

FOLLOW-UP RESULTS OF ACHILLES TENDON RUPTURE TREATMENT BY THE METHOD OF MODIFIED PERCUTANEOUS SUTURE

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SUMMARY – Achilles tendon ruptures are treated by various surgical methods as well as by conservative procedures. Recent surgical methods are aimed at surgical trauma reduction, however, there are few literature reports on the follow-up results of such treatment. Unlike percutaneous technique, we used a smaller incision to visualize approximation of the ruptured tendon ends. The aim of the study was to evaluate follow-up results after Achilles tendon rupture treatment by the technique of modified percutaneous suture. One minor incision of approximately 1-1.5 cm was made laterally of the rupture location, while the suture was placed at both ends percutaneously. All patients operated on by this method at Department of Plastic Surgery, Karlovac General Hospital, during a 2-year period (Jan 1, 2001 – Dec 31, 2002) were analyzed. Minimal follow-up of six months was necessary to satisfy the inclusion criteria. Results were evaluated by the Trillat scoring system. Eleven patients were operated on, age range 29-42 (mean 36.6) years and follow-up 7-16 (mean 11.2) months. According to the Trillat scoring system scale, nine (81.8%) patients met the criteria for 'excellent result' and two (18.2%) patients were in the 'good result' group. This technique was found to provide excellent results in our sample, thus we prefer it to other methods. The sample was rather small, thus a larger series with a longer follow-up should be assessed in a future study.

Key words: *Achilles tendon – injuries; Achilles tendon – surgery; Rupture – surgery; Surgical procedures*

Introduction

Achilles tendon ruptures occur relatively commonly during sports activities, especially in male population (30 to 50 years of age). They usually occur between the second and sixth centimeter of the tendon attachment to the calcaneus, as a consequence of anatomic and biomechanical reasons¹. The ruptures are usually complete, rarely partial, and the tendon sheath can be either undamaged or ruptured. These ruptures are treated by various surgical methods as well as by conservative procedures. Most authors prefer operative treatment, however, a number of other methods have been suggested in the literature²⁻⁷. These more recent surgical methods that have been ever

more commonly used, tend to reduce surgical trauma, however, information on follow-up results of such a treatment currently available in the literature is scarce. Minimal invasiveness is preferred in order to minimize the rehabilitation period, the number of complications, and the cost of treatment⁸⁻¹⁰. Unlike percutaneous technique, we decided to use a smaller incision to visualize the approximation of the ruptured tendon ends. The described method bridges the gap between the open surgical repair and the conservative treatment of Achilles tendon ruptures, at the same time also being a modification of the complete percutaneous technique of ruptured Achilles tendon ends approximation. The modification consists of the use of such a minor skin incision that enables exact visualization of the tendon ends approximation, at the level of tendon rupture, usually nearby the lateral tendon edge.

The aim of the study was to analyze follow-up results of the treatment of Achilles tendon ruptures by the tech-

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nique of modified percutaneous suture. Considering different approaches in the treatment of this injury and scarce information on late follow-up results of this particular method, our intention was to contribute to its evaluation.

Patients and Methods

The Achilles tendon rupture is diagnosed on the basis of clinical history, clinical examination and ultrasound of the Achilles tendon area. Clinical findings are typical, so the diagnosis is usually easily established, although sometimes swelling and hematomas may pose a problem. Thompson, O'Brien and Simmond's tests¹¹ are used on clinical examination in ambiguous cases.

Complete Achilles tendon rupture was confirmed intraoperatively in all of the 11 patients included in the study. The operation is performed by two surgeons. The patient is in the prone position, with his below-knee area mobile. The patient is given local anesthesia, 15-20 ml 1% of Xylocain. The anesthetic is administered subcutaneously into the rhomboid in the operative field, nearby the tendon rupture location, and into the peritendinous space.

The operative technique consists of a 1- to 1.5-cm long vertical skin incision parasagittally laterally from the rupture location. Visualization of the proximal and distal tendon ends is thus achieved. A modified Bunell's suture using Vicryl or Dexon thread is placed through the mini-incision into the proximal tendon end percutaneously with four mini-incisions, so that the incision is made over the top of

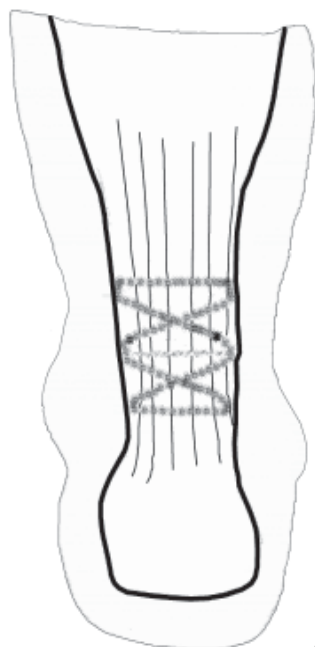


Fig. 1. Modified Bunell's suture



Fig. 2. Suture placement: the procedure of tendon ends approximation

the needle by a No. 11 scalpel (Fig. 1). The procedure is identical for the distal end, and the suture exit is on the same side as the suture entrance (Fig. 2).

After approximation of the tendon ends, the site of incision is closed by individual sutures in two layers. The leg is immobilized above the knee, the knee is in the position of semi-flexion, while the ankle is in plantar flexion.

Patient cooperation with the physiotherapist plays a major role in the postoperative period. The aim is successful performance of the rehabilitation program, as follows:

- after the operative procedure, on the same day, the patient is mobilized and walking using crutches, without weight bearing on the operated leg;
- the patient is discharged from the hospital on postoperative day 3 and is instructed to do the learned physical therapy exercises at home;
- during the first 3 weeks after surgery, immobilization by the above knee plaster with knee joint semiflexion and plantar flexion of the foot at 10-10° angle;
- week 3-5: immobilization by a below knee plaster in a neutral foot position;
- week 5-6: foot immobilization at 90° angle;
- between weeks 6 and 8 of the procedure, the immobilization is removed and active physical therapy is initiated. Walking with crutches is allowed, with gradual increase in the ankle movement diameter;

- 3 months after the procedure, swimming, bike riding and jogging are allowed; and
- 6 months after the procedure full sports activities are allowed.

Results were evaluated according to the Trillat scoring system (Table 1)¹². Minimal follow-up of six months was necessary to satisfy the criteria for the study. Trillat scoring system is composed of subjective and objective criteria for patient classification as excellent, very good, good, satisfactory and poor results.

Results

During a two-year period (January 1, 2001 – December 31, 2002), a total of 11 patients were operated on using this technique, eight (72.7%) male and three (27.3%) female, age range 29-42 (mean 36.6) years and follow-up of 7-16 (mean 11.2) months. According to the evaluation of results by the Trillat scoring system scale, nine (81.8%) patients satisfied the criteria for 'excellent result', whereas two (18.2%) patients were in the 'good result' group. Patients with no subjective problems, objectively without local complications such as infection, necrosis or edema, and without any signs of limited ankle function were included in the excellent result group (n=9). After physical therapy, plantar flexion and dorsiflexion were identical on both feet. In this group, the volume in the below-knee middle third was identical on the operated and nonoperated leg at 7 or more months after the procedure (Figs. 3 and 4).

Two patients were categorized in the group of 'good results'. Subjectively, they were without troubles, whereas objectively one patient developed edema in the early postoperative period and did not involve in sports as intensively as prior to the injury. The other had temporary

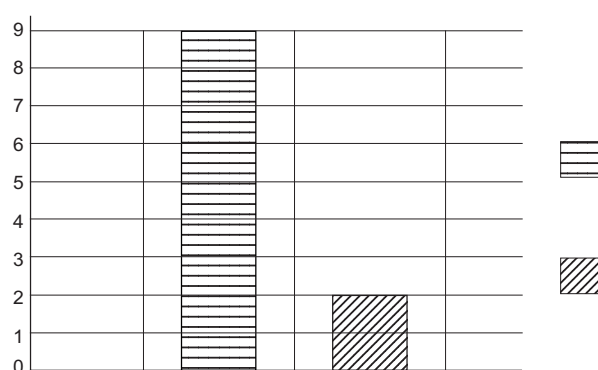


Fig. 3. Results according to the Trillat scoring system



Fig. 4. Result at 8 months of surgery

hyposthesia and occasional localized pain in the area of sural nerve innervation. There were no complications such as shortening or lengthening of Achilles tendon or rerupture at the site of reconstruction.

Discussion

Numerous publications have reported data on a high percentage, even up to disturbing 29%, of complications associated with the open method of treatment for Achilles tendon rupture^{8,9,13}. More commonly reported complications are infections, skin necroses, sural nerve injuries and reruptures. Some authors prefer the conservative approach to treatment, pointing out the ambulance procedure and avoidance of operative complications as advantages of this method¹⁴. Cetti *et al.* in a prospective randomized trial of surgical *versus* conservative treatment in 111 patients found no difference in the incidence of complications or reruptures in the two groups¹⁵. Yet they find that conservative management of Achilles tendon rupture may be indicated in older patients. Other authors report on a high percentage of reruptures, significantly worse functional results, and residual lengthening of Achilles tendon¹⁶. With the conservative treatment of total Achilles tendon rupture, retraction of the m. triceps surae occurs, result-

ing in poor contact and a gap between the ruptured ends. The introduction of the percutaneous treatment technique significantly decreased the number of postoperative complications, mainly tendon infections and reruptures, with improved functional results^{8-10,17}.

The aim of the modified percutaneous technique is an exact approximation of tendon ends, maintenance of m. triceps tonus, and sparing the surrounding structures (cutis, subcutis, tendon sheath, and the tendon itself) from any additional trauma and ischemia. The possibility of technical error during the procedure is reduced by the modification of the percutaneous method with minimal skin incision and visualization of end approximation.

The opportunity of conducting the procedure under local anesthesia further simplifies the preparation for the surgical procedure and expands the indications⁸.

Neither should economic parameters be neglected, considering that the average hospitalization time is also reduced. Physical therapy plays a major role in the final result of Achilles tendon rupture management, as it significantly contributes to improvement of functional results and patient ability to resume daily activities¹⁸⁻²⁰.

The modified percutaneous suture technique during the operation was chosen to make use of the advantages of both the complete percutaneous technique^{8-10,13,16-18,20} and the conservative treatment of Achilles tendon ruptures^{14,15}. Complications of Achilles tendon repair include the complications of any surgical procedure, together with deep venous thrombosis, pulmonary embolism, wound infection, wound necrosis, and rerupture²⁰. These complications are observed in particular in individuals known to have been treated with quinolone antibiotics or corticosteroids²¹. Reruptures and bilateral ruptures are rare, but

may be difficult to treat^{22,23}. Incision and subsequent suture of the skin, subcutaneous tissue and tendon sheath are undoubtedly associated with a significant risk of complications such as deep wound infection, skin necrosis, tenocutaneous adhesions, sural nerve injuries, etc. Most authors report in favor of the operative treatment of Achilles tendon ruptures, but classic operative approaches have a high complication percentage. The method described herewith implies minimal operative trauma and exposure, and warrants good approximation of the ruptured tendon ends. Our findings, although based on a relatively small sample with a mean follow-up of 11.2 months, indisputably show that the method results in good final outcome, and also indicate it to be an approach with certain advantages over other treatment options.

Conclusion

The applied technique of Achilles tendon rupture suture yielded excellent results in our patient sample, thus we prefer it to other techniques. On the other hand, the sample was rather small, therefore a larger series with a longer follow-up should be included in a future investigation. Our experience and data found in worldwide references both justify the use of this method in the management of traumatic Achilles tendon ruptures. The indications for operative procedure have been significantly widened, while the preoperative preparation of patients and their hospital stay are shortened and simplified by the possibility of conducting the procedure under local anesthesia.

References

- LAGERGREN C, LINDHOLM A. Vascular distribution of the Achilles tendon – an angiographic and micro-angiographic study. *Acta Chir Scand* 1959;116:491-5.
- GILLIES H, CHALMERS J. The management of fresh ruptures of the tendo Achillis. *J Bone Joint Surg* 1970;52A:337-43.
- PERCYEC, CONOCHIE LB. The surgical treatment of ruptured tendo Achillis. *Am J Sports Med* 1978;6:132-6.
- PAAR O, BERNETT P. Therapie des Achillessehnenruptur beim Sportler. *Fortschr Med* 1984;43:1106-11.
- CARDEN DG. Rupture of the calcaneal tendon. *J Bone Joint Surg* 1987;69B:416-20.
- ZWIPP H. Die Achillessehnenruptur: 10-Jahres-Spätergebnisse nach operativer Behandlung. Eine retrospektive Studie. *Unfallchirurg* 1989;92:554-9.
- NADA A. Rupture of the calcaneal tendon. Treatment by external fixation. *J Bone Joint Surg* 1985;67B:449-53.

Excellent	The patient is as capable to perform his work and sport activities as before the injury, no pain. Motion of the ankle suitable.
Good	The patient is satisfied, but does not involve in sports as intensively as prior to the injury, occasional localized pain.
Satisfactory	The patient is no longer involved in sports, uncertainty while walking on rough ground, the tendon is still hard enough.
Poor	Pain, limping, standing on one leg or running impossible, a swelling is present.

Table 1. Trillat scoring system for Achilles tendon rupture

8. KOSANOVIĆ M, ČRETNIK A, BATIŠA M. Subcutaneous suturing of the ruptured Achilles tendon under local anaesthesia. Arch Orthop Trauma Surg 1994;113:177-9.
9. GORSCHESKY O, VOGEL U, SCHWEIZER A, van LAAR B. Percutaneous tenodesis of the Achilles tendon: a new surgical method for the treatment of acute Achilles tendon rupture through percutaneous tenodesis. Injury 1999;30:315-21.
10. BRADLEY JP, TIBONE JE. Percutaneous and open surgical repairs of Achilles tendon ruptures: a comparative study. Am J Sports Med 1990;18:188-95.
11. MAFFULLI N. The clinical diagnosis of subcutaneous tear of the Achilles tendon. Am J Sports Med 1998;26:266-70.
12. TRILLAT A. Traitement des ruptures anciennes du tendon d'Achille (transfertplastie du court peronier lateral). Lyon Chir 1967;63:603-11.
13. NISTOR L. Surgical and non-surgical treatment of Achilles tendon rupture. J Bone Joint Surg 1981;63A:394-9.
14. LEARB, SMITH L. Non-surgical treatment or tendo repair of tendo Achillis ruptures. J Bone Joint Surg 1972;54A:1398-407.
15. CETTI R, HRISTENSEN SE, EJSTED R, JENSEN NM, JORGENSEN U. Operative *versus* non-operative treatment of Achilles tendon rupture. A prospective randomised study and review of the literature. Am J Sports Med 1993;21:791-9.
16. WATERSTON SW, MAFFULLI N, EWEN SWB. Subcutaneous rupture of the Achilles tendon: basic science and some aspects of clinical practice. Br J Sports Med 1997;31:289-98.
17. MA GWC, GRIFFITH TG. Percutaneous repair of acute closed ruptured Achilles tendon: a new technique. Clin Orthop 1977; 128:247-55.
18. MANDELBAUM BR, MYERSON MS, FORSTER R. Achilles tendon ruptures: a new method of repair, early range of motion, and functional rehabilitation. Am J Sports Med 1995;23:392-5.
19. MORTENSEN NHM, SKOVO, JENSEN PE. Early motion of the ankle after operative treatment of rupture of the Achilles tendon. J Bone Joint Surg 1999;81(A):983-90.
20. SOLDATIS JJ, GOODFELLOW DB, WILBER JH. End-to-end operative repair of Achilles tendon rupture. Am J Sports Med 1997;25:90-5.
21. MELHUS A, APOLQUIST J, LARSON J, ENEROTH M. Levofloxacin-associated Achilles tendon rupture and tendinopathy. Scand J Infect Dis 2003;35:768-70.
22. CETTI R, JUNGE J, VYBERG M. Spontaneous rupture of the Achilles tendon is preceded by widespread and bilateral tendon damage and ipsilateral inflammation: a clinical and histopathologic study of 60 patients. Acta Orthop Scand 2003;74:78-84.
23. STANEC S, STANEC Z, DELIMAR D, MARTINAC P. A composite forearm free flap for the secondary repair of the ruptured Achilles tendon. Plast Reconstr Surg 1999;104:1409-12.

Sažetak

REZULTATI PRAĆENJA NAKON LIJEČENJA RUPTURE AHILOVE TETIVE METODOM MODIFICIRANOG PERKUTANOG ŠAVA

S. Crnica, N. Božić-Božo i Ž. Korac

Rupture Ahilove tetive liječe se raznim operacijskim metodama, ali i konzervativnim postupcima. Operacijske tehnike primjenjivane posljednjih godina nastoje smanjiti operacijsku traumu, no malo je podataka u literaturi o kasnim rezultatima takvog liječenja. Umjesto perkutane tehnike odlučujemo se za manju inciziju radi vizualizacije aproksimacije rupturiranih krajeva tetive. Cilj studije bila je analiza kasnih rezultata liječenja rupture Ahilove tetive modificiranim perkutanom šavom. Primijenjena je manja incizija dužine oko 1-1,5 cm lateralno u visini mjesta rupture, a šav je postavljen dalje perkutano. Analizirani su rezultati u svih bolesnika operiranih tim načinom na odsjeku Plastične kirurgije Opće bolnice Karlovac u dvogodišnjem razdoblju (1.1.2001. – 31.12.2002.). Uvršteni bolesnici zadovoljavali su kriterij minimalnog praćenja od 6 mjeseci. Rezultati su procijenjeni ocjenskom ljestvicom po Trillatu. Dob bolesnika bila je od 29 do 42 godine, prosječno 36,6 godina, a razdoblje praćenja bilo je od 7 do 16 mjeseci, prosječno 11,2 mjeseci. Prema ocjenskoj ljestvici po Trillatu devetoro (81,8%) bolesnika je zadovoljavalo kriterije za "odličan" rezultat, dok ih je dvoje (18,2%) bilo u skupini "dobar" rezultat. Primijenjena tehnika na našem uzorku bolesnika dala je odlične rezultate, pa joj dajemo prednost u odnosu na druge tehnike. Uzorak je još malen, pa bi bilo korisno prikupiti podatke iz veće skupine bolesnika uz duže razdoblje praćenja.

Ključne riječi: *Ahilova tetiva – ozljede; Ahilova tetiva – operacija; Ruptura – operacija; Kirurški zahvat*