

A RETROSPECTIVE EVALUATION OF THE SURGICAL TREATMENT OF ACHILLES TENDON LESIONS

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Abstract: *The surgical treatment of Achilles tendon lesions is still controversial. We undertook a retrospective evaluation of 160 patients with Achilles tendon lesions, treated in the Clinical Emergency County Hospital of Brasov, from 2008 to 2014. Depending of the type of lesion and of surgeon's option, different surgical repair techniques were performed. The average follow-up period was about six months in sectional lesions, and about twelve months in ruptures. The results of our study show that the immediate end to end suture in accidental section is a usual, satisfactory solution. In ruptures, the most preferred method was an augmentation with a centrally free flap. In ruptured lesions, we consider this technique to have a lower rate of re ruptures and to prevent tendon adhesion to the skin.*

Key words: *Achilles tendon lesions, reconstruction, surgical techniques.*

1. Introduction

In accidental section of Achilles tendon, the surgical treatment is the only accepted. Treatment options of acute Achilles tendon ruptures include surgical and nonsurgical management [2], [17]. The re rupture following acute lesion is the most frequent major complication and it is higher in nonsurgical vs. surgical treatment [2]. In chronic ruptures the surgical treatment seems to be the only satisfactory one [1], [3], [18]. Surgeon chose a specific surgical method as it is considered to be associated with good functional results and with a low rate of complications. Various surgical techniques have been described in the

surgical treatment of ruptured lesions, including open, minimally invasive, and percutaneous repair [4], [11].

2. Objective

The aim of the present paper was to report our experience in the surgical treatment of Achilles tendon lesions, and to discuss the used techniques in accidental sections, acute and chronic ruptures. The most frequent method used in ruptures was the augmentation with a centrally free gastrocnemius flap. We believe this method to be associated with a lower rate of re ruptures and skin problems. The position of flap with its smooth surface to

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the skin protects against later adhesion of the tendon to the skin.

3. Patients and Methods

This retrospective study aimed to evaluate all the patients with Achilles tendon lesions who underwent surgical treatment in the trauma department of the Clinical Emergency County Hospital of Braşov between 2008 and 2014. From January 2008 to December 2014, every patient who underwent a surgical treatment of an Achilles tendon lesion was identified and information was abstracted from the medical records. All the 160 patients with accidental sections, acute or chronic ruptures of Achilles tendon operated in this interval were included. Seven patients had Achilles tendon sections, 148 acute, and 5 chronic ruptures.

In patients with sections (5 male and 2 female, aged 30 – 60 years old), the diagnose was established by clinical examination, and in all the cases an immediate surgical repair was performed. In 4 of them an end-to-end Bunnell suture was performed, and in one male an augmentation with a centrally flap was added.

In patients with acute ruptures, the diagnose was based on history and physical examination. In some cases, an ultrasound or MRI examination was also performed. The clinical examination revealed a palpable depression on the tendon, a positive Thompson test and disability to stand on tiptoes on the injured side. In the group of patients with acute ruptures, the time period from injury to surgery varied from a couple of days to five weeks. The group comprised 121 men and 27 women, ranging in age from 23 to 71 years. Most of the ruptures occurred about 4 to 6 cm proximal to the calcaneal insertion. The patients were treated with different techniques. In 92 cases an augmentation with centrally proximal gastrocnemius fascia was done. The other patients with acute ruptures were treated by other surgical techniques.

In patients with chronic ruptures the diagnose was based on a carefully clinical and ultrasound or MRI examination. The patients in whom surgical treatment was prescribed had absent or decreased propulsion in their step and presented enough disability that they could not stand on their tiptoes on the injured side. In patients enrolled in the chronic ruptures group, the time period from injury to surgery ranged from two to six months. One male patient presented an iterative re rupture after a Bunnell suture for an acute rupture. In all the patients with chronic rupture an augmentation with centrally proximal free flap was done.

3.1. Surgical techniques

In all types of tendon repairing, the initial surgical steps were the same. With the patient under general anesthesia, optional tourniquet control and in prone position, the surgery was initiated by posteromedial incision from the calcaneus to the middle third of the calf. The incision was done without dissection, sharply through the skin, subcutaneous tissue and fibrous tendon sheath. The synovial sheath was carefully dissected and then longitudinally incised on both sides of tendon section or rupture, and protected in order to be easier sutured at the end of tendon repair.

In accidental section the techniques used were a Bunnell suture (in 4 patients), and a modified Bunnell suture (in 3 patients), supplemented in all with interrupted circumferential sutures. In the modified Bunnell technique, instead of one centrally running suture in each stump, two laterally sutures on both sides of each stamp were used. In this variant, instead of two knots on the level of section, there were four knots, two in the end of the proximal stump and two in the end of the distal stump. These four knots were not on the level of section, but two up and two down, proximal to the level of section. This modified Bunnell suture of Achilles tendon section represents the

preferred technique of the first author of the article (IS).

In the group of acute ruptures, the only detailed method is that of central flap. This method was used in 92 patients, as follows. The ragged ends of the ruptured tendon were limited excised, especially in fresh ruptures. In old ruptures (three to five weeks), a minimal dissection was performed to release the tendon. Then, the defect gape was measured with the ankle plantar flexed up to 35 degrees, and a centrally free flap 2 cm wide raised from the proximal gastrocnemius fascia. The length of the flap depended on the length of the gape. It represented the sum of the gape plus a minimum of 5-6 cm. The flap was elevated and twisted to 180 degrees, maintaining its smooth posterior surface adjacent to the subcutaneous tissue and glided distally. The flap overlapped the two stumps with a minimum of 2-3 cm each of them. Then with the ankle in plantar flexion, it was fixed with non-absorbable sutures on the stumps. The centrally free flap in the manner just described, was the preferable technique used by the main author (IS).

The other 43 patients with acute ruptures were treated by direct sutures – Bunnell (27 cases), modified Bunnell (11 cases) or Kessler (5 cases) suture. In the rest of the patients a Bunnell suture associated with peroneus brevis augmentation (in 5 patients), a calcaneal reinsertion (in 4 patients) and a percutaneous repair in Griffith manner (in another 4 patients) were used.

In all the 5 patients with chronic ruptures, the same method of a centrally free gastrocnemius flap, as described for the group of 92 patients with acute rupture, was used.

In all the types of Achilles lesions (section, acute or chronic ruptures), after tendon repairing, a synovial sheath suture was done. We paid special attention to that surgical step and carefully sutured the synovial sheath to cover as long as possible the sutured or augmented tendon. Then, the peritenon (fibrous sheath) was closed over the site of the

repair. The wound was approximated with a layered closure.

Postoperatively, in all the types of tendon repairing, a long cast with the knee in 20 degrees of flexion and the ankle in 30 degrees of plantar flexion was applied. After three weeks another short cast (below-knee) was applied with the ankle in 15-20 degrees of plantar flexion. The patient was encouraged to move the knee. Five weeks after surgery a below-knee walking cast with the ankle in neutral position or slight flexion was applied for another two weeks, and the progressive weight-bearing was started. Increased activity and physical therapy were recommended after cast removal, and the patient was advised to wear high heel shoes for another three months.

4. Results

In Achilles tendon section the average follow-up period was about 6 months. All of the patients evolved with no major or minor complications.

In the cases of acute or chronic rupture of Achilles tendon the average follow-up period was about 12 months.

In the 92 patients with acute ruptures treated by a centrally flap augmentation, no surgery related major complication, such as sural nerve injury, skin necrosis, tendon necrosis, wound infection, or deep infection was observed. Two patients experienced a superficial wound infection, and 1 patient, a tendon contracture, which was conservatively resolved. None of the patients had tendon adhesion to the skin, and the skin over the tendon was movable. Three patients had cosmetic complaints concerning the scar, but without affecting the ankle function. All patients were able to stand on their tiptoes. Active range of motion was found to be reduced with limited dorsiflexion in 4 cases, and the difference was less than 10 degrees. At the time of the last follow-up, no case of re

rupture was found. Subjective satisfaction was excellent or good in all the patients.

One of the 43 patients with acute ruptures treated by a Bunnell, modified Bunnell, or Kessler suture suffered a major and another five minor complications. The major complication was an iterative re rupture after a Bunnell suture for an acute rupture. That patient (a man) sustained an augmentation with centrally flap as a second surgery. In that case, after the second surgical procedure no complication was observed. As minor complications, there were three tendon contractures, one superficial wound infection, and one tendon adhesion. In all the patients with minor complications, no supplementary surgical treatment was done. The patient with skin adhesion refused a new surgery, considering the result acceptable.

Active range of motion was found to be reduced with limited dorsiflexion in 3 cases, and another 2 patients had cosmetic complaints concerning the scar, without affecting the ankle function. At the last follow-up, no re ruptures were found. Subjective satisfaction was excellent or good in all but 1 patient. The patient with skin adhesion had an acceptable subjective satisfaction.

In the group with acute ruptures treated by Bunnell suture associated with peroneus brevis augmentation (5 cases), no complication was recorded.

In the cases with acute rupture treated by calcaneal reinsertion (4 cases), 1 patient had cosmetic complaints concerning the scar and some complaint about the shoe wearing, but with no need for another surgical intervention.

In the patients with acute ruptures treated by percutaneous surgery (another 4 cases), there were no complications.

In all the patients with chronic ruptures (5 cases) treated by augmentation with centrally flap, no complication was recorded.

5. Discussions

In accidental section of Achilles tendon, an end-to-end tendon suture is usually done, but simple interrupted suture is not sufficiently. In these cases, we consider Bunnell suture to be the method of choice. All of our patients with tendon section had an evolution with no complications.

In acute Achilles tendon ruptures the treatment options include nonsurgical and surgical management. The nonsurgical treatment has the advantage of avoiding the surgical risks, but it is associated with a high risk of re rupture. Despite the surgical risks, a lot of authors recommend surgery as a common treatment of Achilles acute ruptures [6], [12], [13], [19].

In chronic ruptures, the option is easier, surgical treatment being the only satisfactory one [16], [19]. We also agree this attitude, so we chose surgical treatment in both, acute or chronic Achilles tendon ruptures.

Surgery is commonly performed as an open technique [19]. Although, in acute cases percutaneous procedure increases in popularity. In our department the technique was applied only in 4 cases. According to our experience, we prefer an open technique in both acute and chronic ruptures. In acute ruptures the reconstruction techniques includes both direct primary tendons ends suture and augmentation.

The most usual techniques for primary repair are Bunnell, Kessler, and Krackow sutures [2], [7]. Although there was a re rupture after a Bunnell suture, we consider this method to be a safer one, so that we used it, even as a modified Bunnell technique, in the majority of patients with direct primary sutures. We have limited experience in Kessler suture (only 5 cases).

Various techniques have been described

for the augmentation of the ruptured Achilles tendon, including tendon and fasciocutaneous flaps [10], [14], flexor hallucis longus or peroneus brevis transfer [20], free autogenous and fascia lata flaps [15], [20], reinforcement with pull-out stainless steel wire [2] and allograft and synthetic material [2].

From all these numerous methods, we chose a variant of tendon flap. We consider that the advantage of our method is the surgical technique. The centrally free flap is not turned down, no bulky, and has no added vascular problems at the turning point. Both ends of the flap are sutured into a normal tendon tissue and have a good opportunity to be vascularized from this healthy area. Our technique of a not very tight suture, with no tension, is a beneficial one for the advance of the vascularisation of the flap.

Tendon adhesion to the skin is an important complication [1], [5]. In our technique we consider that the position of the flap with its smooth posterior surface adjacent to the subcutaneous tissue avoids this complication and reduces the risk of skin adhesion [5]. Some authors eliminate the scar tissue formed in-between the ruptured tendon during reconstruction [3], [9], others report reconstruction without removing the scar tissue [8], [21]. We consider the tissue at the level of ruptures (in both acute and chronic Achilles ruptures) is an important biological material so it is advisable to keep it if possible.

We have limited experience with other types of augmentation or with calcaneal reinsertions. There was a Bunnell suture associated with peroneus brevis augmentation in only 5 acute ruptures cases, and a calcaneal reinsertion in another 4 cases [15], [20].

In all type of surgery we consider that it is important to protect and dissect the synovial sheath. At the end of the tendon

repairing, the carefully synovial sheath suture has the advantage to create good biological conditions for flap integration.

6. Conclusions

In conclusion, the results of this study suggest that in acute Achilles tendon ruptures the direct Bunnell or modified Bunnell technique is associated with good functional results and a low rate of complications.

When an augmentation is needed, the centrally free flap, in our opinion, has some advantages. It has no added vascular problems because it is not a turned one and the progress of the flap vascularization is encouraged by sutures with no tension. The position of the flap with its smooth posterior surface adjacent to the subcutaneous tissue reduces the risk of skin adhesion and the carefully suture of synovial sheath create good biological conditions for flap integration.

References

1. Cetti, R., Christensen, S.E., Ejsted, R., et al.: *Operative versus nonoperative treatment of Achilles tendon rupture. A prospective study and review of the literature*. In: Sports Med. (1993), vol. 26, p.791-799.
2. Coughlin, M.J., Schon, L.C.: *Disorders of tendons*. In: Surgery of the Foot and Ankle, Eighth Edition (2007), Mosby Inc.
3. Elias, I., Besser, M., Nazarian, L.N., Raikin, S.M.: *Reconstruction for missed or neglected Achilles tendon rupture with V-Y lengthening and flexor hallucis longus tendon transfer through one incision*. In: Foot Ankle Int. (2007), vol. 28 (12), p. 1238-1248.
4. Henríquez, H., Muñoz, R., Carcuro, G., Bastía, C.: *Is percutaneous repair better than open repair in acute*

- Achilles tendon rupture?* In: Clin Orthop Relat Res (2012), vol. 470, p. 998-1003.
5. Karakurt, L., Belhan, O., Yilmaz, E., Varol, T.: *Augmented repair of Achilles tendon ruptures*. In: Firat Medical Journal (Turkey) (2006), vol. 4, p. 197-200.
 6. Kocher, M.S., Bishop, J., Marshal, R., Briggs, K.K., Hawkins, R.J.: *Operative versus nonoperative management of acute Achilles tendon rupture: expected-value decision analysis*. In: Am J Sports Med (2002), vol. 30, p.783-790.
 7. Krackow, K.A., Thomas, S.C., Jones, L.C.: *A new stitch for ligament-tendon fixation. Brief note*. In: J Bone Surg Am (1986), vol. 68(5), p. 764-766.
 8. Lee, K.B., Park, Y.H., Yoon, T.R., Chung, J.Y.: *Reconstruction of neglected Achilles tendon rupture using the flexor hallucis tendon*. In: Knee Surg Sports Traumatol Arthrosc (2009), vol. 17(3), p. 316-320.
 9. Lepow, G.M., Green, J.B.: *Reconstruction of a neglected Achilles tendon rupture with an Achilles tendon allograft: a case report*. In: J Foot Ankle Surg (2006), vol. 45(5), p. 351-355.
 10. Mendicino, S.S., Reed, T.S.: *Repair of neglected Achilles Tendon ruptures with a triceps surae muscle tendon advancement*. In: J Foot Ankle Surg (1996), vol. 35, p. 13-18.
 11. Metz, R., van der Heijden, G., Verleisdonk, E-J., et al.: *Effect of complications after minimally invasive surgical repair of acute Achilles tendon ruptures*. In: Am J Sports Med (2011), vol. 39, p. 820-824.
 12. Molloy, A., Wood, E.V.: *Complications of the treatment of Achilles tendon ruptures*. In: Foot Ankle Clin (2009), vol. 14(4), p. 745-759.
 13. Nyysönen, T., Lüthje, P., Kröger V.: *The increasing incidence and difference in sex distribution of Achilles tendon rupture in Finland in 1987-1999*. In: Scand J Surg (2008), vol. 97(3), p. 272-275.
 14. Papp, C., Todoroff, B.P., Windhofer, C., Gruber, S.: *Partial and complete reconstruction of Achilles tendon defects with the fasciocutaneous infragluteal free flap*. In: Plast Reconstr Surg (2003), vol. 112, p. 777-783.
 15. Pintore, E., Barra, V., Pintore, R., Maffulli, N.: *Peroneus brevis tendon transfer in neglected tears of the Achilles tendon*. In: J Trauma (2001), vol. 50, p. 71-78.
 16. Soma CA, Mandelbaum BR. *Repair of acute Achilles tendon rupture*. In: Orthop Clin North Am. 1995; 26 (2): 239-247.
 17. Soroceanu, A., Sidhwa, F., Arabi, S., et al.: *Surgical versus nonsurgical treatment of acute Achilles tendon rupture*. In: J Bone Joint (Am) (2012), vol. 94-B, p. 2136-2143.
 18. Wang, C.C., Lin, L.C., Hsu, C.T., et al.: *Anatomic reconstruction of neglected Achilles tendon rupture with autogenous peroneal longus tendon by Endo Button fixation*. In: J Trauma (2009), vol. 67(5), p. 1109-1112.
 19. Wong, J., Barrass, V., Maffulli, N.: *Quantitative review of operative and nonoperative management of Achilles tendon ruptures*. In: Am J Sports Med (2002), vol. 30, p. 565-575.
 20. Wong, M.W., Ng, V.W.: *Modified flexor hallucis longus transfer for Achilles insertional rupture in elderly patients*. In: Clin Orthop Relat Res (2005), vol. 431, p. 201-206.
 21. Yasuda, T., Kinoshita, M., Okuda, R.: *Reconstruction of chronic Achilles tendon rupture with the use of interposed tissue between the stumps*. In: Am J Sports Med (2007), vol. 35(4), p. 582-588.