



Treatment of Achilles tendon rupture using different methods

Liječenje ruptur Ahilove tetive primjenom različitih metoda

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Abstract

Background/Aim. Today there are controversies about searching for the ideal surgical method (conservatively with plaster cast, with open and percutaneous tenorrhaphy) for repairing a ruptured Achilles tendon. The aim of this study was to examine the results of treating Achilles tendon ruptures in patients by using the following methods: percutaneous suturing, open surgery technique and non-surgical treatment by plaster cast immobilisation. **Methods.** Forty two patients treated at our facility in the period August 2003 – September 2010 for Achilles tendon ruptures were included in the study. They were operated on by using different orthopedic procedures (percutaneous reconstruction of the Achilles tendon, open surgery, plaster cast only) and two anaesthesia technique (spinal anaesthesia and local infiltrational anaesthesia). The following parameters were monitored after interventions performed and compared: duration of hospital stay, postsurgical complications, incidence of the reruptures of the Achilles tendon and time for full leg functionality. **Results.** The patients sustained their respective injuries in the following manner: 8 of them while pursuing sports activities, 24 while pursuing recreational activities, 4 at workplace, 4 while performing everyday activities, and 2 of the patients did not know how they had sustained their injuries. The average age of the patients was 40.5, with 37 (88%) men and 5 (12%) women. Surgeries were performed under spinal anaesthesia in 29 (69%) patients, and in 5 (12%) patients tenorrhaphy was performed under local anaesthesia. Anaesthesia was not used in 8 (19%) patients treated with

plaster cast. We performed percutaneous reconstruction of the Achilles tendon in 19 (45%) patients. A total of 14 (33%) patients were treated under spinal anaesthesia, and 5 (11.9%) under local infiltrational anaesthesia with 2% xylocain. We treated 15 (36%) patients with open surgery. The patients treated conservatively stayed in hospital on average for up to 5 hours. Those who underwent an percutaneous surgery stayed 2 days and those who underwent an open surgery stayed 9 days. A total of 28 (66%) patients from the given series experienced no complications. The patients treated with open surgical reconstruction experienced skin complications ranging from inflammatory changes on the skin in 6 (14%) patients to dehiscence and skin necrosis in 3 (7%). The 5 (11.9%) patients whose ruptured Achilles tendon was treated percutaneously experienced temporary redness and delayed healing of the incision(s) longer than 5 mm. A total of 3 (7%) patients treated with open surgery and 1 (2%) patient treated with percutaneous tenorrhaphy had temporary peroneal nerve prolapses. A total of 7 (16.6%) patients had reruptures: 4 were treated with plaster cast, 2 underwent open surgery, and 1 was treated percutaneously. Out of the 8 patients who were treated with plaster cast, 4 sustained reruptures and 3 of the 4 had diabetes. **Conclusion.** Surgical treatment, percutaneous tenorrhaphy, performed in a small operating theatre under local anaesthesia, should be preferred in cases of fresh ruptures of the Achilles tendon.

Key words:
achilles tendon; rupture; orthopedic procedures;
treatment outcome.

Apstrakt

Uvod/Cilj. Danas postoje kontroverze u vezi izbora idealne hirurške metode (konzervativno gipsom, otvorenom ili perkutanom tenorafijom) za reparaciju rupturirane Ahilove tetive. Cilj ovog rada bio je da se procijene rezultati liječenja ruptur Ahilove tetive kod bolesnika metodom perkutanog šivenja, otvorenom operativnom tehnikom i neoperativnim liječenjem – gipsanom imobilizacijom. **Metode.** U studiju su bila uključena 42 bolesnika sa rupturom Ahilove tetive, liječena u našoj ustanovi u periodu avgust, 2003 –

septembar, 2010. godine. Oni su liječeni različitim ortopedskim postupcima (perkutana rekonstrukcija Ahilove tetive, otvorena hirurgija, samo gips) i dvijema tehnikama anestezije (spinalna anestezija i lokalna infiltrativna anestezija). Pratili smo i uporedili slijedeće parametre poslije intervencija: dužinu boravka u bolnici, postoperativne komplikacije, incidenciju reruptur Ahilove tetive, kao i vrijeme potpune funkcionalnosti noge. **Rezultati.** Ispitanici su zadobili povrede: aktivnim sportom (8), na rekreaciji (24), na poslu (4), tokom obavljanja svakodnevnih aktivnosti (4), dok 2 ispitanika nisu znala razlog. Prosječna starost ispitanika bila je

40,5 god. Muškaraca je bilo 37 (88%), a žena 5 (12%). Operativni zahvat izvođen je u spinalnoj anesteziji kod 29 (69%) ispitanika, a kod njih 5 (12%) tenorafija je urađena u lokalnoj anesteziji. Kod 8 (19%) ispitanika koji su liječeni gipsom, anestezija nije upotrebljavana. Perkutana rekonstrukcija Ahilove tetive vršena je kod 19 (45%) ispitanika, 14 (33%) ispitanika liječeno je u spinalnoj anesteziji, a 5 (11,9%) u lokalnoj infiltrativnoj anesteziji (2% Xylocain). Otvorenim operativnim pristupom liječeno je 15 (36%) ispitanika. Konzervativno liječeni ispitanici boravili su u bolnici u prosjeku do pet sati, perkutano hirurški liječeni, dva dana, a otvorenom hirurškom tehnikom liječeni, devet dana. Komplikacije nije imalo 28 (66%) ispitanika. Komplikacije kože imali su bolesnici liječeni otvorenom hirurškom rekonstrukcijom, u rasponu od upalnih promijena kože, šest (14%) pacijenata, do dehiscencije i nekroze kože, tri (7%) pacijenata. Bolesnici kod kojih je perkutano zbrinuta

rupturirana Ahilova tetiva, pet (11,9%), imali su prolazno crvenilo i usporeno zarastanje one incizije čija je dužina bila veća od 5 mm. Prolazni ispadi nervusa peroneusa imala su tri (7%) ispitanika koji su zbrinuti otvorenom hirurškom metodom, i jedan (2%) ispitanik kod koga je tenorafija urađena perkutano. Rerupture je zadobilo sedam (16,6%) ispitanika: četiri liječena gipsom, dva liječena otvorenom hirurškom tehnikom i jedan perkutano. Od osam ispitanika koji su liječeni gipsom, rerupturu su zadobila četiri ispitanika, od kojih je troje bolovalo od dijabetesa. **Zaključak.** Kod svježih ruptura Ahilove tetive prednost treba dati hirurškom liječenju, perkutanoj tenorafiji, koja se izvodi u maloj operacionoj sali uz primjenu lokalne anestezije.

Ključne reči:
ahilova tetiva; ruptura; ortopedske procedure; lečenje, ishod.

Introduction

The Achilles tendon connects the triceps muscle to the heel bone at the back of the lower leg and it plantar flexes the foot, lifting the heel and raising the entire body onto the toes. The Achilles tendon is exposed to physical strain and great stretch load while walking and moving¹.

Continuous activity of strong forces during increased physical strain (athletes, recreationists, manual workers) creates degenerative and infiltrative changes in the Achilles tendon, which makes it vulnerable and most often leads to ruptures of lower extremity tendons. These ruptures occur 2–5 cm above the calcaneal joint, they are found on both sides in approx. 25%–30% of cases, and occur five times more often in men than in women. Ruptures most often occur between the third and fifth decades of life².

Along with an increase in the interest of middle-aged people for recreation and taking part in sporting activities, spontaneous ruptures of the Achilles tendon occur more frequently than it was expected. The incidence of Achilles tendon ruptures in recreationists amounts to 61%².

The reasons for this increased incidence are unclear, but some of them could be the disproportion between body weight and Achilles tendon strength, intensified physical strain, increased use of corticosteroids, growth hormone and testosterone, microtraumas, illness- or age-related degenerative changes^{1,2}.

Ever since Achilles was killed after being shot at the calcaneal (Achilles) tendon people have been interested in it. Hippocrates came to the conclusion that this injury could even be fatal¹, and Jenings and Sefton³ defined the functional importance of the Achilles tendon. In the 16th century, Parè provided the first description of an indirect rupture of the Achilles tendon¹. Myerson⁴ and Rostan⁵ maintain that a normal tendon does not rupture and that this happens to a tendon already damaged in some way prior to the rupture. Burry and Pool⁶ assumed that ruptures could only occur in abnormal tendons and in a com-

ination of intratendinous degeneration and increased mechanical stress.

In 1959, Arner and Lindholm⁷ favoured conservative treatment in their work, maintaining that the results were as good as those of surgical treatment. Ma and Griffith⁸ put an end to the mutual dismissiveness between conservative and surgical treatment in 1977 by introducing percutaneous suturing of the Achilles tendon into practice. Percutaneous suturing of the Achilles tendon has since then been constantly improving, in an effort to get the best possible results. The clinical signs are: strong pain when the tendon ruptures, palpable and sore “dent” in the Achilles tendon, and partial or complete loss of plantar flexion. The definite indication of a rupture is the Thompson “squeeze” test, i.e. the absence of plantar flexion of the foot on manually compressing the shank muscle⁹. Ultrasound confirms the clinical findings. Ultrasound is a highly sensitive and specific method for confirming the clinical diagnosis and monitoring the restitution of Achilles tendon ruptures¹⁰. A fresh Achilles tendon rupture can be treated both surgically and non-surgically⁵.

The aim of the study was to examine the results of treating Achilles tendon ruptures in patients by employing the percutaneous suturing method, open surgery technique, and non-surgical treatment by plaster cast immobilisation and to point out the advantages of percutaneous surgical treatment of fresh Achilles tendon rupture over the open surgical technique and non-surgical treatment by plaster cast immobilisation.

Methods

Forty two patients treated at our facility in the period August, 2003 – September, 2010, for Achilles tendon ruptures were included in the study. They were operated on by using different orthopedic procedures (percutaneous reconstruction of the Achilles tendon, open surgery, plaster cast immobilization) and two anaesthesia technique (spinal anaesthesia and local infiltrational anaesthesia). The following parameters were monitored after interventions performed

and compared: duration of hospital stay, postsurgical complications, incidence of the reruptures of the Achilles tendon and time for full leg functionality.

Results

The patients sustained their respective injuries in the following manner: 8 of them while pursuing sports activities, 24 while pursuing recreational activities, 4 at workplace, 4 while performing everyday activities, and 2 of the patients had sustained their Achilles tendon rupture for unknown reasons. The average age of the patients was 40.5, with 37 (88%) men and 5 (12%) women. Surgeries were performed under spinal anaesthesia in 29 (69%) patients, and in 5 (12%) patients tenorrhaphy was performed under local anaesthesia. Anaesthesia was not used in the 8 (19%) patients treated with plaster cast. On average, all patients were treated, either surgically or with plaster cast, within two days of the injury. All patients received medicamentous thromboembolism prophylaxis.

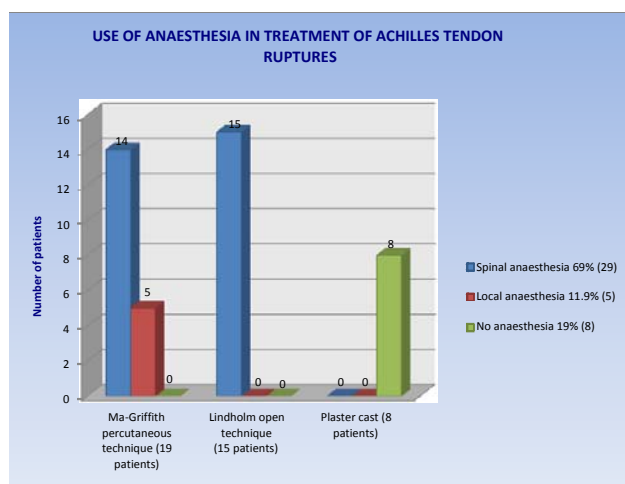


Fig. 1 – Use of anaesthesia in treatment of Achilles tendon ruptures

We performed percutaneous reconstruction of the Achilles tendon in 19 (45%) patients. Fourteen (33%) patients were treated under spinal anaesthesia, and 5 (11.9%) under local infiltrational anaesthesia, with 2% Xylocaine or Lydocaine. Having identified where Achilles tendon rupture occurred, we made 2 to 3 up-to-5-mm posteromedial and posterolateral skin incisions on both sides, distally to the depression in the Achilles tendon (Figure 2). Proximally to the depression in the Achilles tendon, we made 2 to 3 up-to-5-mm posteromedial and posterolateral skin incisions on both sides. Through skin incision, we penetrated diagonally in the proximal region through the skin of the tendon, from lateral to medial position, using a straight or slightly curved needle with slowly resorbing thread (Dexon, Vaykriol or PDS) (0-1 thickness). At the point where the thread exited the skin, it went through both sides towards the distal position, making a Bunnell-type stitch. By this way the tendon was completely restituted and it did not take more than three stitches to establish and maintain the continuity of the Achilles tendon. The suture was tested by using the Thompson test. The skin

was not sutured. Dermal concavities that stayed behind the needle puncture point was not a reason for concern because they subsided on their own in a couple of days. Knots were simply “pulled back” into the incision, using a small pair of scissors. An upper-leg definitive plaster cast with the knee in a flexed position and the foot in an equinus position was put on the operating table. In two weeks’ time the plaster cast was cut shorter, below the knee. Two weeks later the lower-leg definitive plaster cast was put, with the heel positioned for full weight-bearing walking.



Fig. 2 – Posteromedial and posterolateral skin incisions on both sides, distally to the depression in the Achilles tendon

We treated 15 (36%) patients with open surgery. The approach was posteromedial, along the medial border of the Achilles tendon and between 10 and 12 cm in length. After the skin was incised and hemostasis controlled, the ruptured Achilles tendon was approached and restored using the Lindholm technique. Drainage was mandatory. An upper-leg plaster cast was put after the surgery, with the knee flexed and the foot in an equinus position. The average plaster cast immobilisation lasted 7.1 weeks.

Conservative treatment of a ruptured Achilles tendon commenced by putting the ruptured tendon in a total contact position and then by placing a high upper-leg plaster cast with the foot in the maximum equinus position, with the knee flexed 20°. The process of Achilles tendon cicatrisation takes three weeks⁸, and our patients wore the plaster cast for four weeks so that the wound could completely cicatrise. During that time we recommended walking with crutches without weight-bearing through the leg, exercising toes from the very beginning, as well as exercises for strengthening the muscles of the upper leg⁸. After four weeks, the plaster cast was cut shorter, below the knee, and we maintained the foot equinus position for another four weeks. After eight weeks of wearing a plaster cast with the foot in an equinus position, the cast was taken off, and the heavy and sore foot was put in

a neutral position in order to put a lower-leg definitive plaster cast with the heel in the walking position for two weeks. We treated 8 (19%) patients in this way.

All the patients were monitored in an outpatient setting for a year on average. The hospital inpatient stay was as follows: on average, the patients who were treated conservatively for Achilles tendon rupture stayed in hospital for up to 5 h; those who underwent percutaneous surgery stayed 2 days; and those who underwent open surgery stayed 9 days. Twenty eight (66%) patients from that series experienced no complications. The patients treated with open surgical reconstruction experienced skin complications ranging from inflammatory changes on the skin in 6 (14%) patients to dehiscence and skin necrosis in 3 (7%) of the patient (Table 1). The 5 (11.9%) patients whose ruptured Achilles tendon was treated percutaneously experienced temporary redness and delayed healing of the incision longer than 5 mm. The wounds healed when they were dressed with drained physiological gauze.

A total of 3 (7%) patients treated with open surgery and 1 (2%) patient treated with percutaneous tenorrhaphy had temporary peroneal nerve prolapses. A total of 7 (16.6%) patients had reruptures. A total of 4 of the 7 (16.6%) patients with reruptures were treated with plaster cast, 2 underwent open surgery, and 1 was treated percutaneously. Out of the 8 patients who were treated with plaster cast, 4 sustained reruptures (3 of the 4 had diabetes). Out of the 15 patients treated with the Lindholm open technique¹, 2 had Achilles tendon reruptures (Table 1). There was dehiscence prior to rerupture. Out of the 19 patients treated percutaneously with

day, and in plaster cast treatment, there is no need for painkillers (Table 1).

These treatments are accompanied by muscle atrophy.

The atrophy of the lower leg after surgical treatment of the Achilles tendon following the removal of a plaster cast (on average worn for 7.1 weeks) compared to the healthy lower leg amounts to 2 cm on average. Conservative treatment (plaster cast worn for 9.6 weeks) resulted in an average of 3.4 cm atrophy of the lower leg.

In one case, the tendon was elongated by plaster cast treatment. We had no tendon shortening or tendon elongation through surgical treatment.

In all patients treated with the Lindholm open technique the Achilles tendon thickened, which created minor or major clothing problems, due to compression at that point.

On average, full mobility of the ankle joint after percutaneous tenorrhaphy is established after 10 weeks, following the Lindholm open technique after 12 weeks and following plaster cast treatment after 16 weeks (Table 1).

We monitored the restitution of the Achilles tendon by ultrasound. We observed that in the first four weeks ultrasound examination did not detect any statistically significant differences between the surgically treated Achilles tendons and those treated with plaster cast. It suggested that surgically treated tendons were restored more quickly within that time. After twelve weeks, ultrasound did not show any difference between the tendons treated conservatively and those treated surgically.

In the surgical group there were no infections. One of

Table 1

Complications and time for the full leg functionality in patients surgically treated due to Achilles tendon ruptures

Parameters	Ma-Griffith percutaneous technique (n = 19)	Lindholm open technique (n = 15)	Plaster cast (n = 8)
Temporary inflammatory skin changes (n)	5	1	
Dehiscence and skin necrosis (n)		3	
Transitory paresis of peroneal nerve (n)	1	3	
Achilles tendon re-ruptures (n)	1	2	4
Thromboembolic complications (n)		1	
Pain duration during treatment (days)	1	3	
Full leg functionality (weeks)	10	12	16

the Ma-Griffith technique¹, only 1 active athlete experienced an Achilles tendon rerupture during practice, four months after the percutaneous treatment. The analysis of rerupture established that the reason was the athlete's not following the doctor's orders (weight-bearing on the toes, going down stairs, slipping off smooth surfaces, early sporting activity).

The pain felt during surgical treatment, as well as occasional pain later on, are greatest in open surgical treatment of ruptured Achilles tendons, then in percutaneous surgical treatment and in conservative treatment. In open surgical treatment, patients on average take painkillers for three days, in percutaneous surgical treatment they take them for one

the patients who were treated with the open surgical method had a pulmonary thromboembolism.

Discussion

Tomak et al.¹¹ found percutaneous treatment of the Achilles tendon to be more successful than open surgery and that it could be performed under local anaesthesia and in outpatient conditions. In the period between 1991 and 1997, Cretnik et al.¹² made a prospective study about the modified percutaneous method of treatment of the Achilles tendon by monitoring patients over a two-year period. They monitored 134 patients, 124 men and 8 women after acute total rup-

tures. Postoperative care meant wearing a plaster cast for 6 weeks. The results were as follows: 1 (0.7%) complete re-rupture, 4 (3%) partial re-ruptures, and ankle joint contractures were reported in 6 (4.5%) patients¹².

In 1981, Nistor et al.¹³ published a study containing 105 cases of closed ruptures of the Achilles tendon treated surgically and non-surgically in which they showed that the treatment results were very similar. They gave preference to the percutaneous method. This treatment has certain advantages which are reflected in anatomic restitution of the tendon and maintenance of its length, reduction of the scar in the tendon tissue at the point of union and primary healing of the tendon within optimal time. Surgical treatment is usually preferred in younger people and active athletes¹³.

The retrospective analysis conducted by Haji et al.¹⁴ compared open and percutaneous treatment of ruptured Achilles tendons during a 14-year period. A total of 108 patients were monitored, 70 of whom underwent traditional surgical treatment, while 38 were treated by the modified Ma-Griffith treatment method. In the open method group there were 4 (5.7%) cases of re-rupture occurrence, 4 (5.7%) cases of deep infection, 2 (2.9%) cases of palpable stitch knots and 1 (1.4%) lesion of the sural nerve. The complications following percutaneous treatment included 1 (2.6%) case of re-rupture, 5 (13.2%) cases of palpable stitch knots, 4 (10.5%) cases of transitory lesion of the sural nerve, and there were no infections. Statistically speaking, there was no significant difference between the two groups¹⁴.

The method used in the Goschewski et al.¹⁵ study reduced the risk of complications arising from surgery, but it suggested faster postoperative mobilisation and functional treatment. That was percutaneous treatment of the Achilles tendon using two Lengemann extension wires for co-adaptation of the ruptured tendon. Achilles tendon ruptures occurred in the course of sporting activities and, on average, were treated within 22 h. The outcome was very good in 98% of the cases. One (2%) patient suffered re-rupture due to trauma, but there were no other complications¹⁵.

Wallace et al.¹⁶ found percutaneous treatment of the Achilles tendon to be more successful than open surgery treatment.

Josey et al.¹⁷ presented a standardised protocol used in those who opted for non-surgical treatment or did not want to undergo surgery. Wallace et al.¹⁶ presented the results of their non-surgical orthotic treatment which were better than published results of operative treatment of acute Achilles tendon ruptures. Weber et al.¹⁸ presented the results of non-operative and operative treatments, which were equivalent. Additional pain was lesser, and return to unassisted walking and work went faster in the non-surgically treated group¹⁸.

Conservative treatment was indicated in order to avoid surgical complications and reduce costs. That requires more time and immobilisation of the knee and ankle joint in an equinus position, which leads to lower leg muscle atrophy. The risk of an Achilles tendon re-rupture is much greater than after surgical treatment. Conservative treatment also implies the risk of tendon extension, which weakens the functioning of the muscle-tendon unit¹.

Conclusion

In case of fresh Achilles tendon rupture preference should be given to surgical treatment, percutaneous tenorrhaphy, performed in a small operating theatre under local anaesthesia.

Percutaneous tenorrhaphy establishes and maintains the contact between the ruptured ends of the Achilles tendon. This procedure is short, inexpensive, less painful, and the recovery of the muscle strength of the lower leg and the functionality of the ankle joint and the knee is faster.

Statistically, the occurrence of Achilles tendon re-ruptures is not considerable in either surgical treatment method, but is lesser than in conservative treatment.

Skin necrosis, as well as the extension or shortening of the Achilles tendon, is avoided by percutaneous suturing.

Percutaneously operated patients need less time to recover the muscle strength of the tendon and to restore full range of motion. The ultrasound findings in the patients who underwent surgery show better consolidation of the site of rupture of the Achilles tendon with less scar tissue.

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Received on September 28, 2010.

Revised on November 30, 2010.

Accepted on December 4, 2010.