Surgical treatment for chronic Achilles tendinopathy: a prospective seven month follow up study

M Paavola, P Kannus, S Orava, M Pasanen, M Järvinen

Objective: To prospectively assess the early results of surgical treatment of chronic Achilles tendinopathy.

Methods: This seven month prospective follow up study assessed the short term results of surgical treatment of chronic Achilles tendinopathy and compared the subjective and functional outcome of patients with Achilles tendinopathy without a local intratendinous lesion (group A) with that of similar patients with such a lesion (group B). Forty two of the initial 50 patients were examined before surgery and after the seven month follow up. Evaluation included an interview, subjective evaluation, clinical tests, and a performance test.

Results: At the follow up, physical activity was fully restored in 28 of the 42 patients (67%), and 35 patients (83%) were asymptomatic or had only mild pain during strenuous exercise. In clinical tests, significant improvements were observed in climbing up and down stairs and the rising on the toes test. Surgical treatment also seemed to be successful from the total test score, which was excellent or good in 33 patients, compared with before surgery when it was excellent or good in one patient only. Patients in group A fared better than those in group B, whether evaluated by recovery of physical activity after surgery (88% v 54%) or the complication rate (6% v 27%).

Conclusions: Surgical treatment of chronic Achilles tendinopathy gives good and acceptable short term results. A lower complication rate and a trend to better recovery was observed in patients with peritendinous adhesions only than in those with peritendinous adhesions combined with an intratendinous lesion.

Parents and methods

Patients

From August 1995 to November 1998, 50 patients (36 men, 14 women) were treated surgically for Achilles tendinopathy at the Tampere University Hospital, Tampere and Hospital Tohotoritalo 41400, Turku, Finland, and all of them agreed to participate in the prospective follow up. All operations were performed by two senior orthopaedic surgeons (SO and MJ).

Patients with disorders at the Achilles insertion (insertional tendinopathy) or previous surgical treatment of the index tendon were excluded.

In 10 patients, the contralateral Achilles tendon had been previously operated on for an Achilles tendon overuse injury. At baseline, three other patients had exercise induced Achilles pain on this contralateral side also. Therefore the contralateral Achilles tendon could not be used as a control. Instead, the preoperative or baseline values of the index Achilles tendon were used as the basis for the follow up observations.

Surgery is reserved for patients who do not respond adequately to conservative treatment. Excision of the pathological peritendinous tissue or longitudinal incisions of the tendon, alone, or with excision of intratendinous lesion, are the types of surgery normally used. Excision of the intratendinous lesion has been made without augmentation, or with augmentation using tendon or fascia as the augmentation material. Multiple longitudinal incisions have also been performed percutaneously.

The aim of this prospective seven month follow up study was to assess the early results of surgical treatment of chronic Achilles tendinopathy and to analyse the subjective and functional outcome in patients with or without a local intratendinous lesion.
thickening, and, sometimes, palpable nodules at the Achilles tendon). In addition, to confirm the clinical diagnosis, ultrasound and/or magnetic resonance imaging (MRI) examinations were performed in most of the subjects (ultrasound in 15 patients, MRI in two patients, both ultrasound and MRI in 18 patients, and clinical examination alone in seven patients).

In all patients, the overuse symptoms had not been relieved by conservative treatment (mean length of the conservative treatment was 18 months, range 3–192 months). Initially, all patients had been advised to rest or substantially reduce their athletic activities. In addition, 31 of the 42 patients (74%) had been treated with a small amount of corticosteroid, injected between one and four times around the Achilles tendon, and anti-inflammatory medication had been used by almost all of the patients. In all patients, the indications for surgical treatment was failure of the above non-operative treatment—that is, the patient's inability to continue physical activities without pain, persistent swelling around the Achilles tendon, or both.

**Surgical treatment**

All patients were operated on as outpatients. Spinal anaesthesia was used in 19 of the 42 patients (45%), local intravenous anaesthesia in 19 (45%), and local anaesthesia in four (10%). During surgery, the patient was prone. A tourniquet was used in the 19 patients who had local intravenous anaesthesia, otherwise only occasionally (in the cases of a large intratendinous lesion). A longitudinal incision was made to the lateral side of the Achilles tendon, and the small subcutaneous veins were coagulated with diathermy. The distal part of the small saphenous vein and the sural nerve were carefully identified, freed by blunt dissection, and retracted anteriorly.

The final surgical diagnosis was chronic Achilles tendinopathy with peritendinous adhesions in 16 of the 42 patients (38%; group A) and chronic Achilles tendinopathy with peritendinous adhesions and a localised intratendinous lesion in 26 of the 42 patients (62%; group B).

In all 16 patients in group A, the crural fascia was incised and the adhesions, especially those between the paratenon and the crural fascia, were carefully excised, leaving intact as many layers of the true Achilles paratenon as possible. In the 26 patients in group B, an additional longitudinal incision of the tendon itself was performed and the intratendinous lesion removed. When the lesion was extensive, the remaining tendon was reapproximated by side to side sutures.

**Regimen after surgery**

Ankle mobilisation and partial weight bearing with the aid of crutches were gradually started immediately after surgery. Stretching exercises for the Achilles tendon-gastrocnemius muscle complex were initiated and full weight bearing was allowed when the patient was able to walk without limping, usually one to two weeks after surgery. Light sports specific training was allowed when there was no pain on walking and no limitation in the active range of motion of the ankle joint, usually four to six weeks after the operation. Full sports specific training was allowed 6–12 weeks after surgery.

**Study protocol**

Each patient was examined by the same doctor (MP) at study entry (before surgery) and after the seven month follow up. The study protocol was the same at both checkup points. In addition, all the patients were examined two to three weeks after surgery by the operating surgeon to evaluate any early complications and wound healing.

**Interview and subjective evaluation**

The interview and subjective evaluation provided information about the symptoms of the Achilles tendon, ability to walk and run, and current physical activity. At the end of the follow up period, possible complications were also re-evaluated.

**Clinical tests**

Ability to climb up and down stairs was evaluated using two floors with 40 steps (height, 17 cm; depth, 30 cm). In the rising on to toes test, the subject was asked to rise on to tiptoe with one leg as many times as possible at the pace of 60 times per minute to measure fatigue of the ankle plantar flexor muscles. The full range of motion of the ankle was measured using a goniometer (Biomet Inc, Warsaw, Indiana, USA), and calf circumference was measured with a measuring tape at the border of the upper and middle third of the fibula.

**Performance test protocol**

The performance of the lower limbs was determined by a standardised test protocol and scoring scale of Kaikkonen et al. The subjective evaluation was based on three “yes” or “no” questions (subjective assessment of the affected limb, ability to walk normally, ability to run normally) followed by evaluations of walking downstairs, rising on to heel and toes, and a balance test. Finally, an active range of motion of the ankle in dorsiflexion (knee extended) and stability of the ankle joint using the anterior drawer test were measured. The total test score was then calculated.

**Statistical analysis**

The data were analysed with an IBM compatible microcomputer using the 1997 version of the SPSS statistical software (SPSS Inc, Chicago, Illinois, USA).

The results of the subjective assessment of the “symptoms of the Achilles tendon” and “ability to walk” and “run” were analysed by the McNemar test, but statistical tests of the differences between group A and B could not be performed because of empty cells in the cross tabs—that is, in group A, there were no patients who could not walk normally after surgery and no patient who could run normally before surgery. In the remaining frequency variables (‘recovery of physical activity’ and ‘subjective assessment of the symptoms in the index Achilles tendon’), the comparison of differences between the subgroups was performed by the $\chi^2$ test.

In many of the continuous variables (rising on to toes, range of motion of the ankle, the calf circumference, and climbing up and down stairs), the assumption of normality in case distribution was not fulfilled—that is, the distributions were skewed—and therefore non-parametric tests were used for analysis: the Wilcoxon signed rank test was used to determine the intragroup differences between the preoperative and postoperative tests, and the Mann-Whitney $U$ test to determine the differences in the improvement after surgery between groups A and B. Although the results of the performance test
were classified into four different score categories (table 3), the test to test differences (determined by Wilcoxon signed rank test) and differences between the two groups (determined by Mann-Whitney U test) were assessed using a continuous variable, the total performance test score (table 3). The results of the continuous variables are given as a mean (SD) throughout the study unless specified differently.

**RESULTS**

**Subjective evaluation**

At the start of the study, 12 of the 16 patients (77%) in group A and 23 of the 26 patients (88%) in group B had moderate to severe symptoms in the index Achilles tendon. After the seven month follow up period, subjective assessment of these Achilles symptoms showed clear improvement: 15 of the 16 patients (94%) in group A and 20 of the 26 patients (79%) in group B were asymptomatic or had only mild symptoms during strenuous exercise (improvement in group A, p = 0.001; improvement in group B, p<0.001). There were no significant differences in the subjective assessment of the injured Achilles tendon before or after surgery between the patients in the two groups (p = 0.376 and p = 0.322 respectively).

When recovery of physical activity was evaluated, the patients in group A fared better than those in group B: physical activity had returned to the level before injury in 14 of the 16 patients (88%) in group A and in 14 of the 26 patients (54%) in group B (between group difference, p = 0.025).

In both groups, subjective assessment of the ability to walk and run showed significant improvement after surgery of the index Achilles tendon. Before surgery, only 10 of the 16 patients (63%) in group A were able to walk normally and none of them were able to run normally (walking, p = 0.031; running, p<0.001). However, after surgery, it was classified as “good” or “excellent” in all patients in group A, whereas in group B it was classified as “good” or “excellent” in only 19 of the 26 patients (73%). The improvement in the median of the

was considered normal when there was no limp, no pain during light or moderate activity, and stiffness did not limit the range of motion of the ankle. After surgery and the follow up period, all 16 patients in group A could walk normally and 15 of these 16 patients could run normally (walking, p = 0.031; running, p<0.001). In group B, only 14 of the 26 patients were able walk normally and two were able to run normally before surgery, whereas at the end of the follow up period, 24 could walk normally and 20 could run normally (walking, p = 0.006; running, p<0.001).

**Clinical tests**

Table 2 gives the result of the clinical tests. Significant improvements in the climbing up and down stairs tests and the rising on toes test were seen in both groups. However, there were no significant differences between the two groups with respect to these improvements.

The range of motion of the ankle and the calf circumference showed neither significant intragroup changes during the follow up period nor significant differences between the two groups.

**Performance test**

Table 3 presents the distribution of the patients according to the four categories of the total scores in the performance test protocol. In the performance test on the involved lower limb, there were no significant differences in the distribution of the test score between the two groups before surgery (p = 0.21). However, after surgery, it was classified as “good” or “excellent” in all patients in group A, whereas in group B it was classified as “good” or “excellent” in only 19 of the 26 patients (73%). The improvement in the median of the

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**Table 2**

| Variable                        | Group A Before surgery | 7 month follow up | Group B Before surgery | 7 month follow up | Significance between groups A
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Climbing upstairs (seconds)</td>
<td>17 (4)</td>
<td>0.006</td>
<td>15 (2)</td>
<td>20 (6)</td>
<td>0.001</td>
</tr>
<tr>
<td>Climbing downstairs (seconds)</td>
<td>20 (7)</td>
<td>0.001</td>
<td>15 (2)</td>
<td>22 (10)</td>
<td>0.001</td>
</tr>
<tr>
<td>Rising on toes (number)</td>
<td>26 (14)</td>
<td>0.055</td>
<td>20 (10)</td>
<td>21 (15)</td>
<td>0.04</td>
</tr>
<tr>
<td>ROM of the ankle (degree)</td>
<td>58 (9)</td>
<td>NS</td>
<td>55 (8)</td>
<td>55 (11)</td>
<td>NS</td>
</tr>
<tr>
<td>Calf circumference (cm)</td>
<td>38 (3)</td>
<td>NS</td>
<td>38 (3)</td>
<td>37 (2)</td>
<td>NS</td>
</tr>
</tbody>
</table>

Values are mean (SD).

*Wilcoxon signed rank test.
†Mann-Whitney U test.

**Table 3**

<table>
<thead>
<tr>
<th>Score category of involved Achilles tendon</th>
<th>Group A Before surgery</th>
<th>7 month follow up</th>
<th>Group B Before surgery</th>
<th>7 month follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent (85–100)</td>
<td>–</td>
<td>5</td>
<td>–</td>
<td>7</td>
</tr>
<tr>
<td>Good (70–80)</td>
<td>–</td>
<td>11</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Fair (55–65)</td>
<td>18</td>
<td>8</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Poor (&lt;50)</td>
<td>10</td>
<td>–</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Median (range)*</td>
<td>50 (25–65)</td>
<td>80† (70–95)</td>
<td>48 (15–70)</td>
<td>75† (15–100)</td>
</tr>
</tbody>
</table>

*Maximum value = 100
†Wilcoxon signed rank test tested the intragroup score change by time. In both groups, this change was significant (p<0.001), showing, however, no significant intergroup difference in the score improvement (Mann-Whitney U test).
Complications
There were eight complications in the 42 patients (19%) treated surgically for Achilles tendinopathy: four superficial wound infections; two skin edge necroses; two fibrotic reactions or scar formations. Complications were found more often in patients in group B (seven of the 26 patients (27%) in group B v one of the 16 patients (6%) in group A), although the difference was not significant (p = 0.098).

Discussion
The goal for the treatment of chronic Achilles tendinopathy is to return the patient to the desired level of physical activity without significant residual pain. In athletes, the recovery time should also be as short as possible.

Our prospective seven month follow up study shows that the short term results of surgical treatment of chronic Achilles tendinopathy were satisfactory. Full physical activity was restored in 28 of the 42 patients (67%), and 35 patients (83%) were asymptomatic or had only mild pain during strenuous exercise. In clinical tests, clear improvement was observed. In addition, using the performance test protocol as the criterion, the surgical treatment of the Achilles tendinopathy seemed successful.

Although this study is the first prospective follow up report of patients receiving surgery for Achilles tendinopathy (using subjective, clinical, and functional tests as outcome variables), it has two clear limitations. Firstly, although “recovery to the previous level of activity in the shortest possible time” is often emphasised in athletes, a longer follow up is needed to determine the true long term outcome of the surgery. Secondly, we were unable to include a group of non-operatively treated controls, matched for age, sex, and physical activity. A randomised controlled trial is needed to fulfil this requirement.

Cetti et al[22] observed that the overall complication rate in 4083 surgically treated complete Achilles tendon ruptures was 12%. Recently, an overall complication rate of 11% was documented in a series of 432 consecutive patients after surgical treatment for chronic Achilles tendon overuse injury.[23] In that study, most (54%) of the complications involved compromised wound healing, which seemed to occur more often in patients operated on for partial rupture of the Achilles tendon. In our study, the overall complication rate was 19%, and delayed wound healing was the most common problem; the entire rate of skin complications was 14%. The complications seemed to be more common in patients operated on for Achilles tendinopathy with peritendinous adhesions and intratendinous lesion (27%) than in those with peritendinous adhesions only (6%). One reason for the increased risk of complications after surgical treatment of the intratendinous lesion may be extensive thickening of the Achilles tendon followed by abnormal stretching and impaired local circulation of the skin. Also, the more extensive surgery and consequent tissue manipulation may increase the risk of complications.

In many previous studies, surgery for Achilles tendon overuse injuries has given satisfactory (70–95%) results. However, the true long term outcome of the surgery is not well known, although in some patients the results were satisfactory for one to two years but not thereafter.[13-18] The immediate clinical results were better than those of patients treated operatively.[19] The aim of our study was to assess the long term results of surgical treatment for chronic Achilles tendinopathy.

In our study, the patients in group A fared better than those in group B when recovery of physical activity after surgery was evaluated (88% v 54%). This trend of better recovery in patients with peritendinous adhesions only was also found in the performance test on the lower limbs, although the group difference was not significant. Although the surgery was more extensive and the patients somewhat older in group B than in group A, one basic reason for a worse outcome in patients with a coexisting intratendinous lesion may be the more serious form of Achilles tendinopathy. Although the exact role of the intratendinous changes in the cause and pathogenesis of Achilles tendinopathy is unknown, and, in particular, treatment and prognosis of the patients is not known, we feel that imaging of the tendon structure with ultrasound or MRI may be beneficial when planning and timing surgical treatment for this condition. Also, the removal of the peritendinous lesion during surgery should be taken into account when planning a postoperative regimen and restarting sports specific training.

In addition to subjective evaluation, we observed clear improvements in the clinical tests and the performance test of the lower limbs. An important factor in these improvements may be the relief of pain after surgery. Our finding of improvement in the endurance of the calf muscles is in line with the results of a previous study of percutaneous longitudinal tenotomy for Achilles tendinopathy,[30] although in
Surgical treatment of Achilles tendinopathy gives good and acceptable short term results. A lower complication rate and a trend to better recovery was observed in patients with periarticular adhesions only than in those with periarticular adhesions combined with an intratendinous lesion.

In conclusion, this prospective follow up study showed that surgical treatment of Achilles tendinopathy gives good and acceptable short term results. A lower complication rate and a trend to better recovery was observed in patients with periarticular adhesions only than in those with periarticular adhesions combined with an intratendinous lesion. Randomised studies with a non-operative control group and longer follow up are needed to determine the true value of surgery in the treatment of chronic Achilles tendinopathy.

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