

Original Research Article

Clinical and functional outcomes of the double-row suture anchor technique in the surgical treatment of Haglund syndrome: a prospective observational study

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Received: 12 September 2026

Revised: 23 October 2026

Accepted: 26 October 2026

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ABSTRACT

Background: Haglund syndrome comprises a prominent posterosuperior calcaneal tuberosity, retrocalcaneal bursitis and insertional Achilles tendinopathy. Single-row suture anchor repair, with partial tendon detachment, risks incomplete decompression, recurrence and prolonged protected weight-bearing. Double-row fixation permits complete detachment, thorough debridement and stronger footprint repair; evidence in Haglund syndrome is limited.

Methods: Thirty consecutive patients with Haglund syndrome unresponsive to ≥ 6 months of conservative treatment underwent exostectomy, bursectomy, Achilles debridement and double-row suture anchor reattachment via a central tendon-splitting approach (March 2022–September 2023). AOFAS, hindfoot functional score (HFS), VAS and VISA-A scores were recorded preoperatively and up to 12 months; Arner–Lindholm criteria were applied at final review. Paired t-tests were used ($p < 0.05$).

Results: Mean age was 36.33 ± 6.19 years (60% male); mean follow-up was 29.97 ± 4.99 months. AOFAS improved from 57.47 ± 3.18 to 86.63 ± 5.66 at 12 months, HFS from 51.70 ± 1.66 to 87.53 ± 2.37 and VISA-A from 51.00 ± 3.12 to 87.40 ± 3.50 , while VAS fell from 8.13 ± 0.77 to 2.27 ± 0.45 at 6 months (all $p < 0.001$). Arner–Lindholm outcomes were excellent in 14 (46.7%), good in 11 (36.7%) and poor in 5 (16.7%). Recurrence occurred in 5 (16.7%) and residual heel pain in 6 (20%); there were no wound complications, infections or tendon ruptures.

Conclusions: Double-row suture anchor repair via a central tendon-splitting approach produced significant, sustained improvement in pain and function without wound complications or tendon avulsion, allowing earlier mobilisation. Randomised trials against single-row fixation are needed.

Keywords: Haglund syndrome, Double-row suture anchor, Insertional achilles tendinopathy, Retrocalcaneal bursitis, Central tendon-splitting approach, AOFAS, VISA-A

INTRODUCTION

In 1928 the Swedish orthopaedic surgeon Patrick Haglund described posterior heel pain arising from a prominent posterosuperior corner of the calcaneus, aggravated by rigid low-backed shoes.¹ The eponymous condition has since acquired numerous descriptive names pump bump,

retrocalcaneal exostosis, knobby heel, winter heel reflecting both its characteristic appearance and its association with footwear.^{2,3} Haglund syndrome is now understood as a triad of an enlarged posterosuperior calcaneal prominence, retrocalcaneal bursitis and insertional Achilles tendinopathy, frequently accompanied by inflammation of the superficial pre-tendinous bursa.³⁻⁵

Two bursae lie in the posterior heel. The superficial tendo-Achilles bursa lies subcutaneously over the tendon insertion and is present in approximately half of individuals, whereas the retrocalcaneal bursa is constant and interposed between the smooth posterosuperior surface of the calcaneus and the anterior aspect of the Achilles tendon.⁶ Mechanical impingement of this bursa and of the tendon against the bony prominence produces the pain, swelling and tenderness that characterise the syndrome, and chronic impingement may lead to intratendinous degeneration, calcification and, rarely, acute rupture under sudden reverse tension.^{6,7}

The aetiology is largely idiopathic, although a cavus foot with an increased calcaneal pitch tilts the tuberosity posteriorly toward the tendon and predisposes to impingement; a tight gastrocnemius complex, excessive running and rigid heel counters are recognised contributory factors.^{3,8} Initial management is conservative and comprises footwear modification, heel lifts and cushioning, activity modification, eccentric stretching, physiotherapy and non-steroidal anti-inflammatory drugs. Peribursal corticosteroid injection may be used in resistant cases, although intratendinous injection risks tendon weakening and rupture and is avoided.⁹ Conservative treatment is nonetheless associated with a substantial rate of persistent or recurrent symptoms, and patients failing six months of non-operative care are generally considered for surgery.¹⁰⁻¹²

A wide variety of operations has been described, including open lateral or medial exostectomy, dorsally based closing-wedge calcaneal osteotomy and endoscopic calcaneoplasty.¹³⁻¹⁷ It is well recognised that inadequate decompression predisposes to recurrence whereas over-resection risks avulsion of the Achilles insertion, and radiographic confirmation of the adequacy of resection is therefore essential.¹¹⁻¹²

Until approximately 2010 the standard reconstructive technique detached only 50–70% of the Achilles insertion, excised the calcified and inflamed tissue, and reattached the tendon with a single suture anchor. This single-row repair preserved tendon continuity but limited exposure, and its results were not consistently satisfactory: recurrence, Achilles instability and residual heel pain were reported, and the relatively weak construct mandated prolonged immobilisation with delayed mobilisation for up to three months.¹²⁻¹⁵

The double-row suture anchor construct, adapted from rotator cuff surgery, restores a broader tendon-to-bone footprint and provides greater fixation strength. It permits complete detachment of the insertion, and therefore unimpeded excision of the prominence and complete debridement of diseased tendon, while still allowing secure repair. Combined with a central tendon-splitting approach, which affords direct access to all pathological structures through a single incision while avoiding the sural nerve, it offers a theoretically attractive solution to

the shortcomings of single-row repair.^{18,19} Published experience in Haglund syndrome, however, remains limited. The present study was undertaken to evaluate the clinical and functional outcomes, safety and rehabilitation profile of the double-row suture anchor technique in patients with Haglund syndrome.

METHODS

Study design and setting

This prospective observational study was conducted tertiary care hospital, over an eighteen-month, with subsequent follow-up. Ethical approval was granted by the Institutional Ethics Committee and written informed consent was obtained from every participant. Participants were informed of their right to withdraw at any time without prejudice to their clinical care, and confidentiality was maintained throughout.

Sample size

A convenience sampling strategy was adopted in view of time and feasibility constraints. Using G*Power software with a two-tailed hypothesis, an alpha of 0.05, a moderate effect size of 0.75 and 80% powers, the required sample size was calculated as 26. This was increased to 30 to allow for attrition and to improve the robustness of the estimates.

Participants

Consecutive patients of either sex presenting with symptomatic Haglund syndrome that had failed conservative management were screened. Inclusion criteria were: a clinical and radiological diagnosis of Haglund syndrome; surgical treatment by the double-row suture anchor technique; availability of preoperative and postoperative radiographs and a preoperative magnetic resonance imaging study; and a minimum follow-up of 12 months.

Exclusion criteria were: long-standing chronic injury of the hindfoot; inflammatory arthropathy such as rheumatoid arthritis; fracture or other coexisting disorder of the foot and ankle; and comorbidity likely to increase surgical risk, including diabetes mellitus, severe cardiac disease, morbid obesity and peripheral vascular disease.

Preoperative assessment

All patients underwent a detailed history including symptom duration, aggravating factors, footwear history and previous treatment, followed by systemic and local clinical examination with a full neurovascular assessment. Imaging comprised weight-bearing lateral radiographs of the ankle and hindfoot, ultrasonography and magnetic resonance imaging; computed tomography was obtained where additional bony detail was required. The diagnosis was established on the combination of clinical findings and imaging.

Surgical technique

Surgery was performed under spinal or general anaesthesia with the patient prone and a thigh tourniquet inflated after exsanguination. A posterior paramedian longitudinal incision was made over the Achilles tendon and the paratenon incised. The tendon was split centrally in line with its fibres to expose the posterosuperior calcaneal prominence, the retrocalcaneal bursa and the insertional footprint.

The inflamed retrocalcaneal bursa was excised and the degenerate, scarred and calcified portions of the tendon were debrided. The Achilles insertion was then completely detached to allow unimpeded access. The first (antero-proximal) row of suture anchors was inserted at the proximal margin of the calcaneal insertion, and the detached tendon was captured with a Krackow locking suture using four passes. The size of the posterosuperior prominence was reassessed and an impaction test performed to confirm impingement, after which the prominence was resected with an osteotome and the cut surface smoothed with a rasp until no contact with the tendon occurred on maximal dorsiflexion. Adequacy of resection was confirmed with intraoperative fluoroscopy.

The second (posterodistal) row of knotless anchors was then inserted at the distal margin of the resection surface, and the limbs of the proximal-row sutures were passed over the tendon and secured to compress the tendon against the prepared cancellous bed, completing the double-row bridging construct. The tourniquet was released, haemostasis secured, the paratenon repaired and the skin closed with 3-0 non-absorbable sutures. A below-knee slab was applied with the ankle in slight equinus.

Postoperative protocol

Routine perioperative antibiotics and analgesic and anti-inflammatory medication were administered. The limb was elevated and the slab retained for the first two weeks, after which sutures were removed. Because the double-row construct is mechanically stronger than a single-row repair, gentle active and active-assisted ankle range-of-motion exercises were commenced early, from approximately the tenth postoperative day, within the limits of pain. Protected partial weight-bearing in a walker boot with a heel raise was permitted from the third to sixth week, progressing to full weight-bearing in normal footwear thereafter, with graduated calf strengthening. Return to unrestricted activity and sport was permitted once strength and range of movement were symmetrical with the contralateral side.

Outcome measures and follow-up

Patients were reviewed clinically at 3 weeks, 6 weeks, 12 weeks, 4 months, 6 months and 12 months, and thereafter at annual intervals. At each visit the following instruments were recorded: the American Orthopaedic Foot and Ankle

Society (AOFAS) ankle–hindfoot scale; a hindfoot functional score (HFS); the Visual Analogue Scale (VAS) for pain; and the Victorian Institute of Sport Assessment–Achilles (VISA-A) questionnaire.^{24,25} The Arner–Lindholm criteria were applied at the latest review to classify the overall result as excellent, good or poor. Radiographs were obtained at 1, 4, 6 and 12 months, and additionally as symptoms dictated, to confirm complete excision of the prominence and to exclude recurrence.²⁶ Complications were recorded prospectively and classified as preoperative, immediate postoperative or late postoperative.

Statistical analysis

Data were entered into a Microsoft Excel spreadsheet and analysed using IBM SPSS Statistics version 26 with the assistance of the Department of Community Medicine. Normality of continuous variables was assessed with the Shapiro–Wilk test. Descriptive statistics are presented as frequencies and percentages for categorical variables and as mean $\pm$ standard deviation with range for continuous variables. Preoperative and postoperative scores were compared using Student's t-test, and categorical variables using the chi-square test. A p value of 0.05 or less was considered statistically significant.

RESULTS

Baseline characteristics

Thirty patients were enrolled and all completed the minimum follow-up. The mean age was 36.33 ± 6.19 years (range 27–48). Eighteen patients (60%) were male and twelve (40%) females. The right heel was involved in 17 patients (56.7%) and the left in 13 (43.3%). The mean duration of follow-up was 29.97 ± 4.99 months (range 25–39). Baseline characteristics are summarised in Table 1.

Functional outcome

The mean AOFAS ankle–hindfoot score improved steadily at every review point, from 57.47 ± 3.18 preoperatively to 61.33 ± 3.24 at 3 weeks, 68.75 ± 4.20 at 6 weeks, 72.49 ± 4.48 at 12 weeks, 77.83 ± 5.09 at 4 months, 80.31 ± 5.11 at 6 months and 86.63 ± 5.66 at 12 months. The improvement from baseline to final review was statistically significant ($p=0.0001$; Table 2).

The hindfoot functional score showed a parallel pattern, rising from 51.70 ± 1.66 preoperatively to 87.53 ± 2.37 at 12 months ($p=0.0001$; Table 3).

Pain

Pain scores fell progressively after the immediate postoperative period. The mean VAS was 8.13 ± 0.77 preoperatively, 7.99 ± 0.64 at 3 weeks, 6.32 ± 0.57 at 6 weeks, 4.35 ± 0.53 at 12 weeks, 2.83 ± 0.49 at 4 months and 2.27 ± 0.45 at 6 months ($p=0.0004$; Table 4). The greatest

reduction occurred between the sixth and twelfth postoperative weeks, coinciding with progression to full weight-bearing. The VISA-A score improved from 51.00 ± 3.12 preoperatively to 87.40 ± 3.50 at 6 months ($p=0.0007$; Table 5), indicating substantial recovery of tendon-specific function.

Overall outcome and complications

By the Arner–Lindholm criteria at final review the result was excellent in 14 patients (46.7%), good in 11 (36.7%)

and poor in 5 (16.7%), giving a satisfactory (excellent or good) outcome rate of 83.4%. Recurrent symptoms during the follow-up period were reported by 5 patients (16.7%) and residual heel pain by 6 (20%). Postoperative radiographs confirmed complete excision of the posterosuperior prominence in all cases. There were no wound dehiscences, superficial or deep infections, sural nerve injuries, anchor pull-outs or Achilles tendon ruptures, and no patient required revision surgery or a flexor hallucis longus transfer during the period of observation (Table 6).

Table 1: Baseline demographic and clinical characteristics (n=30).

Variables	Value
Age, years (mean $\pm$ SD)	36.33 $\pm$ 6.19
Age range, years	27–48
Male, N (%)	18 (60.0)
Female, N (%)	12 (40.0)
Right heel, N (%)	17 (56.7)
Left heel, N (%)	13 (43.3)
Follow-up, months (mean $\pm$ SD)	29.97 $\pm$ 4.99
Follow-up range, months	25–39

SD, standard deviation.

Table 2: AOFAS ankle–hindfoot score before and after surgery (n=30).

AOFAS	Preop	3 wk	6 wk	12 wk	4 mo	6 mo	12 mo
Mean	57.47	61.33	68.75	72.49	77.83	80.31	86.63
SD	3.18	3.24	4.20	4.48	5.09	5.11	5.66

Student's t-test, preoperative versus 12 months: $p=0.0001$. AOFAS, American Orthopaedic Foot and Ankle Society; SD, standard deviation; wk, weeks; mo, months.

Table 3: Hindfoot functional score (HFS) before and after surgery (n=30).

HFS	Preop	3 wk	6 wk	12 wk	4 mo	6 mo	12 mo
Mean	51.70	57.47	64.77	71.04	76.32	81.04	87.53
SD	1.66	2.22	3.18	2.26	2.36	2.34	2.37

Student's t-test, preoperative versus 12 months: $p=0.0001$. HFS, hindfoot score; SD, standard deviation.

Table 4: Visual analogue scale for pain before and after surgery (n=30).

VAS	Preop	3 wk	6 wk	12 wk	4 mo	6 mo
Mean	8.13	7.99	6.32	4.35	2.83	2.27
SD	0.77	0.64	0.57	0.53	0.49	0.45

Student's t-test, preoperative versus 6 months: $p=0.0004$. VAS, Visual Analogue Scale; SD, standard deviation.

Table 5: VISA-A score before and after surgery (n=30).

VISA-A	Preop	3 wk	6 wk	12 wk	4 mo	6 mo
Mean	51.00	63.62	70.08	73.48	82.44	87.40
SD	3.12	3.27	3.34	3.42	3.49	3.50

Student's t-test, preoperative versus 6 months: $p=0.0007$. VISA-A, Victorian Institute of Sport Assessment–Achilles; SD, standard deviation.

Table 6: Final outcome and complications (n=30).

Outcomes	N (%)
Arner–Lindholm: excellent	14 (46.7)

Continued.

Outcomes	N (%)
Arner–Lindholm: good	11 (36.7)
Arner–Lindholm: poor	5 (16.7)
Recurrent symptoms	5 (16.7)
Residual heel pain	6 (20.0)
Wound complication or infection	0 (0)
Achilles tendon rupture or avulsion	0 (0)
Sural nerve injury	0 (0)
Revision surgery	0 (0)

DISCUSSION

The principal finding of this study is that calcaneal exostectomy, retrocalcaneal bursectomy and Achilles debridement combined with double-row suture anchor reattachment through a central tendon-splitting approach produced large and statistically significant improvements in pain and function that were maintained at a mean follow-up of approximately two and a half years, without tendon avulsion, wound breakdown or infection. Non-operative treatment remains the first line of management. Shoe modification, heel lifts, cushioning, activity modification, eccentric loading and anti-inflammatory medication relieve symptoms in a proportion of patients, particularly those in whom footwear is the dominant provocative factor.^{3,4,23} When these measures fail, retrocalcaneal decompression with resection of the prominence is the accepted surgical solution; controlled studies comparing surgical techniques specifically in Haglund syndrome remain scarce.^{12,24,25}

Reported surgical options include open lateral, medial and posterior approaches, dorsal closing-wedge calcaneal osteotomy and endoscopic calcaneoplasty.^{13-17,23} Each has recognised limitations. Lateral and medial paratendinous approaches provide restricted exposure, often requiring vigorous retraction and risking incomplete debridement, and the lateral approach places the sural nerve at risk.^{19,23} Calcaneal osteotomy achieves reliable decompression but at the cost of a convalescence reported to extend from six months to two years, a source of considerable patient dissatisfaction. Endoscopic calcaneoplasty is associated with less soft-tissue morbidity and faster recovery but does not readily permit management of an extensively calcified or degenerate insertion. Schneider and co-workers reported disappointing results after open surgery and attributed failure principally to residual posterior prominence, underlining the importance of intraoperative and postoperative radiographic confirmation of resection.^{12,14-17}

The central tendon-splitting approach used in the present series addresses the exposure problem directly. Since its description for insertional Achilles tendinopathy, it has been shown to give comprehensive access to the bursa, the prominence and the whole insertional footprint through a single midline incision, while avoiding the sural nerve

laterally and preserving the tendon's blood supply better than transverse or Cincinnati-type incisions.^{18,19,26} A single posterior incision may also carry a lower risk of wound problems than paired medial and lateral incisions. In our hands the approach permitted complete visualisation of the pathology and secure anchor placement in every case.

The rationale for double-row fixation is mechanical. Single-row repair, in which 50–70% of the insertion is preserved to maintain continuity, constrains both the extent of bony resection and the completeness of tendon debridement, and reconstitutes only a narrow line of tendon-to-bone contact. The double-row construct a proximal row capturing the tendon with a Krackow suture and a distal row of knotless anchors compressing it against the prepared cancellous surface restores a broad footprint and permits complete detachment without compromising the strength of the repair. This is the feature of most practical consequence for rehabilitation: whereas single-row repairs have conventionally required immobilisation and delayed mobilisation for up to three months, our patients began protected range-of-motion exercises from approximately the tenth postoperative day and progressed to full weight-bearing by six weeks. The steep fall in VAS between the sixth and twelfth weeks, together with the absence of any anchor failure or tendon avulsion, is consistent with a construct that tolerates early loading.

The magnitude of improvement in this series compares favourably with the published literature. AOFAS scores improved by approximately 29 points and VISA-A scores by 36 points, and 83.4% of heels achieved an excellent or good result by Arner–Lindholm criteria. These figures are broadly in line with previously reported outcomes for tendon-splitting debridement and reattachment in insertional Achilles disease and for arthroscopic and open decompression of refractory retrocalcaneal bursitis.^{27,28} The recurrence rate of 16.7% and the 20% incidence of residual heel pain in the present series merit comment: both compare favourably with historical single-row cohorts, in which recurrence, tendon instability and persistent posterior pain were the principal reasons for the technique falling out of favour, but they indicate that a minority of patients remain symptomatic despite radiographically complete excision. This is consistent with the observation that symptoms in Haglund syndrome correlate more closely with Achilles calcification and the

presence of a posterior bony prominence than with any single radiographic angle, and it reinforces the principle that the decision to operate, and the assessment of the adequacy of resection, should be driven primarily by clinical findings supported by imaging rather than by angular measurement alone.²⁹

Limitations

Several limitations should be acknowledged. First, this was a single-centre, single-arm observational study without a concurrent control group treated by single-row repair or by an alternative approach, so no direct comparative inference is possible. Second, the sample size of 30, determined by feasibility, limits precision and precludes subgroup analysis.

CONCLUSION

Calcaneal spur excision, retrocalcaneal bursectomy and Achilles tendon debridement with double-row suture anchor reattachment through a central tendon-splitting approach proved effective and safe in this series, producing significant improvement in AOFAS, HFS, VAS and VISA-A scores sustained at a mean follow-up of nearly thirty months, with no tendon avulsion, infection or wound complication. Postoperative pain was well tolerated and the strength of the double-row construct permitted earlier mobilisation than is customary after single-row repair. Randomised comparative studies are needed to confirm these advantages and to refine treatment algorithms.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Hazra MK, Chakraborty A, Mukherjee AN. Clinical and functional outcomes of the double-row suture anchor technique in the surgical treatment of Haglund syndrome: a prospective observational study. *Int J Res Med Sci* 2026;14:5247-53.