle thread No (16,18 gauge), the foot must be in a dorsiflexed and abducted position. A long-leg plaster cast was applied immediately, and after 1 hour of supervision, we reviewed the complete course of clubfoot management in each of the babies underwent Achilles tenotomy.

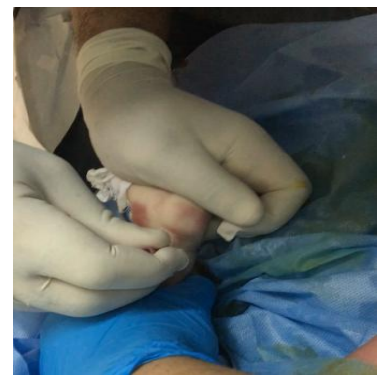
The child was placed in supine position, with the knee flexed to 90 degrees and the hip abducted to make the heel easily accessible. An assistant maintains the position till the procedure is completed. tendoachilles is easily palpated when foot is forced into dorsiflexion, which makes the tendon tense. With all the aseptic precautions using povidine iodine and 1% lignocaine of ~0.2ml given using an insulin syringe, medial border of tendo-achilles palpated and a 16 gauge sterile needle was inserted from the medial border of the tendo-achilles about 1 to 2 cm proximal to the tendo-achilles insertion into calcaneum. Sectioning of the tendon performed using the beveled tip of the needle through lateralization and elevation movements of the cutting end (Figure 1).



A



B



C



D



E



F



G



H



I



J

Figure (1): Steps of percutaneous needle tenotomy A: Sterilization of the foot, and palpation of tendoachilles of the left foot. B: Introduction of needle medial to the tendon. C: Cutting of tendoachilles (tenotomy). D: Improving dorsiflexion after complete tenotomy. E,F,G,H: The same tenotomy steps for the right foot. I: Casting after by bilateral tenotomy. J: After cast removal 3 weeks after tenotomy.

Post-operative follow up:

Removal of post-tenotomy cast. Fitted into foot abduction brace (to be worn for 23 hours per day). Period of follow-up was for six month. Assessment of residual equinus or repeated tenotomy was specifically sought.

Statistical analysis

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis. P value was set at <0.05 for significant results & <0.001 for high significant result.

RESULTS

Mean age at time of presentation was **10.83±2.08** days with minimum 7 and maximum 14 Days. As regard sex distribution male represent 58.3% and female 41.7%. As regards the side distribution; six cases (50%) were right, three (25%) were left and three (25%) were bilateral [Table 1].

Table (1): Age and sex distribution among studied group

Age / days	Mean± SD	10.83±2.08	
	Median (Range)	12.0 (7-14)	
		N	%
Sex	Male	7	58.3
	Female	5	41.7
Total		12	100.0
Side distribution among studied group		N	%
Side	Left	3	25.0
	Right	6	50.0
	Bilateral	3	25.0
	Left	12	100.0
Total		12	100.0

There was a statistically significant decrease of the **mid** and **hind** foot contracture score from pre to 3 month of follow up and also significant decrease between pre and 6 months of follow up score but no significant difference founded between scores of 3 months and 6 months [Table 2].

Table (2): MID, Hind foot contracture score distribution at pre, 3 months and 6 months of follow up

MID	Mean	Std. Deviation	Paired t	P
MFCS_PRE	2.5833	0.51493	11.406	0.00**
MFCS_3months	0.6417	0.21569		
MFCS_PRE	2.5833	0.51493	10.352	0.00**
MFCS_6months	0.4167	0.13340		
MFCS_3months	0.6417	0.21569	0.897	0.389
MFCS_6months	0.4167	0.13340		
Hind foot	Mean	Std. Deviation	Paired t	P
HFCS_PRE	2.5417	0.39648	17.861	0.00**
HFCS_3months	0.5417	0.19810		

HFCS_PRE	2.5417	0.39648	9.398	0.00**
HFCS_6months	0.5021	0.12621		
HFCS_3months	0.5417	0.19810	0.220	0.830
HFCS_6months	0.5021	0.12621		

In this study, there was a statistically significant decrease of total Piriani score from pre to 3 month of follow up and also significant decrease between pre and 6 months of follow up score but no significant difference founded between scores of 3 months and 6 months [Table 3].

Table (3):Total piriani score distribution at pre, 3 months and 6 months of follow up

	Mean	Std. Deviation	Paired t	P
Total piriani score pre	5.1250	0.85613	12.310	0.00**
Total piriani score 3months	1.0833	0.37312		
Total_piriani_score_pre	5.1250	0.85613	10.372	0.00**
Total_piriani_score_6months	0.9167	0.32007		
Total_piriani_score_3months	1.0833	0.37312	0.742	0.474
Total_piriani_score_6months	0.9167	0.32007		

In this study, there was a statistically significant increase of talocalcaneal angle (TCA) from pre to 3 month of follow up and also significant increase between pre and 6 months of follow up score but no significant difference founded between scores of 3 months and 6 months [Table 4].

Table (4):Radiological assessment (TCA) distribution at pre, 3 months and 6 months of follow up

	Mean	Std. Deviation	Paired t	P
TCA pre	20.8000	1.52128	20.805	0.00**
TCA post 3 months	30.4667	1.72654		
TCA pre	20.8000	1.52128	19.552	0.00**
TCA post 6 months	29.3521	2.03072		
TCA post 3 months	30.4667	1.72654	0.856	0.423
TCA post 6 months	30.3521	2.03072		

In this study, there was a statistically Significant decrease from pre to 3 month of follow up and also significant decrease between pre and 6 months of follow up score but no significant difference founded between scores of 3 months and 6 months [Table 5]

Table (5):Radiological assessment TIC- lateral tibio calcaneal angle distribution at pre, 3 months and 6 months of follow up

	Mean	Std. Deviation	Paired t	P
TiC pre	102.8000	5.01711	26.531	0.00**
TiC post 3 months	62.4667	4.50185		
TiC pre	102.8000	5.01711	19.769	0.00**
TiC post 6 months	63.4667	7.52962		
TiC post 3 months	62.4667	4.50185	1.105	0.288
TiC post 6 months	63.4667	7.52962		

As regards the complications in this study, there were two feet of relapse (13.3%), one foot relapsed equinus deformity and one adductus foot deformity [Table 6].

Table (6): Complication distribution among studied group (15 feet)

		N	%
Relapse	No	13	86.7
	Yes	2	13.3
	Total	15	100.0

As regards the final outcome, 13 feet had favorable outcome (8 cases excellent and 5 cases good) and 2 feet had fair outcome [Table 7].

Table (7):Outcome (according to Piriani) distribution among studied group

Piriani score		N	%
Outcome	Fair	2	13.4
	Good	5	33.3
	Excellent	8	53.3
	Total	15	100.0

DISCUSSION

In order to improve the management of club foot, we conducted this prospective randomized clinical study in the Orthopedic outpatient clinic of Zagazig University hospitals, which included 15 feet in 12 children with an average age at presentation of 10.832.08 with a minimum of 7 and a maximum of 14 days, and a male to female ratio of 41.7 percent. 7:5, 50% were right-sided, 25% were left-sided, and 25.0% were bilateral. This was consistent with Agius^[6] study, which included 59 clubfeet (40 newborns, 19 bilateral cases) with idiopathic congenital clubfoot. Tenotomy was performed at an average post-natal age of 10.5 weeks in the clinic group and 12.1 weeks in the theatre group. Males outnumbered girls by a factor of two.

Porecha^[7] also stated in his study that 49 individuals with 67 clubfeet were treated and observed for a mean of five years. Out of 49 patients, 39 (79.59%) were male, resulting in a male-female ratio of 3:9. Out of 49 patients, 18 (36.73%) had bilateral involvement, whereas 31 (63.27 percent) had unilateral involvement, with 17 (54.84%) having right foot involvement and 14 (45.16%) having left foot involvement. There was no evidence of a link between birth order or family history. At the start of treatment, 42 patients (85.71%) are between the ages of 0 and 12 weeks (mean 2 weeks), 5 patients (10.20%) are between the ages of 13 and 24 weeks (mean 15 weeks), and 2 (4.08%) are between the ages of 25 and 36 weeks (mean 34 weeks).

There was a significant decrease in mid and hind foot contracture score and total piriani from pre to 3 months of follow up, as well as a significant decrease between pre and 6 months of follow up, but no significant difference was found between scores of 3 months and 6 months (2.580.51, 0.640.21 and 0.410.13), (2.540.39, 0.540.19 and 0.500.12), and (5.120.8, 1.080.37 and 0.910.32)

Porecha^[7] discovered that at the start of treatment, 17 of the 18 bilateral clubfeet patients (36 clubfeet) had a Pirani severity score of six, while one child (2 clubfeet) had a Pirani score of five. The mean Pirani score in the unilateral group was 5.83. (range 5-6). The overall group's mean midfoot and hindfoot scores were 2.8 (range 2.5-3) and 2.76 (range 2-3), respectively. The average number of casts used to obtain correction was 6.8. (range 6-8). The more severe the initial deformity and the commencement of treatment after 12 weeks of age, the more casts were necessary to achieve rectification. Percutaneous tenotomy was required

in 47 children (95.91%), 18 in the bilateral group and 29 in the unilateral group. At the time of equinus deformity, the mean midfoot score and hindfoot score for the entire group were 0.5 and 2.5, respectively. There was no time lag between the removal of the final cast and the fitting of the D-B splint.

Regarding radiological assessment talocalcaneal angle (TCA), there was a statistically significant increase from pre to 3 months of follow up and also a significant increase between pre and 6 months of follow up score but no significant difference found between scores of 3 months and 6 months (20.81.5, 30.471.7, and 29.32.03) while regarding lateral tibio calcaneal angle (TIC), there was a statistically significant increase from pre to 3 months of follow up

Concerning the outcome, after completion of treatment in the current study, 13 feet had favorable outcome (8 cases (53.3%) excellent and 5 cases (33.3%) good and 2 feet had fair outcome (13.3); these 2 feet had relapse (13.3%), one foot relapsed equinus deformity and one adductus foot deformity, the equinus deformity patient responded to repeated tendo-achilles tenotomy and the adductus foot deformity patient After therapy, the outcomes in both cases were satisfactory. There was no significant relationship between the outcome and the features of the youngsters.

These findings were consistent with those of Porecha^[7], who found that the average period of treatment from the start of treatment to the installation of the D-B Splint was 9.6 weeks. With the Ponseti technique, initial correction was attained in all 67 clubfeet (100%). A return of the abnormality occurred in fourteen children (28.57%) (19 feet 28.35%).

In contrast to our findings, Gerlach^[8] observed relapse in 68% (19 of 28 foot) after a mean of 7.1 months, with the majority of cases being treated with reapplication of the Ponseti technique.

In contrast, Agius^[6] discovered in his study that a satisfying rate was found among 6 cases out of 19 (32%) by the parental satisfaction survey.

Another study analyzed 55 clubfeet (37%) prospectively to establish clinically whether the Ponseti approach was beneficial in the management of clubfoot in older children aged 12 to 36 months (mean: 24.8 months). According to the Pirani score, all of the patients had moderate to severe deformities. In 49 clubfeet, painless, supple, plantigrade, and cosmetically acceptable foot were accomplished. Recurrence of adduction, varus, and equinus deformity occurred in seven patients (seven feet), while equinus deformity occurred in three individuals (five feet). These seven individuals reacted well to repeat treatment and had positive outcomes. Four of the seven patients had their tibialis anterior transferred to the third cuneiform for dynamic supination. Three patients who had an isolated recurrence of equinus deformity underwent a repeat tenotomy. One foot had adequate dorsiflexion, three feet had tendoachilles lengthening, and another foot had posterior release to produce adequate dorsiflexion. To treat clubfoot abnormalities, six to twelve casts (mean=10) were necessary. The average time spent immobilized in a cast was 13.9 weeks (10–15 weeks). They discovered that the Ponseti technique is successful in children aged 12 to 36 months^[9].

In a tertiary center, a retrospective, consecutive review was conducted over a 10-year period. A total of 11 children with 18 myelomeningocele-associated clubfeet were included in the study, with a 4.5-year average follow-up (range 3–9 years). The typical presentation age was 4.7 weeks, with a Pirani score of 5.5. All children received initial correction with an average of 7 (range 4–9) Ponseti casts, and tendo-achilles tenotomy was performed in 17 of 18 feet (94.4%). At the end follow-up, nine children with 15 of 18 (83.3%) myelomeningocele-associated clubfeet had an acceptable outcome, with functional, pain-free feet. Recurrence occurred in five of fifteen (33.3%) foot, which were successfully handled with a second tendo-achilles tenotomy and further Ponseti casting. Ponseti treatment was unsuccessful in two children out of 18 (16.7 %)^[10].

CONCLUSION

The Ponseti method is an effective first-line treatment for syndrome-associated talipes equinovarus to achieve functional painless feet.

Ponseti method is safe and effective for the correction of complex clubfeet. Early diagnosis and strict adherence to the Ponseti principles are keys to achieve deformity correction. Patients with complex clubfoot require frequent follow-up because of a higher recurrence rate which can be repaired by repetition of the procedure.

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