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Functional outcome of tendoachilles following Ponseti's tenotomy for treatment of congenital talipes equino varus in children older than two years

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ABSTRACT

Background: Long term results of tenotomy and Ponseti technique are established worldwide. However, functions of Tendoachilles following Ponseti's tenotomy in these cases i.e. idiopathic/neglected/operated/relapsed clubfeet (after casting or surgical correction) are not established. Tendoachilles regeneration after tenotomy has been confirmed on USG and MRI but only a few studies have done functional evaluation of tendoachilles**.** This study was done to evaluate the functional outcome of tendoachilles after tenotomy in patients older than two years presenting with CTEV. This study also assessed the influence of age and any previous treatment on tenotomy.
Methods: In this study, 42 children (68 clubfeet) were seen in the two year study period. Children between 2-13 years coming to the outpatient department for treatment using the Ponseti's method were followed during and after completion of treatment for 2 years. Patients were divided into two groups-first according to age and second according to previous treatment. Clinical evaluation of tendoachilles regeneration was done by evaluating the child's ability to stand on tip of toes on single leg and walking ability.
Results: The ability to stand on tip of toes after removal of the final cast was delayed maximum in the previously operated patients (9.5 weeks), lesser in patients who were previously treated by casting (7.3 weeks) and least in neglected patients (7 weeks). It also increased as the age increased (2-5 years age group required 7.4 weeks whereas 11-13 years age group required 16 weeks). Neglected patients started walking earlier (4.6 weeks) as compared to patients treated conservatively (4.8 weeks) or operatively (7.2 weeks). Younger children started walking earlier (age 2-5 years required 4.7 weeks whereas 11-13 years age group required 12 weeks).
Conclusions: Functional evaluation of tendoachilles showed that all children who had tenotomy could walk and stand on tip of toes irrespective of age and previous treatment. However, older child and children having history of previous treatment, required longer time for recovery.

Keywords: CTEV, Ponseti techniques, Tendoachilles tenotomy, Tendoachilles function

INTRODUCTION

Congenital Talipes Equino Varus (CTEV) or Clubfeet is one of the most common congenital deformities in paediatric orthopaedics.[1,2] It is a congenital dysplasia of all musculoskeletal structures (muscles, tendons, ligaments, osteoarticular and neurovascular structures) distal to the knee.[2] The foot presents equinus, cavus, varus and adducted positions and is supinated. In the 1980s and 1990s, soft-tissue posteromedial release

surgeries were performed. This procedures yielded poor outcomes, with stiffness, pain and functional impairment of the foot.[3]

It is generally agreed that initial treatment of clubfoot should be non-operative; regardless of severity of deformity.[2] Ponseti method has now become the gold standard, which comprises of serial manipulation and casting. Ponseti's technique done in early infancy has been shown to be effective in 85-90% of cases.[6] He has scientifically shown that supinating the foot while abducting it gives a more normal correction of the deformity. In this method the fulcrum is talonavicular joint and all the components of the deformity are corrected simultaneously except the equinus which is corrected by percutaneous tenotomy of tendoachilles.[5] It prevents the incidence of recurrences and development of rocker bottom foot; brings down the cost of treatment by decreasing the number of casts required to correct the equinus deformity and also by obviating the need of extensive soft tissue surgery.[6-8] As the Achilles tendon is one of the most important tendons of the foot considering its functional contribution, there are apprehensions regarding the sectioning of this tendon. These apprehensions have been identified as the most important hurdle in the widespread acceptance of this method in the developing countries.[9]

Long term results of tenotomy and Ponseti technique are established worldwide. However, functions of Tendoachilles following Ponseti's tenotomy in these cases i.e. idiopathic/neglected/operated/relapsed clubfeet (after casting or surgical correction) are not established. Tendoachilles regeneration after tenotomy has been confirmed on USG and MRI in children below 2 years of age but none of the studies have done functional evaluation of tendoachilles.[9-12]

This study has been done to evaluate functional outcome of Tendoachilles following Ponseti's Tenotomy for treatment of Congenital Talipes Equino Varus in children older than 2 years and to assess the influence of age/previous treatment on the functional outcome of tendoachilles after tenotomy.

METHODS

A retrospective and prospective study of 42 patients with 68 clubfeet (idiopathic/neglected/operated/relapsed) clubfeet was conducted between August 2010 and December 2012 in the Department of Orthopaedics, St. Stephen's Hospital and aged older than two years were screened.

Inclusion criteria were all new cases of idiopathic CTEV older than 2 years of age will be assessed prospectively; all patients older than 2 years of age who have undergone treatment of the clubfoot by Ponseti's method will be assessed retrospectively.

Exclusion criteria were children with less than 2 years of age; children with secondary causes of clubfeet; other conditions resulting from chromosomal deletions.

Patients were divided into two groups-first according to age and second according to previous treatment.

Ponseti's treatment and tenotomy[1,4,5]

A sequential correction of cavus, adduction, varus and equinus was done. The cast changes were made weekly once and always started by cavus correction, followed by gradual correction of the adduction, supination and varus. Finally, the equinus was corrected by dorsiflexing the foot, generally facilitated by a simple percutaneous tendoachilles tenotomy under local anaesthesia by introducing surgical blade no.15 through skin on to the medial edge of tendoachilles about 1-2 cms above calcaneum insertion. Tenotomy was done when hindfoot score >1; midfoot score <1; and head of talus was covered (According to the Pirani score).[1]

Care was taken to avoid inserting the blade any deeper than necessary to avoid damaging the nearby neurovascular bundles and other tendons. A pop sound is heard as tendon is cut and an additional 10-15 degrees of dorsiflexion is gained after tenotomy. A final cast is applied with the foot abducted to 70 degrees and in 10-15 degrees of dorsiflexion. This cast is left in place for 3 weeks after complete correction.

The brace is worn for 23 hours per day for the first 3 months, and then at night and during nap time (12-14 hours/day) till the age of 5 years. Ankle-foot-orthrosis is advised after the age of 5 years. To help preventing a recurrent equinus deformity, parents are taught to perform a range of motion exercises for ankle when it is out of the brace.

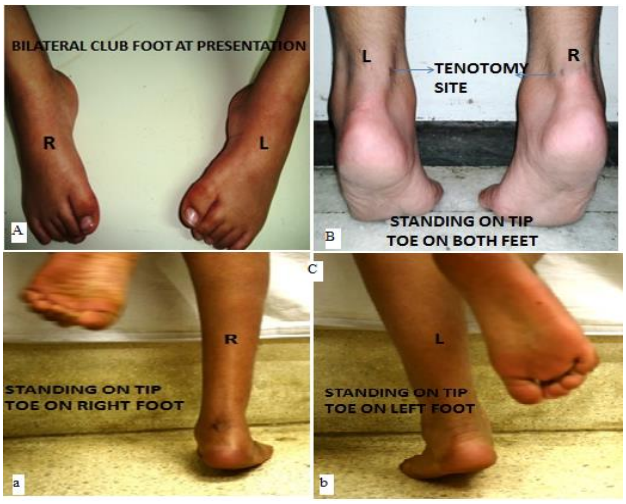

Figure 1: (A) Bilateral club foot at presentation, (B) Standing on tip toe on both feet with tenotomy mark (C) Standing on tip of toe on single foot- a) on right foot; b) on left foot.

Clinical photographs were taken from the front, back and side profile at the time of presentation and after completion of treatment (Figure 1A-1C).

RESULTS

In this study, there were a total of 42 children, and among these, there were 25 boys (40 feet) and 17 girls (28 feet). Before presentation to our hospital 8 patient had conservative (casting) treatment, 10 patients had been operated (PMSTR, JESS, Tendoachilles lengthening, Tenotomy), 24 patients came untreated (neglected) (Table 1).

An average number of casts applied in patients who had untreated were 6.8, in patients who had been treated by casting previously were 7.6 and for those who were previously operated were 8.6. It is also increased as the age increased (2-5 years age required 6.5 casts in neglected cases and 8 casts required in operated cases whereas 9 casts required in 11-13 years who underwent surgery (Table 2).

Table 1: Demography of the study population.

Variables	Total number	Number of feet
Gender		
Boys	25	40
Girls	17	28
Laterality of clubfoot		
Bilateral	26	52
Unilateral	16	16
Side of foot		
Left	08	08
Right	08	08
Treatment received for clubfoot before presentation		
Neglected	24	37
Casting	08	14
Operated	10	17

Table 2: Average number of casts applied at presentation according to different age.

Variables	No. of patients	Average no. of casts applied	Age									
			2-5 years		5-7 years		7-9 years		9-11 years		11-13 years	
			No. of patients	Average no. of casts applied	No. of patients	Average no. of casts applied	No. of patients	Average no. of casts applied	No. of patients	Average no. of casts applied	No. of patients	Average no. of casts applied
Neglected	24	6.8	19	6.5	2	7.5	2	7.5	1	6	0	0
Casting	8	7.6	4	7.8	2	7.5	2	7.5	0	0	0	0
Operated	10	8.5	4	8	4	8.8	1	8	0	0	1	9

Table 3: Average number of weeks after which patient started walking and standing on tip of toe according to different treatment methods.

Variables	Number of patients	Average number of weeks
Walking ability according to different treatment methods		
Neglected	24	4.6
Casting	8	4.8
Operated	10	7.2
Standing ability according to different treatment methods		
Neglected	24	7.3
Casting	8	7.3
Operated	10	9.5

The ability to stand on tip of toes after removal of the final cast was delayed maximum in the previously operated patients (9.5 weeks), lesser in patients who were previously treated by casting (7.3 weeks) and least in neglected patients (7 weeks) (Table 3). Ability to stand on tip of toes increased as the age increased (2-5 years age group required 7.4 weeks whereas 11-13 years age group required 16 weeks). Neglected patients started

walking earlier (4.6 weeks) as compared to patients treated by casting (4.8 weeks) or operatively (7.2 weeks). Younger children started walking earlier (age 2-5 years required 4.7 weeks whereas 11-13 years age group required 12 weeks) (Table 4). All the observations were evaluated using the statistical tool ANOVA test in SPSS.

Table 4: Average number of weeks after which patient started walking and standing on tip of toe according to different age.

Variables	Age									
	2-5 years		5-7 years		7-9 years		9-11 years		11-13 years	
	Total no. of patients	Average no. weeks	Total no. of patients	Average no. of weeks	Total no. of patients	Average no. of weeks	Total no. of patients	Average no. of weeks	Total no. of patients	Average no. of weeks
Walking ability	27	4.7	8	5.5	5	5.8	1	6	1	12
Standing on tip of toe	27	7.4	8	8	5	8.2	1	6	1	16

DISCUSSION

Treatment for neglected feet ranges from extensive soft tissue release to complex correction using different types of external fixator, corrective osteotomy and triple arthrodesis.[13,14] However; these techniques are long and costly and have a significant rate of complications. Dobbs et al. reported that results in nearly 50% of patients who treated by an extensive soft tissue release at 25 years follow-up, mainly as a result of stiffness.[15] Also reported that patients treated with open surgery presented weakness in the tibio-tarsal and subtalar joints, arthritis, loss of muscle strength (especially the sural triceps), pain and residual deformity.[11,13]

Ponseti's technique is simple method with gentle serial manipulations, casting and percutaneous Achilles tenotomy enjoys the reputation of most successful method in non-operative treatment of congenital clubfoot with correction of all the deformities in more than 90% of patients.[16]

The study done by Spiegel et al and Lourenço et al found no differences in the number of casts required and their patient required an average of seven casts per patient and they not mentioned the operated children.[17,18] But in our study, the need for a total number of casts was highest in previously operated patients, lesser in previously conservatively treated patients and least in patients who were neglected. The need for cast also increased as the age increased.

Tenotomy of the Achilles tendon is an integral part of Ponseti's technique for the treatment of clubfeet. The indication for tenotomy has been clearly described and is reported to be necessary in approximately 70% to 80% of patients.[4,9,10] Success of this method lies in the fact that it follows the normal biomechanics of talo-calcaneo-navicular joint (acetabularepedis) in relation to the pathological anatomy of the deformity. Ponseti stated that clubfoot mimics the normal extreme position of talo-calcaneonavicular motion of flexion; adduction and inversion. Ponseti's principle of manipulation was based on the kinematic coupling of the ankle and subtalar motion. Calcaneopedal block that is calcaneum and forefoot moves as a unit around the talus (acetabularepedis), had also an important bearing on the development of this technique.[10]

As the Achilles tendon is one of the most important tendons of the foot considering its functional contribution. Percutaneous tenotomy of tendo Achilles in older children carries a theoretical risk of weakness of the gastroc-soleus. These apprehensions have been identified as the most important hurdle for avoiding the tenotomy.[9]

Tenotomy in the operated cases was technically difficult as the tendon after tendoachilles lengthening is thinner, less prominent and not clearly palpable. Unlike the unoperated cases, no clear end point for tenotomy can be appreciated as scoring prevents the sudden sharp or giving way that is felt after conventional tenotomy.

Tendoachilles of all the patients were evaluated clinically after tenotomy and removal of the final cast. Clinical evaluation of tendoachilles regeneration was done by checking the ability of the patient to stand tip toe, range of motion of dorsiflexion and plantar flexion. The mean dorsiflexion after treatment was 12.5^0 (range10^0–14^0), and it is near comparable to the available study.[18] Tendoachilles of all the 42 patients (68 feet) regenerated and were fully functional irrespective of their age and history of previous treatment, but the duration of tendon regeneration took longer time in older children. Various studies have done to evaluate the endoachilles regeneration using USG and MRI; they noted that there is continuity of Achilis tendon from 3-12 weeks after the tenotomy.[9,11,12]

Number of weeks after which the patient started walking and standing on tip toe after removal of the final cast was highest in previously operated patients, lesser in patients who were treated conservatively previously and least in neglected patients. It also increased as the age increased.

The problem confronted with the older patients has been that of brace noncompliance, erythema, plaster sores, pain and stiffness in the knee.[18]

CONCLUSION

Functional evaluation of tendoachilles showed that it has good regeneration potential and all children who had tenotomy could walk, stand on tip of toes irrespective of age and previous treatment. However, older child and children having a history of previous treatment, required longer time for recovery. To conclude, tendoachilles completely regenerates and were fully functional after Ponseti's method and tenotomy of CTEV children even in older children age more than 2 years. So that benefit of painless, supple, functional, cosmetically acceptable and plantigrade feet can be shared with all children who have been born with clubfoot by avoiding the extensive soft tissue surgery at an early age.

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