

## A COMPARATIVE STUDY OF RECONSTRUCTION OF CHRONIC TENDO ACHILLES RUPTURE WITH FLEXOR HALLUCIS LONGUS AND PERONEUS BREVIS

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### ABSTRACT

#### BACKGROUND

Chronic rupture of the tendo Achilles is debilitating and difficult to treat, as there is usually a gap between the tendon ruptured ends, and also due to scarring and retraction of the tendon ends. Surgical reconstruction is superior to conservative management.

#### MATERIALS AND METHODS

25 patients aged between 30 to 60 years underwent reconstruction of chronically ruptured tendo Achilles either with flexor hallucis longus or peroneus brevis. Ruptures are due to stumbling in fields, fall from stairs and some are uneventful. All these patients attended Orthopaedics OP of Government General Hospital, Kurnool. The patients were admitted and surgically treated after appropriate counselling and consent. The results were compared with Quigley Scale and Leppilahti Scores.

#### RESULTS

Rupture of the Achilles tendon is more common in middle aged males. Delay in diagnosis is due to lack of adequate knowledge to the treating physician and lack of immediate disability to patient. Thompson test has high sensitivity and specificity in diagnosis. Complications such as superficial skin infections, wound dehiscence are more in patients treated with peroneus brevis. Sensory disturbance on foot is an exclusive complication of patients treated with peroneus brevis.

#### CONCLUSION

Flexor hallucis longus is superior to peroneus brevis because of anatomical and technical advantages, less incidence of superficial infections, wound dehiscence and sensory disturbance, with better weight bearing times and functional recovery.

#### KEYWORDS

Tendo Achilles, Flexor Hallucis Longus, Peroneus Brevis.

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#### BACKGROUND

Injury to the tendo Achilles is relatively common in middle aged persons and athletes.<sup>1,2</sup> Pushing heavy objects with only forefoot on the ground, bearing weight, sudden unexpected dorsiflexion,<sup>3</sup> and violent dorsiflexion of the plantigrade foot. In people of low socioeconomic background who walk bare foot on the uneven ground with heavy weights are risk of rupture due to stumbling. Administration of steroids<sup>4</sup> for calcaneal tendinosis may lead to tendon degeneration and rupture due to insignificant injury. Mucoïd degeneration<sup>5</sup> of the tendon and inhibitor malfunction<sup>6</sup> are also the causes sited.

Various modalities of treatment include conservative management with splints and casts.<sup>7</sup> Operative treatment with gastrocnemius V-Y plasty, augmentation with plantaris tendon, peroneal tendons, flexor hallucis longus, flexor digitorum longus. Other materials used include allografts, synthetic materials such as Dacron weave, Carbon fibre, Marlex mesh. In the present study we use either flexor hallucis longus or peroneus brevis for augmentation of chronically ruptured tendo Achilles.

#### Aims and Objectives

1. To study the effectiveness of augmentation of ruptured tendo Achilles with flexor hallucis longus and peroneus brevis tendon transfer.
2. To compare the risks and benefits of either procedure.
3. To study the complications of each procedure.

#### MATERIALS AND METHODS

The present is a prospective comparative study comprised of 25 patients with chronic rupture of Achilles tendon, who attended the orthopaedic outpatient department of Government General Hospital, Kurnool, Kurnool district. All

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the cases were treated surgically by reconstructing the tendo Achilles with either flexor hallucis longus or peroneus brevis tendon.

### Inclusion Criteria

Patients with both sexes with closed rupture of Achilles tendon which are at least 3 weeks old, and the patients aged between 25 to 60 years.

### Exclusion Criteria

- Prior history of surgery for the correction of tendon repair.
- Ruptures associated with other generalised conditions.
- Ruptures associated with open wound.

### Sample Size

25 cases .13 of the 25 patients were treated with flexor hallucis longus tendon transfer and the remaining 12 patients were treated with peroneus brevis tendon transfer.

### Tendo Achilles Rupture Reconstruction with Flexor Hallucis Longus Tendon Transfer (Modified Wapner Method)

- The patient is positioned in semi-lateral position towards the affected side, such that the body below the pelvis appears to be in prone position. This helps in such a way that posterior and medial part of the foot facing towards the ceiling.
- A sand bag is placed at the level of the ankle so that it holds the foot in plantar flexion.
- Through posteromedial approach, a direct incision is given all the way on to the Achilles tendon from a point 15 cm above the insertion of tendo Achilles. The incision is extended until the paratenon is identified and split longitudinally. Ruptured ends are identified, and distal 1 cm of the proximal part is debrided and sent for histopathological examination.
- Deep posterior compartment is opened and fhl identified, confirmed and separated.
- Through separate incision at the level of midfoot on medial side which is about 5 cm, abductor hallucis is identified and retracted posteriorly to identify the flexor hallucis longus tendon. The tendon is cut immediately distal to the knot of Henry.
- Tendon is retracted into the posterior incision and secured to the tendo Achilles proximal part, by interlacing it in coronal plain and securing with 2.0 vicryl. The tendon exits at the distal tip of the proximal end.
- The tendon complex is secured with a 1.0 proline by aBunnelstitch. A tunnel is made in the calcaneus 1 cm. anterior to its insertion exiting the sole of at about 2 cms from the posterior border by using 4 mm drill bit.
- The tendon is passed into the tunnel of the calcaneus. The pull-out suture is secured with a button or a gauge roll. After wound closure ankle immobilised in 10° plantar flexion.

### Achilles Tendon Rupture Reconstruction with Peroneus Brevis Tendon Transfer

- Through posterior approach, an incision is given over the distal portion of leg starting 8 -12 cm from the insertion of tendo Achilles, the incision is deepened till the paratenon is opened and split longitudinally.
- The ruptured ends are identified, and the distal 1 cm of the tendon is cut and sent to histopathological examination
- The second incision is placed on the base of the fifth metatarsal such that it is at a right angle to the tendon of peroneus brevis at its insertion. The peroneus muscle tendon is identified at the proximal incision by opening the lateral compartment at the lateral margin of the incision and confirmed by retracting and palpating it at its insertion.
- Peroneus brevis cut at its distal end the tendon retracted to the proximal site. The tendon of peroneus brevis is interlaced on to the proximal part of ruptured Achilles tendon in coronal plain and secured 2.0 Vicryl.
- The tendon complex is anchored with a 1.0 proline by a Bunnel stitch. With a bone awl tunnel is made in the calcaneus from a point just anterior to the Achilles tendon insertion to a point 2 cm from the posterior border of the foot
- The peroneus tendon is passed through the tunnel and is secured with a button or a gauge roll. After wound closure ankle immobilised in 100 plantar flexion.

### Postoperative Management and Follow up

- The drain is removed on 2nd day and sutures on the 14th day.
- At the end of two weeks below knee cast is applied in 100 equinus and continued till the end of 6 weeks.
- After 6 weeks cast is removed along with pull-out suture patient is advised complete weight bearing at his comfort.
- Heel rise is given for another two weeks along with physiotherapy (calf strengthening exercises)
- Complete weight bearing is advised after 8 weeks of surgery at the comfort of the patient.

### Follow-Up

Patients of both groups are followed up at 2, 4, and 6 months and were individually assessed clinically. The following criteria used to assess the strength and stability of ankle, along with the strength and power of plantar flexion.

### The scoring systems that are adapted to assess the outcome are-

- Quigley Scale<sup>8</sup>
- Leppilahti Score<sup>9</sup>

### RESULTS

We have treated 25 cases of chronic rupture of Achilles tendon by surgical reconstruction with flexor hallucis longus and peroneus brevis. In group A flexor hallucis longus is used and in group B peroneus brevis is used.

	Group A	Group B	Total
Male	7	7	14
Female	6	5	11
	13	12	25

**Table 1. Sex Distribution**

	Group A	Group B	Total
30 – 40 Years	3	3	6
40- 50 Years	6	6	12
More than 50 Years	4	3	7
Total	13	12	25

**Table 2. Age Distribution**

	Group A	Group B	Total
Fall from Stairs	3	4	7
Stumbling in Fields	6	4	10
Unknown Injury	4	4	8
	13	12	25

**Table 3. Mode of Injury**

	Group A	Group B	Total
Right Side	7	6	13
Left Side	6	6	12
Total	13	12	25

**Table 4. Side of Rupture**

	Group A	Group B	Total
3 to 5 Weeks	6	6	12
More than 5 Weeks	7	6	13
Total	13	12	25

**Table 5. Time Gap from Injury to Surgery**

	Group A	Group B	Total
2-3 CM	4	3	7
3-4 CM	8	8	16
More than 4 CM	1	1	2
Total	13	12	25

**Table 6. Gap in Ultrasound**

	Group A	Group B
Pain	8	4
Steroid Infiltration	3	3
Diabetes	2	5
Calf Weakness	3	2

**Table 7. Presentation and Associated Factors**

	Group A	Group B
Superficial Skin Infections	2	4
Wound Dehiscence	2	2
Deep Infections Requiring Skin Flap Coverage	0	0
Rupture	0	0
Neurological Symptoms	0	3

**Table 8. Post-Operative Complications**

	Group A	Group B
Excellent	6	2
Good	7	9
Fair	0	1
Poor	0	0

**Table 9. Quigley Scale**

	Group A	Group B
91-100	8	2
81-90	3	7
71-80	2	3
<70	0	0

**Table 10. Leppilahti Score**

**DISCUSSION**

The goal of treatment of neglected tendo Achilles rupture is to allow normal gait and endurance of person for walking and other daily activities by restoring the continuity of tendon with sufficient strength and healthy tissue without inflammation and also decrease the chance of rerupture which is most common complication of non-operative treatment.

In the present study we have surgically treated 25 patients with tendo Achilles rupture with either flexor hallucis longus (group A) or peroneus brevis (group B) tendon transfer. 13 patients were among the group A and 12 patients were among the group B. Of these 11 were female (44%) and 14 were male (66%). Of this 6/13 (46%) were female in group A and 5/12 (41%) were female in group B. The Achilles tendon tears are more common in males because they are more commonly involved in sports and recreational activities. Ruptures of Achilles tendon tears are seen in middle-aged males unconditioned for sports activities.

Side of injury is equal on both sides i.e. 12/25 (48%) were on the left side and 13/25 (52%) were in the left side.

Mode of injury in our study is most commonly stumbling in the fields (10/25 cases i.e. 40%), as the majority of patients are farmers and agricultural laborers. Other causes include fall from steps, (7/25 case i.e. 28%) which may cause sudden violent dorsiflexion of the ankle leading to rupture of the tendo Achilles. Remaining cases do not have a history of fall or any such incident which may lead to rupture of the tendo Achilles.

Almost 50% of the patients (8 in group A and 4 in group B) has the history of pain in the posterior region of the ankle before the rupture. 25% of the patients (3 in group A and 3 in group B) has a history of steroid infiltration for ankle pain, which has been cited as a cause for the rupture of the Achilles tendon. Steroid infiltration is associated with decreased wound healing capacity and decrease local immunity. It also decreases the thickness and quality of skin at the infiltration site. Other comorbidities like diabetes present in 25% of the cases. Almost all the cases 90% have fissures in the sole of foot.

Inglis<sup>6</sup> has classified the timing as early if within 3 weeks after rupture and late of over 3 weeks. Gabel et al<sup>10</sup> described that an Achilles tendon rupture is considered

chronic if there is a 4-week interval between the rupture and repair.

Criteria suggested by<sup>11</sup> Turco which positively influence the outcome of the reconstruction include the suturing of the shredded tendon, prevention of lengthening of the tendon, debridement of the ischemic ends of the tendon, eliminating the excessive equinus, secure fixation and eliminating of the cast disease. These guidelines are followed in the reconstruction of the tendons in both the groups.

#### **Following are the advantages of flexor hallucis longus over peroneus brevis:<sup>12,13</sup>**

1. Flexor hallucis longus tendon is second strongest tendon acting to plantar flex the ankle.
2. The axis of contraction of the flexor hallucis longus is in line with that of the Achilles tendon.
3. Flexor hallucis longus fires in line with that of the gastrocnemius-soleus complex.
4. Flexor hallucis longus is in anatomical proximity to the Achilles tendon.
5. Digitations present between flexor hallucis longus and flexor digitorum longus helps retain flexion of the first distal interphalangeal joint.

In the non-athletic patient, the clinical deficit resulting from the harvest of the flexor hallucis longus seems to be remarkably limited. Most patients in the published series are over 50 years. It is unclear if loss of hallucial push-off would be more noticeable in a younger population to whom the ability to sprint or jump is more highly valued. Coull et al analyzed morbidity following flexor hallucis transfer. A trend toward decreased loading of the hallux on the operative side was noted on force plate pressure measurement, and a clinically apparent decrement in flexion strength of hallux was noted on physical exam. Nevertheless, clinical symptoms were essentially absent, and no transfer metatarsalgia was present. This result has been borne out in other follow-up studies of procedure; the success of the surgery may well outweigh any perceived deficits with the toe.

The average time for complete weight bearing in group A is 7 weeks and that of group B is 8.5 weeks. Almost (90%) all the patients from group A can bear complete weight by 7 weeks and comfortably walk without discomfort by 8 weeks. In the case of group B only 60% of patients can walk comfortably by 8 weeks. Major complications such as reruptures, deep wound infections have not been encountered. 15% of cases from group A (2/13) and 33% of Group B (4/12) have the complication of superficial wound infection which has been treated with parenteral antibiotics. 23% of group A and 41% of the cases of group B has the complications of wound dehiscence, sensory disturbance in 25% (n=3) of the case in group B.

92% of the patients in group A can stand on tiptoes by the end of 12 weeks and brisk walk by end of 18 weeks. For one patient in group A it took 22 weeks for standing on tiptoes and 24 weeks for brisk walking. In case of group B only 60% of the patients can stand on tiptoes by the end of

12 weeks and only 50% of patients can briskly walk by the end of 18 weeks. 2 patients in group B cannot stand on tip toes even after 22 weeks.

Quigley scale introduced by Thomas B Quigley in his journal in 1980, to objectively measure the success of surgical repair of tendo Achilles rupture. The components he considered were calf muscle atrophy, range of motion at the ankle joint, the difference in toe raises. He compared the results with that of the unaffected leg. In the present study, we have 46% (n=6) of the patients with excellent results in group A and only 16% (n=2) in the group B. All the patients with excellent results in both groups were less than 50 years and non-diabetic. We have good results 53% (n=7) of group A and 75% (n=9) in group B. we have got fair results in 8% (n=1) of cases in group B and none in group A. the patient with fair results is an elderly patient with diabetes.

The Leppilahti score provides a comprehensive assessment of outcome after tendon transfer for neglected rupture of tendo Achilles as it takes into consideration both subjective and objective criteria. In the present study Leppilahti score of 91-100 (excellent) is achieved in 61% (n=8) in group A and 16% (n=2) in group B. This is because all the patients in group A with scores more than 90 are below 50 years of age and had regular follow-up. None of them has gap more than 4 cm intraoperatively. They all have healthy and bulbous tendon ends. Both the cases in group B with Leppilahti scores more than 90 are less than 50 years of age and intraoperative gap less than 4 cm. Leppilahti scores between 80 and 90 (good) are seen in 23% (n=3) in group A and 58% (n=7) in group B. Leppilahti scores 71-80 (fair) are seen in 15% (n=2) in group A and 25% (n=3) in group B. Both the cases in group A are more than 55 years and one among them is diabetic and the other is suffering from chronic kidney disease. In group B all the patients are diabetics and aged more than 50 years. So the outcome of reconstruction of neglected rupture of tendo Achilles is poor in elderly and diabetics. With Leppilahti score we can conclude that flexor hallucis longus has better outcomes both objectively and subjectively.

Age and diabetes are the predisposing factors for the complications. All the cases with diabetes has the complication of superficial wound infection in group A and 4 out of 5 cases with diabetes had superficial skin infections. These complications can be avoided by preoperative glycaemic control, avoiding the incision over subcutaneous skin over the Achilles tendon, avoiding excessive equinus of the ankle in the post-operative period.

#### **CONCLUSION**

- Rupture of Achilles tendon is more common in middle age males than that of females because males are more commonly involved in recreational, athletic and strenuous activities.
- Rupture occurs more commonly in unconditioned individuals for particular sports or athletic activities.
- Common complications include superficial skin infections, wound dehiscence and scar hypertrophy.

- Flexor hallucis longus seems to be advantageous over peroneus brevis for augmentation because of the anatomical and technical advantages, less incidence of superficial skin infections, wound dehiscence and sensory disturbance, with better weight bearing times and functional recovery.

#### REFERENCES

- [1] O'Brien M. Functional anatomy and physiology of tendons. *Clin Sports Med* 1992;11(3):505-520.
- [2] Jennings AG, Sefton GK. Chronic rupture of tendo Achilles. Long term results of operative management using polyester tape. *J Bone Joint Surg Br* 2002;84(3):361-363.
- [3] Jozsa L, Kvist M, Balint BJ, et al. The role of recreational sport activity in Achilles tendon rupture. A clinical, pathoanatomical and sociological study of 292 cases. *Am J Sports Med* 1989;17(3):338-343.
- [4] Mahler F, Fritschy D. Partial and complete ruptures of the Achilles tendon and local corticosteroid injections. *Br J Sports Med* 1992;26(1):7-14.
- [5] Kannus P, Jozsa L. Histopathological changes preceding spontaneous rupture of a tendon. A controlled study in 891 patients. *J Bone Joint Surg Am* 1991;73(10):1507-1025.
- [6] Inglis AE, Scott WN, Sculco TP, et al. Ruptures of tendo Achilles. An objective assessment of surgical and non-surgical treatment. *J Bone Joint Surg Am* 1976;58(7):990-993.
- [7] Cetti R, Christiansen SE, Ejsted R, et al. Operative versus non-operative treatment of Achilles tendon rupture. A prospective randomized study and review of the literature. *Am J Sports Med* 1993;21(6):791-799.
- [8] Quigley TB, Scheller AD. Surgical repair of ruptured Achilles tendon. Analysis of 40 patients treated by the same surgeon. *Am J Sports Med* 1980;8(4):244-250.
- [9] Rodrigues RC, Masiero D, Mizusaki JM, et al. Translation, cultural adaptation and validity of the American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hind foot scale. *Acta Orthop Bras* 2008;16(2):107-111.
- [10] Gabel S, Manoli A. Neglected rupture of the Achilles tendon. *Foot Ankle Int* 1994;15(9):512-517.
- [11] Turco V, Spinella AJ. Achilles tendon ruptures--peroneus brevis transfer. *Foot Ankle* 1987;7(4):253-259.
- [12] Coughlin M, Mann R. *Surgery of foot and ankle*. Vol. 2. 7<sup>th</sup> edn. St Louis: Mosby 1999.
- [13] Wulker N, Stephens M. *An atlas of foot and ankle surgery*. London: Martin Dunitz 1998.