Treatment of Achilles tendon rupture using different methods

Liječenje rupture 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 infiltration 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 19 (45%) 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

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 moving. 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 life.

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%.

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.

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 fatal, and Jennings and Selfon defined the functional importance of the Achilles tendon. In the 16th century, Paré provided the first description of an indirect rupture of the Achilles tendon. Myerson and Rostam 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 Pool assumed that ruptures could only occur in abnormal tendons and in a combination of intratendinous degeneration and increased mechanical stress.
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.

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, Vaykril 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.

We treated 15 (36%) patients with open surgery. The approach was percutomedial, 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 weeks, 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 leg. 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. Twentyeight (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 technique 1, 2 had Achilles tendon reruptures (Table 1). There was dehiscence prior to rerupture. Out of the 19 patients treated percutaneously with the Ma-Griffith technique 1, only 1 active athlete experienced an Achilles tendon rupture 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 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 the patients who were treated with the open surgical method had a pulmonary thromboembolism.

Table 1

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

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 ruptures. Postoperative care meant wearing a plaster cast for 6 weeks. The results were as follows: 1 (0.7%) complete re-
rupture, 4 (3%) partial reruptures, and ankle joint contrac-
tures were reported in 6 (4.5%) patients 12.

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 prefer-
cence to the percutaneous method. This treatment has cer-
tain 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 pri-
mary healing of the tendon within optimal time. Surgical
treatment is usually preferred in younger people and active
athletes 13.

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 rerupture 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 compli-
cations were reported in 6 (4.5%) patients 12.

While the open method group had 4 (5.7%) cases of rerupture 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, there were no infections. Statistically speaking, there was 4 (5.7%) cases of rerupture 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 rerupture, 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 groups 14.

The method used in the Goschewski et al. 15 study re-
duced 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 rerupture due to
trauma, but there were no other complications 15.

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 unas-
sisted walking and work went faster in the non-surgically
treated group 18.

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 unit 1.

Conclusion

In case of fresh Achilles tendon rupture preference
should be given to surgical treatment, percutaneous tenor-
raphy, 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 re-
covery of the muscle strength of the lower leg and the func-
tionality of the ankle joint and the knee is faster.

Statistically, the occurrence of Achilles tendon rerup-
tures 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 re-
cover 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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