Mid-term results after surgical resection of calcifying enthesiopathy of the Achilles tendon

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Purpose
The purpose of this study was to present the surgical technique together with the mid-term results for patients with calcifying tendinitis of the distal insertional part of the Achilles tendon.

Materials and methods
A total of 43 patients (23 female and 20 male), with a mean age of 54.8 (range: 21–71) years at the time of surgery, were operated between 1999 and 2012. Four patients underwent bilateral surgery, with a total of 47 feet undergoing the resection of the calcifying enthesiopathy of the Achilles tendon. A total of five patients were lost to follow-up including two patients who withdrew from the study. Subsequently, 39 patients were followed up with an average of 57.4 (6–144) months after surgery. Clinical and radiological evaluations were carried out and the hindfoot American Orthopedic Foot and Ankle Society score was used before and after the surgery.

Results
The postoperative American Orthopedic Foot and Ankle Society score at the time of the final follow-up was 88.9 (69–100) points. No ruptures of the Achilles tendon were documented in this study. There were two wound infections in need of revision surgery, and two cases of distal deep vein thrombosis. Overall, 70% of the patients worked at the time of the final follow-up. The average time off work reported in this cohort of patients was 10.5 (6–24) weeks.

Conclusion
The longitudinal incision of the Achilles tendon with distal release of the tendon and reinsertion with a suture anchor is a reliable procedure for the treatment of calcifying tendinitis of the Achilles tendon with good to excellent results for the majority of patients.

Keywords:
Achilles tendon, calcifying tendinitis, surgical treatment, tendinopathy

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Introduction

Chronic heel pain and pain around the insertion of the Achilles tendon represent a frequent problem, particularly among athletes [1–4]. A differential diagnosis is predominantly essential to define the various entities of the chronic heel pain. Alongside the acute and chronic aspect of the paratenon, it is crucial to distinguish between the insertional and noninsertional Achilles tendinopathy [5].

Histomorphologically, because of the absence of an underlying inflammatory process [6,7], the term tendinopathy is more precise than tendinitis [8]. The insertional tendinopathy presents repeatedly with retrocalceneal bursitis in combination with a posterolateral calcaneal bony enlargement (also known as Haglund exostosis) [9]. Correspondingly, it is imperative clinically to diagnose and assess the calcifying insertional tendinopathy (enthesiopathy) of the Achilles tendon.

In addition to the conservative treatment, physiotherapy, and shock wave therapy [10], the surgical intervention offers the last alternative in order to competently relieve the patient's complaints [11–13]. In contrast to the retrocalcaneal bursitis and the Haglund exostosis, the calcifying insertional Achilles tendinitis cannot be accessed by using the minimally invasive endoscopic surgery [14–16]. According to our observations, the calcification lies far distal at the insertion of Achilles tendon and involves exclusively the dorsal portions.

The current study aimed to evaluate the mid-term results of the surgical resection of the calcification through detachment of the Achilles tendon by longitudinal incision and subsequent re-fixation with a 5 mm

titanium suture anchor, and to compare the findings with those obtained in similar or related studies in the literature.

Materials and methods

Forty-three patients (23 women and 20 men), with a mean age of 54.8 (21–71) years and suffering from insertional calcifying Achilles tendinitis (enthesiopathy), were operated upon between 1999 and 2012 (Fig. 1). Four patients were operated bilaterally, so that a total of 47 calcifications were included in the study. A total of five patients were lost to follow-up including two patients who withdrew from the study. Therefore, a total of 39 patients were evaluated postoperatively. The authors certify that their institution has approved the conduction of and their participation in this study and that all investigations were conducted in conformity with ethical principles of research and therefore have been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

The mean follow-up period was ~57.4 (6–144) months. Clinical and radiological evaluation of the patients was carried out postoperatively. Furthermore, the functional outcome was assessed using the American Orthopedic Foot and Ankle Society (AOFAS) score for the hindfoot [17]. Previous illnesses, medications, and previous operations were documented. Furthermore, patients were queried about whether they would undergo surgery again in the context of their experience.

Procedure

Surgery was undertaken at a single hospital by the first two authors of this study. The surgical technique used is described below.

Under spinal anesthesia, by using a dorsal approach, a 4–5 cm central incision was made longitudinally along the distal part of the Achilles tendon (Fig. 2). Following opening of the paratenon, the Achilles tendon was splitted longitudinally at its insertion and the calcification was explored through detachment of the dorsal aspect of the tendon. Meticulous attention was paid to the medial and lateral bands, which were protected with Hohmann levers (Fig. 3). After exploration, the calcification was excised (Fig. 4) using fine osteotome and nebular. Furthermore, the subcutaneous calceneal bursa and the calceneal tuberosity were resected to prevent the impending development of secondary bursitis. Reinsertion of the Achilles tendon was carried out by either transosseous suturing through a bony tunnel (7/47 patients) or insertion of a 5 mm titanium suture anchor with two nonresorbable suture strands (Smith & Nephew Inc., Naples, USA) in a predrilled socket within the calcaneus (40/47 patients) (Figs 5–7).

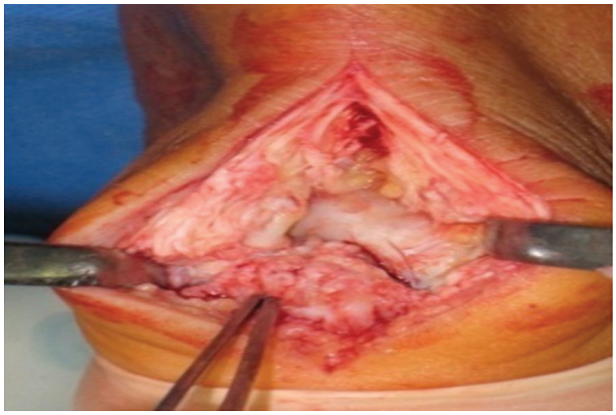
Figure 1

Preoperative radiograph showing the Haglund exostosis.

Figure 2

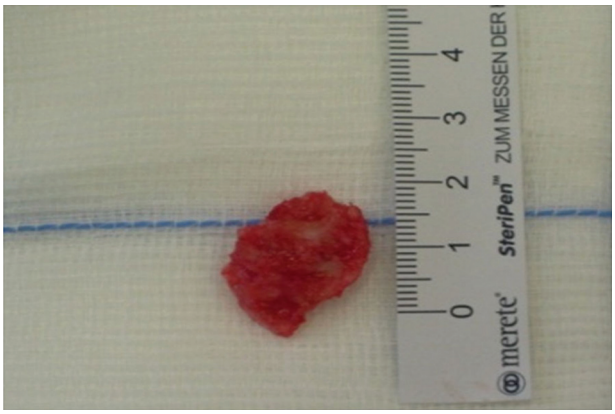
Dorsal central longitudinal skin incision.

Figure 3



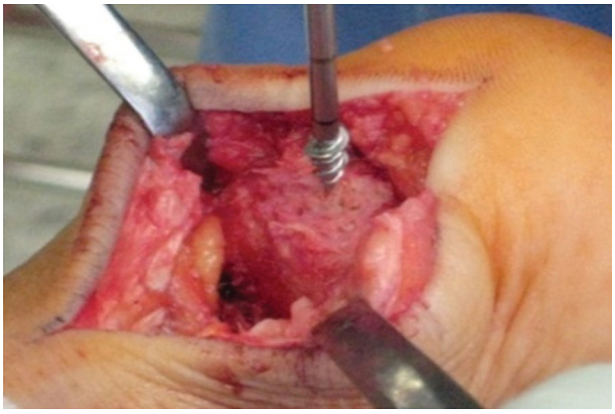
Insertional calcification.

Figure 4



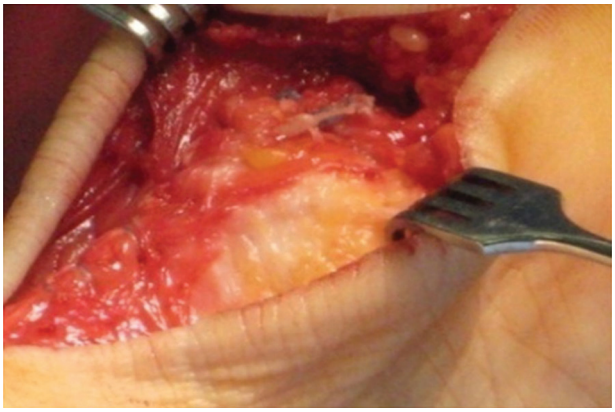
Resected piece.

Figure 5



Placement of the suture anchor.

Figure 6



Reattached tendon.

Figure 7

Postoperative radiograph after excision of the calcifying enthesiopathy and reinsertion of the tendon by suture anchor.

Postoperative care

All patients received an Achilles tendon orthosis (Aircast Achilles Pneumatic Walker; ORMED DJO Inc., Freiburg, Germany) postoperatively to stabilize the ankle in a neutral position for 6 weeks. Partial weight-bearing was instructed initially for 2 weeks till wound healing, followed by gradually increasing weight-bearing using elbow crutches. After 6 weeks, full weight-bearing was allowed using conventional shoewear.

Results

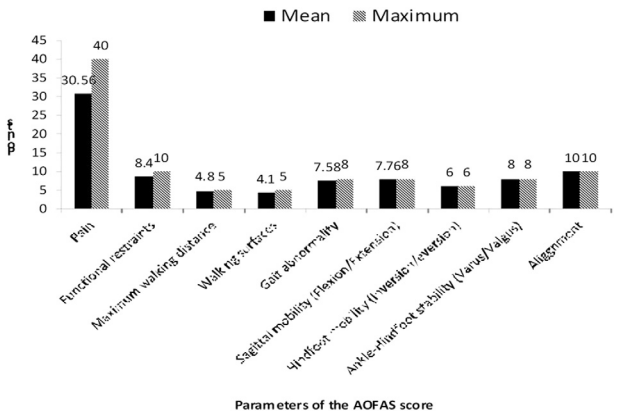
The postoperative AOFAS score of the study population averaged 88.9 (69–100) points. In total, 35/43 patients showed good to excellent clinical outcomes regarding full weight-bearing and gait analysis (AOFAS score 77–100 points). In contrast, poor clinical outcome (for those with AOFAS score of 54 points) was attributed to the short follow-up (6 months after operation).

The AOFAS questionnaire comprises nine items distributed over three categories, pain (40 points), functional aspects (50 points), and alignment (10 points), totaling 100 points. They were represented among patients as follows (Fig. 8): mean score of pain was 30.56 (10–40) points, functional restraints of activities 8.4 (4–10) points, walking distance 4.8 (4–5) points, gait abnormalities 7.58 (7–8) points, and range of motion and extension/flexion 7.76 (7–8) points. Limited pronation/supination was not observed. There were no cases of rupture Achilles tendon after operation.

About 70% of the patients included in our study were actively working at the time of operation and regained their preoperative work after operation. The work-off period averaged 10.5 (6–24) weeks.

In response to the question, whether they would undergo surgery again in the context of their experience, 38/43 patients answered with a yes.

Figure 8



Mean and maximum values of American Orthopedic Foot and Ankle Society parameters.

Complications

Two patients developed postoperative wound infection, which required surgical debridement. Another two patients developed deep venous thrombosis despite the use of the Aircast-Walker.

Discussion

We reported good to excellent mid-term results of the surgical resection of the calcification through detachment of the Achilles tendon by longitudinal incision and subsequent re-fixation with a 5 mm titanium suture anchor with patients reporting a mean postoperative AOFAS score of 88.9 points. Overall, 81% of the patients demonstrated good to excellent clinical outcome. Poor clinical outcome for patients (those with an AOFAS score of 54 points) might be attributed to the short follow-up period.

The precise pathogenesis of the development of calcifying enthesiopathy of the Achilles tendon has not been clearly understood till now. There has not been a precise identification of the predictors for the occurrence of insertional Achilles tendinitis [18]. Maffulli *et al.* [19], in his cadaveric study, indicated that in patients with calcifying insertional tendinopathy, the tenocytes undergo chondral metaplasia and therefore produce abnormal collagen (types 2 and 3). Alternative clarification was reported by Shim and Elder [20], who, in his in-vitro animal study on rats, revealed that a short-term cyclic loading (hydrostatic pressure) on the tendon tissue leads to an increased gene expression for collagen type 2 and downregulation for collagen type 1. He concluded that, the cyclic hydrostatic pressure load on the tendon tissue can induce fibrocartilaginous metaplasis of the tenocytes through altered gene expression.

On the other hand, Lyman *et al.* [21] in their cadaveric study demonstrated that strains in the posterior portion of the tendon increased significantly as the movement from plantar flexion into dorsiflexion occurred. This differed significantly from the anterior portion, which showed a trend toward decreasing strain. The authors, hereby, realized that, although the anterior portion of the Achilles tendon is generally affected in Achilles insertional tendinitis (AIT), a relative strain shielding is seen in this portion of the tendon. Many other authors established a correlation between sports and incidence of calcific spurs [22]. These findings suggested that the role of repetitive tensile loads in the causation of AIT is more complex than what is often described.

The fact that calcifying insertional Achillis tendinopathy occurs not only in runners, but also in persons with repetitive continuous stresses of the Achillis tendon. This probably adopts an underlying multifactorial pathogenesis. Because of the lack of reliable clinical and experimental studies, no recommended treatment strategies have been proposed till now [23].

In cases with chronic complaints of the Achilles tendon, a trial of conservative therapy is recommended. This period is also beneficial to give a chance to properly distinguish between the different entities of the Achilles tendinopathy. Recent evidence backs operative management of insertional Achilles tendinosis, especially for those patients who fail to respond to the conservative therapy [24–27]. Nevertheless, there is a disagreement among surgeons regarding the extent of tendon detachment to satisfactorily debride it and decompress the calcaneal exostosis.

To undertake a proper operative therapy aiming to obtain a satisfactory outcome, both radiological and clinical confirmation of the diagnosis are indispensable. The differentiation between insertional and noninsertional tendinopathy is easier during the acute phase. In noninsertional tendinopathy, tendon thickening, local tenderness, and palpable crepitus over the thickened part while gliding are easily elicited [3,25,28].

The differentiation between the retrocalcaneal bursitis combined with Haglund exostosis and the calcifying insertional tendinopathy could be sometimes problematic. In Haglund exostosis, a patient's complaints tend to be localized, more likely subcutaneously on the dorsal upper edge of the calcaneus. Whereas in AIT, the main pain can be triggered dominantly over the distal dorsal third of

the calcaneus near the tuberosity. If in doubt, infiltration of a local anesthetic is helpful in achieving a clear differentiation.

Recently, the minimally invasive endoscopic therapy was introduced as a good alternative surgical option in the management of the retrocalcaneal bursitis combined with Haglund exostosis. Van Dijk *et al.* [16] described, for the first time, the technique of the endoscopic calcaneoplasty. In his retrospective study on 20 patients with a mean follow-up of 3.9 years, good to excellent results were achieved in 19/20 patients. In our previous study by Jerosch *et al.* [15] on 81 patients with a mean follow-up of 35 months, similar results were obtained. In both studies, the complication rate reported was less than that of the open technique. Shortening of the operation time with simultaneously improved assessibility of existing pathological changes are additional advantages of the endoscopic over the open technique.

In contrast to Haglund exostosis, the endoscopic therapy is not applicable in the treatment of the calcifying enthesiopathy of the Achilles tendon. This is attributed to the distal location of the calcification in the Achilles tendon with more distal extension over the calcaneal tuberosity.

In our study, a central longitudinal incision with detachment of the tendon insertion was used to achieve a comprehensive overview of the pathological changes in the Achilles tendon. As the medial and lateral Achilles tendon fibers [29] were not affected by the pathology, a detachment of these bands was not necessary. It is better to avoid detachment of the bands in order not to endanger the stability of the insertion, so that a cautious attention is paid to the integrity of these bands during surgical dissection. By protecting and preserving these bands, as well as the transosseous reinsertion of the Achilles tendon with a titanium anchor, a high primary stability of the tendon could be reached. Correspondingly, the postoperative orthosis could be held in a neutral position that avoids the need of a special therapy to prevent tendon shortening, as occurs frequently with the equinus position.

DeVries *et al.* [30] performed a retrospective review of 17 patients, undertaking the whole detachment of the tendon, with debridement and removal of the retrocalcaneal bursa, together with ostectomy of the calcaneal exostosis, and then re-attached with two suture anchors. The patients demonstrated significant improvement in pain after surgery. Moreover, 84% were satisfied with the outcome of the surgery. None of this cohort of patients showed rupture of the repair. They concluded that this technique was efficient, significantly improving the function and pain.

Anderson *et al.* [31] retrospectively reviewed 30 patients (31 feet) who undertook the tendon-splitting approach and compared their results with 32 preceding patients (35 feet) who had a lateral incision with a minimum follow-up of 12 months. The mean AOFAS score improved postoperatively in both groups. Then, they concluded that both approaches to calcaneal ostectomy provided symptomatic pain relief. However, patients in the tendon-splitting group returned to normal function (mean 4.1 months) quicker than did patients in the lateral incision group.

Johnson *et al.* [11] prospectively gauged the postoperative functional outcome of 22 patients after a central tendon-splitting approach for persistent insertional calcific Achilles tendinosis using the AOFAS score. The follow-up averaged 34 (11–64) months. They routinely used suture anchors to augment the tendon insertion after debridement. Postoperatively, they observed a significant relief in pain with significantly improved function, shoewear, and ability to work without painful postoperative scars.

Nevertheless, these results were comparable to those obtained in the current study. Although the detachment of the Achilles insertion and the transosseous re-fixation could be considered an invasive approach, a good functional outcome was achieved with no complications, such as re-rupture and scar formation, that might lead to discomfort with shoewear.

The risk for re-rupture was studied by Maffulli *et al.* [12] and they recommended the detachment of the Achilles tendon to excise the calcific deposit fully and then reinsertion in the calcaneus with suture anchors. They recruited 21 patients with recalcitrant calcific insertional Achilles tendinopathy. None of the patients experienced a traumatic rupture of the re-attached tendon. They reported good to excellent results for 11 patients. Nevertheless, five patients were not able to return to their original level of physical activity. Similarly, Wagner *et al.* [32] compared 26 patients (31 heels) with debridement of the Achilles tendon with no or partial detachment of the tendon, with 49 patients (50 heels) with complete detachment, debridement, and reattachment with suture anchors of the Achilles tendon associated with proximal V-Y lengthening of the proximal aponeurosis. They noted no statistically significant

differences as regards postoperative pain, activity limitation, gait change, walking distance, and return to sport or work. However, the number of unsatisfied patients was higher in the detached group than in the nondetached group.

However, a possible reason can be the underlying disease itself and not the surgical method. While a retrocalcaneal bursitis and Haglund exostosis can be treated without detachment of the Achilles tendon, the insertional calcification is not possible to be operated upon without at least partial tendon detachment.

Johansson *et al*. [33] retrospectively assessed the outcomes of surgical treatment for Achilles tendinitis and examined the postoperative histological features of the tendon. They demonstrated that good clinical outcomes were significantly associated younger age and professional athleticism. In this context, Watson *et al*. [13] reported significant differences regarding the functional outcome after retrocalcaneal decompression when comparing patients with retrocalcaneal bursitis with those suffering from calcific Achilles insertional tendinosis. Besides lower pain scores and lower satisfaction rate, patients with calcific Achilles insertional tendinosis required nearly twice the time to reach maximum symptomatic improvement.

These findings are in agreement with those of the current study, where patients required a period of 8–10 months to reach maximum symptomatic relief and regain their original work and sport statuses. In the current study, the longitudinal incision of the Achilles tendon with posterior detachment of the tendon insertion and subsequent reinsertion with bone anchors represented a low complication technique for the treatment of calcifying insertional tendinopathy. The mid-term functional results ranged from good to excellent for the majority of patients.

The risk of rupture of the Achilles tendon seems to be negligible if the surgeon pays particular attention to ensure the integrity of the lateral bands during surgical dissection. Despite the presence of complication risk in some patients, especially the deep infection with its deleterious consequences, the operative therapy remains the treatment of choice in the management of calcifying insertional tendinopathy, especially after failure of conservative treatment.

Well-designed randomized control studies comparing these different surgical interventions in future are highly recommended.

Conclusion

The longitudinal incision of the Achilles tendon with distal release of the tendon and reinsertion with a suture anchor is a reliable procedure for the treatment of calcifying tendinitis of the Achilles tendon, with good to excellent results for the majority of patients. By increasing the understanding of the pathophysiology of this disease, it is possible in the future to establish special training programs that allow early intervention and prevent the development of the advanced stage of the disease with its refractory symptoms.

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Conflicts of interest

There are no conflicts of interest.

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