

COMPARISON OF PERCUTANEOUS TENOTOMY TECHNIQUES FOR CORRECTION OF EQUINUS DEFORMITY IN CONGENITAL TALIPES EQUINO VARUS (CTEV) IN CHILDREN: A RANDOMIZED CLINICAL TRIAL

Raghvendra Choubey¹, Ashish Jain²

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ABSTRACT: Tendo-achillies tenotomy is required as last step of ponseti method of treatment of Congenital Talipes Equino Varus (CTEV). By this study we compared the two methods of percutaneous tenotomy for correction of equinus deformity in congenital talipes equino varus (ctev) in children. **METHODS:** It is a prospective randomized clinical study, conducted during the period of November. 2012 to April 2015 at the Department of orthopedics in the tertiary level hospital. **RESULTS:** Total fifty five CTEV feet were treated. Twenty seven feet were of blade tenotomy variety and twenty eight feet were of needle tenotomy variety. In this study mean pre-treatment Pirani score was 5.62 vs 5.58 in blade and needle tenotomy group respectively. Out of 57 feet 56 were managed successfully. One patients of needle tenotomy variety developed relapse of the deformity due to poor and faulty application of D-B Splint. Author do not find any significant difference between the two methods of percutaneous tenotomy. **CONCLUSION:** In the treatment of equines deformity of CTEV, the percutaneous needle tenotomy technique is a simple, excellent, minimally invasive, effective, less expensive, takes less time and which is possible without general anesthesia even in neonates. **KEYWORDS:** Congenital Talipes Equino Varus, Clubfoot, Percutaneous Tenotomy, Tendoachillies.

INTRODUCTION: Idiopathic congenital clubfoot consists of complex malalignment of the foot that involves soft and bony parts which is characterized by equinovarus hind foot, mid foot and fore foot cavus and adduction.¹⁻² In past, the correction of deformities is by means of extensive surgical releases, and nowadays trend is towards correction with conservative methods that are becoming less and less aggressive.³ The Ponseti method is becoming increasingly widespread today, with many favorable reports in several countries.⁴⁻¹⁰ Tenotomy of the tendo-achillis is essential to correct the equinus deformity to gain dorsiflexion and required in almost 85% of cases of Congenital Talipes Equino Varus (CTEV) treated with Ponseti technique.^{1,2} Mini-open and percutaneous techniques are been described for doing tendo-achillis tenotomy.

Percutaneous tenotomy by surgical knife is widely ues all over across the world but recently new technique by using wide bore surgical neddle is increasingly used in the last decade which was first described by Minkowitz et al.^{3,4,5} The technique with needle may possibly have advantages when compared to others tendon lengthening techniques, duo to the minimally invasive approach, the simplicity and very low morbidity.^{8,9} Percutaneous tenotomy with a needle is performed in an outpatient setting and under local anesthesia. The surgeon avoids incising the skin. Since this is a recent technique, it is a good idea to have it validated and compared with other methods and this is one of the justifications for our present investigation, and searching the English literature this is the first study which compared the two methods of percutaneous tenotomy.

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MATERIAL AND METHODS: It is prospective randomized clinical study with Thirty-seven patients with idiopathic congenital clubfoot, with a total 57 feet affected and submitted to tenotomy (Two cases with bilateral involvement did not require tenotomy on one of the feet, due to equinus correction with plaster changes), between November 2012 and April 2015 in tertiary hospital. The following inclusion criteria were established: (1) children with idiopathic CTEV, treated by the Ponseti technique and submitted to tenotomy of the Achilles tendon for correction of residual equinus; (2) midfoot pirani score came to zero after serial casting by ponseti technique. (3) Primary and follow-up treatment done completely at our institution, (4) age less than one year, The exclusion criteria included (1) the non-acceptance of the parents in participation in the study and (2) syndromic clubfoot.

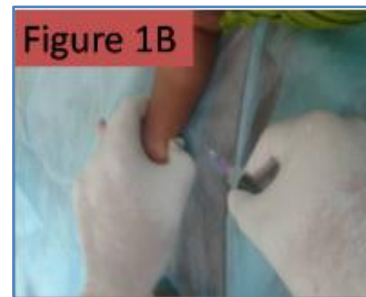
All parents were informed about the procedure and a written consent was taken. Each patients was screened by a single paediatrician to rule out syndromic cases or other congenital anomaly. From each participants all the relevant data were collected that includes patient's clinical profile including pre and post tenotomy Pirani's severity scoring score,¹⁰ post treatment complications like pressure sore, skin abrasions, excessive bleeding after tenotomy or any other complication. Fifty seven feet's were randomly allocated into one of the two group according to the type of method used for tenotomy (Percutaneous needle tenotomy or percutaneous blade tenotomy). Percutaneous tenotomy was performed by single orthopaedic surgeon in an outpatient setting with technique as described by Minkowitz et al. Ten minutes before the procedure, orally sedative was given for sedation purposes, and locally anaesthetic cream was applied on the skin over the region of the Achilles tendon (lidocaine 2.5%). (Figure 1A).

The patient was placed in supine position. An assistant maintained the positioning of the limb with Knee is kept at 90° flexion and hip abducted to reach the posterior part of the foot. The equinus deformity at the ankle is assessed. All aseptic precautions are taken. Antisepsis was performed with a solution of povidine iodine. Local anesthesia was used with a solution of 1% lidocaine (~0.2mL) injected in the subcutaneous tissue, at the region of the entrance for performance of the tenotomy. (Figure 1B) The tendo-achillis is palpated as a tense cord when the foot is dorsiflexed. In group 1 Sterile 16 gauge needle is chosen for the procedure attached to a 3.0 mL syringe, to facilitate grip and control over the positioning of the needle. Care was taken to avoid injuring the posteromedial neurovascular bundle (Posterior tibial). In this manner needle was inserted from the medial border of the tendoachillis about one finger breadth proximal to the insertion of tendo-achillis or the posterior heel crease (Figure 1C) The bevelled tip of the needle was used to cut the tense fibres of tendoachillis and a Grating sensation can be felt and heard.

In group 2 instead of needle surgical knife with blade 11 no. Was used. In both group dorsiflexion force is continuously applied to the foot and as the tenotomy is completed a snap was perceived with a click and sudden visible increased correction of dorsiflexion. (Figure 1D) Clinical signs of success of the tenotomy were investigated, which were palpable depression over the tendon in the sectioning region, increase of dorsiflexion, and lack of foot movement, positive Thompson sign (Manual squeezing of the calf). A light pressure was given over needle insertion site for hemostasis. The circulatory conditions of the toes was observed by seeing nail blanching. Afterwards, corrective cast is then applied for 3 weeks. The patient observed for circulatory conditions of the ankles, to general state, and signs of bleeding for thirty minutes. Postoperatively paracetamol, was administered orally for pain relief.

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Patients were followed on second day (to check neurovascular status), three weeks (For cast removal and to give DB splint) and report if any problem occurs during treatment. Denis-Browne splint (DB splint) was applied after cast removal to prevent relapse of the deformity. DB splint was used at least 23 hours each day during the first 3 months and then CTEV shoes for a daytime and DB splint for 12 hours at night. Follow up of the patients was done every month for 3 months after application of D-B splint till the patients were two years of age. The final outcome was measured by using Pirani score, according to which there are 6 scores for clinical signs: 3 scores each for hind-foot and mid-foot. The Pirani score 0 indicated normal foot while 6 indicates severely abnormal foot. So the successful management was reflected by excellent (when Pirani score became 0) and good (Pirani score 0.5 to 1) outcomes and poor if the score became more than 1.



OBSERVATION AND RESULTS: Between November 2012 to April 2015 Fifty five feet [thirty (54.6%) patients with unilateral involvement, twenty five (45.4%) patients with bilateral involvement] were able to be followed up to one year and included into final observation who completed the inclusion criteria. Three patients were excluded from the study, as one patient had polydactyl, one with spinal anomaly, and one with Streeter Syndrome. Out of these fifty five patients, there were thirty three (60%) boys and twenty two (40%) girls. The mean age at start of treatment was 3.75 weeks. In the study group, mean pre-treatment Pirani score of the blade and the needle tenotomy varieties (5.61 vs. 5.58) (Table1) shows that there was no significant difference between them. The mean age at the time of tenotomy was 9.52 weeks. Mean time taken for blade tenotomy was 10.5 minutes while in needle tenotomy group was 13.2 minutes. Due to poor and faulty application of D-B Splint and irregular follow up, one feet of needle tenotomy developed relapse of the deformity and advised surgery. Post-treatment mean Pirani score in the blade tenotomy group was 0.26 while in needle tenotomy group was 0.31. There was no statistically significant difference between the two groups ($p > 0.05$). Two cases developed plaster cast complications (One with pressure sores over medial aspect of great toe which was in blade tenotomy group and one case had skin abrasions over the

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thigh which was in needle tenotomy group) which were managed successfully. Two patients in blade tenotomy group developed soakage over cast hence cast was changed immediately and managed successfully. There were no cases of excessive bleeding, neurovascular compromise, infection or psuedoaneurysm formation.

DISCUSSION: Tenotomy of the tendo-achillis is an essential step of ponseti treatment of CTEV for correction of deformity. Conventional blade tenotomy achieves good correction, however complications like damage to neurovascular structures leading to bleeding or pseudo aneurysms are reported.^{6,7} Moreover parents drops out from the treatment in India because of illiteracy when treating doctor says to parents that the baby requires surgery and explaining the procedure that tendon require sectioning by blade. Probably this is the advantage gained by treating doctors when tendon sectioned by needle and procedure explained to parents. Needle tenotomy is a relatively simple procedure which is less invasive and probably has less morbidity and already described in literature.^{3,4} It does not require an operation theatre and can safely be done as OPD procedure under sedation. This will also decrease the cost of the procedure.

We achieved successful management in 98.2% of CTEV feet. Figure appears to be very high but it might be because of shorter follow up time period however success rates for this method of treatment in children have been reported to vary from 78% to 96.7%.¹¹⁻¹⁴ this percutaneous needle technique is easy to learn and is relatively free of complications and will be much useful. In all cases adequate correction could be achieved and no open procedure was required in any case. Even with such good results, authors found that the technique is poorly reported in literature with only three series.^{3,4,5} Limitations of study includes small sample size, small age of baby undergoing tendon sectioning, shorter follow up, not a blinded study, syndromic feet's are not included in the study etc. The main purpose of this study is to create awareness of this technique and to evoke other surgeons to use and validate it as more data is required in terms of defining the limitation of the technique, use in delayed and older cases and use in syndromic feet.

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PIRANI SCORE	BLADE TENOTOMY GROUP No.=27	NEEDLE TENOTOMY GROUP No.=28
06	15	17
5.5	7	5
05	3	3
4.5	-	1
04	2	1
3.5	-	1
3.0	-	-

Table 1: Initial Pirani Score

RESULT	BLADE TENOTOMY GROUP No. =27 (%)	NEEDLE NOTOMY GROUP No. =28 (%)	TOTAL No. =55 (%)
Successful	27	27	54
-Excellent(Pirani score 0)	12(21.81)	14(25.45)	26(47.27)
-Good (Pirani score 0.5-1)	15(27.27)	13(23.63)	28(50.9)
Unsuccessful	-	1(1.8)	1(1.8)
-Poor (Pirani score>1)	-	1(1.8)	1(1.8)

Table 2: Final Result

COMPLICATIONS	BLADE TENOTOMY GROUP	NEEDLE TENOTOMY GROUP
Skin abrasions	1	0
Cast saw injury	0	0
Skin blisters	0	0
Slippage of cast	0	0
Excessive bleeding	2	0
Infection	0	0
Pressure sore	0	1
Neurovascular compromise	0	0
Pseudoaneurysm formation	0	0

Table 3: Complications

AUTHORS:

1. Raghvendra Choubey
2. Ashish Jain

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Orthopaedics, BMC SAGAR (M. P.).
2. Assistant Professor, Department of Paediatrics, BMC SAGAR (M. P.).

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Dr. Raghvendra Choubey,
Flat No. 7-B, Type-IV,
Bundelkhand Medical College,
Sagar-470002, Madhya Pradesh.
E-mail: dr_raghvendra2006@yahoo.co.in

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