[Orthopaedics]

CEU

Heel Pain in the Athlete

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Context: Heel pain, a relatively common problem in the athlete, can present a diagnostic and therapeutic dilemma. The purpose of this article is to review treatment techniques for common causes of heel pain in the athlete.

Evidence Acquisition: Articles in the English literature through August 2008 were selected and reviewed in the context of the management of heel pain in the athlete. Clinical and surgical photographs are presented as an illustration of preferred techniques and pertinent pathologic findings.

Results: Although nonoperative treatment remains the mainstay for most painful heel pathologies, a number of surgical interventions have shown encouraging results in carefully selected patients.

Conclusions: The management of heel pain in the athlete requires diagnostic skill, appropriate imaging evaluation, and a careful, initially conservative approach to treatment. Surgical treatment can be successful in carefully selected patients.

Keywords: sports injuries; plantar fasciitis; insertional achilles tendinosis; calcaneal stress fracture

A relatively common problem in the athlete is heel pain, which can present a diagnostic and therapeutic dilemma. The complexity of the functional anatomy around the heel and plantar foot contributes to an expansive list of potential pathologies and broad implications for management and return to sport. Although nonoperative treatment remains the mainstay for most painful heel pathologies, a number of surgical interventions have shown encouraging results in carefully selected patients.

The purpose of this article is to review treatment techniques for common causes of heel pain in the athlete. The differential diagnosis for heel pain is expansive (Table 1) and beyond the scope of this review; instead, this review focuses on the most common heel-pain pathologies in the athletic population. These comprise the general groups of posterior and plantar heel pain. Posterior heel pain is typically a result of insertional disorders of the Achilles, whereas plantar heel pain is usually a product of plantar fascial disorders.

INSERTIONAL ACHILLES TENDON DISORDERS

The cause of Achilles tendinopathy has been associated with athletes who participate in impact sports, such as running and jumping.[18] It can also be brought about by overuse syndromes, poor footwear, sudden increases in training intensity, and postural problems. The symptoms can be made worse by bony impingement (ie, Haglund deformity), calcification of a diseased Achilles tendon, chronic bursitis, shoe pressure, and continued overuse. Some evidence suggests that Achilles tendonitis may represent a prerupture state, particularly if it is long-standing.[29] Athletes presenting with bilateral posterior heel pain—especially, those with signs of retrocalcaneal bursitis—should be evaluated for a rheumatologic disorder (eg, Reiter syndrome).

Retrocalcaneal Bursitis

With rectrocalcaneal bursitis,[16] patients typically complain of pain anterior to tendon near its calcaneal insertion. Examination will show a positive 2-finger squeeze test and pain with dorsiflexion and eversion. There is often localized soft tissue fullness; a bony prominence (Haglund deformity) may also be present. Radiographs are an important part of the workup for insertional Achilles disorders: They may show a Haglund deformity or cortical erosion on the posterior superior region of the tuberosity, a result of chronic inflammation from the bursitis (Figure 1).

Insertional Tendonitis/Tendinosis

Insertional tendonitis can be a spectrum of inflammation, tendinosis, and prominent bone.[29] Tendinosis more typically occurs in older athletes and is characterized by intratendinous degeneration without evidence of peritendinitis. Histology shows noninflammatory collagen degeneration with occasional local necrosis or calcification. This painful inflammatory process likely occurs secondarily and is initiated by degeneration

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Table 1. Differential diagnosis of heel pain in athletes.

Soft tissue disorders
Achilles tendonitis
Fat pad atrophy
Heel contusion
Plantar fascia rupture
Posterior tibial tendonitis
Retrocalcaneal bursitis
Abductor digiti quinti nerve entrapment
Bony disorders
Calcaneal epiphysitis (Sever disease)
Calcaneal stress fracture
Infections (osteomyelitis)
Lumbar spine disorders
Neuropathies
Tarsal tunnel syndrome
Subtalar degenerative disease
Metabolic disorders
Osteomalacia
Paget disease
Sickle cell disease
Tumors

of periosteal fibrocartilage (ie, fissuring, fragmentation, and calcification).[33] Patients report symptoms of posterior heel pain worsened by climbing stairs or hills. There is point tenderness over the posterior tendon but not the bursae. As in retrocalcaneal bursitis, there may be an inferior spur-forming bony prominence or insertional ridge. A frequent concomitant finding is an Achilles contracture (ie, tight heel cord). A sleeve avulsion may occur if the inflammatory process progresses inferiorly along the tendon, weakening or disrupting Scarpe's fibers.[5] Radiographs should be obtained to assess calcification within the tendon or at the inferior insertion (Figure 2).

Pump Bump

Pain associated with a bony enlargement arising from the posterolateral calcaneus—also known as a pump bump—has been described as a separate entity from insertional Achilles tendonitis[7] (Figure 3). With this condition, pain and tenderness are predominant over the posterolateral aspect of the calcaneus and are often associated with constricting footwear. Examination may show skin thickening and callous formation, but there is usually minimal or no Achilles tendon involvement with a pump bump.

Treatment of Insertional Achilles Disorders

Most cases of insertional Achilles disorders in athletes are successfully managed nonoperatively.[8] Conservative treatments include nonsteroidal anti-inflammatory drugs, ice massage, rest and activity modification (decreasing mileage, avoiding hills and hard surfaces), backless/soft-counter shoes, gentle heel cord stretching, physical therapy modalities, heel lift/

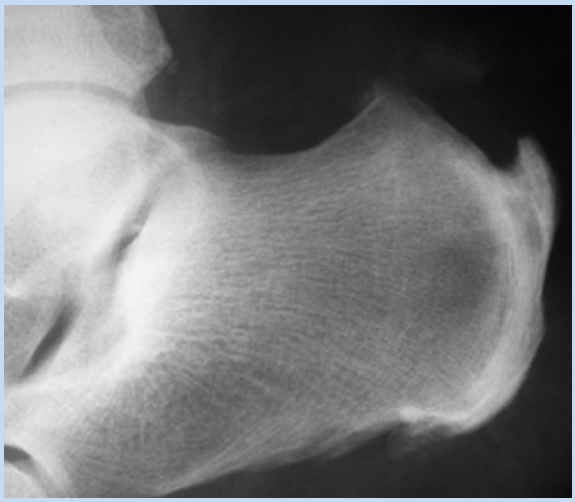

Figure 1. Lateral radiograph of calcaneus showing a Haglund lesion.

Figure 2. Lateral radiograph illustrating calcification within the Achilles insertion.

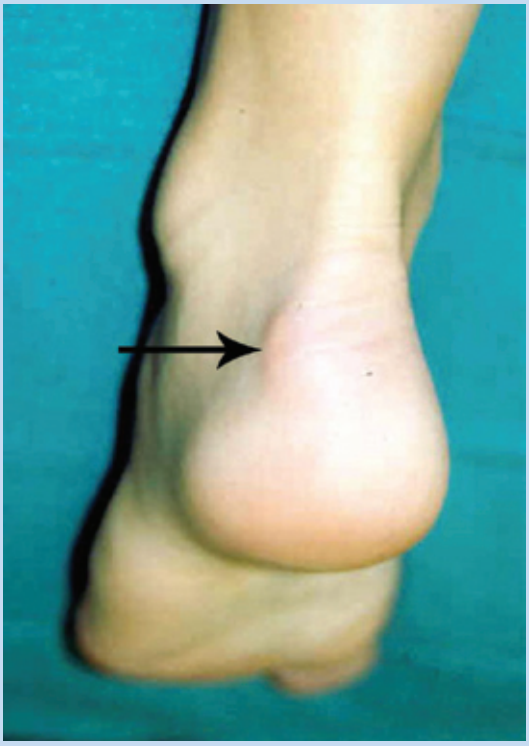

Figure 3. Lateral bony prominence, or pump bump.

Figure 4. Posterolateral incision adjacent to the lateral border of the Achilles tendon.

cup, immobilization in a cast, and shockwave therapy (anecdotal success only). Intratendinous injection of corticosteroid is not recommended, because of increased risk of tendon rupture.[7] Radiofrequency lesioning has been advocated for Achilles disorders,[36,37] but there are no published data to date on this technique for such disorders.

Surgical management should be considered after a minimum of 6 months of symptoms recalcitrant to conservative treatment. The goal of surgery is adequate posterior decompression with resection of Haglund deformity, superior and inferior to insertional ridge (if needed); bursectomy; debridement of the degenerated tendon; and removal of calcific deposits from the Achilles tendon. Patients should be placed in a prone position. A popliteal fossa block is often adequate for anesthesia and postoperative analgesia. Options for incision include the following: lateral, lateral and medial, J or hockey stick, semicircumferential transverse (Cincinnati), and posterior central splitting. No incision has been demonstrated as being superior to the others. The tendon insertion should be repaired with nonabsorbable suture. Suture anchors are rarely necessary.

Posterior Central Splitting Approach

The central tendon-splitting approach[25] has been advocated for running athletes.[3] This approach facilitates the removal of calcific deposits from within the tendon substance. The major problems with this approach include (1) difficulty decompressing Haglund lesions from the posterolateral tuberosity[6] and (2) a potentially hypertrophic or sensitive posterior scar that can be irritated by the heel counter.

Endoscopic Decompression

Endoscopic decompression of the Achilles has been described for retrocalcaneal bursitis and Achilles insertional tendinopathy.[22,23] This technique allows for posterior decompression and bursectomy, but it is inadequate for debridement of larger calcific deposits or an inferior bony ridge; furthermore, repair of the Achilles detachment through this technique does not provide sufficient strength.[22] It is best suited for the younger running athlete with isolated retrocalcaneal bursitis and a relatively small Haglund prominence.

Preferred Approach

Through a posterolateral incision (Figure 4), elevation of the Achilles tendon, from lateral-to-medial and proximal-to-distal resection and repair, maintains a sufficient insertion area and allows as much of 50% of the tendon to be resected safely.[17] This approach is advantageous because superficial fibers are commonly uninvolved. The posterior tuberosity and inferior spur are aggressively decompressed (Figure 5) as calcific deposits and degenerated tendon are identified and debrided from the deep surface of Achilles tendon. The tendon insertion is then repaired laterally (Figure 6) to a cuff of tissue or with suture anchors.

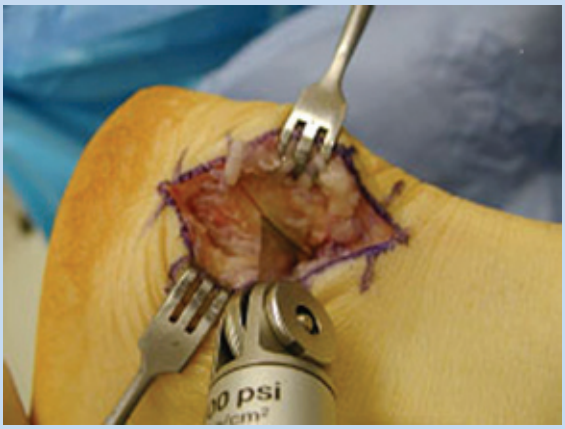

Figure 5. After careful dissection and elevation of the Achilles tendon at its insertion, the bony Haglund lesion is resected using an oscillating saw.

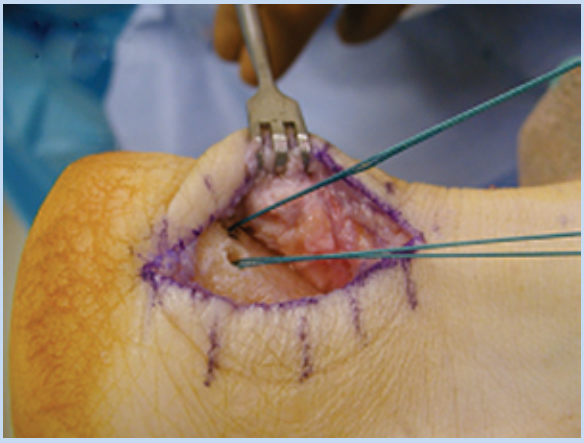

Figure 6. After aggressive decompression of the posterior tuberosity, the Achilles tendon is repaired to the calcaneus using 2 suture anchors.

Failed Posterior Decompression

In athletes who have continued symptoms despite appropriate surgical intervention, it is important to assess whether degenerative tendon remains and whether adequate resection was performed. The former can be best determined via a magnetic resonance imaging (MRI) scan.[12] It is important to attain adequate bone resection and thoroughly remove prominent medial and lateral ridges. Further intervention may be considered, including more aggressive bony decompression or tendon excision with augmentation using transfer of the flexor hallucis longus (Figure 7).[11,40]

Sleeve Avulsion Injuries

Nonbony avulsion of the Achilles tendon from its calcaneal insertion (ie, Achilles "sleeve" avulsions) can be difficult to repair. A transcalcaneal suture repair technique has been described with good results.[5] The technique involves retrocalcaneal exostectomy and advancement of the Achilles to denuded bone. Gasctocnemius recession and/or flexor hallucis longus transfer may be added to assist with advancement, if necessary.

Postoperative Management

Patients are initially placed in nonweightbearing immobilization for 2 weeks to protect the tendon, followed by a short leg walking cast for 2 weeks, a boot for an additional 2 to 4 weeks, followed by a heel lift for 6 weeks that is gradually shortened. With a healthy Achilles tendon or a secure flexor hallucis longus tendon transfer, strengthening and stretching may begin at 4 weeks as the patient's comfort allows. The period of immobilization is doubled in cases where an Achilles avulsion is repaired to bone.

Complications

The most common complications of surgical intervention include wound dehiscence, tendon rupture/avulsion, nerve injury (sural, calcaneal) recurrence, exostosis, calcification, and persistent discomfort (consider tendon degeneration).[44]

Clinical Results

In a retrospective review of 38 feet in 29 patients who underwent surgical incision for Achilles tendinopathy via a posterolateral approach (Miller Orthopaedic Clinic, Charlotte, North Carolina), 22 had insertional calcification and 16 had no calcification. In the calcific group, the average time to plateaued improvement was 11.4 months; in the noncalcific group, 6.5 months. Satisfaction rates were 79% (calcific) and 93% (noncalcific). No complications occurred in the noncalcific group, but the calcific group had complications in 8 of 16 feet, including an Achilles avulsion, which occurred in 1 patient at 2 months postoperatively with a significant traumatic event.[41]

Schepsis et al[31] reported on 79 patients who underwent open debridement for various insertional Achilles overuse pathologies. Ten of 15 patients with some level of Achilles tendon degeneration had good or excellent results, and 18 of 24 patients with the diagnosis of retrocalcaneal bursitis had good or excellent results with retrocalcaneal bursitis.

PLANTAR FASCIITIS

Subcalcaneal heel pain frequently occurs in the athlete, and it may affect training and/or performance. Potential causes and associations for this common entity include training errors, overuse (ie, running on hills), and a tight Achilles tendon. Like posterior heel pain, the differential for subcalcaneal heel pain is considerable (see Table 1). The most common causes are plantar fasciitis, plantar fascia rupture, and calcaneal stress fracture.

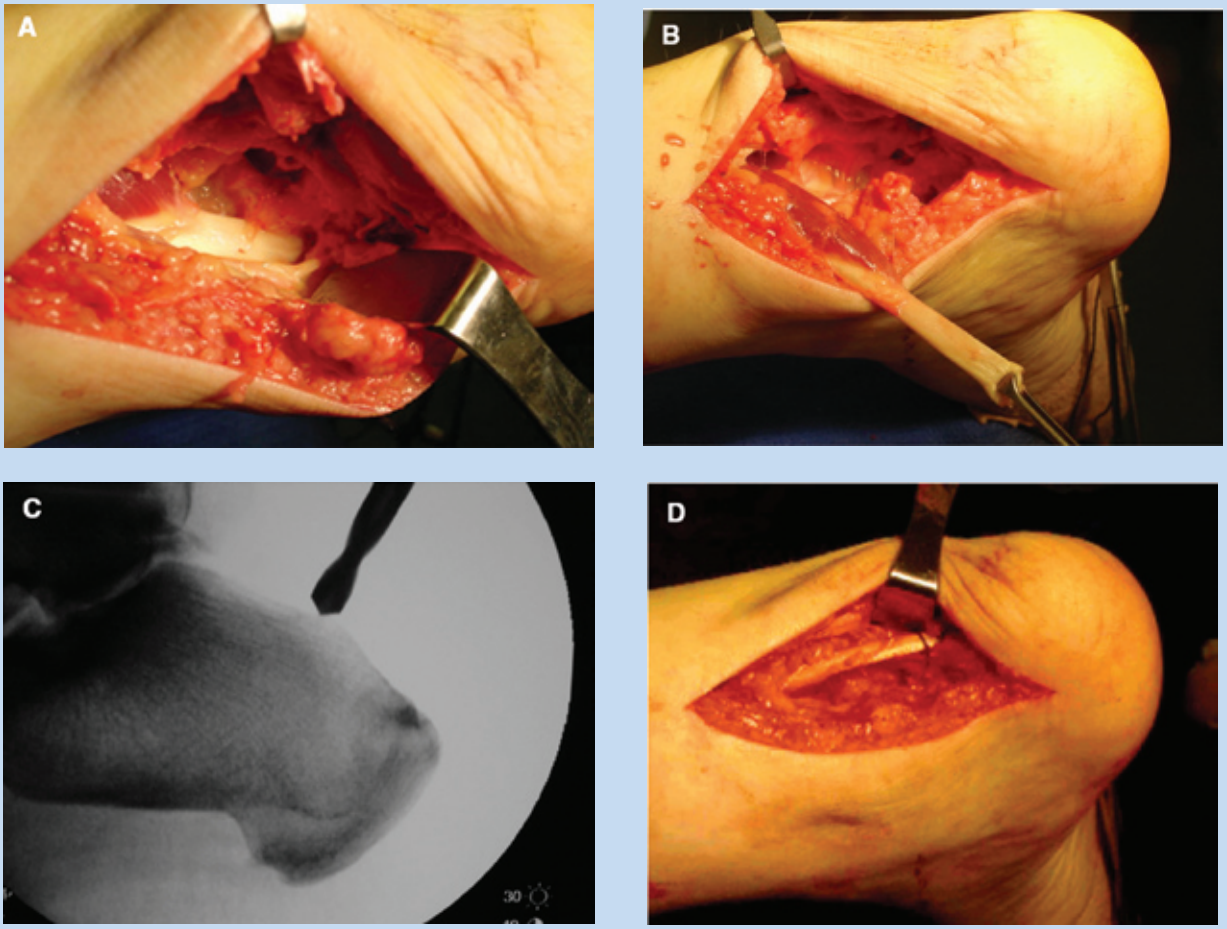

Figure 7. Technique of flexor hallucis longus transfer for augmentation of Achilles tendon repair. A, the flexor hallucis longus tendon is identified through standard posterior or posteromedial incision; B, the flexor hallucis longus is then tenotomized distally at about the level of the calcaneus; C, under fluoroscopic guidance, a drill hole is created in the calcaneus; D, the flexor hallucis longus tendon is advanced through the drill hole and secured using a biotenodesis screw.

Clinical Evaluation

Patients present with pain and tenderness in the plantar heel, usually worse in the morning or on the initial steps after long periods of rest. The pain often improves with walking but worsens after a long day or rigorous training. Physical examination will show tenderness to deep palpation in subcalcaneal region, usually over the origin of the medial band of the plantar fascia. It is important to differentiate between plantar fasciitis and other common causes of heel pain by noting the results of a calcaneal squeeze test (stress fracture) and the absence of tenderness over the medial abductor hallucis (entrapment of the first branch of lateral plantar nerve).

A standing lateral radiograph should be obtained to evaluate for fracture and to assess mechanical alignment. Rheumatologic screening should be considered if involvement is bilateral. Advanced imaging studies can help to differentiate stress fracture, tumors, cysts, and other soft tissue pathologies. Bone scans are a relatively specific but nonsensitive diagnostic tool for plantar fasciitis.[43] MRI scans are of little value in routine cases, but they may allow for the visualization of the plantar fascia and the identification of ruptures.[38] Electrodiagnostic studies are not indicated for routine cases but may show a prolonged sensory latency in the distribution of the lateral plantar nerve.[28] In these cases, surgical treatment (if necessary) should include decompression of the lateral plantar nerve.

Treatment

As with most causes of heel pain in the athlete, a majority will improve after a period of nonoperative management without functional deficit.[26]

The best place to start is with activity modification (alternative conditioning by avoiding impact training), footwear assessment, heel cup orthosis, icing, nonsteroidal anti-inflammatory drugs, night splinting, Achilles tendon stretching, and intrinsic

strengthening. Compliance with a stretching and strengthening regimen is important (twice per day for at least 5 minutes per session). Athletic participation may continue as long as symptoms allow adequate function and performance.

Shock Wave Therapy

High-energy shock wave therapy was approved by the Food and Drug Administration in 2000 for the treatment of chronic proximal plantar fasciitis, present for a minimum of 6 months and resistant to reasonable conservative management. Although this therapy has been shown to be effective in reducing heel pain,[13,39] the technology remains experimental. Most studies to date have been from a limited group of researchers with relatively low numbers of patients and short follow-up.[9,39] The data are conflicting, lacking uniform protocols and a comparison to conservative methods of treatment. However, the results are encouraging and the risks are low. Although many insurance companies are currently hesitant to reimburse, the long-term results may ultimately determine that even a relatively low success rate is cost-efficient compared to surgical intervention. The low-energy form has advantages of low cost and convenience. Although there are no absolute contraindications, special attention is warranted in patients with concomitant morbidities or problems with anesthetics.

Corticosteroid injections should generally be avoided because they have not been shown to be effective and they have been associated with several potential complications, including fat pad atrophy and plantar fascia rupture.[1,20,32] An athlete needs to be informed of the possibility that a rupture is likely to occur after 2 injections.[32] It is not entirely clear whether these ruptures occur as a result of the injections or as part of the natural history of the disorder and its treatment. For athletes who have failed other therapies, a 1-time corticosteroid injection followed by cast immobilization for 1 to 2 weeks may be helpful before initiating a rehabilitation regimen. As an alternative, use of a short leg walking cast for 4 to 6 weeks may help calm an inflamed tendon.

Despite evidence that autologous blood injections are effective in the treatment of medial epicondylitis in the elbow[35] and patellar tendinosis in the knee,[15] there is presently little evidence for the short- or long-term efficacy for plantar fasciitis.[21]

Surgical Options

Several surgical options are available for the patient who fails nonoperative measures and has at least 6 months of persistent symptoms despite compliance.

Open partial plantar fascia release with decompression of the first branch of the lateral plantar nerve[42] (Figure 8) has shown up to 93% satisfaction in multiple studies.[3,10,42] This is the standard approach for patients who are recalcitrant to nonoperative management for at least 6 months. Watson et al[42] reported good or excellent results in 88% of cases without removing a

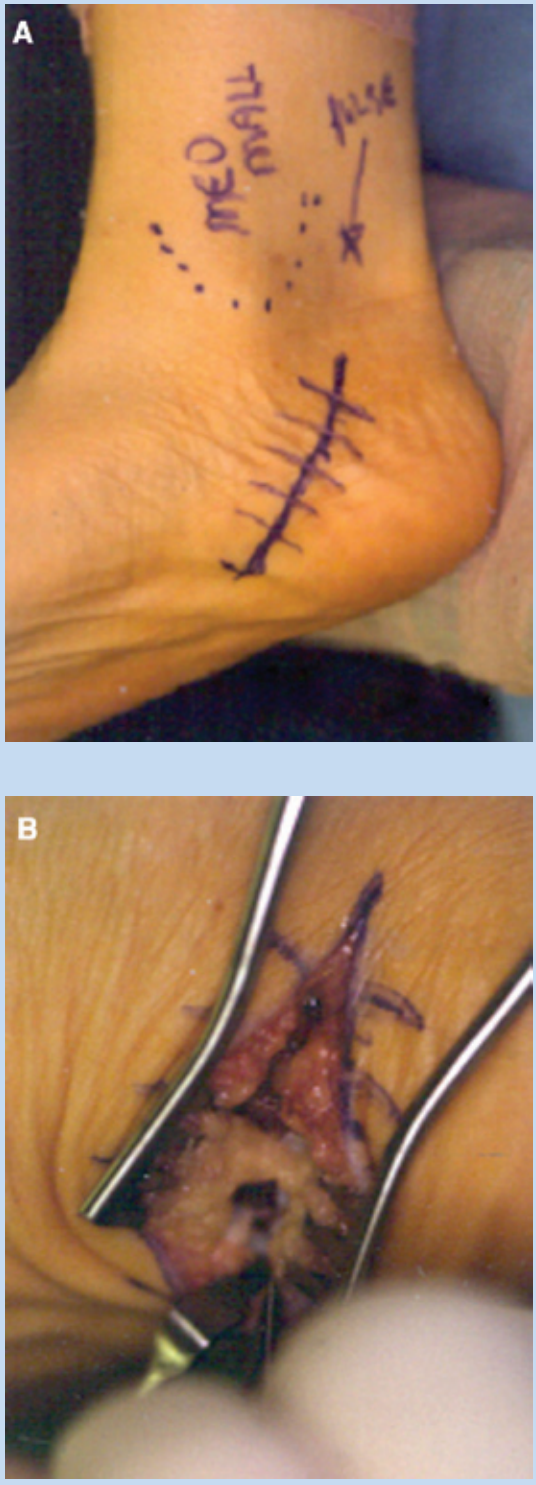

Figure 8. A, medial incision for open partial plantar fascia release; B, approach to plantar fascia release and decompression of first branch of lateral plantar nerve.

heel spur. Complications of plantar fascia release include lateral column instability, pain in the calcaneal cuboid joint, and calcaneus fracture after heel spur removal.[24]

Endoscopic Release

Endoscopic release of the plantar fascia has been advocated as a safe and effective alternative to open release. Good results have been shown, but most studies are small or difficult to interpret.[2,4,27] Concerns with the endoscopic approach include poor visualization, unintentional complete release, difficulty releasing the lateral plantar nerve, and risk for neurovascular injury. To date, there are no prospective evaluations of radiofrequency lesioning for heel pain.[34,36,37]

PLANTAR FASCIA RUPTURE

Athletes who participate in repetitive activities or in those producing high-strain impact on the windlass mechanism are at risk for plantar fascial rupture. The pathophysiology is thought to stem from a weakened plantar fascia, sustained stretch, and/or hyperextension of the forefoot. Patients with plantar fascia rupture often have a history of plantar fasciitis, corticosteroid injection,[1,20,32] a tight gastrocnemius/soleus complex, or Achilles contracture.

Patients may hear a pop during athletic activity. The event is often quite painful, and the patient is subsequently unable to stand, run, or push off with strength. Physical examination shows plantar midfoot ecchymosis and swelling, painful heel-toe gait and windlass testing, and loss of continuity of the medial band, compared to the contralateral foot. Radiographs are usually normal but should be obtained to rule out avulsion, calcaneal fracture, and injury to the Lisfranc complex. MRI is diagnostic but usually not necessary.

Treatment

Initial treatment includes placement in a nonweightbearing short leg walking cast and reexamination every 7 to 10 days. Ice, elevation, and nonsteroidal anti-inflammatory drugs help to alleviate pain and swelling. Weightbearing may be advanced in the cast as discomfort allows. Once the patient is asymptomatic, the foot is placed into a rigid-sole shoe with an orthosis (a turf toe plate should be considered in running athletes), and intrinsic muscle strengthening is initiated. The average duration for cast and boot is 3 to 4 weeks. Average time for return to play has been 9 weeks, but it may be longer, if injury is severe.[30]

Late Sequelae of Plantar Fascia Rupture

Patients may complain of lateral column foot pain. Bone scan or MRI may confirm edema in and around calcaneal-cuboid joint, which can be treated with relative rest, a walking boot, and gradual return to activity in a custom orthosis. Hypertrophic scarring may develop at the site of rupture, causing pain and a mass similar to a plantar fibroma. Pressure can be relieved with an orthosis, and corticosteroid injection can be considered, with surgical excision a last resort. Finally, progressive pes planus after plantar fascia rupture may be identified by a decrease in calcaneal pitch[1] (more likely in a flexible foot) and treated with an orthotic arch support. Other late sequelae include cuboid and metatarsal stress fractures.

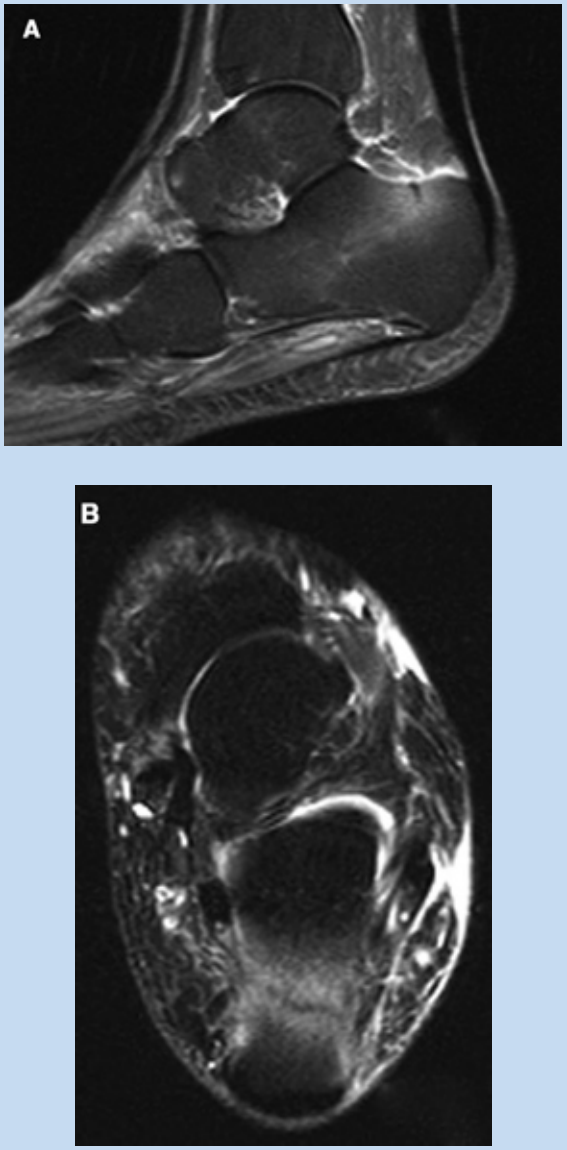

Figure 9. Magnetic resonance imaging scan, T2 sagittal (A) and T2 coronal (B), depicting a stress fracture in the superior calcaneal tuberosity with surrounding edema. Radiographic findings were normal.

Outcomes

Results of plantar fascial rupture are good, though sparsely reported. Leach[20] showed 100% return to athletics (6 of 6), with 1 athlete requiring excision of a mass. In another series,[1] 50% of patients remained symptomatic after 1 year.

CALCANEAL STRESS FRACTURE

Stress fractures of the calcaneus can occur after significant increases in athletic activity after long periods of rest, and they can be associated with gait alterations[14] and plantar fascia ruptures. Patients present with a prodromal period of 7 to 10 days, followed by swelling and posterior and plantar heel pain. Calcaneal stress fractures are often misdiagnosed as plantar fasciitis but can be differentiated by a positive medial-lateral squeeze test.

Radiographic findings can be negative but include a line at the postero-superior aspect of the calcaneus that is perpendicular to the trabecular stress lines of the calcaneus,[19] but MRI may show early edema in the posterior or posterosuperior calcaneal tuberosity (Figure 9). Other causes for pathologic fracture must be ruled out radiographically. Treatment usually involves immobilization and nonimpact weightbearing until symptoms resolve, followed by gradual return to impact-loading activities in 8 weeks. Surgical treatment is not indicated and recurrence is rare.

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