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 35 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% vs 54%) or the complication rate (6% vs 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.

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 Tohtoritalo 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.

Patients in group A fared better than those in group B, whether evaluated by recovery of physical activity after surgery (88% vs 54%) or the complication rate (6% vs 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.
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 otherwise only occasionally (in the cases of a large intratendinous lesion). In all patients, the indications for surgical treatment were coagulated with diathermy. The distal part of the small subcutaneous veins were freed by blunt dissection, and retracted anteriorly.

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 otherwise only occasionally (in the cases of a large intratendinous lesion). In all patients, the indications for surgical treatment were coagulated with diathermy. The distal part of the small subcutaneous veins were freed by blunt dissection, and retracted anteriorly.

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 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.

Table 1 Basic characteristics of the 16 patients with Achilles tendinopathy with peritendinous adhesions (group A) and 26 patients with Achilles tendinopathy with peritendinous adhesions and intratendinous lesion (group B)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Age (years)</td>
<td>37 [12]</td>
<td>46 [14]</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affected side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Left</td>
<td>5</td>
<td>13</td>
</tr>
</tbody>
</table>

Where applicable, values are mean (SD).

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.20 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 groups 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 χ² 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 filled—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). 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

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group A</th>
<th>Group B</th>
<th>Significance between groups A and B at the 7 month follow up, comparing improvement by time between the groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climbing upstairs (seconds)</td>
<td>Before surgery</td>
<td>p Value</td>
<td>7 month follow up</td>
</tr>
<tr>
<td>Index Achilles tendon</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Values are mean (SD).
*Wilcoxon signed rank test.
†Mann-Whitney U test.
ROM, Range of motion.

---

Table 3: Distribution of the patients according to the performance test score categories and the median (range) of the total score of the involved Achilles tendon in the 16 patients with Achilles tendinopathy with peritendinous adhesions (group A) and 26 patients with Achilles tendinopathy with peritendinous adhesions and intratendinous lesion (group B)

<table>
<thead>
<tr>
<th>Score category of involved Achilles tendon</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before surgery</td>
<td>7 month follow up</td>
<td>Before surgery</td>
</tr>
<tr>
<td>Excellent (85–100)</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Good (70–80)</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Fair (55–65)</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>Poor (≤50)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Median (range)*</td>
<td>50 (25–65)</td>
<td>80† (70–95)</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).
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. 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 isolated tendinopathy (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, most of these studies were retrospective, and in only a few were the results based on objective evaluations, such as range of motion of the ankle.

To our knowledge there have only been three prospective studies on surgical treatment of the Achilles tendinopathy. Alfredson et al. evaluated prospectively the effect of surgical treatment on isokinetic calf muscle strength in 13 patients with various types of Achilles tendon overuse injury. They found that six months of rehabilitation after surgical treatment was not enough to restore concentric and eccentric plantar flexion muscle strength to that of the uninjured side. A problem in their study design was that the surgery was followed by a relatively long (six weeks) immobilization period in a plaster cast, although muscle tissue is known to be very sensitive to atrophy even after shorter (one week) periods of disuse, and its rehabilitation to normal function and volume is known to be one of the most difficult, tedious, and time consuming tasks, even in sports medicine. However, in a more recent study, Alfredson et al. found no obvious advantages in recovery of isokinetic concentric and eccentric plantar flexion muscle strength of 11 patients with chronic tendinopathy by using a shorter immobilization time (two weeks).

Maffulli et al. evaluated the results of percutaneous longitudinal tenotomy in 52 middle and long distance runners with unilateral Achilles tendinopathy (peritendinitis and/or intratendinous lesion) on the basis of isometric strength, endurance measurements, and subjective evaluation (six and 18 months after the operation respectively). They found that the presence of peritendinitis was a poor prognostic factor, the patients with tendinopathy associated with peritendinitis being less satisfied, less strong, and less resistant after the follow up period than patients with isolated tendinopathy (intratendinous pathology without peritendinous alterations at the ultrasonographic examination). In their surgical procedure, they did not trim the peritendinous adhesions, leaving the peritendinous tissues adherent to the Achilles tendon and surrounding structures. In our experience, all cases of Achilles tendinopathy with an intratendinous lesion show additional peritendinous adhesions, and we recommend that these adhesions are removed during the operation.

In the prospective non-controlled follow up study of Alfredson et al., interesting preliminary results were obtained using an intensive muscle training regimen for chronic Achilles tendinopathy. After the 12 week follow up period, all 13 patients were restored to their previous levels: full running activity; the pain during activity had decreased significantly; calf muscle strength on the injured side had increased significantly and did not differ significantly from that of the uninjured side. These preliminary results with important clinical implications have recently been reproduced in a randomised controlled study by Mali et al. They showed that the good clinical results with eccentric training in patients with chronic Achilles tendinopathy were superior to treatment with concentric training.

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% vs. 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, related symptoms, 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 intratendinous 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 was in line with the results of a previous study of percutaneous longitudinal tenotomy for Achilles tendinopathy, although in...
that study there was still a slight difference between the injured and uninjured side six months after the operation. Longer follow ups are needed to see whether the above improvements in the function of the calf muscle-Achilles complex are indeed lasting.

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 peritendinous adhesions only than in those with peritendinous adhesions combined with an intratendinous lesion.

ACKNOWLEDGEMENTS

This work was supported by the Medical Research Fund of Tampere University Hospital, Tampere, Finland.

REFERENCES