



Outcome following repair of chronic Achilles tendon rupture by modified Bosworth technique

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Abstract

Background: Achilles tendon is the strongest and largest tendon of human body. The spectrum of TA ruptures includes both acute and chronic injuries due to various causes like trauma, steroid injections, etc. The treatment options include surgical repair with immobilization, surgical repair with early rehabilitation and non-operative management. Many surgeons treat it surgically owing to its better functional outcome. Success of procedure selected in a given case is depends upon surgeon's skills, nature of defect, patients' compliance and proper rehabilitation. This article aims at analyzing the midterm functional outcome following such repairs.

Materials and Methods: A retrospective cohort study of 10 surgically treated chronic Tendo Achilles ruptures by Modified Bosworth technique in Govt Mohan Kumaramangalam Medical College hospital, Salem from June 2019 to October 2020. All patients were followed periodically for minimum 12 months and maximum 20 months. The outcomes were assessed using both Subjective and Objective criteria. Objective criteria are ankle range of motion and neurological status of foot. Modified Rupp score and AOFAS ankle hind foot score were used for subjective analysis.

Results: We had 20% excellent 50% good results, 20% fair and 10% poor results as per modified Rupp scoring.

Conclusion: Results of surgical repair of chronic Achilles Tendon rupture showed favorable outcomes like early weight bearing and ambulation.

Keywords: Achilles tendon, Bosworth technique

Introduction

The definition of a "Chronic rupture has ranged from those diagnosed and treated more than 48 hours after injury to those diagnosed and treated up to 2 months after injury"^[1]. These are more difficult to treat than acute injuries. Diabetes, prolonged oral corticosteroids or local corticosteroid injection are potential risk factors. The management of chronic TA rupture differs from that of acute, as the cut ends of tendon have retracted and this is a watershed area, the ends of the tendon should be freshened and end-to-end repair of such retracted tendons is not usually successful and is prone to infection and skin necrosis. So, the repair of TA can be augmented with tendon transfer, tendon grafting, or reinforcement with synthetic materials. The tendon of the flexor hallucis longus, plantaris, and peroneus brevis are used for augmentation^[2, 3]. Peroneus brevis tendon transfer was popularized by Perez-Teuffer^[4]. Gastrocnemius soleus complex "turn-down" of proximal Achilles tendon tissue was described by Bosworth⁵. Any of these techniques each with their own pros and cons can be used by the surgeon depending in the patients demand and surgeon's expertise.

Aims and Objectives

This study is aimed at analysing the functional outcome following repair of chronic Achilles Tendon rupture. Patients presented with Chronic TA rupture were operated by Modified

Bosworth Technique^[6] and functional outcome was analysed based on both Subjective and Objective criteria. Objective criteria are ankle range of motion and neurological status of foot. Modified Rupp score and AOFAS Ankle-Hindfoot score were used for subjective analysis^[7].

Materials and methods

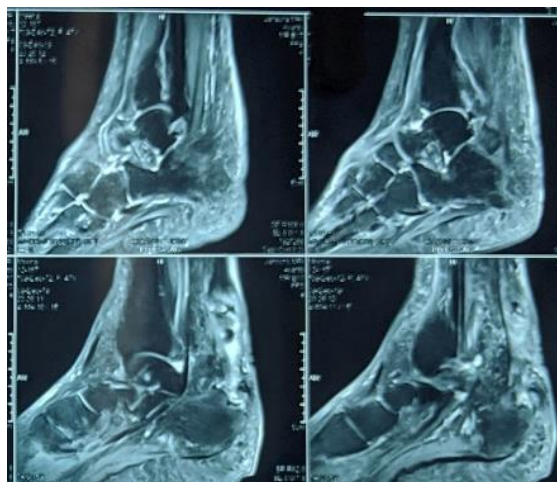


Fig 1

This is a retrospective analysis of 10 patients admitted in our hospital, GMKMCH, Salem from June 2019 to October 2020 diagnosed with chronic Achilles Tendon rupture treated surgically by Modified Bosworth technique. Patient with associated severe comorbidities such as uncontrolled diabetes, poor skin condition, and open Achilles tendon rupture were excluded from the study. Magnetic resonance imaging of the affected leg was done on each patient to assess the severity of rupture, partial rupture, or complete tear. This study has been accepted and recommended by the institution's Ethical Committee.

Surgical Procedure

Modified Bosworth technique

Under spinal anaesthesia, patient in prone position, with all aseptic precautions, parts painted and draped. A posterior S-shaped longitudinal midline incision is made from the calcaneus to the proximal third of the calf. Two important structures viz.,

the short saphenous vein and the sural nerve were secured and isolated. The ruptured tendon was exposed and the scar tissue formed between the ends of the ruptured tendon is excised. From the median raphe of the gastrocnemius muscle, a strip of tendon approximately 1.5 cm wide and 17.5-22.5 cm long was freed and left attached just proximal to the site of rupture. Strip was then turned distally and passed transversely through proximal tendon and anchored there with absorbable suture. The strip was then passed distally and then transversely through the drill hole made in calcaneum differing from passing through distal end of the tendon in conventional method and passed again through this end from anterior to posterior. While holding the knee at 90° and the ankle in plantar flexion, the fascia strip was drawn tight and anchored with absorbable suture. 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 with drain placed and above knee cast was applied with ankle in maximum equinus.



Fig 2

Post-operative care

Stiches were removed at 14 days and above knee cast with ankle at maximum equines continued till 4 weeks. After that, cast was changed again and below knee cast with foot gradually brought in plantigrade position was applied for next 2 weeks. At 6-8 weeks, full weight bearing was allowed with the application of removable brace with foot in plantigrade position, and gentle range of motion exercises for 20 min twice a day was begun along with isometric ankle exercises supplemented with knee strengthening exercise. After 3 months, toe raising exercise with progressive resistance exercises and proprioceptive exercises were started. After 6 months, full unrestricted activity was allowed.

Follow-up protocols

The patients were called for 1st follow-up at 14th day for stitch removal. 2nd follow-up was at 1 month after surgery when below knee cast was applied bringing the foot in plantigrade position from equines. 3rd follow-up was at 2 months after surgery when

the cast was removed and physiotherapy started. Then at next visit after 2 months functional assessment was done and subsequent follow up assessments were performed at 2 months interval till 2 years [8].

Results

All patients were examined using objective and subjective criteria. Objective criteria (Table 1) are ankle range of motion and neurological status of the foot. Subjective criteria are the Rupp score, as modified by Kerkhoffs *et al.* (Fig.4) and AOFAS Ankle-Hindfoot scoring (Fig. 5) results are tabulated (Table. 2).

Table 1

Objectives	Before Surgery	After Surgery
Average dorsiflexion	23	25
Average plantar flexion	27	39
Nerve paraesthesia	-	Nil
Wound complications	-	2 cases



Fig 3

Modified Rupp score

1. Subjective satisfaction		5. Do you fear re-rupture?	
excellent	5	yes	-1
good	1	no	1
satisfactory	-1	6. Do you have limitations in your work?	
poor	-5	does not apply	0
2. Do you experience pain on bearing weight?		none	5
none	5	minor	-1
with extended weight-bearing	1	major	-3
with slight weight-bearing	-2	changed profession due to Achilles tendon problem	-5
continuous pain	-5	7. Do you have limitations in sporting activities?	
3. Do you experience pain independent of bearing weight?		does not apply	0
none	5	none	5
pain associated with changes in weather	1	minor	-1
pain sometimes associated with rest	-2	major	-3
continuous pain	-5	stopped with the activity due to Achilles tendon problem	-5
4. Has your ankle function decreased since the operation?		Total:	
no	±2	>30	Excellent
reduction of muscle strength	±2	15-30	Good
tendency to swelling	±2	5-15	Fair
tendency to cramp	±2	<5	Poor

Fig 4

Ankle-Hindfoot Scale (100 Points Total)

Pain (40 points)	
None	40
Mild, occasional	30
Moderate, daily	20
Severe, almost always present	0
Function (50 points)	
<i>Activity limitations, support requirement</i>	
No limitations, no support	10
No limitation of daily activities, limitation of recreational activities, no support	7
Limited daily and recreational activities, cane	4
Severe limitation of daily and recreational activities, walker, crutches, wheelchair, brace	0
<i>Maximum walking distance, blocks</i>	
Greater than 6	5
4-6	4
1-3	2
Less than 1	0
<i>Walking surfaces</i>	
No difficulty on any surface	5
Some difficulty on uneven terrain, stairs, inclines, ladders	3
Severe difficulty on uneven terrain, stairs, inclines, ladders	0
<i>Gait abnormality</i>	
None, slight	8
Obvious	4
Marked	0

<i>Sagittal motion (flexion plus extension)</i>	
Normal or mild restriction (30° or more)	8
Moderate restriction (15°-29°)	4
Severe restriction (less than 15°)	0
<i>Hindfoot motion (inversion plus eversion)</i>	
Normal or mild restriction (75%-100% normal)	6
Moderate restriction (25%-74% normal)	3
Marked restriction (less than 25% normal)	0
<i>Ankle-hindfoot stability (anteroposterior, varus-valgus)</i>	
Stable	8
Definitely unstable	0
Alignment (10 points)	
Good, plantigrade foot, midfoot well aligned	15
Fair, plantigrade foot, some degree of midfoot malalignment observed, no symptoms	8
Poor, nonplantigrade foot, severe malalignment, symptoms	0
Total=	100

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 From: <http://www.aofas.org/i4a/pages/index.cfm?pageid=3494>

Fig 5

Aetiology

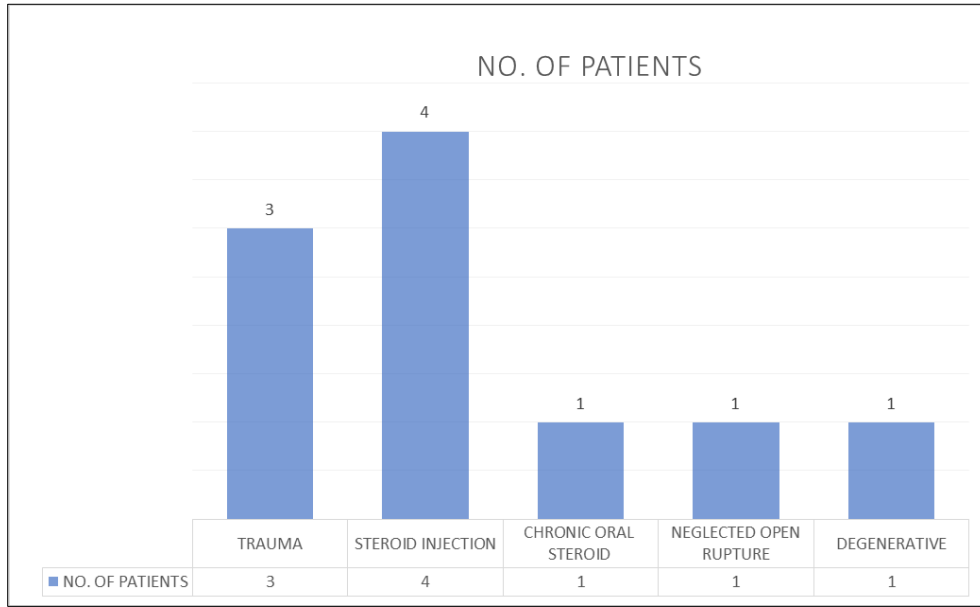


Fig 6

Table 2

Results of Cases Operated By Modified Bosworth Technique					
No	Case	Modified Rupp score	Impression	Pre Op Aofas Score	Post Op Aofas Score
1	CASE 1	29	Good	61	85
2	CASE 2	30	Good	70	89
3	CASE 3	28	Good	65	90
4	CASE 4	4	Poor	60	70
5	CASE 5	15	Fair	61	88
6	CASE 6	32	Excellent	66	88
7	CASE 7	30	Good	61	89
8	CASE 8	33	Excellent	65	86
9	CASE 9	7	Fair	60	71
10	CASE 10	28	Good	61	85

Table 3

Rupp Score		Preop Aofas Score		Post Op Aofas Score	
Mean	SD	Mean	Sd	Mean	SD
23	11.1	63.83	3.87	85	7.54

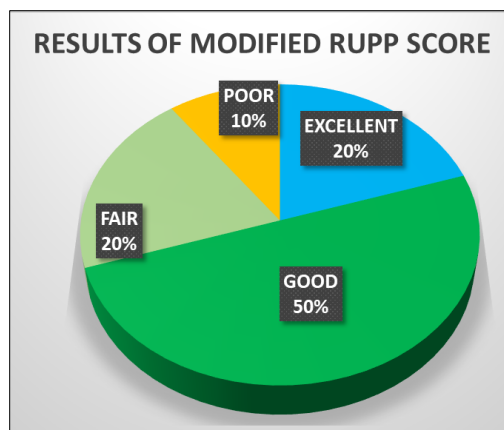


Fig 7

Complications

Complications in this study included Scar Hypertrophy, superficial infection and delayed wound healing due to comorbidities like Type-2 Diabetes Mellitus. Superficial infection was treated with oral antibiotics and regular dressings. Fortunately, none of the patients had reported re-rupture of the Achilles tendon Post Surgery. Table 3. Shows number of patients who had these complications.



Fig 8

Table 4

Complications	No. of patients
Scar hypertrophy	1
Superficial infection	2
Deep infection requiring surgical intervention	1
Re-rupture	Nil

Discussion

The management of chronic TA rupture is a challenge for most orthopaedic surgeons [9]. It is different from the acute Achilles tendon rupture in pathophysiology. Chronic Achilles tendon ruptures with large gaps may lead to ankle dysfunction. If the gap of rupture is bridged by scar tissue, ankle weakness and gait disturbances may occur due to severely infiltrated fat composition [10]. Though chronic Achilles tendon rupture is not unusual, it is frequently misdiagnosed.

In our study out of 10 patients 6 of them were females suggesting male to female ratio of 2:3. Age of the patients ranged from 31 to 54 with mean age of 40 years. And 3 patients had history of trauma, 4 had history of local steroid injection, 1 had history of chronic oral steroid intake, 1 had history of open injury of ankle where wound was sutured and immobilised without TA being checked and later presented with difficulties in ankle movements. 1 patient didn't give significant history.

In patients operated with modified Bosworth technique Ankle plantar flexion was 10° – 30° before surgery and improved to range of 38 – 44 degrees. Post-operatively they had Modified Rupp score ranging from 4 to 33 with mean value of 23 and median of 28.5 suggesting good functional outcome. Pre-op AOFAS ankle-hindfoot score was 60 – 70 which significantly increased to 70- 90 following surgery. 2 patients had wound complications like infection and one required surgical debridement and flap cover and one patient had hypertrophied scar for which patient was not willing for any treatment. 7 out of 10 patients operated by this method were able to return back to their routine work with better ankle functioning and 1 had given complaints of chronic dull aching pain with walking and 2 patient had to change her work because of this ailment.

It has been found that modified Bosworth technique is easy as it gives a wide field exposure and only single compartment of leg is handled, the technique involves drilling of calcaneus bone and

have considerable risk to Sural nerve and short saphenous vein. There is significant chances of postoperative complications like infection, wound dehiscence.

The significance of difference between average dorsiflexion in the patients operated with modified Bosworth technique were tested using paired T test the values obtained were significantly increased(2 +/- 0.7)

The average plantar flexion before and after the surgeries was tested using paired T test. There was significant increase in the values (Mean 12 +/- 1.79 SD).

All the tests were done at a P value of 0.005.

Modified Bosworth technique does not requires a distal stump of at least 2cm as in conventional method and hence this is very useful in treating rupture with larger defects.

We have started ankle mobilisation exercises as early as 2-month post-operative period and ankle strengthening exercises were started within 3-month post-operative period in order to minimise the post-operative stiffness and to achieve better range of motion at the ankle joint and practical difficulties of rehabilitation were similar following both the procedure.

With respect to aetiology, outcome following repair of rupture due to neglected trauma is better when compared to that of rupture due to local corticosteroid injection. Rupture due to degeneration gave poor functional outcome

Conclusion

Modified Bosworth technique is technically simple and safe procedure. It requires a wide exposure but the adjacent compartments of the leg are not disturbed and it doesn't require distal stump of at least 2cm and is useful in treating large defects.

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