

Original Article
Orthopaedics

A PROSPECTIVE STUDY ON GASTROSOLEUS TURN DOWN FLAP AUGMENTATION REPAIR WITH V-Y PLASTY OF NEGLECTED TENDO ACHILLES RUPTURE

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Article submitted on: 18 October 2017

Article Accepted on: 23 October 2017

Abstract:

Introduction: The Achilles tendon is subjected to both extensive static and dynamic loads, 2-3 times the body weight while walking and 10 times while athletic activities. The Achilles tendon is one of the most common tendon to rupture spontaneously. Without appropriate treatment, the tendon either heals in an elongated position or fails to heal altogether. At our centre most of neglected Achilles tendon tear are repaired with Gastrosoleus turn down flap augmentation repair with v-y plasty. The purpose of the study was to assess the results, patient satisfaction and complications of our case series.

Materials and methods: A prospective Study was performed Between 2015 to 2017, 12 patients were included in the study. The inclusion criteria were chronic neglected tear (> 4 weeks), age more than 20 years, no bony avulsion, unilateral injury, good functional activity before injury, patient following regular with rehabilitation and minimum 6 months of follow up. The exclusion criteria were previous tendon surgery or injury and patient not following rehabilitation protocol.

Results: At the most recent follow up, in objective assessment, calf diameter only decreased by mean 1 cm in operated side as compared to normal side. Each patient regained average 10° of dorsiflexion. 10 of 12 patient regained normal plantarflexion. Subjective assessment done using modified Rupp score, 6 patients had excellent, 5 patients had good, and 1 patient had

fair results. Mean VAS for pain was 1.5 and VAS for Satisfaction was 8.5. All patients returned to their pre-injury functional status and job. All patient are able to do their activities with no or minimal restrictions.

Conclusion: Combined technique for repairing old large defect of the Achilles tendon is a safe and effective method. Repairs are strong enough to allow early weight bearing ambulation with good results.

Key words: Neglected tendo Achilles rupture, Gastrosoleus turn down flap augmentation repair, v-y plasty

Introduction

The Achilles tendon is the largest and strongest tendon in the human body. The Achilles tendon is subjected to both extensive static and dynamic loads, which may be 2-3 times the body weight while walking and 10 times the body weight while athletic activities.^{1,2} The Achilles tendon is one of the most common tendon to rupture spontaneously.³ The tendon is almost entirely composed of type 1 collagen and approximately rotates 11° to 90° in medial direction. This construct will provide potential energy and mechanical advantage. In doing so it strangulates the distal portion known as watershed area.^{4,5} Watershed area is approx 2 to 6 cm proximal to the insertional area. Blood flow decreases with age, with gender (men), and during certain physical loading conditions. Loss of Achilles function causes a significant loss in plantar flexion strength, which in turn can lead to an inability to run, stand on tip toes, play sports, and difficulty climbing stairs.^{7,8} Some of these patients, after their initial episode of discomfort, may have significant decrease in their level of pain leading to delays in them seeking medical attention.

Without appropriate treatment, the tendon either heals in an elongated position or fails to heal altogether.⁶ controversy continues for the treatment of Achilles tendon rupture between conservative versus surgical treatment. Advocates of conservative treatment base their opinion on avoidance of many serious postoperative complications, but this may result in a lengthened tendon with reduced power of gastrosoleus muscle and high rerupture rate. Advocates of surgical treatment shown decrease in rerupture rate of 2-5% and shorter rehabilitation time.

Various repair techniques have been described. This includes end-to end anastomosis with strips of gastrocnemius tendon flapped across the defect to augment the repair⁹. Other techniques used gastrocnemius recession¹⁰, V-Y tendinous flap¹¹ or free tendinous autograft¹² to increase length to help close a large defect. Several surgeons reinforced the ruptured Achilles tendon with plantaris tendon¹³ or by peroneus brevis tendon transfer^{14,15}. Other techniques used synthetic mesh or carbon fibers to help augmentation the repair site¹⁶. Recently, some surgeons preferred percutaneous repair of the ruptured tendo-Achilles. They alleged that the technique is simple, has low rate of complications and gives better cosmetic results^{17,18}.

At our centre most of neglected Achilles tendon tear are repaired with Gastrosoleus turn down flap augmentation repair with v-y plasty. The purpose of the study was to assess the results, patient satisfaction and complications of our case series.

Materials and methods

A prospective Study was performed to assess the results of Gastrosoleus turn down flap augmentation repair with v-y plasty for neglected tendo Achilles tear. Between 2015 to 2017, 12 patients were included in the study. The inclusion criteria were chronic neglected tear (> 4 weeks), age more than 20 years, no bony avulsion, unilateral injury, good functional activity before injury, patient following regular with rehabilitation and minimum 6 months of follow up. The exclusion criteria were previous tendon surgery or injury and patient not following rehabilitation protocol. The included patients were 7 male and 5 female. The mean age of the patients

was 45 years.

Rupture of Achilles tendon was diagnosed clinically by palpable defect, Thompson test, including gait observation, tiptoe stance and calf circumference compared to contra lateral side. Associated bony avulsions were excluded by anterior- posterior and lateral radiographs. MRI was used in some patients to delineate the extent of the gap. Patient's mechanism of injury was noted and most of them had rupture due to minor fall or injury. 6 patients were diabetic and 1 patients were on oral steroid in past. Surgery was performed on average 45 days after injury.

Operative technique

The tendon was repaired under regional or general anaesthesia. Posterior longitudinal midline incision extending from the calcaneus to the proximal third of the calf. The ruptured ends were exposed and the scar tissue excised. A inverted "V" incision' in the proximal aponeurosis was placed to close a gap between the ends of a chronic Achilles rupture. Advancement of the tendon was done with closure of the gap and the conversion of the "V" into a "Y". A strip of tendon 2-2-5 cm wide was cut from median raphe of the gastrocnemius muscle. It was left attached just 1.5 cm proximal to the rupture site and the strip was turned down to reinforce the repair. Wound closed. Dressing was done. Above knee anterior slab applied with knee in 20-30° flexion and ankle in 10 -20° planter flexion.

Above knee slab was continued for 3 weeks. Patients were kept non-weight bearing during this period. The foot was then placed in to the below knee cast with the ankle in neutral position for additional 4-6 weeks. Patients were allowed to partially

weight bear during this period. The cast was removed and patients were allowed to increase weight bearing progressively on extremity. Active and active assisted range of motion exercise, isometric strengthening, isometric and proprioceptive exercises were started simultaneously. Running

was not allowed till 6-8 months.

At the time of follow up our results were evaluated by measuring calf diameter of the injured and uninjured side, range of movement, VAS for pain and satisfaction, strength assessment by heel raise test and modified Rupp score for subjective evaluation.¹⁹

Table 2: Modified Rupp score for subjective evaluation¹⁹

1	Subjective satisfaction	
	Excellent	5
	Good	1
	Satisfactory	-1
	Poor	-5
2	Do you experience pain on bearing weight?	
	None	5
	With extended weightbearing	1
	With slight weightbearing	-2
	Continuous pain	-5
3	Do you experience pain independent of bearing weight?	
	None	5
	Pain associated with changes in weather	1
	Pain sometimes associated with rest	-2
	Continuous pain	-5
4	Has your ankle function decreased since the operation?	
	No	+2
	Reduction of muscle strength	+2
	Tendency to swelling	+2
	Tendency to cramp	+2
5	Do you fear rerupture?	
	Yes	-1
	No	1
6	Do you have limitations in your work?	
	Does not apply	0
	None	5
	Minor	-1
	Major	-3
	Changed profession due to Achilles tendon problem	-5
7	Do you have limitations in sporting activities?	
	Does not apply	0
	None	5
	Minor	-1
	Major	-3
	Stopped with the activity due to Achilles tendon problem	-5

Total:

>30	Excellent
15-30	Good
5-15	Fair
<5	Poor

Results

At the most recent follow up, all patients were evaluated by objective and subjective parameters. The average follow up period was 2 years. (Range 8 months- 6 years). All patients had normal walking and stair climbing without any support. In objective assessment, calf diameter only decreased by mean 1 cm in operated side as compared to normal side. Each patient regained average 10° of dorsiflexion. 10 of 12 patient regained normal plantarflexion. 2 patients had terminal 10-20° restriction of plantarflexion. All patients were able to do heel raise for at least 30 seconds.

Subjective assessment done using modified Rupp score, 6 patients had excellent results, 5 patients had good results, and 1 patient had fair result. At the most recent follow up mean VAS for pain was 1.5 (range 1-3) and VAS for Satisfaction was 8.5 (range 7-9).

All patients returned to their pre-injury functional status and job. All patient are able to do their activities with no or minimal restrictions. In our study, there were no complications such as re-rupture, deep infection, sural nerve injury, skin necrosis, chronic fistula, deep vein thrombosis, or persistent equinus. 1 patient had delayed wound healing, for which ultimately skin flap was required.

Discussion

The incidence of ruptured or spontaneously ruptured Achilles tendons seems to be growing. Rates of Achilles tendon rupture have been reported from 2 to 18 ruptures per 100,000.^{20,21,23} A study conducted in Scotland in total of 4201 Achilles tendon ruptures between 1980 and 1995, demonstrated similar rupture rates of 4.7 per 100,000 in 1981 and 6 per 100,000 in 1995. The peak

incidence in men was from age 30 to 39 years but in women the risk increased after the age of 60 years, and the incidence after the age of 80 years was greater in women than in men.²³

The etiology of Achilles tendon ruptures remains unclear. Achilles tendon rupture has been described to be associated with multiple disorders like inflammatory conditions, autoimmune disorders, collagen abnormalities,²⁰ infectious process, exposure to antibiotics (fluoroquinolones),²⁴ systemic or injectable steroid use,²⁵ repetitive microtrauma, tendon variations, decreased blood flow with advanced age,²⁶ abnormal pronation and mechanics, ankle equinus, and Achilles calcification.²⁷ Achilles tendon is unique as it lacks a true synovial sheath. Achilles tendon disorders are now been labelled as Achilles tendinopathy.²⁸ Puddu et al²⁹ classified Achilles tendon disease into 3 categories: (1) pure peritendinitis or inflammation of peritendinous tissue with normal tendon, (2) peritendinitis with tendinosis or inflamed peritendinous tissue and degenerative changes of the tendon and (3) tendinosis or normal peritendinous tissue with degenerative changes of the tendon. They also reported spontaneous ruptures had evidence of degenerative lesions in the tendon tissue and no evidence of peritenon alteration.²⁹ Astrom and Rausing³⁰ performed biopsies in 163 patients. Degeneration or tendinosis was demonstrated in 90% of biopsied specimens from symptomatic parts of the tendon and in only 20% from nonsymptomatic portions, and it was found that the paratenon was mostly normal or revealed slight changes.

Tendon rupture if left untreated, the tendon will heal with elongated scars. The treatment of rupture remains

controversial despite an extensive literature. Treatment options are many like conservative methods, surgical repairs or percutaneous sutures. Multiple studies have demonstrated that overall operative repair provides earlier return to sporting activities and less rate of rerupture.³¹⁻³⁴ A prospective and randomized study by Cetti and colleagues³¹ of 111 patients who were randomly assigned to either an operative or a nonoperative group found that the operative group had a significantly higher rate of resuming sport activities, lesser calf atrophy, more ankle joint range of motion (ROM), and lesser rerupture rates than the conservative group. End to end suturing of the tendon percutaneously have been developed, but incidence of sural nerve injury and rerupture rate is high.³⁵ A variety of surgical repairs are described in the literature, including open repair, percutaneous repair, and mini-open repair techniques. Open repair can include end-to-end repair with or without graft augmentations and be combined with tendon lengthening, turn-down flaps, or tendon transfers. Central gastrosoleus turn down repair is superior to standard Kessler repair by virtue of its strength. Gerdes et al.³⁶ have shown, in a series that one flap augmented repair had an average strength of 217 Newton, whereas Conventional repair with two interrupted Kessler sutures failed at an average of 154 Newton. Christensen³⁷ described the use of a 2 _ 10-cm flap that was raised from the proximal tendon fragment and turned down to cover the defect in both acute and chronic ruptures. He reported 75% of outcomes as being satisfactory. Abraham and Pankovich³⁸ described the use of a V-Y tendinous flap. They reported results in four patients with chronic Achilles rupture, with a gap

of 5 to 6 cm between ends, with three of four patients regaining full strength. Leitner and colleagues³⁹ reported on three patients who had 8- to 10-cm defects closed with the use of this technique and had good results. Us and colleagues⁴⁰ reported on six patients treated with this technique. All six patients were able to perform a single leg heel raise, walk on their toes, and return to preinjury activities. Cybex testing of these patients noted a peak torque deficiency from 2.5% to 22.0% when compared with the contralateral limb. They inferred that the V-Y recession allows intrinsic healing resulting in a tendon with enhanced elasticity, strength, and mobility and additionally avoided the sacrifice of other significant lower limb tendons.

In our series, we used both V-Y plasty and turn down augmentation technique. V-Y plasty had the advantage of allowing healthy tendon-to-tendon apposition, minimizing tension at the repair site and avoiding foreign materials at the site of healing and augmentation by adding collagen to the repair site allows earlier mobility, weight bearing and a more aggressive rehabilitation program with reduction in the incidence of rerupture. Turn down also prevent adhesion of the repaired tendon to the overlying skin. All patients had normal gait pattern, returned to their pre-injury functional status and job and regained near normal ankle range of movements. All patients were able to do heel raise for atleast 30 seconds. Subjective satisfaction was excellent to good in 11 patients. 1 patient had fair result probably related to poor wound healing for which plastic surgery was required.

In conclusion, combined technique for repairing old large defect of the Achilles tendon is a safe and effective

method. Repairs are strong enough to allow early weight bearing ambulation with good results.

References

- Soma CA, Mandelbaum BR. Achilles tendon disorders. *Clin Sports Med* 1994;13:811–23.
- Hamilton WG. Surgical anatomy of the foot and ankle. *Ciba Clin Symp* 1985; 37(3):1–32.
- Kongsgaard M, Aagaard P, Kjaer M, et al. Structural Achilles tendon properties in athletes subjected to different exercise modes and in Achilles tendon ruptures. *J Appl Physiol* 2005;99:1965–71.
- Carr AJ, Norris SH. The blood supply of the calcaneal tendon. *J Bone Joint Surg Br* 1989;71:100.
- Lagergren C, Lindholm A. Vascular distribution in the Achilles tendon. An angiographic and micro-angiographic study. *Acta Chir Scand* 1958–9;116:491–6.
- Davies MS, Peereboom J, Saxby T. Hyperdorsiflexion sign in tears of the tendo Achillis. *Foot Ankle Int.* 1998 Sep; 19(9):647.
- Heckman DS, Gluck GS, Parekh SG. Tendon disorders of the foot and ankle, part 2: Achilles tendon disorders. *Am J Sports Med.* 2009;37(6):1223–34.
- Padanilam TG. Chronic Achilles tendon ruptures. *Foot Ankle Clin.* 2009;14(4):711–28.
- Jacobs D, Martens M, Van Audekercke R, Mulier JC, Mulier F. Comparison of conservative and operative treatment of Achilles tendon rupture. *Am J Sports Med.* 1978 May-Jun; 6(3):107–11.
- Parker RG, Repinecz M. Neglected rupture of the achilles tendon. Treatment by modified Strayer gastrocnemius recession. *J Am Podiatry Assoc.* 1979 Sep; 69(9):548–55
- Abraham E, Pankovich AM. Neglected rupture of the Achilles tendon. Treatment by V-Y tendinous flap. *J Bone Joint Surg Am.* 1975 Mar; 57(2):253–5.
- Schuberth JM, Dockery GL, McBride RE. Recurrent rupture of the tendo Achillis. Repair by free tendinous autograft. *J Am Podiatry Assoc.* 1984 Apr; 74(4):157–62.
- Lynn TA. Repair of the torn achilles tendon, using the plantaris tendon as a reinforcing membrane. *J Bone Joint Surg Am.* 1966 Mar; 48(2):268–72.
- Perez Teuffer A. Traumatic rupture of the Achilles Tendon. Reconstruction by transplant and graft using the lateral peroneus brevis. *Orthop Clin North Am.* 1974 Jan; 5(1):89–93.
- Turco VJ, Spinella AJ. Achilles tendon ruptures--peroneus brevis transfer. *Foot Ankle.* 1987 Feb; 7(4):253–9.
- Amis AA, Campbell JR, Kempson SA, Miller JH. Comparison of the structure of neotendons induced by implantation of carbon or polyester fibres. *J Bone Joint Surg Br.* 1984 Jan; 66(1):131–9.
- Kakiuchi M. A combined open and percutaneous technique for repair of tendo Achillis. Comparison with open repair. *J Bone Joint Surg Br.* 1995 Jan; 77(1):60–3.
- Webb JM, Bannister GC. Percutaneous repair of the ruptured tendo Achillis. *J Bone Joint Surg Br.* 1999 Sep; 81(5):877–80.
- Kerkhoffs GM, Strijs PA, Raaymakers EL, Marti RK. Functional treatment after surgical repair of acute Achilles tendon rupture: Wrap vs walking cast. *Arch Orthop Trauma Surg* 2002;122:102–5.
- Mafulli N. Current concepts review: rupture of the Achilles tendon. *J Bone Joint Surg Am* 1999;81(7):1019–36.
- Leppilahati J, Puranen J, Orava S. Incidence of Achilles tendon rupture. *Acta Orthop Scand* 1996;67:277–9.
- Moller A, Astros M, Westland N. Increasing incidence of Achilles tendon rupture. *Acta Orthop Scand* 1996;67:479–81
- Waterston S, Squair J, Douglas AS, et al. Changing incidence of Achilles tendon rupture in Scotland. *J Bone Joint Surg Br* 1994;81:304.
- Movin T, Gad A, Gunter P, et al. Pathology of the Achilles tendon in association with ciprofloxacin treatment. *Foot Ankle* 1997;18:297–9.
- Kleinman M, Gross AE. Achilles tendon rupture following steroid injection. A report of three cases. *J Bone Joint Surg Am* 1983;65:345–7.
- Kannus P, Natri A. Etiology and pathophysiology of tendon ruptures in sports. *Scand J Med Sci Sports* 1997;7:107–12.
- Deangelis JP, Wilson KM, Cox CL, et al. Achilles tendon rupture in athletes. *J Surg Orthop Adv* 2009;18(3):115–21.
- Jarvinen T, Kannus P, Mafulli N, et al. Achilles tendon disorders: etiology and epidemiology. *Foot Ankle Clin* 2005;10:255–66.
- Puddu G, Ippolito E, Postacchini F. A classification of Achilles tendon disease. *Am J Sports Med* 1976;1(4):145–50.
- Astrom M, Rausing A. Chronic Achilles tendinopathy: a survey of surgical and histopathological findings. *Clin Orthop Relat Res*

- 1995;316:151–64.
31. Cetti R, Christensen 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;21:791–9.
 32. Moller M, Movin T, Granhed H, et al. Acute rupture of tendon Achilles: A prospective randomized study of comparison between surgical and nonsurgical treatment. *J Bone Joint Surg Br* 2001;83:843–8.
 33. Weber M, Niemann M, Lanz R, et al. Non-operative treatment of acute rupture of the Achilles tendon: results of a new protocol and comparison with operative treatment. *Am J Sports Med* 2003;31:685–91.
 34. Wong J, Barrass V, Mafulli N. Quantative review of operative and non-operative management of Achilles tendon ruptures. *Am J Sports Med* 2002;30:565–75.
 35. Bradley JP, Tibone JE. Percutaneous and open surgical repair of the Achilles tendon rupture. *Am J Sports Med* 1990;18:188-95.
 36. Gerdes MH, Brown TD, Bell AL, Baker JA, Levson M, Layer S. A flap augmentation technique for Achilles tendon repair: Postoperative strength an functional outcome. *Clin Orthop* 1992;280:241-6.
 37. Christensen I. Rupture of the Achilles tendon: analysis of 57 cases. *Acta Chir Scand* 1953; 106:50–60
 38. Abraham E, Pankovich AM. Neglected rupture of the Achilles tendon. Treatment by V-Y tendinous flap. *J Bone Joint Surg Am* 1975;57:253–5.
 39. Leitner A, Voigt C, Rahmanzadeh R. Treatment of extensive aseptic defects in old Achilles tendon ruptures: methods and case reports. *Foot Ankle* 1992;13:176–80.
 40. Us AK, Bilgin SS, Aydin T, et al. Repair of neglected Achilles tendon ruptures: procedures and functional results. *Arch Orthop Trauma Surg* 1997;116:408–11.