OUTCOMES OF SURGICAL MANAGEMENT OF HAGLUND'S TRIAD BY USING ACHILLES TENDON CENTRAL SPLITTING APPROACH ANDREATTACHING WITH SUTURE ANCHORS - A PROSPECTIVE STUDY

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KEYWORDS
Haglund's triad; central splitting approach; surgical correction.
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ABSTRACT:
Posterosuperior calcaneal prominence, also known as Haglund's deformity, can often lead to retrocalcaneal bursitis, a significant cause of posterior heel pain. Surgery is indicated for symptomatic patients, after a period of conservative treatment including analgesia, physiotherapy, activity and/or shoe wear modification has failed. Surgical options include both open and endoscopic techniques, and typically involve excision of the retrocalcaneal bursa, resection of the calcaneal prominence, and debridement of the diseased Achilles tendon.
In our study, weevaluated the outcomes of surgical management of Haglund's triad using Achilles tendoncentral splitting approach with Achilles tendon partial detachment and debridement, excision of the retrocalcaneal bursa, resection of Haglund's prominence, and reattachment of the Achilles tendon with anchor sutures. A total of 22 patients who came to OPDwere taken into the study, the surgical outcomes of whom were evaluated and postoperative followupwas done .
The VisualAnalogScale (VAS)pain score, and American Orthopaedic Foot and Ankle Society(AOFAS) Ankle-Hindfoot scale score were collected preoperatively, 6 months postoperatively and at the last visit. Significant improvement was found in the mean VAS pain score, and average AOFAS Ankle-Hindfoot scale score. The technique of excision of Haglund's lesion we used, not only provided good pain relief and functional improvement, but also enhanced thepatients' daily activity of living. More research is required to further evaluate the outcomes of our surgical approach to treat Haglund's triad and the possible risk factors.

Introduction:

Haglund's deformity, also known as Mulholland deformity, retrocalcaneal exostosis or simply, pump bump,is a posterosuperior calcaneal prominence affecting the supero-anterior bursa and the Achilles tendon,which was first described by Patrick Haglund in the year 1927[1]. Haglund's syndrome is a triad of conditions, which consists of a bony prominence on top of the heel bone (Haglund's deformity), insertional Achilles tendinopathy, in conjunction with inflammation between the Achilles tendon and the heel bone (retrocalcaneal bursitis) . Clinically, any of these pathologic entities can present as an isolated condition, but when all 3 occur together, they comprise of the Haglund's triad[2].

The anatomical location of the retrocalcaneal bursa is betweenthe posterior and superior aspects of the tuberosity of the calcaneus, and the anterior aspect of the distal Achilles tendon. Repetitive impingement of the retrocalcaneal bursa between the Achilles tendon and the calcaneal prominence can result in retrocalcaneal bursitis, which is a significant cause of posterior heel pain, characterized clinically by prominent bursal bony projection[3]. Patients afflicted with this condition typically describe pain localizing to the retrocalcaneal region[4]. Tenderness can be elicited by palpation laterally and medially to the Achilles tendon at the level of the posterosuperior border of the calcaneum, with ankle in dorsiflexion. The increased pressure between the heel and the heel contour of the shoe causes symptoms of Haglund'ssyndrome[1]. Repetitive pressure of protrusion on the superior side of the posterior calcaneus causes retrocalcaneal bursitis, which appears as inflammation and swelling between the calcaneum and the Achilles tendon[3].

This anomaly is frequently defined radiographically based on measurement of the FowlerPhilip Angle(FPA) and CalcanealPitch Angle(CPA)[5]. However, the relationship between symptomatic Haglund's syndrome and measurement methods, especially determination of FPA and CPA, remains poorly understood.

Initial treatment mostly consists of nonoperative methods, including shoe modification, heel elevation, stretching of the gastrocnemius-soleus complex, anti-inflammatory drugs, steroid injection, and shockwave therapy[6,7].A local steroid injection may lead to an increased risk of acute tear, and hence, is not recommended. Casting may be necessary for pain reduction in some cases. But sometimes, it may be difficult to treat effectively by nonoperative measures alone. Surgery is a reasonable option for patients (10%), not responding to 3–6 months of nonoperative treatment. Surgical options are posterior calcaneal osteophyte removal, excision of Haglund's deformity, limited Achilles debridement, complete debridement of the tendon insertion with bone anchor re-attachment, isolated gastrocnemius fascia release, excision of the retrocalcaneal bursa, and calcaneus osteotomy[8].Several incisions have been advocated for treatment of insertional Achilles tendinopathy, including posterior central midline, medial and/or lateral J-shaped, and transverse incisions. Traditionally, surgery of the Achilles tendon is performed through longitudinal extensile incisions.

The purpose of this study is to determine the effectiveness of the central tendon splitting approach. We believe that it provides an excellent exposure to the tendon, facilitating adequate debridement of the tendon and bursa. Concerns regarding the tendonsplitting approach include wound healing, wound breakdown, and compromisation of the integrity of the tendon with a slow return to full function and scar irritation about the heel counter.

Materials and Methods:

From March 2022 to March 2023, a total of 20 patients were managed surgically for Haglund's triad in our hospital. Patients with a history of smoking and peripheral vascular disease were excluded from the study. Informed consent was taken from all patients to participate in the study. Patients' details like age, sex, prior history of steroid injection, and medical comorbidities like diabetes mellitus (DM) and hypertension (HT) were documented. They were examined clinically to assess swelling (Fig. 1), retrocalcaneal tenderness, range of ankle movements, and gastrocnemius tightness. Preoperative radiological evaluation was done, which included a lateral radiograph of the hindfoot of both sides (Fig. 2,3,4).


Fig. 1

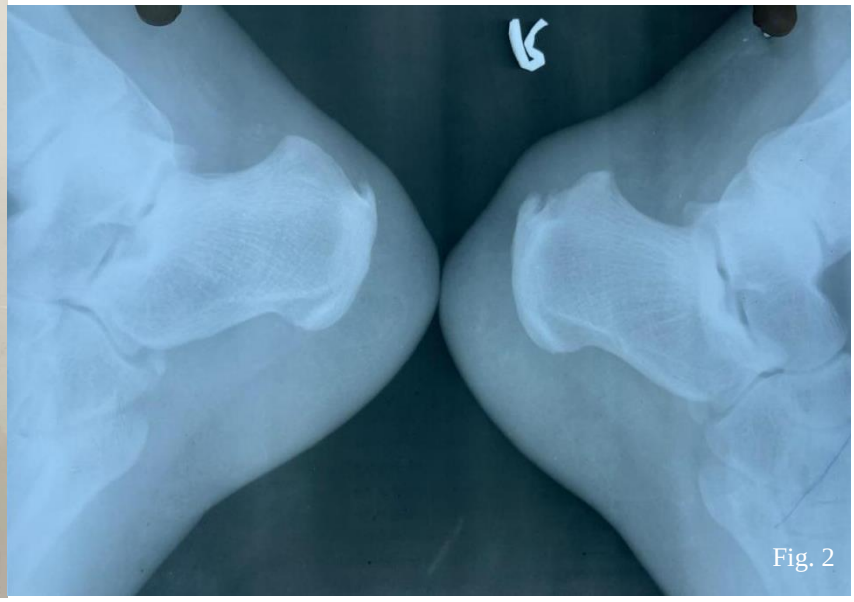
Fig. 2

Fig. 3

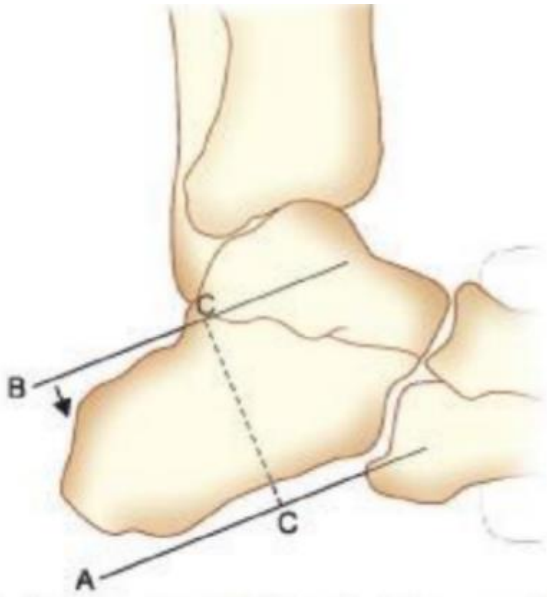

Fig. 4

Fig. 1: Haglund's deformity clinical picture; Fig. 2: Pre-operative lateral radiograph of bilateral hindfoot of one of our patient; Fig. 3: Lateral radiograph of hindfoot showing a prominent bursal projection of calcaneus (black arrow); Fig. 4: Hindfoot showing area of pathology— bursal projection of calcaneus (black arrow)

All the patients underwent surgical management using a central tendon splitting approach, with Achilles tendon partial detachment and debridement, excision of retrocalcaneal bursa, resection of Haglund's prominence, and reattachment of the Achilles tendon with suture anchors. Patients were excluded if they had experienced previous Achilles tendon rupture or had undergone any previous surgery over the same heel, or if they had undergone surgical correction of Haglund's triad with complete detachment of the Achilles tendon.

The data collected included age, gender, body mass index (BMI), types and duration of conservative management, duration of surgery, and postoperative complications. VAS score was used to measure the preoperative and postoperative subjective pain during activities, with 0 indicating no pain and 10 indicating extremely severe pain. The AOFAS Ankle-Hindfoot scale was used to evaluate the pre and postoperative functional outcomes.

Surgical technique:

All the procedures were performed under spinal anesthesia, in prone position, withutilization of a thigh tourniquet.

A longitudinal incision was made over the Achilles tendon, starting approximately 8 cm proximal to the Achilles tendon insertion and extending distally to the glabrous skin. The ankle joint was plantar flexed, and by sharp and blunt dissection, the Achilles tendon was identified. The scalpel was placed directly at the proximal end of the incision, then through the mid-line of the Achilles tendon, it was brought straight distally till the paratenon. The tendon was split centrally and partially detached along the insertion, from the midline to the lateral aspect of calcaneum, leaving as much of the tendon insertion as possible, to ensure adequate exposure for debridement of the diseased tendon and excision of the calcification. This was decided by surgeon using repetitive palpation of the tendon.

The retrocalcaneal bursa was resected to expose the superior aspect of the calcaneus and the posterior aspect of the subtalar joint,while the Haglund's prominence was excised using an oscillating saw and rongeur (Fig. 5). Care was taken to excise the overlying periosteum by sharp dissection in total, from the excised tuberosity, to avoid new bone formation later on. Sharp edges of the tuberosity were smoothened with a rasp and rongeur. In some cases, it was necessary to resect some amount of the tendon from the calcaneum for proper exposure. All areas of fibrous degeneration and calcification were then removed from the tendon with sharp dissection. Subsequently, the Achilles tendon was reattached to the posterior calcaneum using 2 suture anchors, with the foot in a plantigrade position. We used corkscrew-type suture anchors loaded with the number 2 fiberwire,

that was inserted into the posterior tubercule of the calcaneus (Fig. 6). One leg of the suture was woven up and down, with a locking loop technique forming a suture column in the Achilles tendon. The second leg was passed through the distal stump and also the distal end of the tendon, in some cases (Fig. 7). Sutures were knotted over the distal end or distal stump. The mid-line incision through the Achilles tendon was repaired with 2-0 Vicryl suture, with the knots buried in the deep aspect of the tendon, followed by paratenon repair with 2-0 Vicryl (Fig. 8). The wound was then closed using non-absorbable sutures without drain. Tourniquet was released and spirit dressing was applied. Finally, the confirmatory image was obtained to make certain that Haglund's deformity, posterior insertional osteophytes, and all tendon calcifications have been adequately removed under an image intensifier, followed by a plaster castapplication with the foot in plantigrade position.Postoperatively, plain radiographs were taken to reassess the posterior aspect of the calcaneum in slab (Fig. 9).

Fig. 5

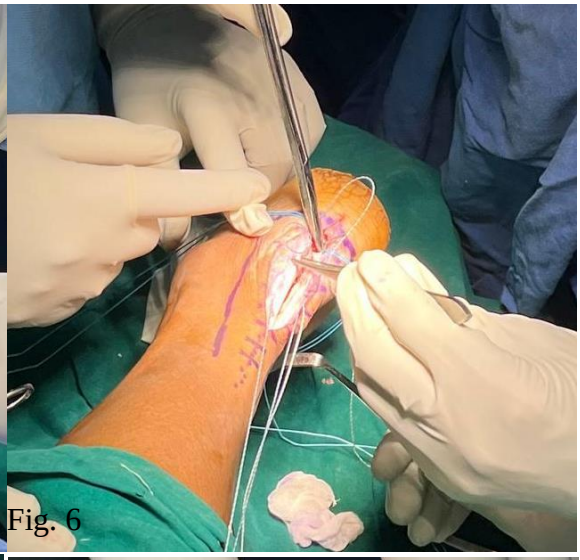

Fig. 6

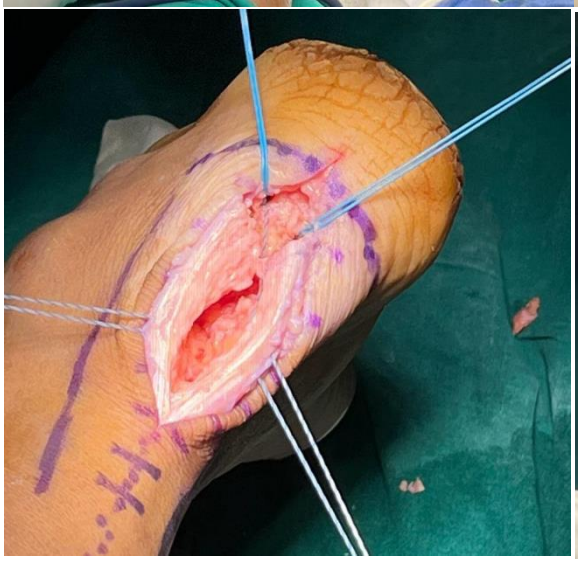

Fig. 7

Fig. 8

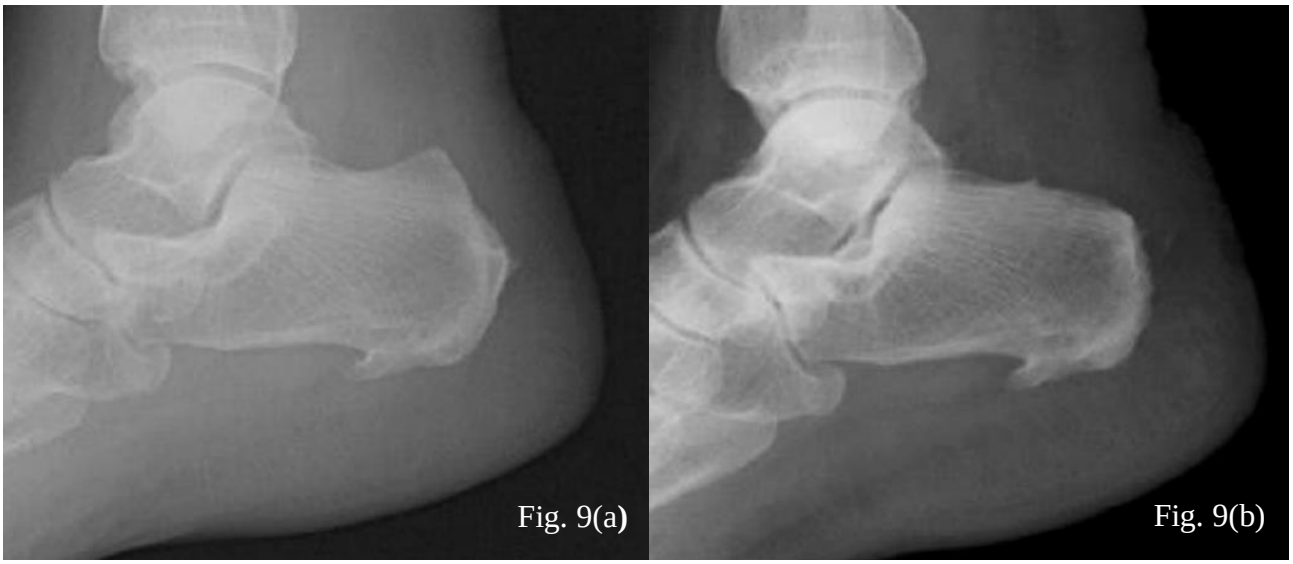

Fig. 5: Haglund's prominence excision using a rongeur; Fig. 6: Anchor with fibrewire insertion into the posterior tubercule of the calcaneus; Fig. 7: Tied first and second leg of the suture; Fig. 8: Achilles tendon repaired with the knots buried inside; Fig. 9: (a) Pre-op vs (b) post-op radiograph of one of our patient

Table 1. Patient Demographic Data

S.no.	Gender	Age (in years)	BMI (in kg/m^2)	Side	Conservative Treatment Option	Duration of Surgery (in minutes)	Follow-up duration(in months)
1.	Female	59	31.7	Left	NSAIDS	48	12
2.	Female	57	24.9	Left	RAO	35	12
3.	Male	56	29.9	Right	NSAIDS	55	18
4.	Female	48	26.4	Left	RAO	40	12
5.	Male	46	24.7	Right	PP	35	15
6.	Male	53	25.2	Right	HC	39	12
7.	Female	42	22.0	Left	NSAIDS	49	24
8.	Female	44	23.8	Right	PP	37	12
9.	Female	60	31.2	Left	PP	45	18
10.	Male	52	30.4	Left	NSAIDS	46	12
11.	Female	51	22.2	Right	HC	40	12
12.	Female	55	31.9	Right	HC	43	18
13.	Male	54	21.9	Right	NSAIDS	46	15
14.	Female	55	28.7	Left	PP	37	12
15.	Male	46	25.4	Left	RAO	45	24
16.	Male	53	29.3	Right	NSAIDS	36	18
17.	Female	40	27.0	Right	PP	53	12
18.	Male	48	27.6	Left	PP	43	12
19.	Male	43	33.0	Right	HC	56	18
20.	Male	57	27.1	Left	PP	39	18
21.	Female	44	28.5	Right	NSAIDS	39	12
22.	Female	41	28.0	Right	NSAIDS	47	12

The patients were given analgesics, enzymes, prophylactic antibiotics, limb elevation for 3 days and were discharged on the fifth postoperative day (POD). Sutures over the surgical wound were removed at POD-12 to POD-15, depending on the condition of the healing wound. Immediate post-operative rehabilitation was started as non-weight bearing walking, active toe movements, quadriceps and hamstrings strengthening. Bracing consisted of a non-weight bearing plaster cast with a window for dressing for 2 weeks postoperatively, followed by a controlled ankle motion walker boot with weight bearing as tolerated for the next 4 weeks. After removal of the controlled ankle motion walker at the sixth postoperative week, shoe wearing was allowed and rehabilitation was started. Rehabilitation consisted of Achilles tendon stretching, ankle range of motion exercises and proprioception training. Rehabilitation was continued until the patient was sufficiently trained and the functional goals had been met.

Results:

22 patients with a diagnosis of Haglund's triad underwent surgical management using central tendon splitting approach. Of the 22 patients, 12 were females (54.54%) and 10 were males (45.45%), with a mean age of 50 (range 40 to 60) years. The average BMI at surgery was 27.3 kg/m^2(range 21.9 to 34.5). Of the 22 heels, 11 were right heels (50%) and 11 were left (50%). For all patients, various modalities of conservative management, which had been conducted for 6 months, had failed preoperatively. Conservative management consisted of one of the following modalities:nonsteroidal anti-inflammatory drugs (NSAIDS), removable ankle orthotics (RAO), heel cups (HC), and professional physiotherapy (PP). The mean duration of surgery was 43.4 minutes (range 35 to 60). The mean follow-up duration was 15 months (range 12 to 24) postoperatively. The patient demographic data is summarized in **Table 1**.

The mean VAS pain score improved significantly from 7.8 preoperatively (PO) to 4.1 at 6 months postoperatively (6MFU), and 1.8at the last visit (LV) ($p<0.001$). The average AOFAS Ankle-Hindfoot scale score hadincreased significantly from 39.3 preoperatively to 67.3 at 6 months postoperatively and 83.0 at the last visit ($p<0.001$). The outcomes are summarized in **Table 2**.

The postoperative complications included 2 cases of delayed healing of the superficial wound that lasted >4 weeks but resolved with dressing changes, and 1 case of sensation loss over the heel wound area. No complications of Achilles tendon rupture, wound infection, or painful scars occurred. Of the 22 patients, 3 (13.6%) rated the overall result of their surgery as excellent, 9 (40.9%) rated it as very good, and 5 (22.7%) rated their surgical outcome as good. The overall satisfaction rate (good to excellent) for our surgical technique was 77.3% (17 of 22). An analysis of the possible risk factors associated with the clinical outcomes was performed and the 2 factors were gender and BMI. However, stratifying the patients by gender did not result in statistically significant differences. The differences in the pre and postoperative VAS pain scale or AOFAS Ankle-Hindfoot scale, were not statistically significant between females and males. We also divided the 22 patients into 2 groups according to the BMI at surgery (11 patients each with BMI >27.5 kg/m2, and BMI <27.5 kg/m2). The mean BMI for the 2 groups was 30.7 and 24.9 kg/m2, respectively . However, the differences in the preoperative and postoperative VAS pain scale or AOFAS Ankle-Hindfoot scale, between the 2 groups were not statistically significant.

The VAS pain score and AOFAS Ankle-Hindfoot scale score were prospectively collected preoperatively, 6 months postoperatively and at the last visit.

Table 2. Post-operative Outcomes

S.no	VAS Pain Score			AOFASAnkle-Hindfoot scale score		
	PO	6MFU	LV	PO	6MFU	LV
1	8	4	1	40	67	83
2	8	4	1	40	68	82
3	8	4	2	39	66	83
4	7	3	1	40	68	83
5	8	4	1	42	70	85
6	9	4	1	38	66	82
7	8	3	1	39	68	83
8	8	4	1	40	68	84
9	8	4	2	39	67	82
10	7	3	1	40	68	83
11	9	5	2	38	66	82
12	8	4	1	40	67	84
13	8	4	1	40	68	83
14	9	4	2	39	68	83
15	8	4	1	40	68	84
16	8	3	2	39	67	83
17	8	4	1	40	68	84
18	9	5	2	38	66	82
19	8	4	2	39	67	82
20	8	3	1	40	68	83
21	8	4	1	42	70	85
22	8	3	2	39	67	83

Discussion:

Usually, the Haglund's traid is idiopathic and bilateral but there are some common provoking factors, which include age, increased repetitive loading, obesity, and systemic inflammatory diseases (psoriatic arthritis, spondyloarthropathy, rheumatoid arthritis, and Reiter's disease)[9]. Other infrequent factors include genetic susceptibility, malalignment in lower limbs, corticosteroids, fluoroquinolones, protease inhibitors, inflammatory disorders, connective tissue diseases, vascular diseases, diabetes mellitus, hypertension, and hypercholesterolemia.

It usually affects the middle-aged people with an active lifestyle, including runners and athletes, with females having a higher predisposition than males. Usually, bursal inflammation is due to impingement or mechanical irritationbetween the Achilles tendon and the calcaneal tuberosity, in dorsiflexion. The clinical features consist of pain at the posterior aspect of the heel, which is predominantly present when the patient begins to walk after a period of rest or inactivity.

Diagnosis is confirmed on the lateral radiographs of the ankle, which reveals a bony projection at the posterosuperior part of the calcaneal tuberosity, calcaneal bursal swelling, and increased density in the bursa.Radiographic measurements such as Fowler's angle and parallel pitch lines are commonly used to determine the degree of prominence[5]. Ultrasound evaluation of the ankle can be used to evaluate retrocalcaneal bursitis, and Achilles tendon degeneration and calcifications. Magnetic resonance imaging (MRI) may be required for doubtful cases.Most patients will have a gastrocnemius contracture on examination.

Conservative management is recommended as the first-line treatment for Haglund's disease. This includes usage of nonsteroidal anti-inflammatory medications, rest, leg elevation, cold packs, shoe wear modifications (avoidance of tight shoes or those with rigid heel counter, and usage of paddings), and physiotherapy (stretching and strengthening of gastrocnemius and soleus, eccentric tendo-Achilles exercise, extracorporeal shock wave therapy), which lead to the resolution of symptoms in most patients. A local steroid injection may lead to an increased risk of an acute tear andhence, is not recommended. Casting may be necessary for pain reduction in some cases. But sometimes, it may be difficult to treat effectively by nonoperative measures alone.

For patients who do not respond to non-operative treatment, there are surgical options. The results of surgical treatment have been varied and inconsistent, as to when surgery is indicated and what procedures result in optimal clinical outcomes. Reported studies have described various surgical procedures to address the components of Haglund's triad. To address the 3 components, surgical management has involved debridement of the degenerative and calcific areas of Achilles tendon, excision of the inflamed retrocalcaneal bursa, and

resection of Haglund's prominence. Surgery can be accomplished using an endoscopic or open approach. The endoscopic approach results in difficulty in addressing the debridement of degenerative tissue and calcification from the Achilles tendon and requires a long learning curve[10]. Kondreddi et al reported that post-endoscopic resection patients with IAT had significantly inferior results compared with those with isolated retrocalcaneal bursitis[11]. Thus, an open approach has usually been used for surgical treatment of Haglund's triad. The use of open approach isdetermined by the posterior heel pathologic findings and surgeon preference. Open approaches can be performed with a longitudinal incision such as posteromedial, posterolateral, or central tendon-splitting incisions, a J-shaped incision, a transverse incision, or a combination of posteromedial and posterolateral incisions[8].

In our case series, we have used the central tendon-splitting approach. This was first described by McGarvey et alfor insertional Achilles tendinosis in 2002[12].This approach has the advantage of excellent visualization, allowing surgeons to treat all elements of posterior heel pathologic features without unnecessary damage to the uninvolved medial or lateral edges of the Achilles tendon. McGarvey et al found that 95% of their surgical patients had central involvement of the Achilles tendon and only 14% had additional or separate isolated diseased tissue laterally. This approach also avoids the risk of sural nerve injury and minimizes vascular compromise of the Achilles tendon. In addition, this approach allows surgeons to treat intratendinous lesions or perform simultaneous tendon release. Anderson et al observed that patients in the central tendonsplitting approach group returned to normal function earlier than those in the posterolateral approach group[13]. The primary concern with this approach is the presence of a painful scar, because the wound can be irritated by shoe wear. However, no painful scar was observed in our study. Another disadvantage of this approach is that the skin and subcutaneous tissues are placed under substantial tension after closure, which could have negative effects on wound healing. Various postoperative complications have been reported after a central tendonsplitting approach[8,12,13]. McAlister and Hyer reviewed the largest case series to date with 98 patients (100 heels)[14]. Of these patients, 4% had rupture or avulsion of the Achilles tendon insertion and 2% had recurrent pain and tendinitis.

It has been demonstrated that excision of the retrocalcaneal bursa, adequate debridement of the diseased Achilles tendon, and resection of Haglund's prominence will improve patients' symptoms and function[15]. To adequately debride the tendon and excise the bony prominence, detachment of the Achilles tendon seems unavoidable, which can be performed either partially or completely. It is a common concern that more the tendon that is detached, greater be the risk of complete rupture. Currently, no consensus has been reached among surgeons regarding the amount of Achilles tendon detachment that is essential for adequate debridement but minimizes the risk of rupture. A biomechanical study by Kolodziej et al showed that Achilles tendons can be detached by 50% without fear of rupture in cadaveric samples[16]. Calder and Saxby evaluated the risk of tendon rupture after insertional Achilles tendon surgery and found that in a follow-up period of 26 months postoperatively, none of the patients experienced Achilles tendon rupture[17].

Additionally, the loss of plantarflexion strength was minimized by preserving as much of tendon insertion as possible and reattaching the tendon with suture anchors, although this parameter was not evaluated in our study. One strength of our study was the assessment of possible risk factors on the clinical outcomes. In the published data, the risk factors that can affect the outcomes of surgical treatment of Achilles tendon pathologic features or Haglund's deformity have also been discussed. McGarvey et al concluded that the central surgical approach to insertional Achilles tendinosis should not be offered to patients >50 years old[12]. However, this conclusion was not supported by the study by Johnson et al[18]. Highlander and Greenhagen reported that gender might be a risk factor for wound complications. In our case series, both gender and BMI were evaluated for their effects on the outcomes of surgical treatment as assessed using the VAS pain score and AOFAS Ankle-Hindfoot scale score. Neither gender nor BMI were found to be statistically significant factors. Thus, it seems that gender and BMI do not affect the outcomes of surgery for Haglund's triad.

Conclusion:

The results of the present study should be interpreted in light of its limitations. First, the follow-up duration was relatively short. Previous studies have suggested that patients who undergo surgical correction of Haglund's deformity required 6 months to 2 years to fully recover[19,20]. A longer follow-up duration might be required to evaluate the maximal benefits from surgery. Second, the number of patients in our study was relatively small

owing to the strict inclusion criteria. The sample size might not have been large enough to detect any potential factors associated with surgical outcomes. Finally, this was a retrospective study from a single institution, which could have resulted in selection and observational biases. A prospective multicenter research study with a longer follow-up duration and larger sample size is required to further evaluate the outcomes of surgery to treat Haglund's triad and the possible risk factors. In conclusion, surgical correction of Haglund's triad using a central tendon-splitting approach, with Achilles tendon partial detachment and debridement, excision of the retrocalcaneal bursa, resection of Haglund's prominence, and reattachment of Achilles tendon, provides an effective treatment, providing pain relief, functional improvement, and overall enhancement of patients' health. The results of our study showed that gender and BMI do not affect the surgical outcomes.

References:

1. MRI of heel pain. Lawrence DA, Rolen MF, Morshed KA, et al. Am J Roentgenol. 2013;200:845–855. [PubMed][Google Scholar]
2. The Haglund syndrome: initial and differential diagnosis. Pavlov H, Heneghan MA, Hersh A, et al. Radiology. 1982;144:83–88. [PubMed] [Google Scholar] [Ref list]
3. Diagnosing heel pain in adults. Aldridge T. Am Fam Physician. 2004;70:332–338. [PubMed] [Google Scholar]
4. Abnormality of the calcaneus as a cause of painful heel its diagnosis and operative treatment. Fowler A, Philip JF. Br J Surg1945;32:494–8.
5. The Haglund syndrome: initial and differential diagnosis. Pavlov H, Heneghan MA, Hersh A, Goldman AB, Vigorita V. Radiology 1982;144:83–8.
6. Posterior heel pain associated with a calcaneal step and Achilles tendon calcification. Fiamengo SA, Warren RF, Marshall JL, Vigorita VT, Hersh A. Clin OrthopRelat Res 1982;203–11.
7. Achilles tendinopathy: aetiology and management. Maffulli N, Sharma P, Luscombe KL. JRSM 2004;97:472–6.
8. Surgical correction of Haglund's triad using complete detachment and reattachment of the Achilles tendon. DeVries J, Summerhays B, Guehlstorf D. J Foot Ankle Surg 48:447–451, 2009.
9. Haglund syndrome with pump bump. Kucuksen S, Karahan AY, Erol K. Med Arch. 2012;66:425–427. [PubMed] [Google Scholar]
10. Endoscopic treatment of Haglund's syndrome with a three portal technique. Wu Z, Hua Y, Li Y, Chen S. Int Orthop. 2012;36:1623–1627. [PMC freearticle][PubMed][Google Scholar]
11. Outcome of endoscopic decompression of retrocalcaneal bursitis. Vamsi Kondreddi, R Krishna Gopal, Ranjith K Yalamanchili. Indian J Orthop. 2012 Nov-Dec; 46(6): 659-663.
12. Insertional Achilles tendinosis: surgical treatment through a central tendon splitting approach. William C McGarvey, Robert C Palumbo, Donald E Baxter, Bryan D Leibman. Foot Ankle Int. 2002 Jan;23(1):19-25.
13. Surgery for Retrocalcaneal Bursitis: A Tendon-splitting versus a Lateral Approach. John A. Anderson, Eduardo Suero, Padhraig F. O'Loughlin, John G. Kennedy. Clin OrthopRelat Res. 2008 Jul; 466(7): 1678–1682.
14. Safety of achilles detachment and reat- tachment using a standard midline approach to insertional enthesophytes.McAlister JE, Hyer CF. J Foot Ankle Surg 2015 Mar-Apr;54(2):214-219.
15. Technique and results of Achilles tendon detachment and reconstruction for insertional Achilles tendinosis. Wagner E, Gould JS, Kneidel M, Fleisig GS, Fowler R. Foot Ankle Int 2006 Sep;27(9):677-684.
16. Efficacy and complications of open and minimally invasive surgery in acute Achilles tendon rupture: a prospective randomised clinical study—preliminary report. ŁukasKołodziej, Andrzej Bohatyrewicz, JustynaKromuszczyńska, Jarosław Jezierski, Maciej Biedroń. Int Orthop. 2013 Apr; 37(4): 625–629.
17. Independent evaluation of a recently described Achilles tendon repair technique. J D F Calder, T S Saxby. Foot Ankle Int. 2006 Feb;27(2):93-6.
18. Johnson KW, Zalavras C, Thordarson DB. Surgical manage- ment of insertional calcific achilles tendinosis with a central tendon splitting approach. Foot Ankle Int 2006 Apr;27(4): 245-250.
19. Nunley JA, Ruskin G, Horst F. Long-term clinical outcomes following the central incision technique for insertional Achilles tendinopathy. Foot Ankle Int 2011 Sep;32(9):850-855.
20. Greenhagen RM, Shinabarger AB, Pearson KT, Burns PR. Intermediate and long-term outcomes of the suture bridge technique for the management of insertional achillestendi- nopathy. Foot Ankle Spec 2013 Jun;6(3):185-190.