

Angle Analysis of Haglund Syndrome and its Relationship with Osseous Variations and Achilles Tendon Calcification

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ABSTRACT

Background: Haglund syndrome is a cause of posterior heel pain. The prominent posterosuperior projection into the retrocalcaneal bursa is thought to be a major etiology. Many methods have been proposed to measure the posterosuperior projection of the tuberosity into this bursa. The Fowler angle and the parallel pitch lines are the most frequently used. However, the relation between symptomatic Haglund syndrome and the measuring methods, especially the Fowler angle and parallel pitch lines, is not clear. The purposes of this paper were to study the predictive value of the most frequently used measurement methods to evaluate bursal impingement and to determine if other osseous variations and Achilles tendon calcification are associated with the development of Haglund syndrome. **Methods:** From October, 1996, to March, 2003, we evaluated 37 heels in 31 patients with symptomatic Haglund syndrome, and 40 heels in 27 individuals without posterior heel pain. On a lateral view radiograph, the Fowler angle, and the parallel pitch lines were measured, in addition to Achilles tendon calcification and the osseous variations, such as a posterior calcaneal step spur or plantar osseous projection. **Results:** The average Fowler angles in the control group and study group were 62.31 ± 7.79 degrees and 60.14 ± 7.01 degrees, respectively. There was no statistically significant difference ($p = 0.490$). The positive parallel pitch lines in the symptomatic group were 56.8% and in the control group 42.5%. There was no statistically significant difference ($p = 0.474$) between the groups. **Conclusions:** No statistically significant differences were noted between the groups concerning the Fowler angle and parallel pitch lines. The posterior calcaneal step spur and Achilles

tendon calcification were statistically significant between these two groups. The Fowler angle and parallel pitch lines were of little predictive value for the Haglund syndrome.

Key Words: Achilles Tendon; Calcification; Fowler Angle; Haglund Syndrome; Heel Pain; Parallel Pitch Line

INTRODUCTION

Haglund syndrome is a cause of posterior heel pain. Haglund syndrome was first described by Patrick Haglund,⁷ in 1928, to occur in patients who had a prominence of the posterosuperior surface of the calcaneus and wore tight, rigid shoe counters. It occurs commonly in adolescent girls who wear high heels with restrictive heel counters and may occur in people with rheumatoid arthritis.¹⁶ Haglund syndrome has also been termed “pump bump,” “winter heel,” “knobby heels,” “calcaneal altus,” “highbrow heels,” and “cucumber heels.”^{3,9,10,12}

The anatomy of the posterior calcaneus consists of the medial calcaneal tuberosity, posterior calcaneal tuberosity, posterosuperior border or bursal projection, retrocalcaneal bursa, Achilles tendon, and superficial bursa (Figure 1, A). The bursal projection of the tuberosity arises from the posterior calcaneal tuberosity and may be hypertrophic in patients with Haglund syndrome. The prominent posterosuperior bursal projection is thought to be a major etiology. Many methods^{1,2,5,11,12,14,17} have been proposed to measure the posterosuperior bursal projection. The Fowler angle⁵ and the parallel pitch lines¹¹ are the most frequently used among these methods. In addition to the bursal projection, other calcaneal osseous variations have been proposed to be associated with Haglund syndrome, such as the posterior calcaneal step spur,⁴ hypertrophy of the plantar osseous projection,^{8,17} and Achilles tendon calcification (Figure 1, B).⁴

However, the relation between symptomatic Haglund and the measuring methods, especially the Fowler angle and parallel pitch lines, is not clear. Patients with symptomatic

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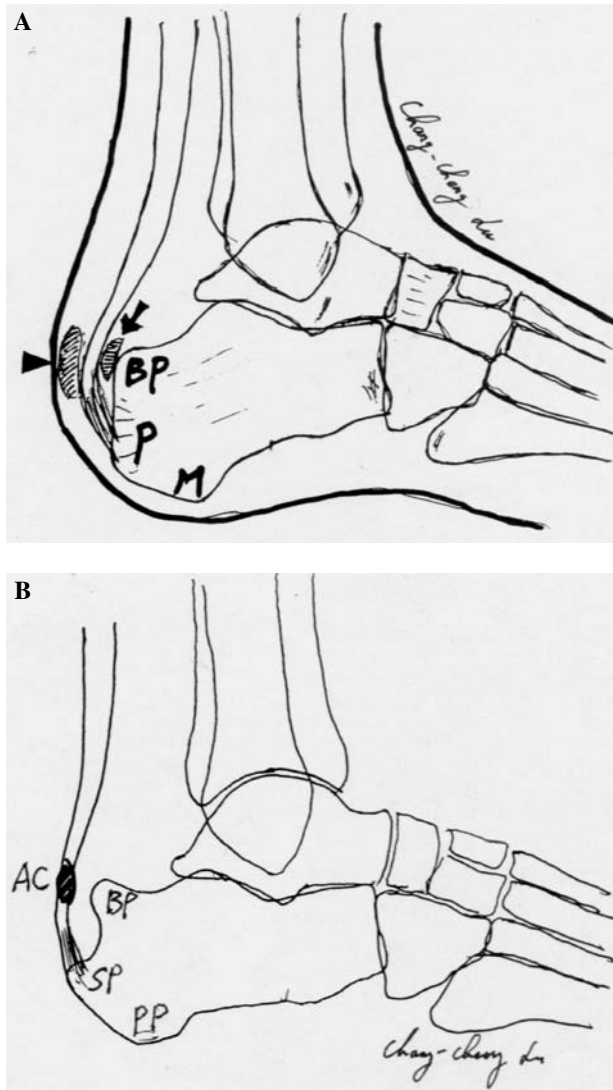


Fig. 1: A, The anatomy of the posterior calcaneus. The bursal projection (BP) is the prominence of the posterosuperior corner of the calcaneus. The posterior calcaneal tuberosity (P) is the area of the distal insertion of the Achilles tendon. The medial tuberosity (M) is the weightbearing area of the calcaneus. Also shown are the superficial subcutaneous bursa (arrow head) and the retrocalcaneal bursa (arrow). B, The variable osseous variations include the bursal projection (BP), the posterior calcaneal step spur (SP), and the hypertrophic plantar osseous projection (PP). The Achilles tendon calcification (AC) also is shown.

Haglund syndrome often do not meet the pathologic radiographic criteria, even those who need surgery. Conversely, some asymptomatic patients have a high Fowler angle on radiographs and positive parallel pitch lines. Patients with symptomatic Haglund syndrome often have Achilles tendon calcification and osseous variations. The purposes of this paper were to study the predictive value of the most frequently used measurement methods of bursal projection and to determine if there is an association of osseous variations and Achilles tendon calcification with Haglund syndrome.

MATERIALS AND METHODS

From October, 1996, to March, 2003, we evaluated 37 heels in 31 patients with symptomatic Haglund syndrome and 40 heels in 27 individuals without heel pain in Kaohsiung Medical University Hospital and Hsiao-Kang Hospital. The symptomatic group included patients who visited our clinic or were admitted for operation with posterior heel pain and swelling in the area of the Achilles tendon insertion. The control group included patients who visited our clinic for other ankle and foot problems without a history of posterior heel pain or pump bump. The study and control patient profiles are shown in Table 1.

All patients had a lateral view radiograph of the ankle taken. The Fowler angle (Figure 2, A) and the parallel pitch lines (Figure 2, B) were measured, and the Achilles tendon calcification, and osseous variations, such as a posterior calcaneal step spur and plantar osseous projection, were evaluated (Figures 1 and 2). A positive result of the parallel pitch lines is defined as the bursal projection extending beyond the parallel pitch lines. A posterior calcaneal step spur is located in the middle of the posterior surface where the Achilles tendon inserts into the calcaneus.⁴ If the medial tubercle, the point of attachment of the plantar aponeurosis and flexor retinaculum, is hypertrophic it is thought to be a plantar osseous projection.⁸ The final data were analyzed by the t-test and chi-square method.

RESULTS

The symptomatic Haglund group included 31 patients with 37 heels, and there were 12 men and 19 women; the average age was 49.7 (range 24 to 64) years. There were 14 right heels and 11 left heels, and six bilateral cases. The control group included 27 subjects with 40 heels, there were five men and 22 women; the average age was 47.7 (range 19 to 73) years. There were eight right heels and six left heels, and 13 bilateral heels.

The average Fowler angle in the symptomatic group was 62.31 ± 7.79 (44.5 to 77.9) degrees and in the control group 60.14 ± 7.01 (37.3 to 82.5) degrees. There was no significant difference between the two groups ($p = 0.490$). There were three heels in which the Fowler angle was more than 75 degrees, two heels in the symptomatic group (5.4%) and one heel (2.5%) in the control group. Therefore, 35 of 37 heels did not meet the Fowler pathologic criteria in the symptomatic group, and the false negative rate was 94.6%. The distribution of the Fowler angle in these two groups is shown in Figure 3.

The parallel pitch lines in the symptomatic group were positive in was 56.8% and in the control group in 42.5%. There was no statistically significant difference ($p = 0.474$) between the two groups. The false negative rate was 43.2% using the parallel pitch lines measurement.



Fig. 2: A, The Fowler angle (X) is defined by the intersection of a line tangential to the posterosuperior prominence of the bursal projection and another line tangential to the anterior tubercle (A) and the medial tuberosity. The normal range of the Fowler angle is between 44 to 69 degrees. **B,** The parallel pitch line is defined by the baseline tangent to the anterior tubercle and the medial tuberosity (PPL1) and a parallel line (PPL2) from the posterior lip of talar articular facet (T). It is positive or pathologic if the bursal projection of the tuberosity extends beyond the PPL2.

When evaluating posterior calcaneal step spurs, the symptomatic group was 11 times more likely than the control group to have spurs (56.8% compared to 5%, $p < 0.001$). Sixteen percent of the symptomatic group had posterior osseous projections compared to 12.5% in the control group ($p = 0.642$). Concerning Achilles tendon calcification, 78.4% of the symptomatic group and 12.5% of the control

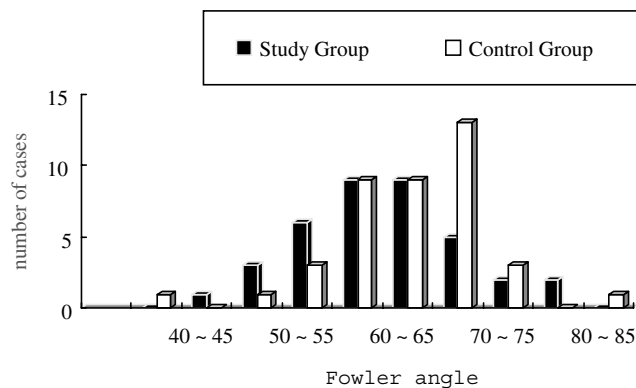


Fig. 3: The distribution of the Fowler angle in the symptomatic Haglund group (black block) and the control group (white block).

group had calcification ($p < 0.0001$). The posterior calcaneal step spur and Achilles tendon calcification were statistically significantly higher in the symptomatic Haglund group (Table 2).

DISCUSSION

Haglund syndrome is characterized clinically by thickening of the soft tissues at the Achilles tendon insertion or a painful “pump bump” and retrocalcaneal bursitis, Achilles tendinitis, and a prominent posterosuperior calcaneal border or bursal projection. The retrocalcaneal bursa is filled with 1 to 1.5-ml of synovial fluid and is situated between the calcaneus and Achilles tendon. The superficial subcutaneous bursa between the skin and Achilles tendon protects the Achilles tendon from the calcaneus and external pressures (Figure 1). Haglund syndrome is caused by mechanically-induced inflammation of the Achilles tendon and its bursa, from abnormally high pressure between the bursal projection of the calcaneus, the Achilles tendon, and the bursa. Many methods have been proposed to measure the prominence of the bursal projection of the calcaneus, such as the Fowler angle,⁵ the parallel pitch lines,¹¹ combining the calcaneal inclination angle and Fowler angle,^{12,17} the Denis and Huber-Levernieux test,² the angle of Steffensen and Evensen,¹⁴ and the CL angle.¹ The Fowler angle and parallel pitch lines are the most frequently used methods.

In the study by Fowler and Philip⁵ the normal value of the Fowler angle was 44 to 69 degrees. A high angle (more than 75 degrees) was associated with a “prow-like” projection of the posterosuperior prominence of the calcaneus and painful swelling of the soft tissues surrounding the Achilles tendon insertion. In our series, there was no significant difference ($p = 0.490$) in the symptomatic Haglund group (62.31 ± 7.79 degrees) compared with the control group (60.14 ± 7.01 degrees). In the symptomatic Haglund group, there were only two heels with a Fowler angle of more than 75 degrees, and the false negative rate was 94.6%. Our study concurs with the findings of Fiamengo et al.⁴ and

Table 1: Patient profiles of the study and control group

Patient group	Case numbers			Average age	Heel numbers			
	Male	Female	Total		Right	Left	Bilateral	Total
Study group	12	19	31	49.68 ± 10.59	14	11	6	37
Control group	5	22	27	47.67 ± 13.01	8	6	13	40

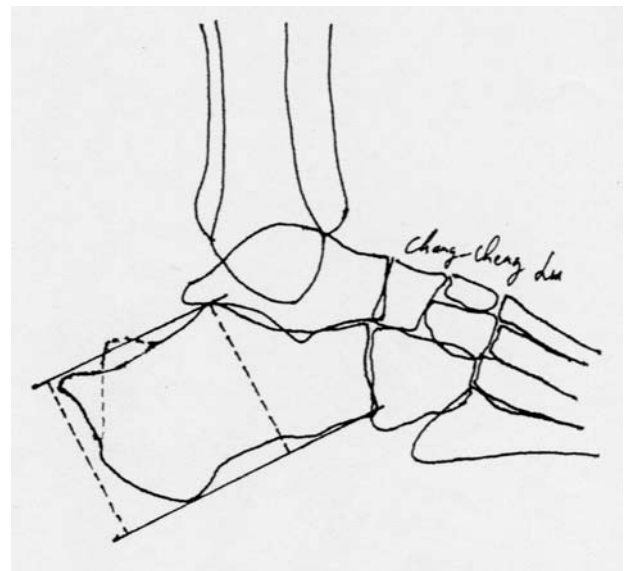
Table 2: The result of Achilles tendon calcification and the positive osseous variations rate between the study and control groups

	Average Fowler angle	Parallel pitch lines	Posterior calcaneal step	Plantar osseous projection	Achilles tendon calcification
Study group	62.31 ± 7.79°	56.8%	56.8%	16.2%	78.4%
Control group	60.14 ± 7.01°	42.5%	5%	12.5%	12.5%
<i>p</i> value	0.490	0.474	<0.0001	0.642	<0.0001

Pavlov et al.¹¹ High false-negative rates, ranging from 86% to 100%, also were found in many reports.^{6,8,12} Stephens¹⁵ stated that the Fowler angle does not reflect the relationship of the calcaneus to the sole of the foot. In a cavus foot, the bursal projection is more prominent because of a more vertical calcaneus even with a normal Fowler angle.

In our study, the difference in positive parallel pitch lines was not statistically significant ($p = 0.474$) between the two groups (56.8% compared to 42.4%). Heneghan and Pavlov⁸ and Chauveaux et al.¹ also had the same findings, with 33% and 15% false negative rates. In addition, the prominent bursal projection was hypertrophic and positioned anteriorly without any possible pathologic significance (Figure 4).

Osseous variations of the calcaneus, such as hypertrophic plantar osseous projection¹¹ and a posterior calcaneal step spur⁴ (Figure 1, B), are reported to be associated with Haglund syndrome. In our series, the posterior calcaneal step spur and Achilles tendon calcification were both statistically significantly higher in symptomatic patients than the control group (56.8% compared to 5%, $p < 0.001$) and (78.4% compared to 12.5%, $p < 0.001$), respectively. In the study by Fiamengo et al.,⁴ the occurrences of Achilles tendon calcification and posterior calcaneal step spurs were eight ($p = 0.004$) and 9.2 ($p < 0.001$) times higher in patients with chronic posterior heel pain compared to those without heel pain. Sella et al.¹³ suggested that a posterior calcaneal step, by increasing the length of the calcaneus, increases the tension on the Achilles tendon. Achilles tendon calcification is thought to be caused by the prominent bursal projection tenting the Achilles tendon with degenerative changes. In our series, the plantar osseous projection was not statistically significantly different between the two groups (16.2% compared to 12.5%, $p = 0.642$).

**Fig. 4:** The parallel pitch line may be positive while the hypertrophic bursal projection situated on the superior and very anterior position without any possible pathologic significance.

This finding was consistent with the study of Pavlov et al.¹¹

The Fowler angle and parallel pitch lines are not reliable enough to make a decision about surgery. In our study, the symptoms of Haglund syndrome were associated with Achilles tendon calcification and a posterior calcaneal step spur. It is important that the clinician diagnose and treat symptomatic posterior heel pain according to the clinical symptoms and use the radiographic measurements as only an ancillary tool.

REFERENCES

1. **Chauveaux, D; Liet, P; Le Huec, JC; Midy, D:** A new radiologic measurement for the diagnosis of Haglund's deformity. *Surg. Radiol. Anat.* **13**:39-44, 1991.
2. **Denis, A; Huber-Levernieux, C:** Les bursites du talon postérieur. In *Actualité Rhumatologique 1980* présentée au praticien. Expansion Scientifique Française, Paris p117, 1980.
3. **Dickson, PH; Coutts, MB; Woodward, EP; Handler, D:** Tendo Achilles bursitis: report of twenty-one cases. *J. Bone Joint Surg.* **48-A**: 77-81, 1966.
4. **Fiamengo, SA; Warren, RF; Marshall, JL:** Posterior heel pain associated with a calcaneal step and Achilles tendon calcification. *Clin. Orthop.* **167**:203-211, 1982.
5. **Fowler, A; Philip, JF:** Abnormality of the calcaneus as a cause of painful heel: its diagnosis and operative treatment. *Br. J. Surg.* **32**:494-498, 1945.
6. **Fuglsang, F; Torup, D:** Bursitis retrocalcanearis. *Acta Orthop. Scand.* **30**:315-323, 1961.
7. **Haglund, P:** Beitrag zur Klinik der Achillessehne. *Z. Orthop. Chir.* **49**:49-58, 1928.
8. **Heneghan, MA; Pavlov, H:** The Haglund painful heel syndrome: experimental investigation of cause and therapeutic implications. *Clin. Orthop.* **187**: 228-234, 1984.
9. **Miller, BF; Buhr, AJ:** Pump bumps or knobby heels. *Nova Scotia Med. Bull.* **48**:191, 1969.
10. **Nisbet, NW:** Tendo Achilles bursitis("winter heel"). *BMJ*, **2**:267-273, 1954.
11. **Pavlov, H; Heneghan, M; Hersh, A; Goldman, AB; Vigorita, V:** The Haglund's syndrome: initial and differential diagnosis. *Diag. Radiol.* **144**:83-88, 1982.
12. **Ruch, JA:** Haglund's disease. *J. Am. Podiatr. Assoc.* **64**:1000-1003, 1974.
13. **Sella, EJ; Caminear, DS; McLarney, EA:** Haglund's Syndrome. *J. Foot Ankle Surg.* **37**:110-114, 1998.
14. **Steffensen, JC; Evensen, A:** Bursitis retrocalcaneal Achilli. *Acta Orthop. Scand.* **27**:228-236, 1958.
15. **Stephens, MM:** Haglund's deformity and retrocalcaneal bursitis. *Orthop. Clin. North Am.* **25**:41-46, 1994.
16. **Sturgill, BC; Allan, JH:** Rheumatoid like nodules presenting as "pump bumps" in a patient without rheumatoid arthritis. *Arthritis Rheum.* **13**:175-180, 1970.
17. **Vega, MR; Cavolo, DJ; Green, RM; Cohen, RS:** Haglund's deformity. *J. Am. Podiatry Assoc.* **74**:129-135, 1984.