Walking pain-free: a prospective study on the efficacy of surgical resection with Achilles tendon reinforcement for painful Haglund lesions

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Background
Haglund's deformity is a common cause of posterior heel pain, often requiring surgical management when conservative treatment fails. Traditionally, surgery focused solely on resection of the bony prominence, yielding suboptimal outcomes.
Aim
This study assessed the efficacy of surgical resection of painful Haglund lesions combined with Achilles tendon reinforcement for managing insertional Achilles tendinitis.
Methods
Twenty patients with insertional Achilles tendinitis underwent surgical resection of Haglund lesions and Achilles tendon reinforcement with suture anchors. Functional outcomes were evaluated using the American Orthopedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot score preoperatively and at 6 and 12 months postoperatively. Complications were recorded.
Results
The mean AOFAS score significantly improved from 43.5±7.2 preoperatively to 79.0±9.1 at 6 months and 84.5±9.8 at 12 months postoperatively (*P*<0.001). Early weight-bearing was achieved in 2 weeks. The complication rate was 25% (all minor). There were no re-ruptures or revisions during the one-year follow-up.
Conclusion
Surgical resection combined with Achilles tendon reinforcement is an effective treatment for Haglund's deformity, allowing early weight-bearing while significantly improving function. It is associated with a low complication rate and no major adverse events. This technique addresses both bony and soft tissue pathologies, optimizing outcomes.

Keywords:
achilles tendon, calcifying tendinitis, rapid recovery, surgical treatment, tendinopathy

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Introduction

Haglund's Syndrome, also known as Mulholland deformity, retrocalcaneal exostosis, or 'pump bump,' represents a prevalent yet enigmatic orthopedic concern characterized by a prominent bony enlargement on the heel's rear, precisely where the Achilles tendon attaches. This enlargement frequently irritates the neighboring soft tissues, especially when under consistent friction from poorly fitted or tight shoes., resulting in inflammation, pain, and swelling [1]. The complexity deepens when accompanied by insertional Achilles tendinopathy, and manifests as increased pain, swelling, and diminished foot functionality. Additionally, the presence of Haglund's deformity, a significant bony elevation on the calcaneum's posterosuperior lateral section, is frequently observed, sometimes associated with retrocalcaneal bursitis [2,3].

The etiology of Haglund's syndrome has long been a subject of extensive research, yet it remains ambiguous. Several intrinsic determinants emerge as possible contributors to its onset. Achilles tendon contracture, for instance, can lead to increased tension and stress at the tendon's insertion point, potentially exacerbating the syndrome. The cavus foot, a high-arched foot type, may alter normal biomechanics, thus predisposing individuals to Haglund's [4]. Similarly, rearfoot varus, an inward tilting of the heel, can contribute to an uneven distribution of force and added friction. Furthermore, childhood apophyseal injuries, which pertain to injuries to growth plates during developmental years, may have longstanding implications and morphological changes that predispose one to the condition.

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Diagnosis of Haglund's deformity typically involves assessing clinical symptoms, confirmed by radiographic analyses highlighting the calcaneus prominence. Treatment approaches for Haglund's deformity vary, ranging from nonsurgical interventions such as the RICE protocol (Rest, Ice, Compression, Elevation), targeted physiotherapy, and orthotic adjustments, to surgical interventions when conservative treatments fail [3]. These surgical options include endoscopic calcaneoplasty, traditional open interventions, and arthroscopic techniques. However, repeated infiltrations carry a risk of Achilles tendon rupture [5].

Prior to 2010, the predominant surgical approach for managing Haglund lesions involved implementing a conventional single-row suture technique. This method requires detaching a significant portion (50–70%) of the Achilles insertion while preserving the integrity of the tendon, followed by the excision of the inflamed and calcified tendon, and subsequently reattaching the Achilles tendon using suture anchors [6]. Unfortunately, this intervention often resulted in suboptimal outcomes, such as high recurrence rates, Achilles tendon instability, and residual heel pain, limiting its widespread adoption [7].

In recent years, there has been a growing interest in optimizing surgical techniques for the management of Haglund's deformity. Traditionally, surgical approaches primarily focused on the resection of the bony prominence and removal of inflamed and calcified tissues [8]. However, these methods often resulted in suboptimal outcomes, including high recurrence rates, Achilles tendon instability, and persistent heel pain [9,10].

Recognizing these limitations, there has been a shift towards more comprehensive surgical strategies that not only address the bony deformity but also reinforce the Achilles tendon to optimize functional outcomes and reduce complications. This study not only represents our experience using the technique involving surgical resection of painful Haglund lesions combined with Achilles tendon reinforcement to provide a solution addressing both bony and soft tissue abnormalities associated with insertional calcifying Achilles tendinitis but also provide a comprehensive perspective review by comparing our findings with existing literature, we endeavor to discern the most efficacious surgical strategies for managing calcifying insertional Achilles tendinitis.

Methodology

Study population

This prospective study encompassed 20 consecutive patients, consisting of 6 males and 14 females, diagnosed with painful Haglund lesions. These patients underwent surgical resection of the deformity, coupled with Achilles tendon reinforcement, at the ………. Hospital between 2017 and 2022. Inclusion criteria adult patients over 18 years with a confirmed diagnosis of insertional calcifying Achilles tendinitis (enthesiopathy) who underwent the surgical resection. Exclusions were made for patients having other medical conditions affecting the foot and ankle, and those who were lost to follow-up.

Ethical approval and consent

All participants in the study provided informed consent. The study received ethical approval from the Ethical Committee of …….., Egypt (#…..). The research was conducted in adherence to the ethical standards of the institution and with the Helsinki Declaration of 1975, as revised in 2000.

Preoperative assessment

Haglund syndrome is a triad of posterosuperior calcaneal prominence (Haglund deformity), retrocalcaneal bursitis, and insertional Achilles tendinopathy. Comprehensive data collection included patient demographics, medical history, and treatment details. Documentation encompassed past illnesses, medications, surgeries, preoperative American Orthopedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot score, and baseline clinical and radiological data [11]. The AOFAS score is a comprehensive tool used for the clinical assessment of foot and ankle conditions, including pain, function, and alignment. A higher score indicates better foot and ankle functionality.

Surgical procedure

The procedure for the surgical resection of painful Haglund lesions with re-enforcement of the Achilles tendon was carried out as follows: Initially, the patient was placed in a prone position. A longitudinal incision was then made over the Achilles tendon, allowing for the incision of the paratenon and the exposure of the Achilles tendon. Once visible, the Haglund lesion was identified and subsequently excised using a burr or osteotome. To alleviate pressure on the Achilles tendon, the bony prominence on the calcaneus was removed, this required a longitudinal incision. The Achilles tendon was inspected for signs of degeneration and any degenerated tissue present was excised. The next step was to reinforce the resection site, which was accomplished by re-fixing it with a 5 mm titanium suture anchor (5 mm Arthrex Corkscrew titanium anchor with two nonabsorbable sutures). The paratenon was repaired and the initial incision was closed utilizing standard wound closure methods (Fig. 1).

Postoperative care

Upon completion of the surgery, every patient was fitted with an Achilles tendon orthosis (Aircast Achilles

Pneumatic Walker). This device served to stabilize the ankle in a neutral position for a total duration of 6 weeks. The immediate postsurgical instructions entailed partial weight-bearing for the initial 2 weeks, allowing time for the surgical wound to heal adequately. During this phase, patients were provided elbow crutches to aid in movement. As the healing progressed, over the subsequent weeks, the weight-bearing was gradually increased. By the end of the 2-week period, patients transitioned to full weight-bearing with regular footwear.

Rehabilitation and management

Standard postoperative procedures advocated for the immobilization of the ankle, either in a cast or a boot, spanning several weeks. Following this immobilization phase, patients were enrolled in physical therapy sessions. These sessions were meticulously structured to guide the patient in regaining their ankle's range of motion and fortifying its strength. Patients were emphatically cautioned to eschew weight-bearing activities for 2 weeks postsurgery.

Statistical analysis

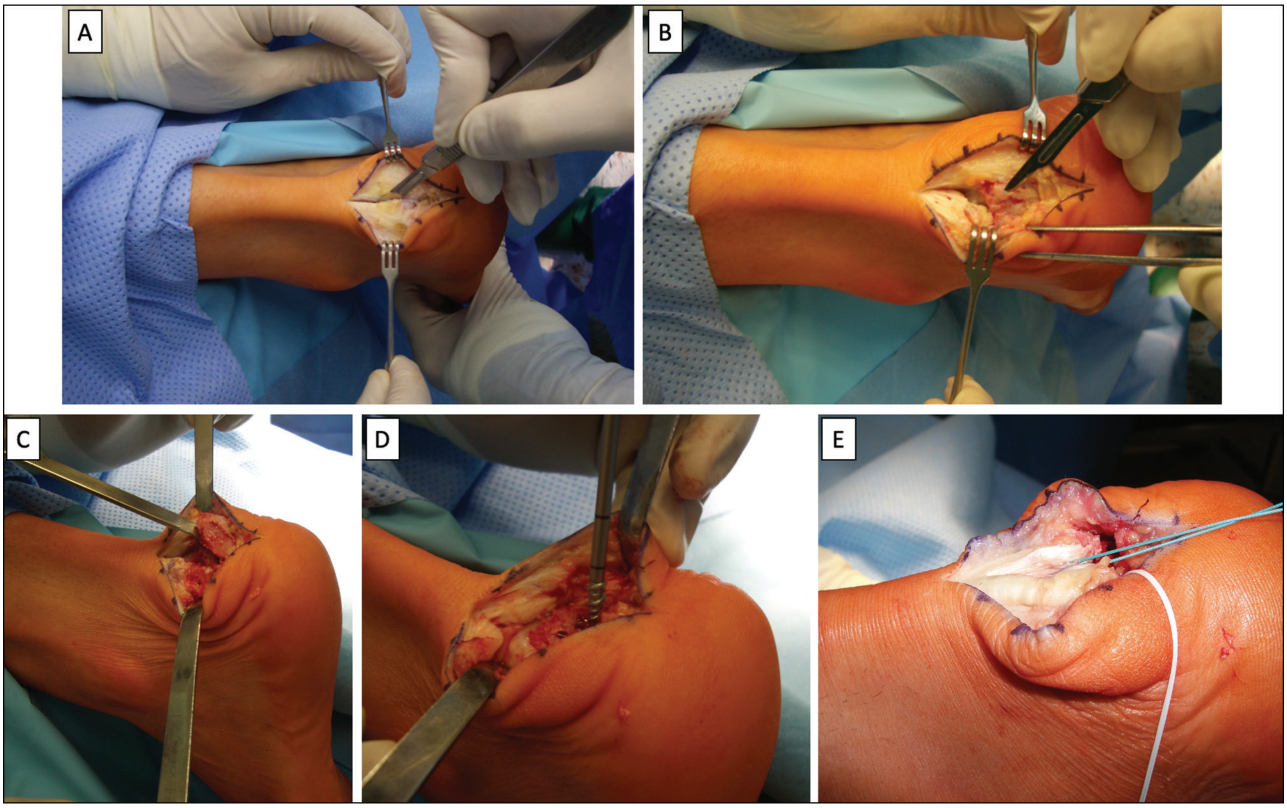
All statistical analyses were performed using RStudio version 2023.06.0 build 421[12] Descriptive statistics were presented as mean±standard deviation for continuous variables and as frequency (percentage) for categorical variables. Comparisons between two groups for continuous data were done using independent samples *t*-test. Categorical variables were compared using χ^2 test or Fisher's exact test as appropriate. All statistical tests were two-tailed and a *P* value less than 0.05 was considered statistically significant.

Results

Patient demographics and comorbidities

The study enrolled a total of 20 patients diagnosed with painful Haglund lesions who underwent surgical resection of the deformity with Achilles tendon reinforcement. Their baseline characteristics are shown in Table 1. The average age of the participants was 49 years, with a standard deviation (SD) of 7.9 years. Most of the participants were female (70%). The mean weight of the participants was 89 ± 9.7 kg, and the mean height was 165.1 ± 8.5 cm, resulting in a mean BMI of 32.8 ± 4.0 Kg/m^2. Of the study population, 20% were smokers, 40% of the participants had hypertension, 40% had diabetes mellitus, and 10% of the participants

Figure 1



Surgical technique for resection of Haglund's deformity with Achilles tendon reinforcement. (A) A direct posterior incision was made over the Achilles tendon with longitudinal splitting of the paratenon to expose the tendon. (B) The Haglund lesion was dissected and identified. (C) The bony prominence was excised using an osteotome. (D) A 5 mm titanium suture anchor was inserted into the calcaneus. (E) The Achilles tendon was reinforced by suturing it to the anchor using nonabsorbable sutures.

had chronic obstructive pulmonary disease (COPD). Figures 2–4 demonstrated preoperative and postoperative radiological imaging of selected patients who underwent surgical resection of painful Haglund lesions combined with Achilles tendon reinforcement.

Surgical efficacy following resection with tendon reinforcement

Traditionally, patients undergoing surgery for Haglund's deformity would require around 6–8 weeks of recovery time before weight-bearing if no tendon reinforcement is done. However, the innovative approach of combining surgical resection of painful Haglund lesions with Achilles tendon reinforcement has shown promising results in enhancing postoperative recovery. This technique allows for complete weight-bearing with crutches as early as two weeks postoperatively, thus promoting early mobility and better functional outcomes. The efficacy of this approach is further demonstrated by the notable improvement in the AOFAS scores of patients. The preoperative mean AOFAS score was 43.5 ± 7.2, indicating a significant limitation in foot and ankle function prior to the intervention. However, postoperatively, there was a significant increase in the mean AOFAS score to 79.0 ± 9.1 at 6 months, and further improvement to 84.5 ± 9.8 at 12 months (all $P<0.001$), (Fig. 5a).

Table 1 Baseline characteristics of the study population (*N*=20)

Characteristics	Levels	Total cohorts
Demographics		
Age, years	Mean (SD)	49.0 (7.9)
Sex	Female	14 (70.0)
	Male	6 (30.0)
Weight, Kg	Mean (SD)	89.0 (9.7)
Height, cm	Mean (SD)	165.1 (8.5)
Body mass index, Kg/m^2	Mean (SD)	32.8 (4.0)
Comorbidities		
Smoking	No	16 (80.0)
	Yes	4 (20.0)
Hypertension	No	12 (60.0)
	Yes	8 (40.0)
Diabetes mellitus type II	No	12 (60.0)
	Yes	8 (40.0)
Chronic obstructive pulmonary disease	No	18 (90.0)
	Yes	2 (10.0)

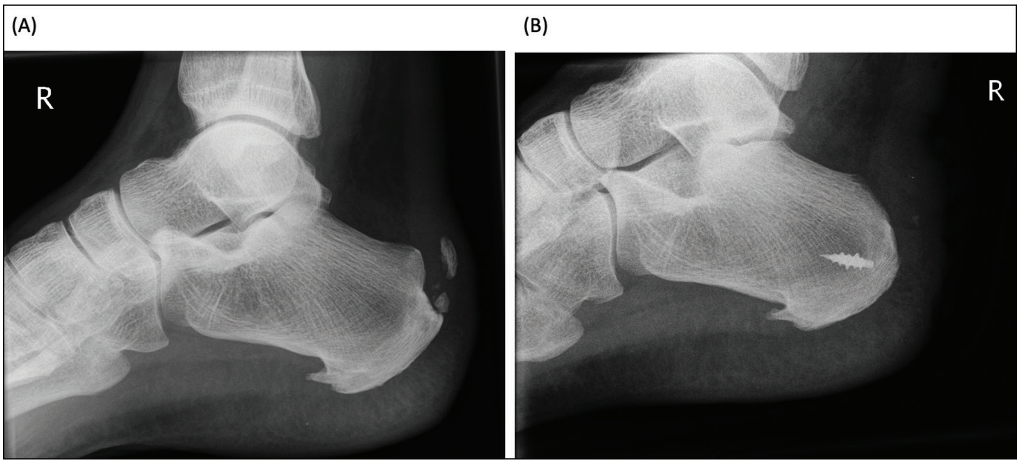
Data is reported as number (percentage) or mean (standard deviation). SD: standard deviation.

On a gender-based analysis, the preoperative mean AOFAS score was 44 ± 6.6 for females and 42.3 ± 9.0 for males, indicating a significant limitation in foot and ankle function prior to the intervention. However, postoperatively, there was a significant increase in the mean AOFAS score to 80.7 ± 9.1 at 6 months, and further improvement to 85.8 ± 9.1 at 12 months for females; and for males, it increased to 75.0 ± 8.5 at 6 months, and further to 81.5 ± 11.5 at 12 months (Fig. 5b). Both genders greatly benefited from the surgery with similar average AOFAS scores at both the 6 and 12-month intervals ($P>0.05$).

Postoperative complications

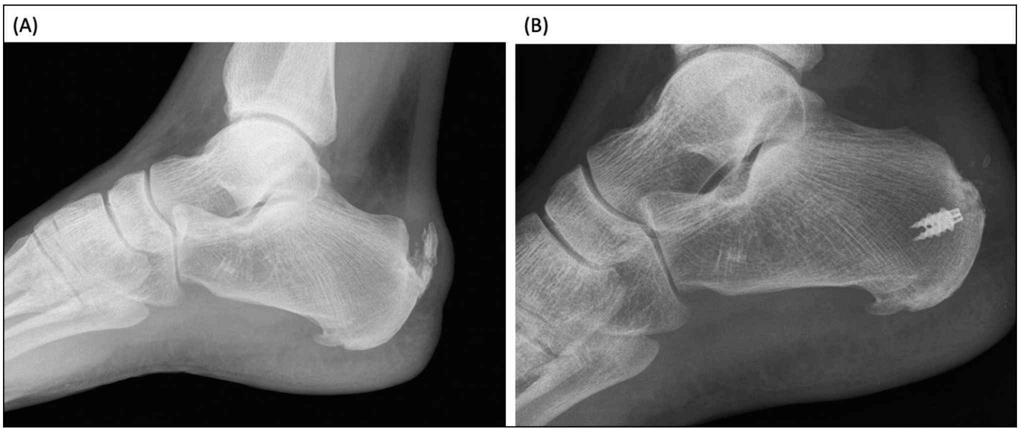
Notably, there were no instances of deep vein thrombosis (DVT), pulmonary embolism (PE), or Achilles tendon re-rupture throughout the first

Figure 2



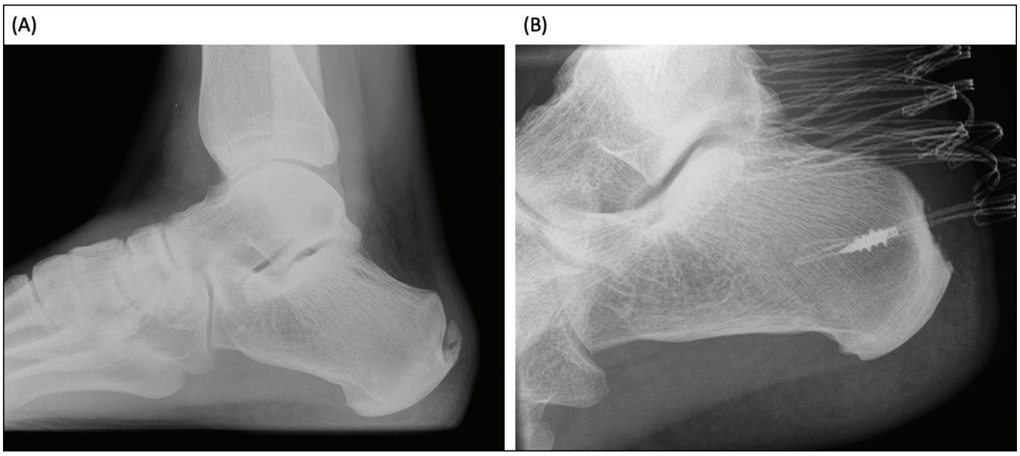
Radiological Images of a Haglund's Deformity Patient: Case 1. Photos presents the lateral view ankle radiological images of a 30-year-old female patient with a BMI of 39.2 kg/m^2, who is nonhypertensive and nondiabetic. The patient underwent surgical resection of painful Haglund's deformity combined with Achilles tendon reinforcement. The patient had an American Orthopedic Foot and Ankle Society score of 51 preoperatively, which improved to 88 at 6 months postoperatively, and further to 92 at 12 months postoperatively. The patient did not experience any complications and was able to achieve complete weight-bearing by day 14 postoperatively. (A) Preoperative radiological image of the ankle showing the anatomical abnormalities associated with Haglund's deformity. (B) Radiological image taken 6 weeks postoperatively showing the result of the surgical intervention and the Achilles tendon reinforcement.

Figure 3



Radiological Images of a Haglund's Deformity Patient: Case 2. Photos presents radiography lateral view of the ankle of a 53-year-old female patient with a BMI of 32.0 kg/m², who is diabetic and hypertensive. The patient underwent surgical resection of painful Haglund's deformity combined with Achilles tendon reinforcement. The American Orthopedic Foot and Ankle Society score of the patient was 33 preoperatively, which improved to 88 at 6 months postoperatively, and further to 90 at 12 months postoperatively. The patient did not experience any complications despite her being diabetic and hypertensive demonstrates the safety of the surgical approach. (A) Preoperative radiological image of the ankle showing the Haglund's deformity. (B) Radiological image taken 6 weeks postoperatively showing the result of the surgical intervention and the Achilles tendon reinforcement.

Figure 4

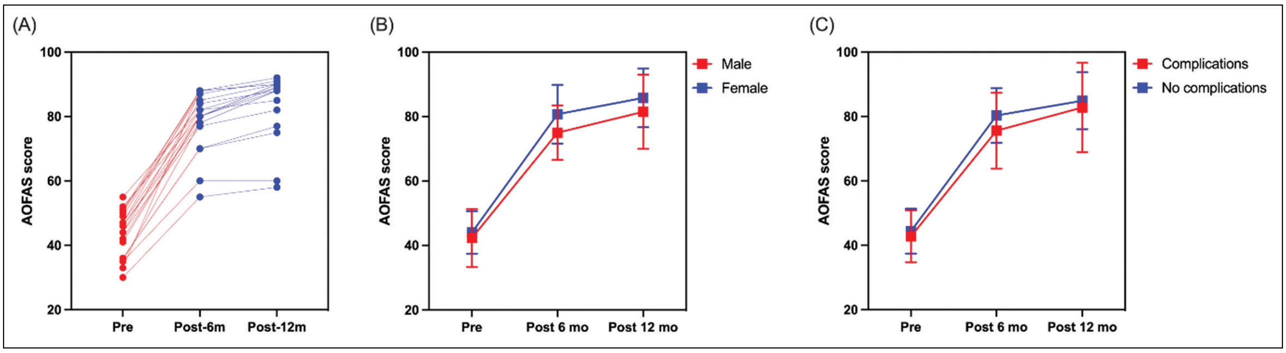


Radiological Images of a Haglund's Deformity Patient: Case 3. Photos presents radiography of ankle lateral view of a 42-year-old male patient with a BMI of 29.1 kg/m², who is a smoker but non-hypertensive and nondiabetic. The patient underwent surgical resection of painful Haglund's deformity combined with Achilles tendon reinforcement. The American Orthopedic Foot and Ankle Society score of the patient was 52 preoperatively, which improved to 80 at 6 months postoperatively, and further to 90 at 12 months postoperatively indicating a significant enhancement in the foot and ankle functionality of the patient. The patient experienced a superficial infection as a minor postoperative complication which was resolved by antibiotics. (A) Preoperative radiological image of the ankle showing the Haglund's deformity. (B) Immediate postoperative radiography showing the result of the surgical intervention and the Achilles tendon reinforcement.

year of follow-up. Furthermore, no patients required debridement, repeat, or revision surgery. Of the 20 patients, five encountered minor complications: three patients developed superficial infections, successfully treated with a 10-day course of antibiotics, and three patients developed sural nerve neuropathy, which spontaneously resolved within 6-8 weeks. Noteworthy is that one patient experienced both a superficial infection and sural nerve neuropathy (Fig. 6).

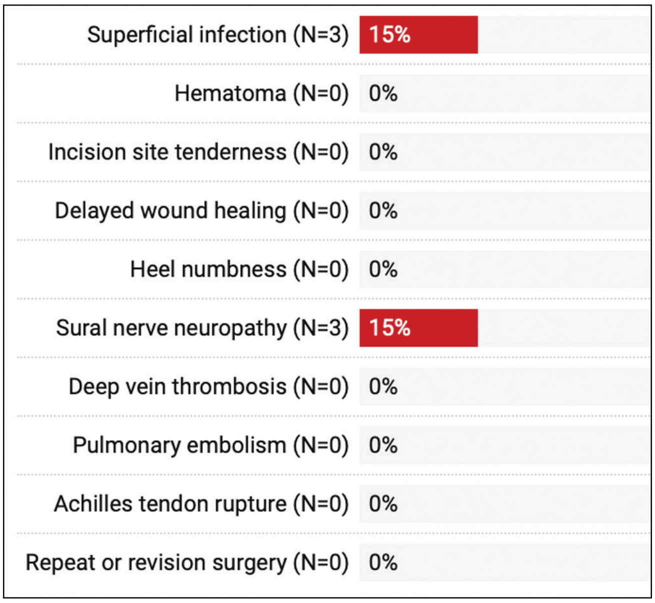
Figure 5c illustrates the preoperative and postoperative AOFAS scores of patients who experienced complications *versus* those who did not, over a period of 12 months. The data reveals that, on average, both groups of patients, those with complications and those without, showed significant improvements in their AOFAS scores postoperatively. For the group with complications, the preoperative mean AOFAS score was 42.8 ± 8.1, which increased to 75.6 ± 11.8 at 6 months postoperatively, and further improved to 82.8 ± 13.9 at 12 months postoperatively. Similarly, for the group with no complications, the preoperative mean AOFAS score was 44.4 ± 7.0, which increased to 80.3 ± 8.5 at 6 months postoperatively, and further

Figure 5



Perioperative function score in patients underwent surgical resection of Haglund deformity with Achilles tendon reinforcement. American Orthopedic Foot and Ankle Society scores: American Orthopedic Foot and Ankle Society Ankle-Hindfoot score. (A) Overall improvement in American Orthopedic Foot and Ankle Society scores: The mean American Orthopedic Foot and Ankle Society scores preoperatively, and at 6 and 12 months postoperatively for all patients. There was a significant improvement in American Orthopedic Foot and Ankle Society scores at both 6 and 12 months postoperatively compared with preoperative scores. (B) Sex-based analysis of American Orthopedic Foot and Ankle Society scores: The line graph shows the mean American Orthopedic Foot and Ankle Society scores for males and females preoperatively, 6 months postoperatively, and 12 months postoperatively. There was no significant difference between the genders at both 6 and 12-month intervals. (C) American Orthopedic Foot and Ankle Society scores based on postoperative complications: The line graph compares the mean American Orthopedic Foot and Ankle Society scores preoperatively, 6 months postoperatively, and 12 months postoperatively between patients who experienced complications and those who did not. There was no significant difference between the two groups at both 6 and 12-month intervals. Statistical analysis was performed using a two-tailed unpaired *t*-test with a False Discovery Rate (FDR) adjustment.

Figure 6



Postoperative complications following resection with Achilles tendon reinforcement. The frequency of complications among the 20 surgery patients are shown.

improved to 84.9 ± 8.9 at 12 months postoperatively (P>0.05).

Comprehensive perspective review on the surgical procedures for Haglund's syndrome

Our goal was to evaluate the efficacy and safety of different surgical techniques employed for Haglund's syndrome. Despite the absence of a universally accepted gold standard for surgical intervention, open and endoscopic approaches have been documented with varying outcomes. Commonly performed procedures include retrocalcaneal bursectomy, excision of Haglund's deformity, and optionally, Achilles tendon debridement and reattachment. Our perspective review compiled data from 17 studies published between 2000-2021 involving 505 patients who underwent surgical treatment for Haglund's syndrome[13–25]. Of these, 10 studies involving 307 patients investigated open surgical techniques, while 7 studies involving 198 patients explored endoscopic techniques, as detailed in Table 2.

In open surgeries, the lateral approach (N=6 studies, 164 patients) was most frequently utilized, involving a lateral incision in the Achilles tendon to access the posterior calcaneus. Other approaches included medial (N=2 studies, 45 patients), involving a medial incision in the tendon, and central tendon splitting (N=3 studies, 80 patients), akin to our study which included 20 studies. Except for one study, all patients were positioned prone for optimal access. Open procedures comprised a combination of retrocalcaneal bursectomy, calcaneal ostectomy or resection using osteotomes or burrs, and Achilles tendon debridement, decompression, and/or reattachment as required. While some studies included reinforcement of the Achilles tendon repair (4 studies), others did not (6 studies). All 7 studies investigating endoscopic techniques employed standard posterior ankle portals. Patients were positioned prone in 5 studies and supine in 2 studies. These procedures encompassed bursectomy, bone resection, and Achilles tendon debridement, with none of the studies involving reinforcement of the Achilles tendon repair.

Table 2 Characteristics of included studies

Author, year	Ref	Type	Sample size	Approach	Position	Surgical steps			
						Bursectomy	Calcaneal resection	AT debridement and decompression	AT repair
Yasin, 2021	[13]	Open	27	Midline	Prone	Yes	Yes	Yes	Yes
Pi, 2021	[14]	Open	20	Lateral	Prone	Yes	Yes	Yes	NR
Cusumano, 2021	[15]	Open	28	Medial	Prone	Yes	Yes	NR	Yes
Ge, 2020	[16]	Open	32	Lateral	NR	NR	Yes	NR	NR
Xia, 2017	[17]	Open	22	Midline	Prone	Yes	Yes	Yes	Yes
Natarajan, 2015	[18]	Open	46	Lateral	NR	NR	Yes	NR	NR
Anderson, 2008	[19]	Open	35	Lateral	Prone	NR	Yes	Yes	NR
Anderson, 2008		Open	31	Midline	Prone	Yes	Yes	Yes	Yes
Leitze, 2003	[20]	Open	17	Medial and Lateral	Supine	NR	Yes	NR	NR
Schneider, 2000	[21]	Open	49	Lateral	Prone	Yes	Yes	Yes	NR
Pi, 2021	[14]	Endo	27	Portals	NR	Yes	Yes	Yes	NR
Cusumano, 2021	[15]	Endo	26	Portals	Prone	Yes	Yes	NR	NR
Kaynak, 2013	[22]	Endo	30	Portals	Prone	Yes	Yes	NR	NR
Wu, 2012	[23]	Endo	25	Portals	Prone	Yes	Yes	Yes	NR
Kondreddi, 2012	[24]	Endo	25	Portals	Prone	Yes	Yes	Yes	NR
Ortmann, 2007	[25]	Endo	32	Portals	Supine	Yes	Yes	Yes	NR
Leitze, 2003	[20]	Endo	33	Portals	Supine	Yes	Yes	Yes	NR

AT, Achilles tendon; Endo, endoscopic approach; NR, not reported; Ref, references.

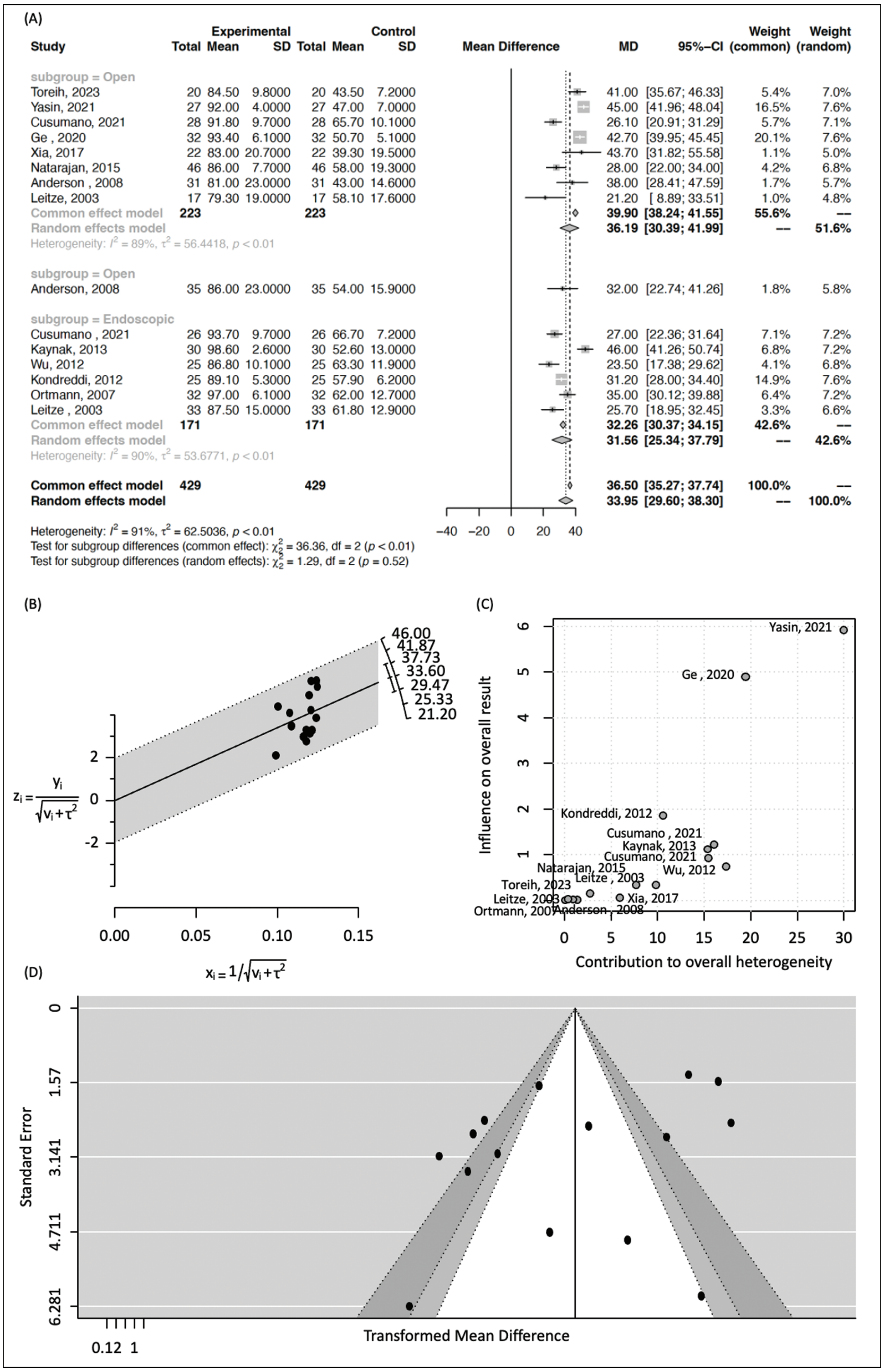
Comparative analysis of functional improvement following surgical procedures for Haglund's syndrome

The analysis compares the functional improvement following surgical procedures for Haglund's syndrome using the AOFAS functional scores. Both open and endoscopic surgical techniques resulted in notable improvement in AOFAS functional scores from preoperative values to 1 year postoperatively. Preoperatively, the AOFAS score was 51.1 (95% CI: 45.5–56.6, I^2=93.1%) for open surgery and 60.80 (95%CI: 56.89–64.70, I^2=86.2%) for endoscopic surgery. At 12 months postoperatively, the scores increased to 87.4 (95%CI: 84.21–90.7, I^2=84%) for open surgery and 92.39 (95%CI: 88.93–95.85, I^2=94.7%) for endoscopic surgery.

Comparing preoperative to 1-year postoperative scores for both surgical procedures revealed a significant postoperative improvement, as illustrated in Fig. 7a. The mean difference in AOFAS scores, analyzed using a random-effects model, was 33.95 (95%CI: 29.60–38.30) for the overall cohorts (both open and endoscopic), signifying a notable postoperative improvement. Subgroup analysis indicated a slightly greater improvement in AOFAS scores for open surgery (36.2, 95% CI: 30.4–42.0) compared with endoscopic surgery (31.6, 95% CI: 25.3–37.8). Despite no outliers in the overall results (Fig. 7b), there was significant heterogeneity between studies (I^2=90.9%), with the studies by Ge [16] and Yasin [13] contributing significantly to this heterogeneity (Fig. 7c). Linear regression Egger's test and the funnel plot showed no evidence of significant publication bias (P=0.108) (Fig. 7d).

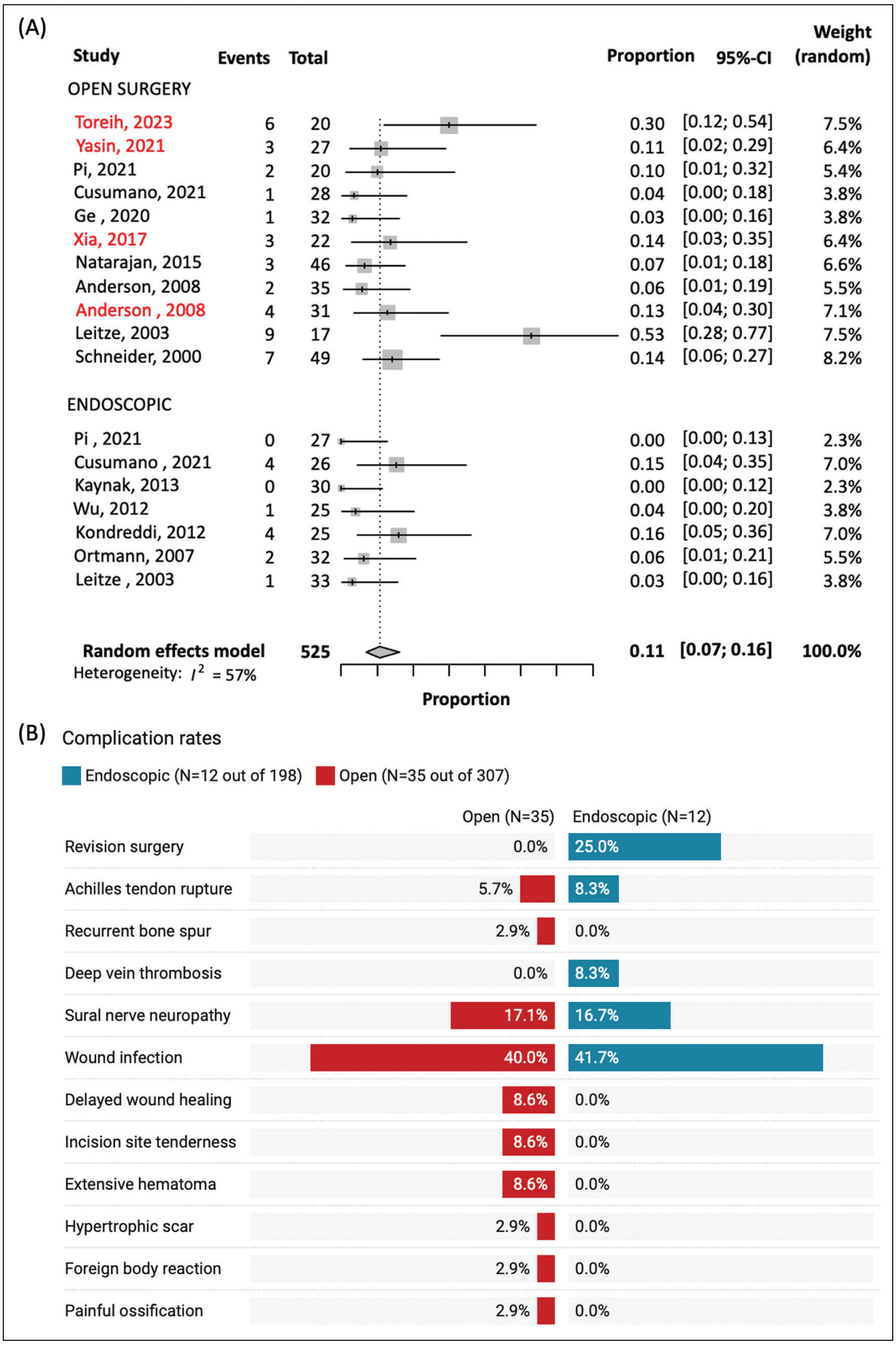
The overall postoperative complication rate for Haglund's syndrome was 10.73% (95% CI: 6.90–16.32%) (Fig. 8a). The most frequent complications were surgical site infections (40.4% of total complications), incisional numbness (17.0%), and extensive hematoma (6.4%). Open surgery had a higher complication rate of 12.96% (95% CI: 7.48–21.51%) compared with endoscopic surgery which had a rate of 8.90% (95% CI: 5.20–14.82%). The most frequent complications of open surgery were wound infection (N=14, 40% of open complications) and sural nerve neuropathy presented as heel numbness or incisional paresthesia ((N=6, 17.1%). Other less common complications included delayed wound healing (8.6%), incision site tenderness (N=3, 8.6%), extensive hematoma (N=3, 8.6%), Achilles rupture (N=2, 5.7%), recurrent bone spur (N=1, 2.9%), painful ossification (N=1, 2.9%), hypertrophic scar (N=1, 2.9%), and foreign body reaction to bone wax (N=1, 2.9%). There were no cases of revision in the open surgery group. For endoscopic surgery, the most frequent complications were surgical site infections (N=5, 41.7% of endoscopic complications) and sural nerve injury presented as neuropathy (N=2, 16.7%). Other less common complications were revision surgery (N=3, 25%), Achilles rupture (N=1, 8.3%), and deep vein thrombosis (N=1, 8.3%) (Fig. 8b).

Figure 7



Comparative analysis of American Orthopedic Foot and Ankle Society scores pre and postoperatively after one year for Haglund's syndrome. This figure presents a comprehensive analysis of American Orthopedic Foot and Ankle Society scores before and after one year of surgery. The inverse variance method and the DerSimonian-Laird estimator for tau^2 were employed via the 'metafor' R package[26]. A random effects model was used due to significant between-study heterogeneity. (A) The forest plot of the mean difference between postoperative and preoperative American Orthopedic Foot and Ankle Society scores. It illustrates the impact of each study as well as the pooled estimate for all cohorts. A subgroup analysis based on surgical approach is also included. Horizontal lines denote study confidence intervals and the diamond represents the overall estimate. (B) The radial (Galbraith) plot evaluating outliers, publication bias, and small-study effects. The scatter plot shows the ratio of each study's effect estimate to its standard error plotted against the reciprocal standard error. No studies fall outside the confidence bands, indicating no outliers. (C) The Baujat plot identifying studies contributing the most to heterogeneity and overall treatment effect. The x-axis represents each study's contribution to heterogeneity and the y-axis represents influence on the overall effect. (D) The funnel plot of individual study effects versus precision. The symmetrical inverted funnel shape indicates an absence of publication bias, which was confirmed by Egger's linear regression test. In summary, this analysis demonstrates significant improvement in American Orthopedic Foot and Ankle Society scores 1 year after surgery using both techniques. Some between-study heterogeneity exists but no evidence of publication bias was found.

Figure 8



Postoperative complications. (A) A one-arm meta-analysis forest plot illustrates the pooled proportions of complications for both surgical techniques using a random effects model, incorporating the current study. Three of these studies, highlighted in red, employed a reinforcement technique similar to our study. (B) Types of complications across studies. The frequency of each complication are compared between open and endoscopic surgical techniques. Details on meta-analytical method: The inverse variance method with restricted maximum-likelihood estimator for tau^2 was used. Clopper-Pearson confidence interval was employed for individual studies and a continuity correction of 0.5 was applied in studies with zero cell frequencies.

Subgroup analysis for open surgery with and without tendon reinforcement

An important finding from our meta-analysis was that open surgical procedures utilizing Achilles tendon reinforcement demonstrated greater functional improvement based on AOFAS scores compared with open surgery without reinforcement. In the subgroup of studies employing tendon reinforcement, the mean increase in AOFAS scores from preoperative to 12 months postoperative was 43.6 (95% CI 41.0–46.1). This was significantly higher than the mean AOFAS score increase of 30.6 (95% CI 21.3–39.7) in the subgroup without reinforcement (*P*<0.001) (Fig. 9). This indicates the significant added benefit of tendon augmentation in enhancing functionality after bone resection.

Our study showed that full weight-bearing with crutches was achievable by 2 weeks when Achilles tendon reinforcement was performed. This contrasts sharply with the traditional non-weight-bearing period of 6 weeks after open surgery without augmentation. Although three other studies utilized reinforcement, earlier weight-bearing was not specifically noted. Of note, open procedures utilizing Achilles tendon reinforcement [13,17,19] demonstrated a complication rate of 16.98% (95% CI: 10.60–26.07%). However, this rate overlapped substantially with open surgery without reinforcement, which had a rate of 10.51% (95% CI: 4.33–23.37%).Although the complication rate appears higher for open surgery with reinforcement, it is important to note that apart from one case of traumatic Achilles rupture, all other complications in this subgroup were minor. These included surgical site infection, delayed wound healing, and incisional numbness.

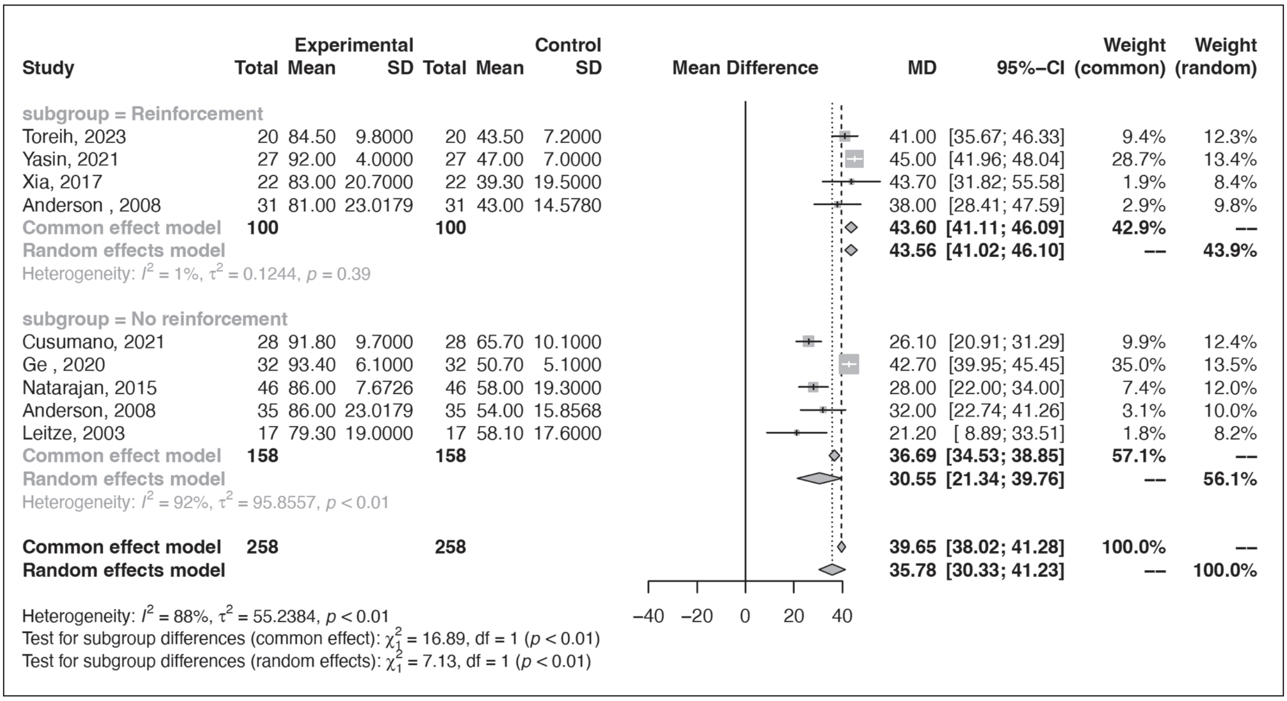
Discussion

Haglund's deformity is a prevalent cause of recalcitrant posterior heel pain often requiring surgery when conservative measures fail. Traditional resection techniques yield variable outcomes including persistent symptoms, Achilles instability, and recurrence [15,20,25]. Our study demonstrates that combining surgical resection with Achilles tendon reinforcement enables notable functional gains, accelerated rehabilitation, and low morbidity.

At 6 and 12 months postoperatively, AOFAS hindfoot scores of our cohort rose significantly from 43.5 preoperatively to 79.0 and 84.5, respectively. This magnitude of improvement is consistent with studies utilizing conventional open [15,16] and endoscopic techniques [22,25]. Our comparative analysis confirmed Achilles reinforcement with the synergistic effect of combining bone resection with soft tissue reinforcement confers significantly greater AOFAS score increases (43.6 points) versus non-augmented bone resection alone (30.6 points). Interestingly, there was no significant difference in AOFAS score change over time between males and females, affirming the overall efficacy of the surgical intervention for all patients, regardless of gender.

Our patients achieved full weight-bearing with crutches by just 2 weeks, contrasting sharply with the traditional 6–8-week protected period advocated after surgery for Haglund's deformity when no reinforcement is performed [16,18]. Our comprehensive perspective review showed that the overall postoperative complication rate for Haglund's syndrome was 10.73% across studies. Open surgery had a slightly higher complication rate of 12.96%

Figure 9



Comparative Analysis of Ankle Functional Improvement in Open Surgery With and Without Achilles Tendon Reinforcement. This analysis utilized the inverse variance method for data pooling, the DerSimonian-Laird estimator for tau², the Jackson method for confidence intervals of tau^2 and tau, and Hedges' g for bias-corrected standardized mean difference using exact formulae.

compared with endoscopic surgery which had a rate of 8.90%, with insignificant difference between those with and without tendon reinforcement. In the reinforced open surgery cohorts including ours, all complications were minor, mostly superficial infections and sural neuropathy. Apart from one case with traumatic tendon rupture [19], all other complications were minor, including superficial infections and sural neuropathy [13,17]. There were no re-ruptures, deep infections, or wound issues. This favorable safety profile indicates suture anchor augmentation does not increase morbidity versus standard debridement. In contrary, they demonstrated higher foot and ankle functionality score.

Limitations include the small sample size and lack of a control group due to resources shortage. The results of follow-up duration were limited to 12 months, and some complications may manifest later. Despite these limitations, it's worth noting that the initial results of this study are promising. The surgical approach of combining Haglund lesion resection with Achilles tendon reinforcement demonstrated advantages such as early weight-bearing, significant functional improvements, and a low rate of complications within the 12-month follow-up period. However, future research with larger sample sizes, longer follow-up periods, and control groups would be valuable for a more comprehensive assessment of this surgical intervention's effectiveness.

Conclusion

In conclusion, surgical resection combined with Achilles reinforcement effectively managed calcifying insertional tendinopathy in Haglund's deformity, allowing remarkably early rehabilitation while significantly improving function. This reinforced strategy addresses both osseous and tendinous abnormalities, optimizing recovery. Further randomized trials with longer follow-up are warranted to substantiate these benefits.

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Conflicts of interest

The authors declare no conflict of interest.

Ethical approval by the institutional review board (IRB) of the participating institution (5287#).

Efficacy of Surgical Resection with Achilles Tendon Reinforcement for Painful Haglund Lesions: A Prospective Study.

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