

A STUDY ON THE CLINICAL AND RADIOLOGICAL CORRELATION BETWEEN POSTERIOR HEEL PAIN AND SEVERITY OF HAGLUND'S DEFORMITY

Dr. Periyannan Somasundaram¹, Dr. Venkataram. V^{2*}, Dr. Vinayagamoorthy Anandapadmanaban³

¹Resident, Department of orthopaedics, Mahatma Gandhi medical college and research institute, Sri Balaji vidyapeeth (deemed to be university), Pondicherry, 607403, India, Peri.somu@gmail.com, Orcid ID : 0009-0001-6420-8201

^{2*}Associate Professor, Department of Orthopedics, Department of orthopaedic, Mahatma Gandhi medical college and research institute, Sri Balaji vidyapeeth (deemed to be university), Pondicherry, 607403, India, venro89@gmail.com, Orcid ID - 0000-0003-1236-9350

³Associate Professor, Department of Orthopedics, Department of orthopaedic, Mahatma Gandhi medical college and research institute, Sri Balaji vidyapeeth (deemed to be university), Pondicherry, 607403, India vngmoorthy16@gmail.com, Orcid- 0009-0000-9118-4674

ABSTRACT

Haglund's deformity is often associated with posterior heel pain, and the link between the morphology of the heel and severity of the condition is not yet clear. This study evaluated the correlation between the radiologic features and the patients' symptoms and the short-term changes in symptoms. The study was a prospective observational study with 62 adults with a symptomatic Haglund's deformity. Lateral radiographs were evaluated for Böhler's angle, Fowler–Philip angle, deformity height, deformity peak angle and calcaneal pitch. A modified 5-item clinical questionnaire was used to document the clinical status at presentation and at the end of 3 months of conservative treatment. A correlation of radiographic parameters with clinical scores was attempted at every visit. Baseline correlations were weak and nonsignificant ($r = -0.128$ to -0.061 ; all $p > 0.05$). Correlations were not significant at three months ($r = -0.130$ to 0.003 ; all $p > 0.05$). Mean clinical scores increased from 29.91 ± 6.04 to 38.51 ± 5.22 , a descriptive difference of 8.60 points. There was no estimation for this observed change. In this group, there was no significant correlation between the conventional radiographic measurements and clinical status. Imaging should be used in conjunction with symptoms. Studies are needed with validated clinical outcome measures and longitudinal analysis that would allow identification of baseline morphologic predictors of clinical improvement.

KEYWORDS: Haglund's deformity; Posterior heel pain; Radiographic measurements; Achilles tendinopathy; Clinical severity

1. INTRODUCTION

Posterior heel pain is a difficult presentation since the pain can be from the insertion of the Achilles tendon, from an adjacent bursa or from the posterosuperior surface of the calcaneus. Haglund's deformity is a bony prominence of the posterosuperior calcaneus which can be associated with insertional Achilles tendinopathy and retrocalcaneal irritation. While the two are often thought of as occurring together, they do not necessarily signal the severity of pain or functional impairment due to the size of the prominence. When a clinical assessment is required, it is important to differentiate between structural morphology and symptomatic disease, and to also consider alternative diagnoses (Lughi, 2020; Hall et al. 2024).

Insertional Achilles disorders may affect walking, shoes, and exercise. Symptoms may be presented due to mechanical compression near the insertion of the tendon, loading of the tendon and individual demands. Changes in lower limb mechanics may also contribute to changes in tendon loading, but there may be a lack of generalizability of the athletic findings to all patients (Quarmby et al., 2023). As opposed to radiographs alone, current clinical advice focuses on taking a history of symptoms, a local assessment, a functional evaluation and imaging (de Vos et al., 2021; Chimenti et al., 2024). In addition, there are wider issues of clinical evaluation, with psychosocial factors and patients' perceptions of disability also influencing the way symptoms are reported (McAuliffe et al., 2022).

Lateral radiographs of the foot are still useful for evaluating the morphology of the calcaneus. These measurements, generally referred to as Böhler's angle, Fowler–Philip angle, calcaneal pitch, and dimensions or angular characteristics of the posterosuperior prominence, have been described. When landmarks and procedures are standardized, these measurements provide reproducible numerical descriptors. Other methods of identifying angles have been suggested to aid in the recognition of Haglund's morphology, and magnetic resonance imaging might provide additional data on tendon and bursal pathology (Nischal et al., 2023; Jenko et al., 2024). Additionally, magnetic resonance imaging (MRI) case descriptions demonstrate that multiple contiguous structures can be involved in a symptomatic presentation, beyond just bone involvement (Zhou et al., 2023).

The clinical significance of calcaneal measurements is not yet known. The size of deformity and insertional Achilles pathology have been investigated, and whether a stronger bony morphology is associated with worse tendon disease has been explored, but an anatomical association does not necessarily correlate with pain experienced by a single individual (Lee et al., 2023). Comparing symptomatic versus asymptomatic heels makes it clear that radiographic markers should be correlated to clinical outcomes, rather than as a given diagnosis (Nakajima, 2024). A more recent study comparing radiographic and magnetic resonance data has looked at the correlation between Haglund's deformity and insertional

tendon pathology, further emphasizing the importance of assessing both osseous and soft tissue characteristics (Tang et al., 2025).

Treatment includes shoe modifications, activity modifications, non-operative treatment and rehabilitation, and surgical options for chronic symptoms. Several surgical approaches are available for the treatment of refractory Haglund's syndrome, but the choice of which approach is preferable depends on the clinical situation and cannot be extrapolated from a single projection on a radiograph (Ge et al., 2020; Yuen et al., 2022). Notably, however, an improvement in symptoms following treatment did not prove that baseline radiographic severity forecasted outcome. Radiographic and functional associations thus must be focused on well-defined outcomes and must differentiate the severity of symptoms at baseline from subsequent clinical status.

Patient-reported outcome measures can measure pain-related disability and function; however, interpretation of the results is dependent on the patient outcome instrument and scoring process used. Transparent reporting and choosing the right outcome domains in Achilles tendinopathy research are key points, according to consensus recommendations (de Vos et al., 2024). If only a few items from a known instrument are selected, that score should be referred to as a modified version of the known instrument, not a score for the same instrument. This categorisation is crucial for understanding changes over time within clinical visits or when comparing results with published cohorts.

In this context, the aim of the present prospective observational study was to investigate the prevalence of Haglund's deformity, as judged by a standard clinical examination in adults with posterior heel pain, in a typical tertiary care clinical practice. Five lateral radiographic parameters were assessed and compared with a modified five-item VISA-A clinical score at presentation and at 3 months following conservative treatment. The study did not assume that radiological prominence was necessarily associated with symptoms or treatment response, but rather whether there were associations with structure and clinical status.

Objectives

- To describe the distribution of the five radiographic measurements in patients with Haglund's deformity who are symptomatic.
- To evaluate correlations of individual radiologic parameters with modified clinical scores at baseline and at three-month follow-up.
- To illustrate the clinical score changes after 3 months of conservative treatment.

2. MATERIALS AND METHODS

2.1. Study Design and Setting

This prospective, observational study was carried out in a single centre at the Department of Orthopaedics, Mahatma Gandhi Medical College and Research Institute, Pondicherry, India. The correlation between radiographic features of Haglund's deformity and clinical severity of posterior heel pain was examined. Assessment of clinical and radiological data was done at baseline and reassessment of the clinical outcome was done after 3 months of conservative treatment. The participants were recruited sequentially from the Orthopaedics outpatient department.

2.2. Study Population and Eligibility Criteria

There were 62 adults older than 18 years with posterior heel pain who were clinically and radiographically diagnosed with Haglund's deformity. Patients who had previously suffered from heel and foot trauma, foot and ankle surgery, calcaneal fracture, malunion or nonunion, inflammatory arthritis or corticosteroid injection near the insertion of the Achilles in the last three months were excluded. Other exclusion parameters were: inability to have standing X-rays, loss to follow-up, and surgery during the study period.

2.3. Sample Size Determination

The sample size was determined based on the descriptive data of VISA-A scores reported by Knobloch et al. (2008) in patients with Achilles tendinopathy, which were 60 ± 19 and 75 ± 22.5 , respectively. The formula used a calculation that was:

$$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 \times 2\sigma^2}{d^2}$$

With a 95% confidence level and 80% statistical power. On the basis of the originally proposed study protocol, the number of participants was calculated as 62.

2.4. Baseline Clinical Assessment

Details of demographic and pertinent clinical data were collected on a structured proforma: age, sex, body mass index, occupation, affected limb, symptom duration and characteristics of pain. The modified Victorian Institute of Sport Assessment–Achilles (VISA-A) was used to assess clinical symptoms and functional limitations. The study gave the first five questions, which measured the experience of morning stiffness, stretching the Achilles tendon or having pain when stretching, pain from walking, difficulties when descending stairs, and single-legged heel raises. The items related to athletic activity were not included. The assessments were made by a trained research assistant in either Tamil or English at baseline and at the three-month follow-up.

2.5. Radiographic Assessment

At baseline, standardised standing weight-bearing lateral X-rays of the affected foot were taken. Five radiological parameters were measured: Böhler's angle, Fowler–Philip angle, height of the Haglund's deformity, peak angle of the Haglund's deformity and the angle of the calcaneus. These were used to describe the morphology and the prominence of the calcaneus' posterosuperior surface. A calibrated digital measurement tool was used in the Picture Archiving and Communication System (PACS) for radiographic measurements. Each measurement was made by a single trained observer, and the average value was taken to minimize the variation in measurement.

2.6. Conservative Management and Follow-Up

Conservative treatment according to the institutional management protocol for Haglund's deformity was given to the participants. Management comprised activity modification, insoles or footwear modification, physiotherapist-supervised Alfredson heel-drop exercises, soft-tissue manipulation and ultrasound. NSAIDs were used if needed for 1-2 weeks. No surgical treatment, corticosteroid injections or platelet-rich plasma injections were given during the follow-up period. Three months later, clinical re-evaluation was done with the modified VISA-A questionnaire.

2.7. Study Outcomes

The main result was the correlation of the radiological measurements at baseline with the clinical scores assessing posterior heel symptoms and functional restrictions. The secondary outcome was the difference between clinical scores at baseline and at 3 months follow-up, and its correlation with the radiographic parameters. Demographic and clinical factors were also explored to see if they were related to functional improvement.

2.8. Statistical Analysis

Microsoft Excel 2019 was used to collate the data, and IBM SPSS Statistics was used for the analysis. Categorical variables were reported as frequencies and percentages, and continuous variables were reported as mean $\pm$ SD (if normally distributed) or median with interquartile range (if not normally distributed). The normality of data was checked by the Shapiro–Wilk test. Pearson's or Spearman's correlation was performed to assess the association between radiological measurements and clinical scores. Paired-samples t-test or Wilcoxon signed-rank test was used, as appropriate, for assessing differences between baseline and follow-up data. For some group comparisons, independent-samples t-tests, Mann–Whitney U tests, chi-square tests, and Fisher's exact tests were specified. The thesis protocol also included several multiple linear regression analyses to investigate the radiological predictors, adjusting for age, sex, body mass index and symptom duration. A two-tailed p-value < 0.05 was considered statistically significant.

2.9. Ethical Considerations

The study was carried out in compliance with the Declaration of Helsinki and the guidelines of the Indian Council of Medical Research for Biomedical research on human subjects. Informed written consent was secured prior to enrollment, and participants' confidentiality was ensured throughout the study. The original dissertation included ethical approval documentation.

3. RESULTS

3.1. Demographic Characteristics of the Study Population

Sixty-two patients with Haglund's deformity were studied. The majority of these, 30 (48.4%), were male, and 32 (51.6%) were female, making the sex distribution fairly even. The age distribution showed that 9 patients (14.5%) were younger than 30 years, 15 (24.2%) were aged 30–39 years, 14 (22.6%) were aged 40–49 years, and 9 (14.5%) were aged 50–59 years. Age-category data were not provided for the other 15 patients in the aggregated demographic data. The demographic characteristics are shown in Table 1.

Table 1. Demographic characteristics of patients with Haglund's deformity (N = 62)

Characteristic	Frequency (n)	Percentage (%)
Sex		
Male	30	48.4
Female	32	51.6
Age group		
Below 30 years	9	14.5
30–39 years	15	24.2
40–49 years	14	22.6
50–59 years	9	14.5
Age category not specified	15	24.2

3.2. Radiographic Characteristics of Haglund's Deformity

The radiographic parameters were five anatomical parameters: Böhler's angle, Fowler–Philip angle, Haglund's deformity height, Haglund's deformity peak angle and calcaneal pitch angle. The mean Böhler's angle was $34.57 \pm 5.79^\circ$, while the Fowler–Philip angle was $56.62 \pm 6.29^\circ$. Haglund's deformity height averaged 6.00 ± 1.12 mm, and the peak angle was $107.31 \pm 9.33^\circ$. The mean calcaneal pitch angle was $20.25 \pm 4.51^\circ$. The descriptive statistics are shown in Table 2 and Figure 1.

Table 2. Descriptive statistics of radiographic parameters (N = 62)

Radiographic parameter	Mean $\pm$ SD
Böhler's angle (°)	34.57 $\pm$ 5.79
Fowler–Philip angle (°)	56.62 $\pm$ 6.29
Haglund's deformity height (mm)	6.00 $\pm$ 1.12
Haglund's deformity peak angle (°)	107.31 $\pm$ 9.33
Calcaneal pitch angle (°)	20.25 $\pm$ 4.51

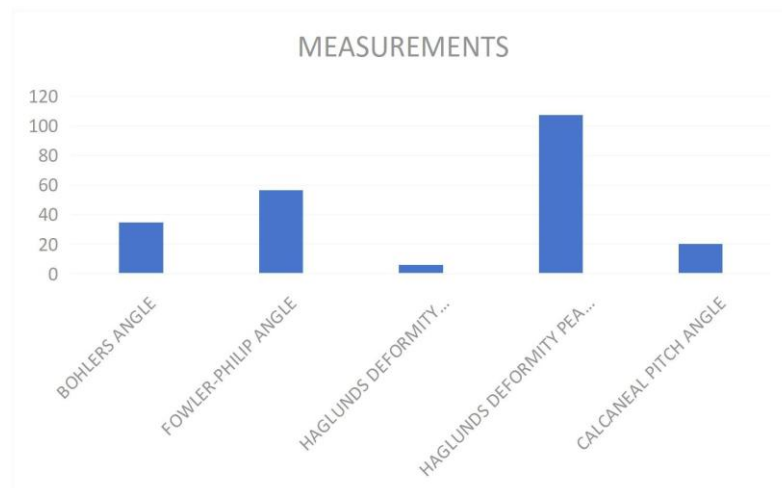


Figure 1. Distribution of baseline radiographic measurements in patients with Haglund's deformity

3.3. Clinical Outcomes at Baseline and Three-Month Follow-Up

The five-item modified Victorian Institute of Sport Assessment–Achilles (VISA-A) questionnaire was used to assess clinical symptoms. At the three-month follow-up, the mean score was 38.51 ± 5.22 , representing an 8.60-point increase from the baseline score of 29.91 ± 6.04 . The average clinical scores for the follow-up assessment were higher than those for the baseline assessment as seen in Table 3 and Figure 2. The observed increase occurred during conservative management, but no comparison group is available to rule out effect of other factors to explain the change.

Table 3. Comparison of modified VISA-A scores at baseline and three-month follow-up (N = 62)

Clinical outcome	Baseline	Three-month follow-up
Mean modified VISA-A score	29.91	38.51
Standard deviation	6.04	5.22
Mean change from baseline	—	+8.60



Figure 2. Comparison of mean modified VISA-A scores at baseline and three-month follow-up

3.4. Changes in Clinical Symptom Categories

There were 33 patients (53.2%) with mild symptoms, 24 patients (38.7%) with moderate symptoms and 3 patients (4.8%) with severe symptoms at baseline. Two patients (3.2%) were judged to be normal.

At three months' follow-up, 31 patients (50.0%) had a normal examination, 27 (43.5%) had mild symptoms, and 4 (6.5%) had moderate symptoms. There were no patients in the severe category. Table 4 shows the findings are a downward trend in the severity of the symptom categories over the observation period.

Table 4. Distribution of clinical symptom categories at baseline and three-month follow-up (N = 62)

Symptom category	Baseline, n (%)	Three months, n (%)
Normal	2 (3.2)	31 (50.0)
Mild	33 (53.2)	27 (43.5)
Moderate	24 (38.7)	4 (6.5)
Severe	3 (4.8)	0 (0.0)
Total	62 (100.0)	62 (100.0)

3.5. Correlation Between Radiographic Parameters and Baseline Clinical Scores

To analyze the correlation of radiographic characteristics with baseline clinical symptom scores, correlation analysis was used. The correlations between all five radiographic parameters and the modified VISA-A score were weak (all negative). The highest absolute correlation coefficient ($r = -0.128$, $p = 0.323$) was observed in the Fowler–Philip angle and followed by the calcaneal pitch angle ($r = -0.116$, $p = 0.370$). Haglund's deformity height ($r = -0.073$, $p = 0.573$), Böhler's angle ($r = -0.066$, $p = 0.609$), and Haglund's deformity peak angle ($r = -0.061$, $p = 0.638$) also showed weak associations. None of the correlations was statistically significant. The results are presented in Table 5, and the correlation between Böhler's angle and baseline clinical scores is shown in Figure 3.

Table 5. Correlation between radiographic parameters and baseline modified VISA-A scores (N = 62)

Radiographic parameter	Correlation coefficient (r)	p value
Böhler's angle	-0.066	0.609
Fowler–Philip angle	-0.128	0.323
Haglund's deformity height	-0.073	0.573
Haglund's deformity peak angle	-0.061	0.638
Calcaneal pitch angle	-0.116	0.370

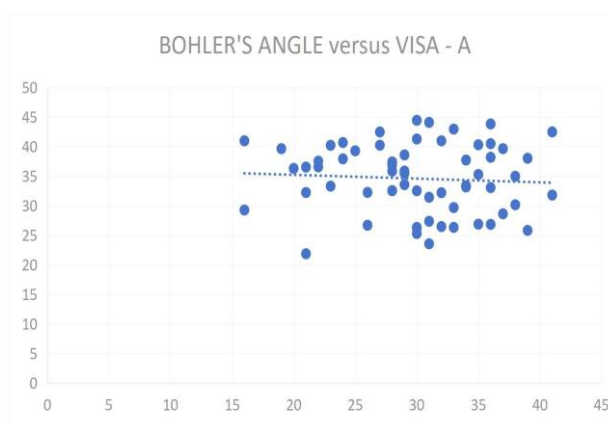


Figure 3. Scatterplot illustrating the correlation between Böhler's angle and baseline modified VISA-A scores ($r = -0.066$; $p = 0.609$)

3.6. Correlation Between Radiographic Parameters and Three-Month Clinical Scores

Correlations at three months between the baseline radiographic measurements and clinical scores were also poor. Calcaneal pitch angle exhibited the largest absolute correlation coefficient ($r = -0.130$, $p = 0.313$), followed by Böhler's angle ($r = -0.113$, $p = 0.382$) and Fowler–Philip angle ($r = -0.091$, $p = 0.483$). However, a weak negative correlation was found between Haglund's deformity height and the height ($r = -0.051$, $p = 0.693$), while an approximately zero correlation was found between Haglund's deformity peak angle and the peak angle ($r = 0.003$, $p = 0.984$). All of these relationships were non-significant. The results are summarized in Table 6 and are shown as association between Böhler's angle and follow-up clinical scores in Figure 4.

Table 6. Correlation between baseline radiographic parameters and three-month modified VISA-A scores (N = 62)

Radiographic parameter	Correlation coefficient (r)	P value
Böhler's angle	-0.113	0.382
Fowler–Philip angle	-0.091	0.483

Haglund's deformity height	-0.051	0.693
Haglund's deformity peak angle	0.003	0.984
Calcaneal pitch angle	-0.130	0.313

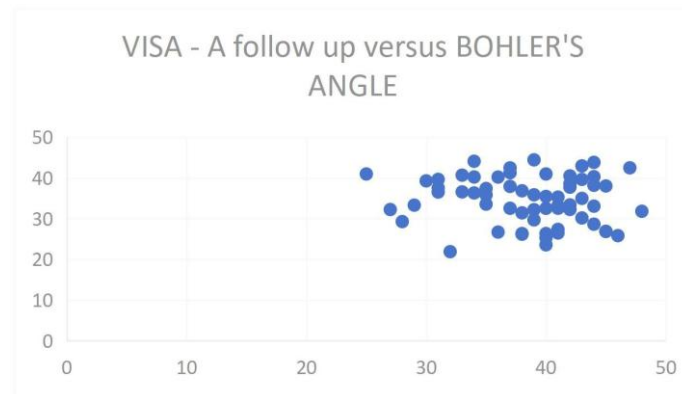


Figure 4. Scatterplot illustrating the correlation between Böhler's angle and three-month modified VISA-A scores ($r = -0.113$; $p = 0.382$)

3.7. Association Between Sex and Clinical Improvement

Improvement in the clinical condition was classified as low, moderate or high. In males, 20 (66.7%) showed moderate improvement and 10 (33.3%) showed high improvement. For female patients, there was low improvement in 1 (3.1%), moderate improvement in 20 (62.5%) and high improvement in 11 (34.4%).

The difference in improvement categories between sex was not significant ($\chi^2 = 0.984$, $p = 0.611$). Likewise, there was no significant gender difference in Böhler's angle between male and female patients ($\chi^2 = 0.186$, $p = 0.666$). The results are tabulated in Table 7.

Table 7. Association of sex with clinical improvement and Böhler's angle classification

Characteristic	Male (n = 30)	Female (n = 32)	p value
Clinical improvement category			0.611
Low	0	1	
Moderate	20	20	
High	10	11	
Böhler's angle classification			0.666
Normal	23	23	
Abnormal	7	9	

3.8. Summary of Principal Findings

Results showed that the mean VISA-A score at baseline was 29.91 ± 6.04 , which increased to 38.51 ± 5.22 after three months, and with the findings, an overall shift was observed toward less severe clinical symptom categories. At both evaluations, however, none of the five radiographic parameters had a statistically significant correlation with clinical scores. The highest absolute values of the correlation coefficients were found for the Fowler–Philip angle at baseline ($r = -0.128$) and for the calcaneal pitch angle at follow-up ($r = -0.130$). These results suggest that there were limited observed linear relationships between the radiographic parameters assessed and patient-reported clinical status among this population.

4. DISCUSSION

The Primary observation from this prospective observational study was that none of the five radiographic measurements was significantly associated with any clinical scores in 62 patients with symptomatic Haglund's deformity. Correlations with the modified five-item VISA-A score were found to be weak for Böhler's angle, Fowler–Philip angle, deformity height, deformity peak angle, and calcaneal pitch at presentation. This trend continued at 3 months, with all correlation coefficients near to zero. These results indicate that the osseous features measured were not sufficiently discriminative of clinical status in this study population, but this is not sufficient to rule out clinically important associations.

The absence of any correlation should be compared with the study reporting on the relationship between deformity dimension and outcome after endoscopic calcaneoplasty (Fathi Mahmoud et al., 2022). The lack of direct extrapolation of the postoperative associations to those treated conservatively may be due to study design, patient selection, outcome definition and intervention. The present analysis focused on the analysis of radiographic measurements versus scores obtained during each visit, not on the relationships between baseline anatomy and changes in individual scores. Thus, the results will not determine if calcaneal morphology is predictive of treatment response.

After 3 months mean modified clinical scores rose from 29.91 ± 6.04 at baseline to 38.51 ± 5.22 at 3-months (descriptive difference of 8.60 points). The proportion of the clinical categories recorded also moved toward more favorable categories.

However, in the absence of a reported paired statistical comparison, a confidence interval or untreated comparator, it is unclear how significant the improvement was, and therefore how certain it was. A systematic review of the results of treatment for insertional Achilles tendinopathy reveals a wide variety of treatments and outcomes, highlighting the need to be careful when making comparisons across studies (Jarin et al., 2021).

There was information relevant to rehabilitation in the literature, but no information that could identify what the contribution of the rehabilitation to the changes observed. The literature available about exercise-based treatment and loading strategies mainly applies to Achilles tendinopathy populations that are distinct from this group of patients (Kim et al., 2023; Maetz et al., 2023). There has also been research on sensorimotor interventions to manage pain and functional outcomes, and recent studies exploring the elimination of tendon compression during insertional rehabilitation (Kim et al., 2024; Pringels et al., 2025). Eccentric exercise evidence also contributes to conservative care, but with caution, treatment protocols and patient factors need to be considered when considering pooled findings for Haglund's deformity (Yuan et al., 2026).

Another possible nonoperative treatment is shockwave therapy. Extracorporeal shock wave therapy (ESWT) has been assessed in a systematic review of all cases of Achilles tendinopathy and in a sham-controlled trial, in cases of insertional symptoms (Stania et al., 2023; Alsulaimani et al., 2025). These studies provide information about the treatment of conditions and do not allow conclusions about the effectiveness of shockwave treatment for the particular group being studied, without specific documentation of shockwave treatment. In general, interpretation of outcomes must be focused on the instruments used. A key aspect of Achilles tendinopathy research is the use of consensus measures (Gräware Silbernagel et al., 2022). As only five VISA-A questions were used here, these scores should not be viewed as validated full-scale VISA-A scores or compared with published cut scores.

An additional view of persistent symptomatic disease is provided by the surgical literature. Functional outcomes and complications of endoscopic and open calcaneoplasty, Zadek osteotomy techniques, and modern surgical procedures have been reported in specific surgical populations (Alessio-Mazzola et al., 2021; Bakaes et al., 2024; Guedes et al., 2026). However, observational data about postoperative protocols and systematic comparisons of tendon repair configurations also reflect patients who have been treated differently from those included in this study (Kutzer et al., 2025; Ramelli et al., 2024). However, failure to improve in surgery does not necessarily indicate failure to have had a prominent radiographic defect prior to surgery or that surgical correction is indicated.

There are a variety of limitations that limit interpretation. The sample size at a single center was small and adjusted analyses for age, activity, comorbidities, and concurrent tendon pathology were not reported. Reliability of measurement in the radiographic technique was not quantified. The modified outcome instrument is not known to be equivalent to the full VISA-A scale, and the three-month follow-up makes it difficult to assess sustained recovery. In addition, the lack of significant correlations could be due to low precision rather than to real anatomical irrelevance. Further multicenter studies are needed to standardize imaging methods and validated outcomes, determine the reproducibility of measurements, and determine if baseline morphology predicts change within patients. Radiographic evaluation should support and not supplant clinical evaluation and functional assessment. Moreover, no evidence of a sex specific association was found in this sample because the sex comparisons observed were nonsignificant. These exploratory comparisons should be interpreted with care, especially because there are few participants in each category and no adjustment for potentially relevant important clinical differences between participants.

5. CONCLUSION

The aim of this prospective, observational study was to explore the association between the radiographic features of Haglund's deformity and clinical presentation of posterior heel pain in 62 patients with posterior heel pain. There were weak, non-significant correlations between Böhler's angle, Fowler-Philip angle, deformity height, deformity peak angle, and calcaneal pitch with modified five-item VISA-A scores at baseline and 3-month follow-up. When these parameters are analyzed individually, these findings suggest they were not a valid measure of symptom burden or functional status in this group. Favorable clinical category changes were made and mean modified clinical scores rose from 29.91 at presentation to 38.51 after three months of conservative treatment. This descriptive improvement, however, would not provide evidence of treatment effectiveness since neither paired inferential estimates were obtained, nor a comparison group was employed. In addition, correlations with follow-up scores should not be taken as evidence for prediction of individual improvement. The results are in favour of combining a clinical examination with radiographic assessment and patient-reported outcomes instead of just focussing on the calcaneal morphology in the evaluation of symptomatic Haglund's deformity. Limitations include the single-centre design, small sample size, short follow-up period and the modified instrument for measurement of the outcome which had not been validated. Further large prospective studies with longitudinal analyses, using standardised imaging, full validated instruments are required to clarify the prognostic relationships and to inform individual management.

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