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Original article

Treatment of achilles insertional tendinopathy: our surgical procedure and medium-term results

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Abstract. *Background and aim:* Achilles insertional tendinopathy (AIT) is a common injury and its pathogenesis is still not entirely clear. It manifests with worsening pain and functional limitations. When conservative treatment fails, surgical treatment is indicated. The purpose of our research is to evaluate the outcome after one year in patients affected by AIT (calcific and non-calcific AIT) who were treated at our centre. *Methods:* Between 2014 and 2021, 42 patients suffering from AIT – a total of 47 feet – underwent surgery at our centre. The patients filled in the VISA-A and AOFAS questionnaires at the pre-operative consultation and at the clinical check-up after one year of follow up. *Results:* Of the 47 feet treated, 28 were calcific AITs treated by medial access and tendon reinsertion using a knotless double suture anchor system (Achilles Suture Bridge™) and 19 were non-calcific tendinopathies treated using a lateral paratendinous approach. The one-year clinical results show an increase in VISA-A scores of 48.6 and AOFAS scores of 44.1 and the absence of complications. Only one patient reported a recurrence of certain symptoms and none of the patients were hospitalized for recurrence. *Conclusions*: The literature is unable to establish a gold standard of treatment for AIT. The method we have used has shown excellent short- and medium-term results without any complications. Further studies are needed to prove its effectiveness in the long term. (www.actabiomedica.it)

Key words: Achilles insertional calcific tendinosis, Achilles insertional tendinosis, Haglund's deformity, Achilles calcific tendinitis, Tendon, Ankle, Achilles Suture Bridge™

Background

The Achilles tendon is frequently involved in situations such as both traumatic and inflammatory pathological injury. Tendinopathies and degenerative phenomena result from repeated stresses and inappropriate weight loads, which can lead to weakening of the tendon to the point of rupture.

Tendinopathies occur more frequently in the proximal portion of the tendon. In only 20%-25% of cases are these lesions considered to be insertional tendinopathies (AIT), involving its portion 2 cm proximal to the calcaneal insertion (1, 2).

The pathological and anatomical symptoms of AIT may take the form of simple retrocalcaneal or retroachilles bursitis, or may involve the mid-portion of the tendon, in some cases presenting in calcific form. If a posterior calcaneal apophysis deformity is present (in association with insertional tendinopathy), this condition is commonly called "Haglund's syndrome" or "Haglund's deformity" (3) (Figure 1).

In clinical terms, AIT initially manifests as local swelling and pain associated with wearing tight or closed footwear, but in its advanced stages it can lead to a limitation of the range of motion (ROM) of the ankle and hypotrophy of the triceps surae muscle.

If pain and functional limitations persist after 3-6 months of conservative treatment with physical and pharmacological therapies, surgical treatment is indicated (4-10). Of the various treatment options available (4, 11-14), the surgical technique we prefer for calcific AIT involves the disinsertion of the central portion of the tendon, which is split to allow removal of the intratendinous calcifications and the retrocalcaneal bursa, treatment of the tendinosis and regularisation of the posterior calcaneal apophysis. The tendon is then reinserted using a knotless double suture anchor system (Achilles Suture Bridge™ – Arthrex, Inc., Naples, FL). In cases of non-calcific AIT, our technique involves treatment of the tendinosis and regularisation of the posterior calcaneal apophysis using a lateral paratendinous approach with or without partial detachment of the lateral portion of the tendon only.

The purpose of this study is to review the medium-term clinical outcomes obtained in 42 patients (total of 47 feet) treated in our clinic between January 2014 and October 2021. The secondary objective is to show our favourite surgical techniques for the treatment of insertional Achilles tendinopathy.

Our experience shows excellent clinical results, especially in terms of pain reduction and improved walking autonomy.

Figure 1. Calcific Achilles insertional tendinopathy.

Materials and methods

Between January 2014 and October 2021, 42 patients (22 males and 20 females) suffering from insertional tendinopathy of the Achilles tendon (a total of 47 feet) underwent surgery in our clinic.

The average age of the patients at the time of surgery was 53 years (23-78) and the average BMI was 24.39 (18.36-31.89) (Table 1).

At the pre-operative consultation, all patients completed the VISA-A questionnaire and the validated Italian version of the AOFAS questionnaire (15).

For all patients undergoing surgery, data relating to the type of tendinopathy, the limb operated (left or right), the type of surgical access, the number of suture anchors used during surgery and any need for surgical follow-up were collected and recorded.

At least 12 months after surgery, patients were all re-evaluated clinically. At these consultations, they were asked to fill in the VISA-A and AOFAS questionnaires again, rating their satisfaction with the surgery performed.

For this study, no ethics committee approval was required. The patients were informed of our intention to use these data anonymously to publish a scientific article and gave their consent. Two patients did not consent to the recording of information about their treatment, and their data have therefore been excluded from this publication.

Surgical technique – calcific insertional tendinopathy

The operation is performed with the patient in a prone position with a support placed under the distal third of the leg. The approach we use involves a median longitudinal incision centred on the distal portion of the tendon and its calcaneal insertion.

Table 1. Patients' biographical data.

Patients	42 (47 feet)
M: F	22: 20
Average age	53 (23 - 78)
Average BMI	24.39 (18.36 - 31.89)

The subcutaneous tissue is incised in line with the skin incision until the tendon is reached. Then, the tendon is split in line with the full-thickness incision from posterior to anterior, in order to remove degenerated tissue and intratendinous calcifications. The tendon is then dislodged distally from its insertion and flipped medially and laterally to expose the entire calcaneal tuberosity.

Particular care should be taken to maintain part of the medial and lateral insertion, so as not to completely disengage the tendon and to ensure that a length reference is available for subsequent reinsertion. Once the bony prominence is exposed (where necessary following removal of the retrocalcaneal bursa), osteotomy is performed on the prominence using a saw and an osteotome.

It is important to ensure that a free, uniform bone surface is obtained to enable easy insertion of the suture anchors (Figure 2).

It is also important to regularise the lateral and medial margin of the posterior calcaneal tuberosity to avoid leaving protrusions that are palpable under the skin and could interfere with footwear. Using dedicated equipment, 4.5 mm holes are then drilled for the suture anchors. These should be drilled 1 cm proximally to the distal insertion of the tendon and centrally in each half of the divided tendon.

The two suture anchors loaded with two high-strength, non-absorbable wires are inserted into the appropriately prepared holes using a bone tapping device and passed through each half of the tendon. Following preparation of the two holes distal to the tendon insertion, one wire per side is then loaded onto the distal suture anchors and fixed using the appropriate tension (Figure 3).

While standard anchor fixation creates a single compression point directly on the suture anchors, the Achilles Suture Bridge™ approach allows for an hourglass pattern on the distal part of the tendon, ensuring a large contact area on the heel bone while improving stability.

The procedure is finished with the attachment of the proximal portion of the tendon split longitudinally using interrupted sutures and the suturing of the surface layers.

The post-operative protocol consists in four weeks without any weight bearing with the ankle protected for the first two weeks in a knee brace then for four weeks with a walker brace. A rehabilitation cycle should begin one month after surgery.

Surgical technique – non-calcific insertional tendinopathy

If intratendinous calcifications are absent, the technique we use is also performed with the patient in a prone position with lateral para-Achilles access.

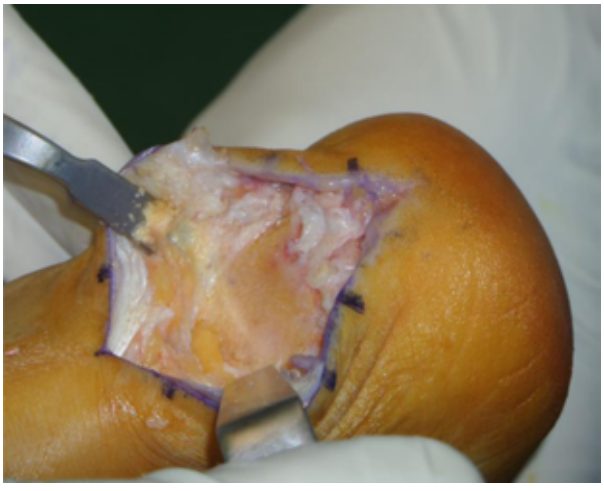

Figure 2. Exposure and removal of the calcific portion of the tendon from the proximal part of the calcaneal tuberosity.

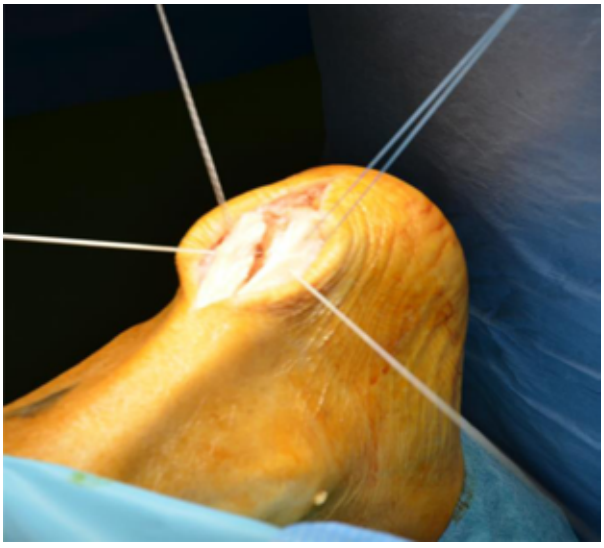

Figure 3. Placement of the two anchors preloaded with two sutures 1 cm proximal to the tendon insertion, so that the tape can be passed through the distal portion of the tendon in a hourglass pattern.

The subcutaneous tissue is incised in line with the skin incision until the lateral insertion of the tendon is reached.

Particular care should be paid to the sural nerve, which crosses the lateral margin of the Achilles tendon at about half its length. The many anatomical variations of this nerve make it vulnerable to iatrogenic injuries.

We then proceed with the excision of the retrocalcaneal bursa, debridement and tendon scarification. In order to expose and remove the posterior, superior bony prominence of the heel, it is sometimes necessary to partially disengage the lateral portion of the tendon insertion (Figure 4).

In such cases, it may be necessary to reinsert that portion of the tendon using a single suture anchor (Figure 5).

The post-operative protocol consists in two weeks without any weight bearing with the ankle protected in a knee brace until removal of the sutures, followed by a gradual resumption of walking with progressive weight-bearing.

Results

Of the 47 surgical treatments performed, 28 (59.6%) were performed via median access to the Achilles tendon to treat calcific AIT, while 19 patients (40.4%) with non-calcific insertional tendinopathy were treated via lateral access.

Four suture anchors are used in all feet treated via median access.

Of the 19 feet treated via lateral access, no suture anchors were used in 16 cases (84.2%). In the remaining three cases (15.8%), the use of suture anchors was necessary (Table 2).

The AOFAS questionnaires completed by the patients at the pre-operative consultation revealed an average score of 46.5 points (30-91) out of a maximum of 100. In particular, the score for pain showed an average value of 12.3 out of 40 (0-40), and the score for the maximum distance that could be travelled without feeling pain indicated a value of 1.3 out of 5 (0-5).

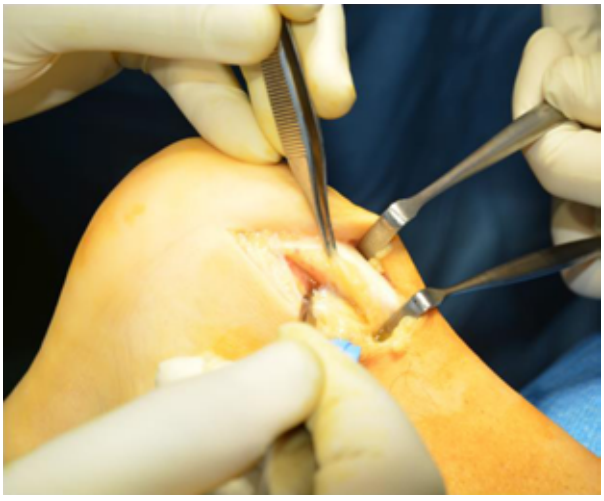

Figure 4. Lateral paratendinous surgical approach and careful isolation of the sural nerve.

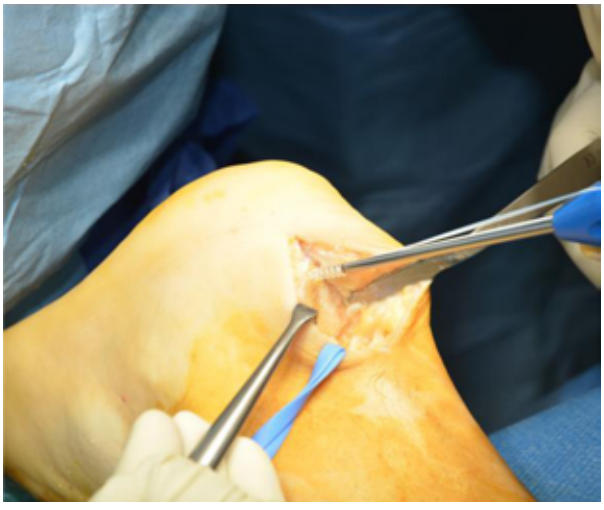

Figure 5. Reinsertion of the lateral part of the tendon after calcaneal tuberosity removal using one anchor preloaded with two sutures.

Table 2. Surgical access and use of suture anchors.

Achilles insertional tendinopathy (AIT) 47 feet	**Calcific**	**Median access**	28 patients (59.6%)	4 suture anchors (28 patients, 100%)
	Non-calcific	**Lateral access**	19 patients (40.4%)	NO suture anchors (16 patients, 84.2%) 1 suture anchor (3 patients, 15.8%)

Before surgery, the average value for the VISA-A questionnaire was 47.8 out of 100 (2-90).

At the one-year clinical follow-up, the patients filled in new AOFAS questionnaires, and these showed an excellent average value of 95 out of 100 points (85-100), an increase over the previous score of 48.6 points (9-70). The most important factors that led to this increment score were the components of pain improvement, showing an average post-operative value of 37.7 out of 40 (30-40), and maximum distance travelled without symptoms, showing an average recorded value of 4.8 out of 5 (4-5).

The post-operative VISA-A questionnaire registered an average score of 92 out of 100 (77-100), and thus an average increase over the pre-operative value of 44.1 points (8-86) (Table 3).

Only one patient (2.1%) reported subjective recurrences of symptoms at the clinical check-up 12 months after surgery: his follow-up radiographs showed the presence of a small recurrent intratendinous calcification, which could justify the recurrence of symptoms, albeit to a lesser extent than the pre-operative consultation.

None of the patients experienced early complications such as dehiscence or suffering of the surgical wound, superficial or deep infections and lesions of the sural nerve. Even at a distance, complications such as secondary tendon ruptures, intolerance to high-strength threads, avulsion of the suture anchors and loss of strength in plantar flexion have not been documented.

All 42 patients (47 feet) stated that they would undergo the surgery again.

Discussion

AIT is a common problem: approximately 6% of the population complains of at least one episode in life of pain or functional limitation of the Achilles tendon, and in approximately one third of these patients the problem is localised in the insertional portion of the tendon (9).

Despite its prevalence, the pathogenesis of the AIT is not entirely clear. In most cases, the aetiology appears to be degenerative, and could be associated with ageing of patients, repeated microtrauma injuries and functional overloading, which is linked to increased vascularisation of the tendon (2, 8).

Clinically AIT manifests with varying severity depending on the stage of the injury and the combination of the various pathological components that might be present (tendinosis, intratendinous calcifications, retrocalcaneal exostosis, retrocalcaneal and retroachilles bursitis, or total or subtotal rupture of the Achilles tendon). Symptoms can range from pain when wearing closed shoes to constant pain with functional limitation of the ankle and, in chronic phases, hypertrophy of the triceps surae muscle. Pain will be the more severe the longer the pathology persists and the more pathological components are present: Anderson et al have shown in an immunohistochemical study that in patients with insertional tendinopathy, increased innervation of both bursae (retrocalcaneal and retroachilles), Haglund's deformity and the distal Achilles tendon can be observed (16). This pathological and anatomical origin explains both the increase in pain as the condition progresses and the relapsing of symptoms in the event of treatments (conservative or surgical) that do not eliminate all of the pathological elements present.

Conservative treatment initially involves eccentric exercises to stretch the triceps surae muscle and Achilles tendon, which can reduce vascularisation of the tendon sheath and improve initial symptoms, but no effect of these exercises on long-term functional outcome in insertional tendinopathy has been demonstrated (17).

Traditional infiltrative treatment with cortisone derivatives can be carried out with or without

Table 3. Clinical outcome.

Average AOFAS (min-max)			Average VISA-A (min-max)		
Pre-op	**1 year post-op**	**Delta**	**Pre-op**	**1 year post-op**	**Delta**
46.5 (30-91)	95 (85-100)	+48.6 (9-70)	47.8 (2-90)	92 (77-100)	+44.1 (8-86)

ultrasound guidance with the benefits described on short-term symptoms, although more evidence and clinical trials are needed for platelet-rich plasma (PRP) treatment (18-20).

Shockwave treatment has been the subject of many studies in publications that have demonstrated its superiority over other non-specific conservative treatments (21) and treatment with eccentric stretching exercises (22).

In addition to it, since in most cases AIT arises as a consequence of altered weight loads in feet suffering from hindfoot malalignment, treatment with orthotics intended to correct the deformity should be considered (23).

Lastly, Costantino et al compared the use of cryoultrasound therapy, targeted radiofrequency therapy (TECAR) and laser CO_2 therapy and showed satisfactory results in all patients treated using these techniques (24).

There is a clear agreement in the published literature that surgical treatment should only be reserved for patients who have not benefited from 3-6 months of conservative therapy (4-10) and that for this surgery to be effective, it must include the elimination of all pathological elements at the root of the tendinopathy: resection of the retroachilles and retrocalcaneal bursae and removal of the tendinosis and any intratendinous calcifications and retrocalcaneal exotosis. In addition to these fundamental surgical procedures, some authors recommend including a tendon transfer (typically the flexor hallucis longus, because of its proximity to the Achilles tendon, its size and significant vascularisation and its synergetic function as a plantar flexor of the ankle) in patients over 50-55 years old with more severe clinical symptoms and in overweight patients.

Many surgical methods have been proposed, but the literature does not currently demonstrate a clear preference for one technique over another. The most important difference between the various methods concerns how the calcaneal exostoses is accessed and how much tendon debridement can be performed. These methods must ensure adequate removal of tendinosis and intratendinious calcifications, avoiding post-operative tendon ruptures and recurrence of symptoms (25).

Techniques involving the complete or partial detachment of the tendon insertion have the advantage of providing easy access to the anterior portion of the tendon and the posterior part of the calcaneaus. Such a technique is useful to eradicate the various pathological elements and prevent the recurrence of symptoms. The downside of these more invasive techniques is the need to restore tension and reinsert the Achilles tendon using bone tunnels or suture anchors, which can lengthen the duration and the cost of the surgery. This could also expose the patient to the risk of a post-operative tendon rupture or avulsion injury. In any case, studies show that tendon reinsertion can be reliable and durable with a very small risk of post-operative rupture or avulsion as long as less than 50% of the central part of the tendon is disengaged (26, 27, 28, 29, 30, 31, 32, 33).

In cases of calcific AIT, thanks to the Achilles Suture Bridge™ approach, we have the possibility of easily accessing the posterior calcaneal exostoses, making it possible to radically remove it and at the same time remove the insertional tendinosis affecting the tendon and the intratendinious calcifications. Radically removing the exostoses and the damaged portion of the tendon is essential to avoid recurrences: in our series, only one out of 47 patients reported a recurrence of pain one year later (although to a lesser extent than in the pre-operative context) at the same time as a radiographic recurrence of intratendinous calcifications.

The patients we treated showed excellent increases in AOFAS and VISA-A scores compared to preoperative. In particular, as regards the AOFAS score, the greatest improvements in the postoperative score were those in the "pain" section (37.7 out of 40) and in the "maximum distance that can be travelled" (4.8 out of 5), highlighting how the surgical treatment of these patients was able to eliminate the two most disabling symptoms of AIT. Furthermore, by keeping the medial and lateral ends of the tendon inserted and relying on a "double-row" system of anchors, the risk of post-operative suture anchor avulsion or tendon rupture is greatly reduced. In the 47 feet that we operated on, there was not a single mechanical failure reported. The exceptional mechanical efficiency of a double-row suture anchor system has already been amply demonstrated in arthroscopic rotator cuff surgery (34, 35).

More recently, studies conducted by Pilson et al (36) and Beitzel et al (37) have also demonstrated its advantages in terms of load-bearing strength in Achilles tendon reinsertion.

Tendon-sparing techniques have the advantage of preserving the tendon insertion and its vascularisation, and thus not requiring tendon reinsertion systems and avoiding the associated complications. On the other hand, such techniques do not allow adequate visualisation of the lesions present, thus exposing the patient to a higher risk of relapse due to insufficient treatment, as explained by Schepis et al (38) and other authors (31, 32). Moreover, the initially "tendon-sparing" approach is often extended during surgery to treat calcaneal exostoses or intratendinous calcifications more efficiently, thus losing the initial benefits of a tendon-sparing technique (25, 30).

Minimally invasive techniques have been described in the past for non-insertional tendinopathies, and more recently, some authors have also demonstrated excellent results, without complications associated with open techniques, for insertional tendinopathies in terms of subjective patient satisfaction and functional recovery (39, 40).

Conclusions

The Achilles tendon is frequently affected by pathological situations but it is only in a minority of cases that this concerns its insertional portion. The pathological and anatomical picture of insertional tendonitis of the Achilles tendon is complex and composed of several separate components that have not yet been fully elucidated but are the result of a degenerative and worsening process. The clinical outcome for the patient is debilitating and, when conservative treatments fail, surgery is required.

Regardless of the surgical technique used, a treatment will be effective if it radically treats all components of tendinopathy while preventing recurrences.

The clinical results we have obtained with the Achilles Suture Bridge™ technique (Arthrex, Inc., Naples, FL) have been excellent, but there is not enough support in the literature to define this, or any other, as the gold standard of treatment for Achilles insertional tendinopathy (27, 30, 32). Since there is no surgical technique clearly superior to the others in terms of patient satisfaction, functional improvement and pain relief, the choice of the type of treatment is still today based on the surgeon's preference (25).

Further studies are needed to clarify which surgical technique is the most satisfactory and the most reproducible.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Authors Contribution: GL, AS made substantial contributions to all the following five points: conceived and designed the analysis; collected the data; contributed data or analysis tools; performed the analysis; wrote the paper. DM, LP, JS were involved in drafting the manuscript and revising it critically for important intellectual content. DM, FC were involved in revising the manuscript critically and gave final approval for the version to be published.

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