ORIGINAL ARTICLE

Surgical treatment of Achilles tendinopathies in athletes. Multicenter retrospective series of open surgery and endoscopic techniques

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KEYWORDS
Achilles Tendon; Calcaneal tendon; Tendinopathy; Tendinitis; Tendinosis; Tendonitis; Haglund

Introduction

The analysis and retrospective series presented by this symposium provides an update on the present knowledge and its limits for the surgical treatment of Achilles tendinopathies in athletes. We must insist upon the nomenclature of Achilles tendinopathies. Insertional tendinopathies must be distinguished from those in the main body of the tendon, for diagnostic, prognostic and therapeutic reasons. In the past 20 years, surgical treatment has progressed, limiting cutaneous complications while maintaining satisfactory function. Selection of candidates for surgery is the

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Surgical treatment of Achilles tendinopathies

first step towards obtaining satisfactory functional results. It should be remembered that despite the frequency of Achilles tendinopathies, the indications for surgery are still rare.

**Multicenter retrospective series**

**Aim**

The aim of this study was to describe and analyse the surgical treatment of Achilles tendinopathies.

**Materials and methods**

This retrospective study was performed from January 2000 to January 2007. Members of the SFA were invited to submit candidates. The centers that responded and corresponded to criteria for patient’s follow-up were included. Included patients were diagnosed with an Achilles tendinopathy and treated surgically. Patients with full thickness tears (ruptures) or second operations were excluded. A follow-up form was drafted under the scientific responsibility of the symposium directors. Patients were seen in the surgical consultation for the last follow-up. The preoperative examination results were entered on the follow-up form afterwards, based on questions to patients and the medical file. Criteria studied were age, sex, assessment of the contralateral side, level of athletic activity according to the competitive, leisure, active, sedentary (CLAS) classification, the type of sports practiced, the details of treatment received prior to surgery (rest, physical therapy, drugs, steroid injections, mesotherapy...). The clinical criteria studied were the type of first symptoms (sudden, gradual onset) and disease progression (permanent, cyclic). The clinical preoperative examination was based on palpation, specific clinical tests for athletes (pain during palpation, passive, concentric, eccentric stretching, rising and descending on one foot, jumping). Patients were classified according to the Blazina and Leadbetter (Appendices 1 and 2) classifications. The results of diagnostic imaging tests were also noted (ultrasound, MRI, plain films). We described the surgical techniques, the delay to surgery after the first symptoms, as well as postoperative protocols (immobilisation, bearing weight, rehabilitation, and delay before beginning sports). At the last follow-up, we evaluated the CLAS level of activity, the clinical examination and clinical tests, the Blazina (Appendix 1) and Leadbetter (Appendix 2) functional scores, a subjective score of postoperative sports activity and a satisfaction index.

**Results**

One hundred and thirty-seven patients were seen at the last follow-up after an average of 42 months of follow-up. Around 5.1% of patients were lost to follow-up. For tendinopathies of the body of the tendon and insertional tendinopathies operated with open surgery and insertional tendinopathies treated endoscopically, the average follow-up and the range were respectively 37.4 months (7–97), 45.4 months (8–96) et 44 months (27–63).

Pain at palpation was moderate or intense in 35 and 41% of patients (n = 130) preoperatively and moderate or extreme after surgery in 6.5 and 5%. Results of dynamic functional assessment showed the presence of slight or intense pain when raising or lowering on one foot and jumping in respectively 26 and 16% of patients (n = 130) preoperatively and in 1.5 and 3% of patients (n = 130) postoperatively.

Running was possible in main body Achilles tendinopathies and insertional Achilles tendinopathies after open surgery in 6.7 months (3–12) and 11.8 months (6–23) respectively. Competitive sports were possible for main body tendinopathies and insertional tendinopathies after open surgery in 11.1 months (6–18) and 15.8 months respectively (7–25).

The preoperative Blazina score was three or 3bis, which indicates reduced performance or having to discontinue sports because of pain in 82% of cases. After surgery, 88% of patients were pain-free, or with slight residual pain that did not affect their athletic activities.

The preoperative Leadbetter functional score was three or four in 85% of patients. After surgery, 85% of patients had no pain or slight residual pain with normal test results, and which did not affect their athletic activities (Table 1).

At the last follow-up for main body tendinopathies, the subjective score of athletic activity was excellent (mean level of athletic activity the same as before treatment) or good (the same but with slight residual pain) in respectively 75.6% and 14.6% of cases (n = 82). However, for insertional tendopathies treated with open surgery, the subjective score was excellent or good in respectively 32.2 and 48.4% of cases (n = 38).

Patients who underwent surgery for an Achilles tendinopathy were very satisfied or satisfied for main body tendinopathies in respectively 71.9 and 18.3% of cases (n = 82) for a global satisfaction index of 90.2%. Patients who underwent open surgery for main body tendinopathies were satisfied or very satisfied in respectively 43.7 and 31.2% of cases (n = 38), for a global satisfaction index of 74.9%.

| Table 1 Subjective results of surgical treatment of the retrospective symposium series. |
|--------------------------------------------------------|------------------------|--------------------------|
|                                                        | Main body (n = 82) (%) | Insertional open surgery (n = 38) (%) | Insertional arthroscopy (n = 10) (%) |
| Excellent > former level                               | 75.6                   | 32.2                      | 40                        |
| Good > former level slight residual pain               | 14.6                   | 48.4                      | 30                        |
| MOYEN < dû à la tendinopathie                         | 9.7                    | 19.3                      | 10                        |
| Poor no sports directly due to injury                  | 0                      | 0                         | 20 (second operation)      |
Review of the literature and discussion

We used the following keywords found in the MeSH for our review of the literature:

- achilles tendon and calcaneal tendon (A02.880.176);
- tendinopathy, tendonitis, tendinitis, tendinosis (C05.651.869; C21.866.874.800);
- Haglund.

Our bibliographic study was performed using the databases ScienceDirect Medline/Pubmed.

The following selection criteria were used:

- clinical studies;
- surgical treatment;
- at least 1 year of follow-up;
- cohort of more than 10 patients, excluding full thickness tears (ruptures).

We analysed:

- the number of patients included and lost-to-follow-up;
- surgical technique;
- functional results at the last follow-up;
- delay before beginning sports activities.

We analysed 11 studies between 1980 and 2000, including from 12 to 201 cases, with a follow-up of 6 to 72 months (three studies did not report their follow-up time), with 3.3 to 4.7% lost to follow-up (only three of the 11 studies provided this data). The results were considered excellent and poor in respectively 51 to 91.7% and 3.5 to 15.7% of cases (Tables 2 and 3).

In general, the results of surgical treatment of Achilles tendinopathies are difficult to interpret. Indeed, the series are extremely heterogeneous. Diagnostic inclusion criteria are not clear and many studies include patients with tendon ruptures. Finally, the results are difficult to compare because the same pathologies have not been studied.

From a quantitative point of view, our series is the largest in the literature.

From a qualitative point of view, our study provides results, which differentiate the different types of chronic Achilles tendinopathies. In our study, all patients presented with tendinopathies without full thickness tears. We provided results of main body tendinopathies and insertional tendinopathies, which do not have the same prognosis. Injury to the bone-tendon insertion site is very serious. Patients began sports after surgery for an insertional tendinopathy 4.5 months later than after surgery for a main body tendinopathy, or an additional delay of 40%. Postoperative sports activity at the same level as before was reached in 75.6% of main body tendinopathies (n = 82) compared to 32.2% of insertional tendinopathies (n = 38). Moreover, 90.2% of patients treated surgically for main body tendinopathies were satisfied or very satisfied compared to 74.9% of patients treated surgically for insertional tendinopathies. The present symposium study is the first to identify a difference in functional results for these two entities.

That said, our global surgical results were excellent in 75.6% of cases, which are similar to the average of results obtained in the 11 studies analysed in the literature.

### Table 2: Review of the literature for surgical treatment of Achilles tendinopathies.

<table>
<thead>
<tr>
<th>Year</th>
<th>Cases</th>
<th>Follow-up (month)</th>
<th>LTF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kvist</td>
<td>1980</td>
<td>201</td>
<td>NR</td>
</tr>
<tr>
<td>Lemaire</td>
<td>1981</td>
<td>83</td>
<td>6–48</td>
</tr>
<tr>
<td>Mansat</td>
<td>1985</td>
<td>72</td>
<td>12</td>
</tr>
<tr>
<td>Saillant</td>
<td>1987</td>
<td>65</td>
<td>40</td>
</tr>
<tr>
<td>Schepsis</td>
<td>1987</td>
<td>45</td>
<td>36</td>
</tr>
<tr>
<td>Nelen</td>
<td>1989</td>
<td>143</td>
<td>24–72</td>
</tr>
<tr>
<td>Leppilahti</td>
<td>1991</td>
<td>150</td>
<td>NR</td>
</tr>
<tr>
<td>Leach</td>
<td>1992</td>
<td>12</td>
<td>NR</td>
</tr>
<tr>
<td>Schepsis</td>
<td>1994</td>
<td>79</td>
<td>60</td>
</tr>
<tr>
<td>Benazzo</td>
<td>1996</td>
<td>90</td>
<td>9</td>
</tr>
<tr>
<td>Série Pitié</td>
<td>2000</td>
<td>108</td>
<td>72</td>
</tr>
<tr>
<td>Symposium SFA2008</td>
<td>2008</td>
<td>137</td>
<td>42</td>
</tr>
</tbody>
</table>

Surgical techniques for the treatment of achilles tendinopathies

### Main body tendinopathy

The open surgery described by Saillant et al. in 1987 [1] is performed in the prone position, with the foot hanging off the table to allow dorsal flexion. A longitudinal internal paramedian incision is made to avoid injuring the small saphenous vein and the sural nerve, which is present in the external subcutaneous tissue. A single incision is made on the same plane down to the peritendinous tissue. It is important to be on the same incisional plane from the cutaneous tissue to the fascia superficialis (or the superficial aponeurosis which is after the crural aponeurosis) to avoid the risk of cutaneous necrosis. A longitudinal incision is made in the paratendon, which is freed from the tendon so the body of the tendon can be felt with the thumb and index fingers. If necessary, the deep fascia can also be opened to make closing easier at the end of the procedure. The
area is then explored to identify and remove degenerative areas seen on imaging (cysts, calcifications, longitudinal tears...). Depending on the size of the remaining tendon, the tendon is cut longitudinally from the proximal to the distal end into three strips of the same size. The incision is postero-anterior proximally with a size of 11 blades, then the strips are separated with a halsted clamp on their upper part, while the distal parts of the strips are separated on the frontal plane. Indeed, the tendon fibers have a spiral form up to the calcaneal insertion. This histological structure must be respected during the tenotomy.

After obtaining hemostasis and releasing the tourniquet, the incision is closed on three separate planes with separate sutures: the fascia superficialis, the subcutaneous and the cutaneous. A redon drain is placed at the deep level, moved on D2 and removed on D3. Total weight may be placed on the foot as long as a resin bivalve boot cast is worn in the equinus position placed on D3 for 21 days, so wound healing can be monitored. Rehabilitation begins on D21.

In 1997, Niek Van Dijk [2] developed mini-invasive endoscopically controlled procedures. He reported the treatment of 11 bursites and three peritendinopathies with this procedure. These are the first images of the retrocalcaneal bursa. The conflict between the deep tendon, which appears inflamed and degenerative and the posterior calcaneum were visualised and the bursitis was resected.

In 2002, Maquirriain et al. [3] reported seven cases of tendinoscopy with peritendinous debridement and two cases of tenotomy. He used two portals, a proximal portal for visualization and a distal portal for instruments. The average follow-up was 16 months (6–27), the functional clinical score went from an average of 30 to 90 out of 100, and a control MRI was performed at the last follow-up (Fig. 1).

In 2008, Vega et al. [4] proposed a percutaneous approach with the arthroscope in a distal portal. The tenotomy was performed under visual control, and the instruments use the same trocar as the arthroscope. The tenotomy was anteretrograde, longitudinal. The series included eight cases of nodular tendinopathy with a follow-up of 27.1 months (18–40). During follow-up, full weight was applied on D15, sports activities were begun between 3 and 6 months after surgery.

For all of these percutaneous techniques, the expected benefits were:

- reduction of postoperative cutaneous risk;
- low morbidity;
- rapid rehabilitation.

On the other hand, the risk of injury to the sural nerve has not been evaluated in cadaveric studies.

### Insertional tendinopathy

In 1992, Anderson et al. [5] described a series of 48 patients including 27 competitive athletes. Twenty-eight patients (58%) were treated with open surgery by synovectomy, bursectomy or osteotomy with 93% success. Recovery took an average estimated 31 weeks.

In 2000, Sayana and Mafulli [6] reported 21 cases treated with bursectomy, paratendon resection, ablation of calcifications, detachment, suture anchor tendon-to-bone repair. Results were excellent in 13 patients, good for five patients and unsuccessful in five (daily pain).

In 2002, Mc Garvey et al. [7] presented a series of 22 patients treated with a combined posterior and posterointernal transtendinous incision (tendon split). The surgical technique associated synovectomy, bursectomy and extenectomy when necessary. Twenty out of 22 patients had begun normal activity 3 months after surgery. Thirteen out of 22 patients had no pain. The rate of satisfaction at the last follow-up was 82% (18/22).

In 2003, Calder and Saxby [8] reported a series of 49 patients treated with synovectomy, bursectomy and resection of up to 50% of the tendon volume. No immobilisation was proposed at follow-up. Two failures out of the 47 patients involved bilateral tendon degeneration and psoriatic rheumatism (Figs. 2 and 3).

The symposium presents an endoscopic surgical technique for the treatment of a retrocalcaneal conflict. The different available treatments for this entity are: conservative treatment, osteotomy and cal-
Calcaneal osteoplasty (open surgery, percutaneous or endoscopic).

Calcaneal osteotomy

Zadek osteotomy [9] is useful for rare indications for morphostatic disorders of the hindfoot with a calcaneal inclination angle of more than 20°.

Open calcaneoplasty

Open calcaneoplasty [10—12] is based on radiological criteria that vary from one author to the other. The clinical negative predictive factors are older age, association with an intratendinous injury and the extent of the resection. Care is taken before indicating this procedure because of the many potential complications reported in the literature [13—15]. These complications are mainly related to the surgical approach (delayed wound healing, edema, painful scar, hypoesthesia).

Percutaneous calcaneoplasty

Percutaneous calcaneoplasty [16] is a recent alternative. However, the learning curve for this procedure is long, and specific material is required. There are fewer cutaneous complications with this approach, but it must be performed very carefully due to the lack of visual control during the surgical procedure.

Endoscopic calcaneoplasty

Endoscopic calcaneoplasty, presented by this symposium is performed with the patient in the prone position with a pneumatic tourniquet, the foot off the table and raised by a rigid support. The foot can then be moved freely to control dorsiflexion. An arthroscope, a 4mm shaver and a motorized drill are needed. The procedure is performed under scopic control, ideally a fluoroscope. Two portals are used: median and lateral para-achilleal, near the tendon, in the angle formed by the tendon and the calcaneum. A needle is inserted under scopic control to identify the tendon as a reference. There are three distinct steps to the endoscopy: bursectomy, identifying the Achilles tendon and then calcaneoplasty. The arthroscope is inserted in the proximal portal for visualisation and the instruments in the distal portal. The first step of a bursectomy is to create a working space. Indeed, there is no space physiologically. It is necessary to work with the shaver very close to the arthroscope under scopic control to avoid being too anterior near the nerve bundle or too posterior and damage the tendon. Once a working space has been created, the bursectomy is performed in an area limited by the superior edge of the calcaneum and the deep Achilles tendon. The second step is to identify the limits of the Achilles tendon behind the working space. The examination is dynamic, by moving the foot and radiographic with the fluoroscope (Image 2). The insertion of the tendon must be identified, as well as its course, and the condition of the tendon body. The third step is to perform the calcaneoplasty. The large tuberosity must be exposed to perform the bone resection (Image 3). This is performed under fluoroscopic control, always taking care to protect the tendon. The lateral resection should be large. The use of the portals can easily be exchanged to facilitate resection. Resection may be associated with other procedures: trimming the edges of the calcaneoplasty or treating a tendinopathy. In the latter case, debridement, ablation of calcifications or suture anchor repair of partial thickness tears may also be performed. In the postoperative follow-up, we propose placing full weight and immediate rehabilitation. Sports activities can be begun within 8 and 12 weeks after surgery.

Conclusion

In conclusion, two entities can be distinguished: insertional tendinopathies and main body tendinopathies. The results of this retrospective multicenter study confirm the difference in management of these two entities. We propose an endoscopic technique for main body tendinopathies or retrocalcanean pathologies. However, care must be taken, because the benefits of this technique have not been clearly established and the indications must be confirmed.

Appendix A. BLAZINA classification.

Stage I Pain after exercising that does not affect athletic activity.

Stage II Pain at the beginning of physical activity that disappears after warming up and comes back after exercising.

Stage III Pain during and after exercise, which progressively affects athletic performance.

Stage III bis All athletic activities are stopped because of pain.

Stage IV Major functional damage.
Appendix B. LEADBETTER classification.

Stage 1 Pain occurs more than activity, spontaneously regresses within several hours, present for less than 2 weeks, normal activity, normal test results.

Stage 2 Pain during and after activity which doesn’t regress, present for 2 to 6 weeks, localized pain, few or no signs of inflammation.

Stage 3 Persistent pain several days after activity stops, reoccurs rapidly when activity begins again, seriously limiting functional capacities and present for more than 6 weeks with signs of inflammation.

Stage 4 Constant pain affecting daily activities, preventing all athletic activity.

References