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Research Article

Evaluation of the functional outcome after Bosworth technique for neglected Achilles tendon rupture - a clinical study

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ABSTRACT:

Background: Most ruptures of the Achilles tendon occur at the watershed area which is about 2 to 6 cm proximal to insertion of the tendon. There are many techniques of repair like using tendon transfer, autograft or synthetic ligament. Bosworth has described a technique of sural triceps aponeurosis turndown. The study was conducted with the objective to describe the effectiveness and functional outcome after Bosworth procedure in chronic ruptures in zone II in cases where end-to-end repair can't be done. Material and Methods: The study consisted of a total 20 patients. Positive Thompson test was elicited in all patients. Bosworth technique was used in for repair in all patients. The functional outcome was assessed at 1 month, 6-month and 1-year follow-up visits using the clinical scoring method described by Leppilahti et al. Results: All patients resumed work at 6 months postoperatively. Almost all patients had normal walking and stair climbing. The range of ankle motion showed significant improvement postoperatively. Conclusion: Bosworth repair for chronic neglected Achilles tendon ruture is still a good method for achieving better functional outcomes for ankle for ruptures of Achilles tendon in zone 2, where more than 2 cm distal stump is available.

INTRODUCTION:

Though Achilles tendon is the strongest, largest, and thickest tendon in the body, yet it is the most frequently ruptured tendon [1,2] . Most ruptures of the Achilles tendon occur at the watershed area which is about 2 to 6 cm proximal to insertion of the tendon [1]. Clinical diagnosis of acute rupture of Achilles tendon is easy, but even then, early diagnosis can be incorrect in 10 to 25% cases of acute rupture [3,4]. Defining what is chronicity is a debate, but, various authors have used 4 to 10 weeks as 4 weeks is the earliest time point that demonstrate histological evidence of chronic healing[1,2,5]. There are many techniques of repair like using tendon transfer [6-8], autograft [9-12] or synthetic ligament [13,14]. Bosworth has described a technique of sural triceps aponeurosis turndown [10]. Surgical treatment improves the strength and function of

gastrocnemius-soleus complex. This includes end to end repair of the tendon like in v-y plasty; also the one described by Bosworth and others like Coughlin of gastrocnemius soleus complex "turn-down" of proximal achilles tendon tissue [10] ; local tendon transfer that of peroneus brevis (pb)[15] or flexor hallucis longus (FHL) tendon or can also use synthetic grafts like carbon fiber composites, polyglycol threads, and polyester mesh.

Neglected Achilles tendon ruptures in zone II (2–6 cm from the calcaneal insertion) do not have a suitable distal stump for repair. The study was conducted with the objective to describe the effectiveness and functional outcome after Bosworth procedure in chronic ruptures in zone II in cases where end-to-end repair can't be done. Plain X-rays showed Achilles tendon rupture by the gap between the tendon ends.

MATERIAL AND METHODS

From January 2016 to January 2018, the study consisted of a total 20 patients with 10 males and 10 females. The age group was 30 to 60 years with mean age 46 years. The mean duration of follow up was 16 months (range 12-20 months). Informed consent was taken from all patients.

Inclusion criteria: Zone 2 ruptures

Exclusion criteria: Non traumatic ruptures, compound injuries

Positive Thompson test was elicited in all patients (squeezing of the calf did not result in plantar flexion of the foot). Plain X-rays showed Achilles tendon rupture by the gap between the tendon ends and presence of calcification in the distal end of the proximal stump of the Achilles tendon. Also palpable and visible gap seen (Figure 1).

Figure 1: palpable and visible gap due to chronic Achiles rupture

Bosworth Technique [10] Spinal anesthesia was used in all patients. In prone position, patient was supported with two bolsters, one under the chest and other under the pubic symphysis. Tourniquet was used. A posterior longitudinal midline incision, extending from the calcaneus to the proximal one third of the calf was given and the ruptured tendon was exposed. Excision of scar tissue between the ruptured ends of tendon was done (figure 2). A strip of tendon approx 1.5 cm wide and about 20 cm long was freed from the median raphe of the gastrocnemius muscle and left attached just proximal to the site of rupture. This Strip was then turned distally and passed transversely through the proximal tendon and anchored there with absorbable sutures. The strip was then passed distally and then transversely through the distal end of the tendon and passed again through this end from anterior to posterior. Knee was held at 90 degrees flexion and the ankle in plantar flexion, the fascia strip was drawn tight and anchored with absorbable sutures. The strip was then brought proximally and passed transversely through the proximal end of the tendon, and then was carried distally and sutured on itself. Wound was closed and above knee cast was applied with ankle in maximum equines for 4 weeks and then cast changed to plantigrade position. After 6 weeks, full weight bearing was allowed. (Figure 3)

Figure 2: fibrosis at the proximal end due to chronicity

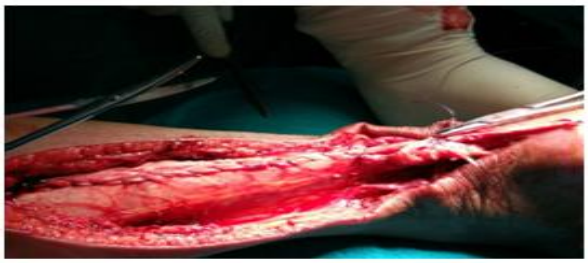

Figure 3: Bosworth technique

The functional outcome was assessed at 1 month, 6-month and 1-year follow-up visits using the clinical scoring method described by Leppilahti et al. [16]. The leppilahti score (table 1) included subjective factors such as pain, stiffness, muscle weakness and footwear restrictions; subjective outcomes as well as objective factors such as the active range of ankle motion and isokinetic calf muscle strength. The maximum score was 100. The results were classified as excellent (≥90 points), good (75–89 points), fair (60–74 points) or poor (<60 points).

Table 1: Leppilahti scoring system

Clinical factor	Points
Pain	
None	15
Mild, no limitations in recreational activities	10
Moderate, limitations in recreational, but not daily activities	5
Severe, limitations in recreational and daily activities	0
Stiffness	
None	15
Mild, no limitations in recreational activities	10
Moderate, limitations in recreational, but not daily activities	5
Severe, limitations in recreational and daily activities	0
Calf muscle weakness	
None	15
Mild, no limitations in recreational activities	10
Moderate, limitations in recreational, but not daily activities	5
Severe, limitations in recreational and daily activities	0
Footwear restrictions	
None	10
Mild, most shoes tolerated	5
Moderate, unable to tolerate fashionable shoes, modified shoes tolerated	0
Active range of motion difference between ankles	
Normal (<6 degrees)	15
Mild (6 to 10 degrees)	10
Moderate (11 to 15 degrees)	5
Severe (>15 degrees)	0

Subjective results	
Very satisfied	**15**
Satisfied with minor reservations	**10**
Satisfied with major reservations	**5**
Dissatisfied	**0**
Isokinetic muscle strength (score)	
Excellent	**15**
Good	**10**
Fair	**5**
Poor	**0**
Leppilahti score	
Excellent	**90-100**
Good	**75-89**
Fair	**60-74**
Poor	**<60**

RESULTS

20 patients (10 males, 10 females) were included in the study, all were operated by Bosworth technique for tendon repair males and females were in the ratio of 1:1. Age group of patients ranged from 30 to 60 years with mean age of 46 years. Out of 20 patients included in the study 12 patients (60%) had Tendo-Achilles rupture at left side and 8 patients (40%) had rupture at Left side. Minimum follow-up was 12 months while maximum was upto 20 months with the mean of 16 months follow up. All patients had history of trauma. Preoperative and postoperative range of motion is given below (Table 2)

Table 2: Mean preoperative and postoperative range of motion

Mean Preoperative active plantar flexion	**20 (10-30) degrees**
Mean Post operative active plantar flexion	45(30-50) degrees

All patients resumed work at 6 months postoperatively. Almost all patients had normal walking and stair climbing. The range of ankle motion showed significant improvement postoperatively.
As per Leppilahti score, functional outcome is described below (Table 3)

Table 3: Functional outcome

Functional outcome	**No of patients**
Excellent	14
Good	3
Fair	2
Poor	**1**

Figure 4: plantar flexion after 6 months

Figure 5: active plantarflexion after 12 months

DISCUSSION

For Achilles tendon repair many methods have been described which depends mainly upon the size of the defect. Percutaneous suture method, modified Kessler, Bunnel, and Krackow techniques can be used if defect is not major. If neglected Achilles tendon rupture presents with significant gap, we need to bridge the defect by tissue or synthetic materials to unite the cut ends with satisfactory strength and allow full range of tendon excursion. For this, Lindholm technique [17], Bosworth technique [10], and V-Y repair [18] are popularly done. Maffulli has suggested the treatment should be individualised according to needs of the patient [19]. For gaps of <2.5 cm between the ruptured ends of the tendon, possibility of end-to-end repair is considered [20]. In 2002 Schepsis et al in their study observed that Tendo-Achilles rupture occurs in men in the fourth to fifth decades, with male to female injury ratios from 2:1 to 12:1 [21]. Langergran and Lindholm divided the Achilles tendon into three zones based on vascularity. Zone I is <3 cm from the calcaneal insertion, zone II 3–6 cm from the calcaneal insertion and zone III >6 cm from the calcaneal insertion [22]. We considered zone 2 repairs in our study. Bosworth repair consists of taking a wide strip of the proximal sural triceps aponeurosis, which was woven through the proximal and distal tendon stumps. This repair needed some amount of distal stump of Achilles tendon for repair [10]. Bosworth method is good for ruptures in zone I, but not good for zone 2 ruptures. End-to-end repair of the Achilles tendon with a modification of Teuffer's technique was described by Turco and Spinella , by passing the peroneus brevis through the distal tendon stump rather than the calcaneus [23, 24]. But this technique can cause eversion weakness and it also does not duplicate the medial pull of the normal Achilles tendon. On his study of FHL transfer on 8 patients, Wapner et al. reconstructed Achilles tendo but the tendon was very thin in diameter and it was inadequate alone [7]. Our study didn't utilise tendon transfers, thereby not compromising the function of that tendon. Bosworth technique is very good for a gap of 2- 6 cm.

CONCLUSION

Bosworth repair for chronic neglected Achilles tendon ruture is still a good method for achieving better functional outcomes for ankle for ruptures of Achilles tendon in zone 2, where more than 2 cm distal stump is available. This is a simple method which doesn't need to harvest tendons for transfer and thus do not hamper their functions.

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