Comparison betweenTenotomy and Sliding of TendoAchillis in Infants UnderPonseti Treatment

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Abstract

Background: Ponseti method is the gold standard for treating clubfoot. Persistent equinus component sometimes requires adding Achilles tendon surgery to the serial manipulation and casting technique. The various methods for achieving this tendon release are yet to be appraised.

Objective: Comparison between complete tenotomy and sliding technique regarding the degree of correction of equinus deformity at the end 6 months follow-up in infants less than 1 year of age undergoing serial manipulation and casting for Talipesequinovarus.

Methods: During the period from January 2008 to July 2011 48 feet in 36 infant under 1 year with clubfeet undergoing Ponseti Manipulative treatment were subjected to tendoAchillis surgery to correct the persistent equinus deformity. Complete tenotomy was performed in 24 (50%) and sliding technique done for 24 (50%) of the feet. Correction of hindfoot equines was appraised at the end of 6 months follow up period.

Results: Optimum dorsiflexion of 15° or more was obtained in 20 (83.3%) infants treated with tenotomy and in 18 (75%) infants treated with tendon sliding. Unsatisfactory dorsiflexion of less than 0° was present in 1 (4.2%) infant in both groups. Intermediate results considered when dorsiflexion between 0-15° was possible and was the sequelea of 3 (12.5%) tenotomies and 5 (20.8%) sliding operations.

Conclusion: Tenotomy and sliding technique are good or satisfactory in 95.8% of the feet.

Tenotomy in younger infants was foundtechnically more convenient.

Keywords: **Ponseti technique, clubfoot, equinus deformity, tenotomy, sliding technique.**

Introduction

Talipesequinovarus or congenital idiopathic clubfoot is a common disorder affecting 1-2 per 1000 live births1,2. It is bilateral in 30-50% of cases. Males are involved twice as much as females and familial tendency is observed in many cases. It may occur as an isolated disorder or as part of other disorders as arthrogriposis or neural tube defects.Club foot has three main components; equinus, varus and cavus that result from a combination of deformities and contractures involving bones, ligaments and tendons1,2,3.

Serial manipulation and casting techniqueadopted by Ignacio P. Ponseti is now considered as the gold standard for the treatment of club foot since it achieves successful correction in as high as 90-98% of cases2,4. The method is based on meticulous understanding of the pathological anatomy of club foot in affected stillbirth models. It utilizes the biological response of young connective tissue and bone to corrective position changes gradually obtained by manipulation and casting3. Minor surgical procedures may be added to shorten time of treatment

and to enhance correction in more resistant and older cases. They include Achillestenotomy or lengthening for correction of equinuscomponent and tibilalis anterior transfer for correction of forefoot adduction component3.

Achilles tendon surgery is performed in 67% (Goksan et al., 2006)5 to 97% (Bor et al., 2006)6 of patients under Ponseti regime. The standard technique is complete Achillestenotomy in infants 1 year or younger. Older children can be helped by open Z-plasty. However, Moreau and Lake described another minimally invasive method for Achilles lengthening originally tailored to correctequinus deformity in cerebral palsy patients. The technique entails3 percutaneous incisions and sliding of tendoAchilles (Moreau and Lake, 1987)7.

Patients and methods

During the period from January 2008 to July 2011, 57 feet in 43infants under 1 year were treated for club foot by the standard serial manipulation and casting technique described by Ponseti. Males were 49 (86%) and females were 8 (14%). The condition was bilateral in 14 (32.6%) of cases. In these infants, 48 feet (84%) required Achilles tendon surgery.

Infants with Idiopathic talipesequinovarus under 1 year who are being treated by standard Ponseti technique were submitted to Achilles tendon release when the degree of passive dorsiflexion measured less than (0) degree after removal of the fifth cast.All cases proved or suspected to have congenital musculoskeletal disorder like arthrogriposis or neuromuscular disorder like neural tube defects were excluded from the study.

Casting was initiated with the first encounter of the child with an age range of the first cast from 1 week to 3 months. Then the cast was changed every 5-7 days with gradual correction of foot adduction at first then equinus deformity, paying attention not to interfere with heel varus or forefoot supination. Residual equinus was appraised after removal of the fifth or sixth cast (when passive forefoot abduction of 30-50 degrees was possible). Any foot with gentle passive dorsiflexion less than (0) degrees was assigned as a candidate for Achilles tendon surgery.

Patients requiring Achilles tendon surgery were allocated in two groups on every other case basis. The first group was subjected to Completetenotomy"this procedure is performed with the patient under general anesthesia in supine position with the foot held tight in dorsiflexion to make Achilles tendon stand out and to take it away from underlying neurovascular structures, a number 15 knife is passed percutaneously from medial to lateral side dividing the Achilles tendon 2 cm above its insertion. The foot should give way in dorsiflexion terminating the procedure. Sutures are not required. Above knee cast is then applied with the foot in 20 degrees dorsiflexion, 70 degrees of abduction and the knee flexed to 90 degrees for 3 weeks.

The second group was treated with "Sliding technique"which is carried out with the patient under general anesthesia in supine position with the foot held tight in dorsiflexion, number 15 knife is used to cut half the substance of Achilles tendon percutaneously at three sites; first medially at the insertion of the tendon, second medially at the musculotendenous junction, and third lateral in between. The foot is then stretched to 20 degrees of dorsiflexion, 70 degrees of abduction and cast is applied in the same manner as above. In very small feet two incisions are made; one medial at the insertion of the tendon and another lateral close to the musculoskletal junction.

The cast was removed after 3 weeks and was replaced by an abduction splint with the foot in 70 degrees of abduction and

10 degrees of dorsiflextion for the affected foot while the sound foot was kept neutral in the splint in unilateral cases. The splint was worn 23 hours a day for 3 months with one hour of rest, massage and exercise. For another 3 months the splint was applied only at night.

At the end of 6 months the degree gentle passive dorsiflexion was measured and is categorized in three groups: those with more then 15 degrees of dorsiflexion were considered as excellent correction, between 0-15 degrees as moderately corrected and those with less than 0 degrees of correction as unacceptable results that necessitates casting.

Intra and post-operative complications including bleeding, nerve injuries, tendon injuries and scarring were also assessed in both groups.

The results were tabulated and chi square was calculated for statistical significance of the results.

Results

A total of 48 out of 57 feet (84%) were assigned as candidates forAchilles tendon lengthening There were 12 (25%) bilateral cases. At the end of 6 months follow up the degree of correction of equinus deformity for the group of 24 feet treated with complete tenotomy were as follows:
In 20 (83.3%) feet excellent results were achieved with gentle passive dorsiflextion possible to beyond 15 degrees. In 3 (12.5%) feet the results were good with 0-15 degrees of dorsiflexion mandating the return to round the clock in the abduction splint with 10 degrees of dorsiflexion to combat the tendency for recurrence of the deformity. Unacceptable measurement of less than 0 degrees of dorsiflexion was encountered in 1 (4.2%) foot only in which case return to casting is warranted.

In the group of 24 feet treated by sliding technique the results were as follows: In 18 (75%) feet the results were excellent with dorsiflexion possible to beyond 15 degrees. In 5 (20.8%) the results were good and the dorsiflexion was between 0-15 degrees. Less than 0 degrees of passive dorsiflexion was found in one patient only (4.2%). There was no significant difference between the two methods at P Valueof less than 0.05 (Table 1).
In both groups bleeding occurred in some cases but it was minimal, controlled by gentle pressure for few minutes and did not affect vascularity of the foot.Tibial and peroneal nerve injury did not occur in any case. However, it was not possible to assess for injury of the sural nerve by eliciting paresthesia over its sensory distribution in these infants.Careful assessment of the movement of the foot and toes did not reveal any injury to the tendons of the flexor halluces longus, tibialis posterior, flexor digitorum, and peroneal muscles.Postoperative scarring was barely visible at the end of follow up.

Discussion

The need for Achilles tendon surgery with Ponseti technique is judged by measuring the degree of residual equinus after 5-6 weekly cast applications3. Manyclinical classification schemes have been proposed, including two of the more recent classifications by Pirani et al. and Diméglio et al. which are based solely on physical examination and require no radiographic measurements or other special studies. In the system of Diméglio et al8, four parameters are assessed on the basis of their reducibility with gentle manipulation as measured with a handheld goniometer: (1) equinus deviation in the sagittal plane, (2) varus deviation in the frontal plane, (3) derotation of the calcaneopedal block in the horizontal plane,

and (4) adduction of the forefoot relative to the hindfoot in the horizontal plane. In this system, equinus deformity is graded as follows:
1 point: dorsiflexion 0 to -20 dorsiflexion possible with gentle manipulation.
2 points: 20-0 degrees dorsiflexion.
3 points: 45-20 degrees dorsiflexion.
4 points: 90-45 degrees dorsiflexion.

Ponseti states that equinus correction beyond 10-15 degrees is often impossible because of the tight posterior ankle ligaments and joint capsule and the inherent deformities in the talus and calcaneum. Ponseti also argues that the clinical assessment of the initial deformity and subsequent follow ups is sufficient and negates the need for radiographic examination since the ossification centers of the tarsal bones are small, ovoid, eccentric and some appears late in childhood as in the navicular which appears at 3 years of age3.

Achilles tendon surgery is justified in very rigid equinus unyielding to standard manipulation after the fifth or sixth cast and also to shorten the time and frequency of manipulations. Foot bones become porotic after the tenth cast and tend to fracture under the force of manipulation and further casting. Taking these factors in consideration a total number of 48 feet were decided to need Achilles tendon surgery. This number represents 84% of the total 57 feet undergoing Ponseti serial casting. This percentage falls within the ranges reported by Ponseti3andChangulani et al.9(85%), in (97%) of feet in the series of Bor et al.6,and in (67%) of feet described by Goksan et al5.

The range of dorsiflexion obtained by complete tenotomy was good (passive dorsiflexion 0-15 degrees) to excellent (dorsiflexion more than 15 degrees) in 23 out of 24 treated by this procedure (95.8%). The summation of good and excellent results in the sliding technique is also 23 out of 24 treated by this way (95.8%). Poor results (dorsiflexion less than 0 degrees) were found in one foot (4.2%) in both methods. The similarity of both methods regarding the clinical outcome and the lack of statistically significant difference should lead to the comparison of the advantages of both methods.

Tenotomy method seems to sever the tendon and sacrifices the anatomical continuity of this tendon. However, when done in the first months of life the tendon scar is barely visible in feet requiring open tendon lengthening later in childhood3. The technique is simple and can be carried out as an outpatient procedure under local anesthesia and is not associated with any significant complication. On the other hand, sliding method is more anatomical in keeping the continuity of the tendon. Postoperative scarring and bleeding are minimal and the procedure can also be carried out under local anesthetic. However the sliding method is more technically demanding in determining the amount of cutting in each incision as more cutting may break the continuity of the tendon and inadvertently render the procedure into a complete tenotomy. On the other hand, cutting less than half the substance of the tendon will lead to failure of sliding of the tendon fibers and again the tendon may rupture under vigorous stretching.

Conclusion

Both complete tenotomy and sliding methods are predictable in achieving good to excellent clinical correction of equinus component of talipesequinovarus in short term follow up.Complete tenotomy is simple and safe procedure and should remain as the standard practice for infants less than one year of age.Sliding method is technically more demanding and is preferably preserved for older children where the Achilles tendon

is more sizeable and anatomical correction is more desirable.

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Table 1: The degree of dorsiflexion achieved by tenotomy versus sliding technique

	Tenotomy		Sliding		Total
Dorsiflexion	No.	%	No.	%	
>15°	20	83.3	18	75	38
0-15°	3	12.5	5	20.8	8
<15°	1	4.2	1	4.2	2
Total	24	100%	24	100%	48

Figure 1: Abduction splint in place

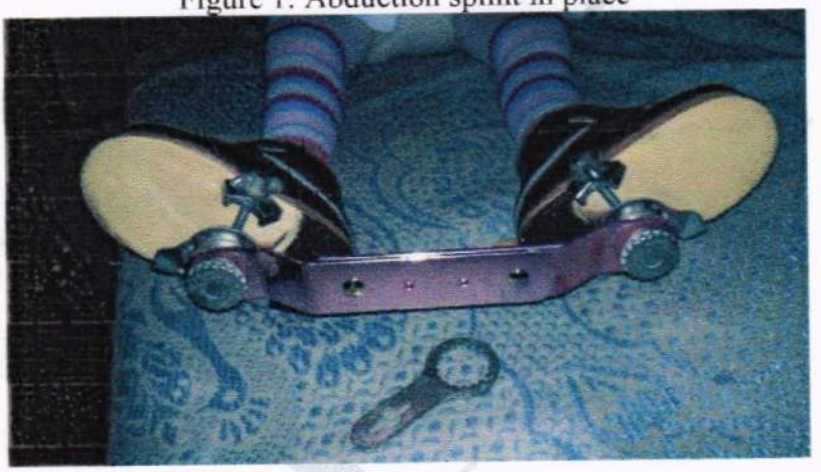

Figure 2: Gentle passive dorsiflexion after Achilles tendon release

Figure 3: Minimal scarring after 2 incision sliding technique

Figure 4: Diméglio classification of equinus component of clubfoot