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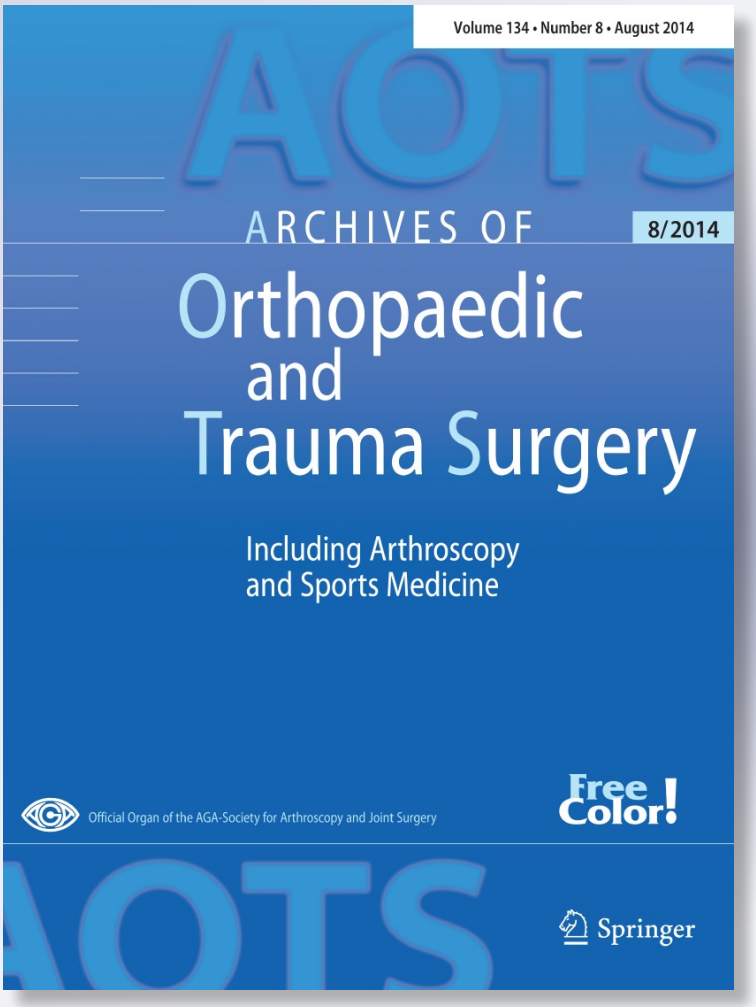

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ORTHOPAEDIC SURGERY

Results of operative treatment for recalcitrant retrocalcaneal bursitis and midportion Achilles tendinopathy in athletes

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Abstract
Background The results of operative treatment for recalcitrant midportion Achilles tendinopathy and recalcitrant retrocalcaneal bursitis were evaluated using the patient administered, disease specific, and validated VISA-A-G questionnaire.
Methods A cohort of 89 patients was prospectively followed. These patients underwent operations for sport induced midportion Achilles tendinopathy (39 procedures) or retrocalcaneal bursitis (55 procedures). Depending on the individual intraoperative findings the patients of either disease were treated with two respective operative modifications (tendon repair or no tendon repair). Preoperative and follow-up status (3, 6, and 12 months) were investigated using the VISA-A-G questionnaire.
Results Preoperatively, the four groups scored from 37.0 ± 17.6 to 45.9 ± 15.2 ($p = 0.376$–0.993) on the VISA-A-G questionnaire. Six and 12 months postoperatively, the VISA-A-G scores improved significantly ($p < 0.001$). Twelve months postoperatively, the groups' scores were not different ($p = 0.100$–0.952) and ranged from 80.8 ± 17.9 to 90.3 ± 10.6.
Conclusion Retrocalcaneal bursitis and midportion Achilles tendinopathy responded equally well to operative treatment. When repaired, additional tendon lesions did not influence this result. We demand to differentiate not only between midportion Achilles tendinopathy and retrocalcaneal bursitis but also to identify additional Achilles tendon lesions to specifically address these lesions during operative procedures.
Level of evidence Prospective mixed cohort study.

Keywords Achilles tendinopathy · Haglund's disease · Retrocalcaneal bursitis · Operation · Results

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Introduction

Achilles tendon related disorders are considered to be a major problem both in recreational and top level runners [1]. Several different overload conditions can manifest at or in the region of the Achilles tendon [2, 3]. Specifically, midportion Achilles tendinopathy and retrocalcaneal bursitis have to be distinguished. Midportion Achilles tendinopathy is clinically defined as an Achilles tendon overload injury occurring 2–7 cm above the Achilles tendon insertion. It is characterized by pain, swelling, and impaired performance [3]. Central Achilles tendon degeneration and/or microtears/partial tears are the underlying morphologic findings [4]. Referring to its first descriptor, retrocalcaneal bursitis was historically termed Haglund's disease [3, 5]. Featured by localized pain and swelling at the anterior aspect of the medial and lateral distal Achilles tendon border, it results from inflammation and hypertension of the bursa located between the anterior inferior side of the Achilles tendon and the posterosuperior calcaneal (Haglund) tuberosity [3, 6–8]. In some cases the corresponding ventral part of the Achilles tendon is subjected to degeneration and partial tears. These lesions are called "impingement lesions" [6, 7].

Table 1 Demographics of the study population (patients) presented as means and standard deviations

	Midportion Achilles tendinopathy ($n = 34$)		Retrocalcaneal bursitis ($n = 55$)	
	Group I	Group II	Group III	Group IV
Gender	4 female;7 male	4 female; 19 male	5 female; 30male	3 female; 17male
Age (year)	48.4 ± 7.3 (39.0–58.0)	50.5 ± 9.9 (23.0–66.0)	47.2 ± 11.2 (16.0–66.0)	47.7 ± 10.6 (25.0–71.0)
Body height (m)	1.75 ± 0.09 (1.67–2.00)	1.77 ± 0.07 (1.64–1.89)	1.79 ± 0.07 (1.60–1.91)	1.81 ± 0.08 (1.65–1.98)
Body weight (kg)	78.0 ± 13.0 (52.0–94.0)	78.2 ± 9.6 (61.0–93.0)	80.6 ± 13.7 (53.0–122.0)	81.8 ± 12.4 (62.0–103.0)
Body mass index (m/kg^2)	25.4 ± 3.9 (18.4–33.7)	24.9 ± 2.6 (20.8–29.7)	25.0 ± 3.7 (20.7–37.0)	24.8 ± 2.8 (21.1–31.4)
Ankle activity score [17]	4.7 ± 0.5 (4–5)	5.3 ± 0.9 (4–8)	5.7 ± 1.2 (4–8)	5.2 ± 1.0 (4–8)

All differences are not significant ($p = 0.151$–1.000). Group I = isolated midportion Achilles tendinopathy; group II = midportion Achilles tendinopathy with central (localized intratendineous) lesion; group III = isolated retrocalcaneal bursitis; group IV = retrocalcaneal bursitis with impingement lesion of the corresponding Achilles tendon

The VISA-A (Victorian Institute of Sports Assessment; the second "A" represents "Achilles tendon") questionnaire was introduced [9] and has meanwhile proven to be a disease specific, valid, responsive, reliable, and internationally applicable measure of severity in Achilles tendon research. Several cross-cultural VISA-A adaptations and validations are available [10–15]. The VISA-A-G (the "G" represents "German version") questionnaire is also separately validated for retrocalcaneal bursitis [13] and is regarded as a "robust" tool [15]. It is a widely accepted measure for the severity of overuse-induced Achilles tendon related disorders. The score is calculated from eight items and the maximum score of 100 represents an asymptomatic person [9].

The aim of the present investigation is to compare the results of operative treatment for recalcitrant midportion Achilles tendinopathy and recalcitrant retrocalcaneal bursitis using the VISA-A-G questionnaire [12, 13].

Materials and methods

The chairman of the local ethics committee considered the study to be not relevant for formal approval. Informed consent was obtained and the rights of the subjects were protected.

Patients

Between 2003 and 2011 we prospectively followed patients operated on recalcitrant sport induced overload Achilles tendon related disorders unresponsive to an average conservative treatment period of 23.7 (range 3–87) months. Our conservative treatment algorithm includes load reduction (or discontinuation of the pain inducing sports activity), eccentrics/physiotherapy and providing sport shoe orthotics in the first level. If unsuccessful for 6 or more weeks, we recommend extracorporeal shockwave therapy (ESWT) for the midportion Achilles tendinopathy patients and a cortisone injection into the retrocalcaneal bursa in retrocalcaneal bursitis patients. If this injection is successful for several weeks and the pain recurs, a second injection can be applied. When these modalities are inefficient, radiation therapy is discussed with the patient.

A review of our charts revealed that 86 patients had performed load reduction and 46 patients discontinued the inducing sport activity, 66 patients were equipped with orthoses, and six with Achilles tendon bandages. Physiotherapy was applied in 83 and massages in 11 cases. Injections were performed in 65, acupuncture in five, and ESWT in 30 patients. Six patients underwent radiation therapy. Taking NSAID was documented in 19 cases.

We performed operative treatment on 34 consecutive patients with 39 midportion Achilles tendinopathies and 55 consecutive patients with unilateral retrocalcaneal bursitis (Table 1). All of these patients related the onset of the symptoms to specific sports activities. Sixty-three of them were involved in competitive sports and 26 in recreational sports. Specifically, there were 56 runners (including three sprinters and one heptathlete), seven tennis players, six basketball players, five triathletes, five Nordic walkers, four soccer players, two volleyball players, one mountain biker, one handball player, one field hockey player, and one fitness enthusiast.

Grouping

Patients were eligible for the study according to our inclusion and exclusion criteria: midportion Achilles tendinopathy and retrocalcaneal bursitis patients both had to report a history of load (running) induced pain, pain when getting up in the morning (start-up pain) or when starting their activity (warm-up pain), and pain following activity. We suspected partial tears of the Achilles tendons when an acute strain event was reported. Differential diagnosis between midportion Achilles tendinopathy and retrocalcaneal bursitis were based on clinical examination [3,

5]. Until now, the literature does not specify sensitivity or specificity of the physical examination findings and in clinical practice, this distinction is often very difficult. We diagnosed midportion Achilles tendinopathy when a spindle-shaped swelling and tenderness at the Achilles tendon 2–7 cm above its calcaneal insertion was present (Fig. 1). Maximum tenderness localized anterior to the medial and lateral distal Achilles tendon border and posterior to the corresponding posterosuperior calcaneal aspect indicated retrocalcaneal bursitis (Fig. 2). As both diagnoses can coexist, we excluded patients presenting both conditions.

Potentially confounding but clinically asymptomatic pathologies like Osteochondrosis dissecans tali, relevant arthritic ankle findings [16], and posterior and plantar heel spurs were identified on radiographs. Specific findings at the posterosuperior calcaneal tuberosity (erosions or cyst formations) indicated chronic retrocalcaneal bursitis. Bone spurs in the Achilles tendon insertion were considered as different pathologies and these patients were included only when the retrocalcaneal bursa or the midportion of the Achilles tendon was symptomatic while the insertional spur was asymptomatic. We deemed that the retrocalcaneal bursa alone but not the "bone spurs" were the cause of pain when a diagnostic local anesthesia injection into the retrocalcaneal bursa was successful.

Our diagnostic algorithm to differentiate the four separate pathologic entities indicated allocation to a specific operative treatment (Fig. 3). Midportion Achilles tendinopathy patients were subdivided (group I and II) based on preoperative findings, while allocation for the retrocalcaneal bursitis subgroups (group III and IV) depended from the intraoperative finding of additional anterior Achilles tendon partial tears. Ultrasonography (12 MHz transducer) and power Doppler investigation were done in all patients. Sagittal Achilles tendon diameter of 7 mm or more in the midportion area, and/or neovessels entering the ventral midportion Achilles tendon were criteria for patients to be included in the "isolated midportion Achilles tendinopathy group" (group I). There is no validation study available so far, to distinguish midportion Achilles tendinopathy from retrocalcaneal bursitis based on the finding of neovessels. In our experience, neovessels, if present, indicate the anatomic location of the lesion and are helpful to differentiate between the two conditions. Only in rare cases, neovessels can be demonstrated both in the midportion area and in the retrocalcaneal region as well. When additionally a central Achilles tendon hypoechogenity or anechogenity was detected, patients were allocated to the "midportion Achilles tendinopathy plus central lesion group" (group II). Retrocalcaneal bursitis was confirmed by fluid (anechogenity) in the retrocalcaneal bursa, and/or hypoechogenity of the corresponding ventral Achilles tendon, and/or neovessels entering the ventral Achilles tendon. MRI investigations were available for 48 patients. Partial Achilles tendon tears were included when <20 % of the Achilles tendon's transverse section was affected. All retrocalcaneal bursitis patients preoperatively had the diagnosis confirmed by local anesthetic injection into the retrocalcaneal bursa.

Fig. 1 Physical examination technique for diagnosing midportion Achilles tendinopathy. Performing a pinch between the investigator's thumb and index finger he/she squeezes the Achilles tendon to elicit the typical tenderness in the midportion region between 2 and 7 cm above the calcaneal insertion

Operative procedures

All interventions were performed under general anesthesia by the senior author. A thigh tourniquet was applied in all cases.

Group I

For isolated midportion Achilles tendinopathy (15 procedures) a 4 cm transverse skin incision was made in the middle of the marked area in a skin fold. When necessary, this incision could be expanded longitudinally medial or/and lateral paraachillear creating a Z or L shaped configuration (Fig. 4a). Initially, the paratenon was prepared and was bluntly removed (rongeur) in the posterior, medial and

Fig. 2 Physical examination technique for diagnosing retrocalcaneal bursitis. Performing a pinch between the investigator's thumb and index finger, he localizes the maximum tenderness anterior to the medial and lateral distal Achilles tendon border and posterior to the corresponding posterosuperior calcaneal aspect

lateral aspect. Next, the anterior Achilles tendon border was carefully dissected from the underlying tissue, therefore, destroying all neovascularization entering the Achilles tendon. Finally, transachillear scarification was performed parallel to the fibers about 5–8 times with a surgical scalpel (blade no. 15). The tourniquet was opened and hemostasis was performed. Wound drainage was optional. The operative wound was closed in layers.

Group II

When midportion Achilles tendinopathy (24 procedures) was found to be accompanied with intratendineous lesions (focal hypoechogenity or anechogenic areas in ultrasonography and/or MRI signal changes indicating focal degeneration or partial tear), the operation started as for group I. The procedure was added by longitudinally splitting the tendon and oval excision of the lesion (degenerative tissue or partial tear). Tendon reconstruction was then performed anteriorly with two or three U-shaped transverse 2-0 Vicryl sutures. Posteriorly, the tendon was readapted with a 3-0 Vicryl continuous running stich suture. The procedure was finished as described for group I.

Group III

For isolated retrocalcaneal bursitis (35 procedures) a 3–4 cm transverse to slightly oblique skin incision was made in a skin fold over the lateral Achilles tendon border and the lateral aspect of the retrocalcaneal bursa

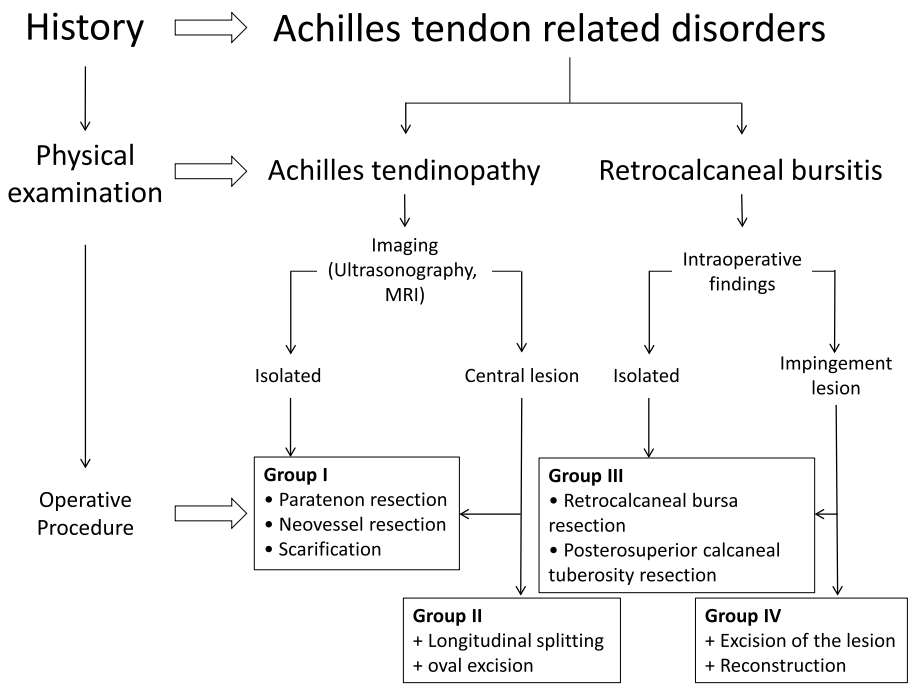

Fig. 3 Flow chart, demonstrating the diagnostic algorithm and allocation of the study population to four different treatment groups. Group I = isolated midportion Achilles tendinopathy; group II = midportion Achilles tendinopathy with central (localized intratendinous) lesion; group III = isolated retrocalcaneal bursitis; group IV = retrocalcaneal bursitis with impingement lesion of the corresponding Achilles tendon)

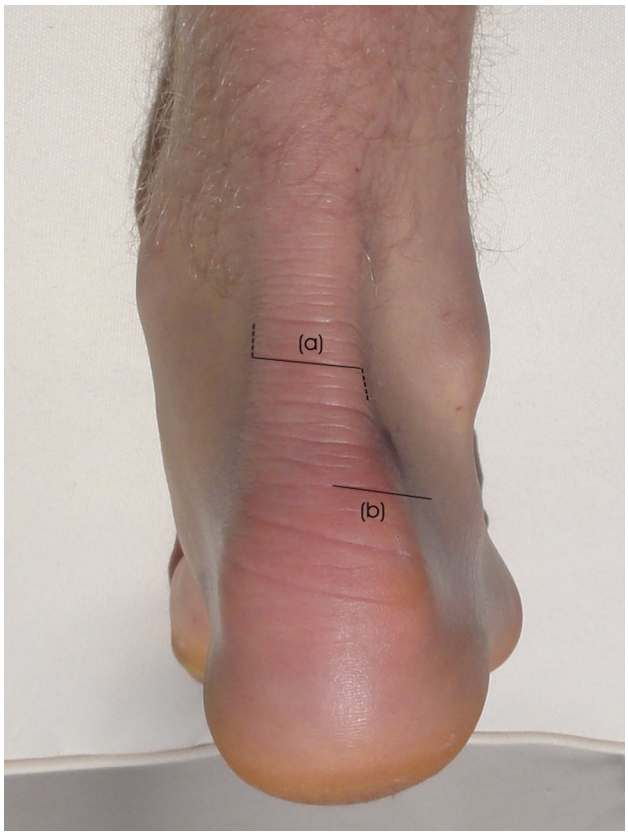

Fig. 4 Schematic representation of the skin incisions used for the study population. We approached midportion Achilles tendinopathy (group I and II) via a 4 cm transverse epiachillear skin incision in the center of the painful midportion area of the Achilles tendon (*a*). If not sufficient, we extended this incision L or Z shaped proximal and/or distal parallel to the Achilles tendon (*short dashes*). For retrocalcaneal bursitis (group III and IV), we centered a 3–4 cm transverse skin incision over the lateral Achilles tendon border and the lateral retrocalcaneal bursa space (*b*)

corresponding to the posterior calcaneal tuberosity (Fig. 4b). Blunt subcutaneous dissection identified the lateral Achilles tendon border. The lateral and posterior aspect of the Achilles tendon was freed from the surrounding scar tissue. Degenerative paratenon structures and optionally an inflamed epiachillear bursa were resected. A sharp longitudinal incision was made at the lateral Achilles tendon border (3 cm) down to the periosteum of the lateral posterosuperior calcaneal tubercle. The lateral Achilles tendon was elevated with a sharp retractor and the retrocalcaneal bursa was excised. Haglund's tuberosity was freed with a periosteal elevator. A Hohmann retractor was inserted with its spike to the medial calcaneal tuberosity and an oblique posterosuperior calcaneal tubercle osteotomy was performed with a 1–1.5 cm broad osteotome from lateral to medial. Using a file the osteotomy was smoothened and rounded. The lateral Achilles tendon border was elevated (sharp retractor) and the anterior Achilles tendon was freed from bursa rest tissue and was inspected for lesions. If degeneration was present, scarification of the anterior Achilles tendon was performed with a surgical scalpel (blade no. 15) parallel to the Achilles tendon fibers. Tourniquet was opened and hemostasis was performed. Wound drainage was optional. The lateral Achilles tendon border was sutured side-to-side to the lateral paraachillear soft tissue (3-0 Vicryl). The operative wound was closed in layers.

Group IV

When corresponding anterior partial tears were detected during the retrocalcaneal bursitis operation (20 procedures) these stumps were resected (transverse lesion) or the lesions were excised (longitudinal split tears). Tendon reconstruction was then performed anteriorly with two or three O-shaped transverse 2-0 Vicryl sutures [6]. The procedure was finished as described for group III.

Postoperative treatment was identical for all groups. A slightly plantar flexed lower leg and foot 3 M™ Scotchcast One-Step Splint (3 M Deutschland GmbH, Neuss, Germany) was applied for 5–6 days. Using crutches the operated leg was unloaded for this period. Then a specific stable shoe (Orthotech® Stabil, Orthotech, Gauting, Germany) was equipped with a 2.5 cm modular heel support and full body load was incrementally resumed over 2–4 days. The stable shoe was continuously worn for the day for 6 weeks and the splint at night for 4 weeks. The heel support was reduced to 1.5 cm in the fourth and to 1.0 cm in the sixth postoperative week. Cycling activities were allowed 4 weeks postoperatively. Running activities were initiated at 12–16 weeks postoperatively at the earliest and according to the clinical and ultrasonographic status.

Follow-up investigation

Preoperatively (baseline) and 3, 6, and 12 months postoperatively, patients filled out the VISA-A-G questionnaire serving as the primary endpoint measure [12, 13]. Four patients in group I and one patient in group II had bilateral operations within 2–4 weeks intervals. We asked these patients to fill out VISA-A-G questionnaires separately for each side. To analyze the level of sports activity we calculated the ankle activity score preoperatively and for the 12-month follow-up [17].

We additionally calculated success rates for the 12-month follow-up (secondary endpoint). For this the percentages of excellent and good results were summarized [18]. Derived from the values presented in a recent systematic search of the literature [15] we defined VISA-A-G score results of 90 and more percent as excellent and 70–89 as good. As VISA-A scores below 60 are "usually found in Achilles tendinopathy patients" we defined VISA-A-G results below 70 as unsuccessful.

Table 2 VISA-A-G results of the study population (operative procedures) at baseline and at follow-up presented as means ± standard deviations for the 34 midportion Achilles tendinopathy patients (39 procedures) and the 55 retrocalcaneal bursitis patients (55 procedures)

	Midportion Achilles tendinopathy		Retrocalcaneal bursitis	
	Group I ($n = 15$)	Group II ($n = 24$)	Group III ($n = 35$)	Group IV ($n = 20$)
Preoperative	44.2 ± 15.5 (16–66)	37.0 ± 17.6 (10–79)	42.2 ± 21.0 (0–93)	45.9 ± 15.2 (19–75)
3-month follow-up	51.4 ± 20.4 (12–86)	57.0 ± 23.2 (12–97)	53.1 ± 21.4 (12–91)	47.7 ± 15.1 (21–78)
6-month follow-up	76.2 ± 18.5 (48–99)	81.0 ± 15.8 (50–99)	66.3 ± 21.2 (12–100)	72.0 ± 21.0 (29–100)
12-month follow-up	86.3 ± 8.8 (73–97)	90.3 ± 10.6 (62–100)	80.8 ± 17.9 (36–100)	83.5 ± 18.5 (35–98)

The ranges are set in brackets. Group I = isolated midportion Achilles tendinopathy; group II = midportion Achilles tendinopathy with central (localized intratendinous) lesion; group III = isolated retrocalcaneal bursitis; group IV = retrocalcaneal bursitis with impingement lesion of the corresponding Achilles tendon)

Statistical analyses

We tested all variables for normal distribution using the Kolmogorov–Smirnov test. When applicable, descriptive statistics (means and standard deviations) were calculated. A repeated analysis of variance with Turkey post hoc tests was conducted to identify the group differences over time and between group differences. Significance level was set at $p < 0.05$. All statistical analyses were carried out using SPSS 20.0 (SPSS GmbH, München, Germany). At the latest follow-up, data of eight (8.5 %) patients were missing. In these cases, the last value carried forward technique has been applied. Additionally, the data were tested for gender differences. A post hoc power analysis was performed by multiple comparisons with the aid of compared *t* tests.

Results

Anthropometry

Preoperatively, no differences were detectable between the groups regarding age ($p = 0.613$–0.999), sex ($p = 0.151$–1.000), body weight ($p = 0.853$–1.000), body height ($p = 0.187$–0.940), and the body mass index ($p = 0.974$–1.000; Table 1).

Preoperatively, the ankle activity score [17] differed significantly only between group I and group III ($p = 0.010$). The sport activity level between the remaining groups was not different ($p = 0.273$–0.999).

VISA-A-G outcome

Over time

Except for group II ($p = 0.001$), the VISA-A-G scores did not increase significantly ($p = 0.119$–0.988) from the preoperative status to the 3-month follow-up (Table 2). Compared with the preoperative values all VISA-A-G scores were increased significantly ($p < 0.001$) at the 6- and 12-month follow-up investigation. From 3 to 6 months postoperatively and from 3 to 12 months postoperatively all VISA-A-G scores increased to significantly higher levels ($p = 0.001$–0.038). From 6 to 12 months postoperatively the VISA-A-G scores increased significantly for group III ($p = 0.019$) but not for group I, II and IV ($p = 0.173$–0.342).

Between group differences

Preoperatively and 3 months postoperatively, the VISA-A-G scores were not different for all tested groups ($p = 0.376$– 0.993). Six months postoperatively the scores for group II and III were significantly different ($p = 0.028$) while the remaining comparisons were not different ($p = 0.362$–0.922). Twelve months postoperatively, no relevant differences were found when comparing the four groups ($p = 0.100$–0.952).

Success rates

The success rates in group I, II, III, and IV were 100 %, 95.8 %, 71.4 %, and 85.0 %, respectively.

Gender differences

With the data available no gender differences were observable with respect to the VISA-A-G outcome when comparing the preoperative and the follow-up values in either group ($p = 0.072$–0.877).

Radiographic data

On preoperative radiographs osteoarthritis (OA) grade I was identified in four ankles of Group I (36 %). Six ankles with an OA grade I and two ankles with an OA grade II were detected in Group II (35 %). Group III revealed seven ankles with a grade I of OA and one ankle with grade II of

OA (23 %). Six ankles of Group IV were affected with an OA grade I and one ankle with an OA grade II (35 %). All other ankles were grade 0 (normal). A posterior heel spur was detected three times (8.8 %) in the midportion Achilles tendinopathy group (one in group I, two in group II). The retrocalcaneal bursitis group revealed 14 (25.5 %) posterior heel spurs (seven in group III, seven in group IV). A plantar heel spur was identified four times (11.8 %) in the midportion Achilles tendinopathy group (one in group I, three in group II) and 12 times (21.8 %) in the retrocalcaneal bursitis group (eight ankles of group III, four ankles of group IV).

Discussion

This study demonstrates that operative treatment for midportion Achilles tendinopathy and retrocalcaneal bursitis is equally effective when judged (VISA-A-G questionnaire) 1 year postoperatively. One year postoperatively we found VISA-A-G scores from 80.8 ± 17.9 to 90.3 ± 10.6. A VISA-A score of 90 or more is proposed to represent an excellent condition and full recovery following treatment [15]. The VISA-A-G scores increased over the covered postoperative period. Between the 6- and 12-month follow-up VISA-A-G results further increased in all groups. This increase, however, was significant only for group III which included the highest number of operations ($n = 35$). The low numbers included in the investigated subgroups give a weakness of our study. This is especially true for group I comprising 15 cases. This small sample size suffers from a lack of statistical power. To get a statistical power 1-beta of 80 % with an alpha error of 0.0125, more numbers are needed. (Group I $n = 21$, Group II $n = 45$, Group IV $n = 31$). Another criticism is that midportion Achilles tendinopathy and retrocalcaneal bursitis are different clinical and pathoanatomic images. However, the Achilles tendon is involved in both of them directly (midportion Achilles tendinopathy) or indirectly (retrocalcaneal bursitis) and this is the reason to compare the outcome of respective operations in this study. Additionally, the results obtained for group I and II (four patients and one patient, respectively, had bilateral procedures) may be biased by a "double dipping effect" [19]. We consider that the 12-month follow-up VISA-A-G questionnaires from eight patients were not available. However, with the "last value carried forward" technique applied, the real result is rather underestimated.

Previously, preoperative midportion Achilles tendinopathy patients scored 44.9 ± 14.2 (range 37.0–52.7) [12] and retrocalcaneal bursitis patients scored 46.5 ± 12.7 (range 40.8–52.3) [13]. It is not easy to compare the VISA-A-G results from this study with the results presented in previous studies, which used different unvalidated tools for the evaluation. A "reliable and sensitive" and "universally accepted outcome measure" has been proposed as a consequence from a critical review published in 2001 [18] and the VISA-A questionnaire with its international adaptations has been developed to fulfill this demand [15]. The fact that our investigation was prospectively performed using this patient relevant, valid, and reliable tool (VISA-A-G) is a strength of this study [15]. Besides this, a rigorous diagnostic algorithm including history, physical findings, imaging, and intraoperative findings (Fig. 3) created the different treatment groups. Our groups, therefore, represent closely defined conditions rather than including different Achilles tendon related pathologies [3]. Randomization was, therefore, not possible. One specialized orthopedic surgeon performed all operations in standardized techniques and the rehabilitation protocol was strictly standardized. To exclude observer bias, the investigator responsible for outcome assessment was independent of the surgeon and could not influence the results because the questionnaire was mailed.

With the available data we were unable to detect a difference in outcome favoring males as it was proposed previously [20]. All the patients included in our study were athletes and this fact could lead to better results when compared with nonathletes [21]. We assume, that the clear male predominance within our study (82 %) is due to the sport specific specialization of our center and this is congruent with previous investigations [1, 7].

A critical review published in 2001 indicated the success rate for operative Achilles tendinopathy treatment to be 77.4 % [18]. A recent systematic review found 91 and 73 % successful operations following endoscopic or open operative treatment for retrocalcaneal bursitis [22]. Only open procedures were included in our analyses and our results are equal. Endoscopic resection of the retrocalcaneal bursa and the posterosuperior calcaneal tubercle are described [23]. A direct comparison with our results, however, is not possible due to different outcome measures. Experimental work comparing open and endoscopic resection of the retrocalcaneal bursa and the posterosuperior calcaneal tubercle was unable to favor one of the two procedures [24] but randomized clinical trials are proposed to further clear this issue.

Probably the operative approach is important. The retrocalcaneal bursa and the posterosuperior calcaneal tubercle are traditionally accessed from medial, lateral, or central longitudinal skin incisions [22]. We present a short (3–4 cm) transverse approach centered over the lateral Achilles tendon border (Fig. 4b). This is a modification of an approach originally described by Fowler and Philipp [25]. We also approached midportion Achilles tendinopathy by a transverse skin incision, which (to our knowledge) is not described in the literature. We expect that the transverse skin incisions will reduce scar formation which is

associated with longitudinal incisions and result in minor compromising the blood supply to the Achilles tendon [26] but the close distance to the sural nerve has to be respected [27].

We specifically addressed partial tears of the distal Achilles tendon (impingement lesions) by direct repair (group IV). However, we consider that 37.2 % of the patients with MRI documented tears recovered after endoscopic resection of the retrocalcaneal bursa and the posterosuperior calcaneal tubercle without specifically addressing the lesions [28]. To further clarify the relevance of suturing anterior tendon partial tears (impingement lesions), prospective and randomized research has to be performed.

Our intraoperative procedure for group III and IV is mainly depending on the intraoperative findings and not from MRI. One could argue whether performing a preoperative MRI in each case could influence the results. In 48 out of 94 Achilles tendons (51.0 %) of our study an MRI was available preoperatively. Most of these MRI investigations have been performed previously to the referral of the patients to our center and, therefore, were not standardized. In a subgroup analysis the difference for the 12-month results between the patients who underwent (VISA-A-G = 82.6) and those who had no preoperative MRI (VISA-A-G = 86.8) was statistically not different ($p = 0.190$). Therefore, we feel that the quality of this imaging modality has to be questioned when analyzing Achilles tendon partial tears.

We observed posterior and plantar heel spurs three and two times more frequently, respectively, in our retrocalcaneal bursitis groups. The reason for this interesting finding is not clear from the presented data. Whether the chronic inflammation of the retrocalcaneal bursa or an accompanying systemic predisposition influences the spur formation has to be subjected to further research.

In summary, this study proofs that pathology driven operation is an option for treatment of recalcitrant midportion Achilles tendinopathy and retrocalcaneal bursitis. Preoperative and intraoperative findings guide the surgeon to choose one of the different operative techniques.

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