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Surgical Strategies: Insertional Achilles Tendinopathy

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INTRODUCTION

Insertional Achilles tendinopathy is a clinical diagnosis comprising the spectrum of acute and chronic pathology involving the Achilles tendon insertion and its surrounding tissues. Posterior heel pain must be distinguished from plantar heel pain. The posterior heel pain experienced with insertional Achilles tendinopathy is distinct from plantar heel pain characteristic of plantar fasciitis. While the differential diagnosis for posterior heel pain includes peritenonitis, midsubstance tendinosis, tendinosis with partial rupture, insertional tendinosis, retrocalcaneal bursitis, and subcutaneous (pretendinous) tendo-Achilles bursitis, these diagnoses may occur in combination.

Patients typically complain of pain and/or swelling directly over the insertion of the Achilles tendon on the posterior aspect of the heel. This may be aggravated by external irritants, including shoe wear, or an increase in activity level. Insertional Achilles tendinopathy is typically associated with a prominent posterosuperior calcaneal tuberosity (Haglund's prominence) and/or radiographically apparent calcification at the tendon's insertion (Figures 1 and 2). Insertional Achilles tendinopathy is generally diagnosed on clinical examination alone. A lateral radiograph may demonstrate calcification within the Achilles tendon insertion and a prominent superior calcaneal prominence. MRI is usually unwarranted.

The term 'tendinopathy' should be applied to the clinical diagnosis; the terms 'tendinitis' and 'tendinosis' should only be utilized when a histologic confirmation of specific tendon pathology is made. Insertional Achilles tendinopathy probably begins as an acute process (tendonitis) but is often not treated until its chronic stages (tendinosis or calcific tendinosis). Although not mutually exclusive, Achilles tendon disorders are broadly categorized into insertional and noninsertional tendinopathy.[4] Surgical strategies for insertional Achilles tendinopathy are the focus of this article, and a separate article addressing noninsertional Achilles tendinopathy is forthcoming.

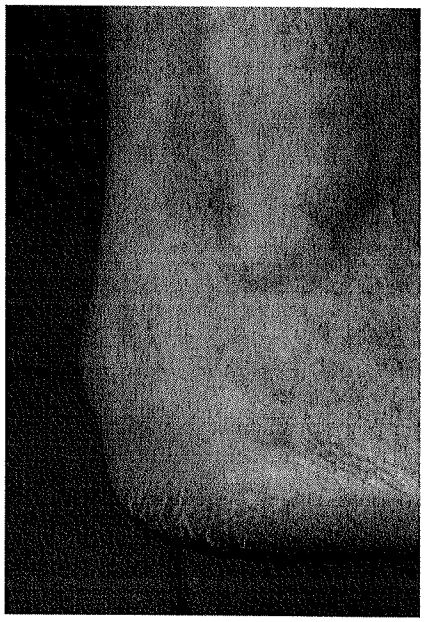

Fig. 1: Clinical appearance of large prominence at insertion of Achilles tendon.

Non-Operative Management

Non-operative treatment includes activity and shoe wear modification, nonsteroidal anti-inflammatory medications, and physical therapy. Patients should avoid activities that place stress on the Achilles tendon insertion (walking uphill, for example). Typical shoewear modifications include soft heel counters, heel lifts, and/or shoes with a heel and an open back (clogs). Temporary use of a cam walker boot that avoids pressure on the posterior heel may be beneficial in relieving symptoms and to allow progression to a physical therapy protocol.

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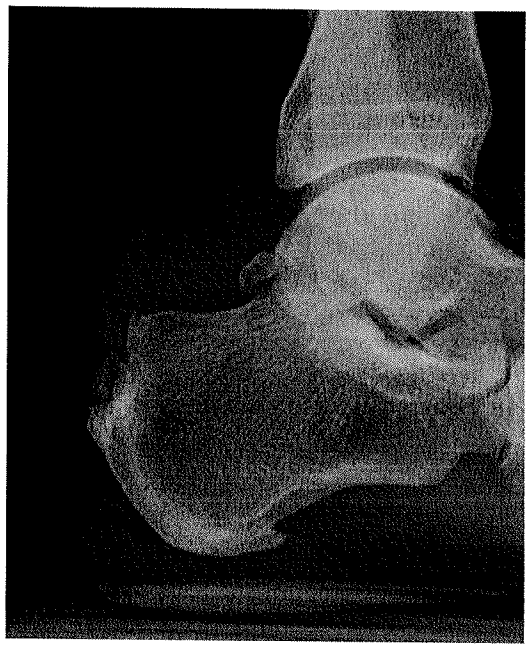

Fig. 2: Calcific deposition seen at posterosuperior calcaneal tuberosity with prominent Haglund's deformity.

Physical therapy must be prescribed judiciously. Conventional Achilles tendon stretching exercises, effective in several foot and ankle disorders, typically aggravate insertional Achilles tendinopathy. Without specific instruction by the physician to the therapist, the patient's symptoms at the Achilles tendon insertion are often increased with physical therapy. In contrast, carefully executed eccentric calf stretching[6,19] may have some benefit, albeit probably more effective for noninsertional disease.[6,19a] Modalities, including cold therapy, ultrasound and iontophoresis may provide some symptomatic relief, but the effectiveness may be questionable for chronic (noninflammatory) stages of this disease.

Single dose highenergy extra corporeal shock wave therapy may be effective for both insertional and noninsertional Achilles tendon disorders and is probably more effective than low energy shock wave therapy.[7,19] Currently, extracorporeal shock wave therapy is not uniformly reimbursed by insurance carriers for insertional Achilles tendinopathy. Additional nonoperative management may include the use of topical glyceryl trinitrate patches applied to the posterior aspect of the heel. In our practice, we have expanded the indications for topical glyceryl trinitrate beyond that for noninsertional disease[18] to insertional disease with some early anecdotal success. We prescribe a 0.2-mg patch which is quartered and applied to the tendon insertion. A new 1/4 patch is rotated to a different spot every 4 hours. The patient is given a 3-month supply. The mechanism of action is unknown but it may be due to an analgesic effect on tendon, stimulation of collagen production by fibroblasts, and modulation of tendon apoptosis or programmed cell death. Corticosteroid injections should be avoided for Achilles tendinopathy due to increased risk of tendon rupture; however, they may be useful for isolated retrocalcaneal bursitis.

A recent investigation suggests that patients with tenderness of the Achilles tendon insertion without obvious signs of infla mmation who demonstrate uniform or diffuse areas of intrasubstance signal changes on sagittal STIR MRI images may not respond to nonoperative treatment,[15] and may be best managed surgically for recalcitrant symptoms. The effectiveness of non-operative therapy is variable with successful results in less than half of the studies[15] to 70% to 90% in other studies.[13]

Surgical Management

Irrespective of surgical approach, the operative strategy for insertional Achilles tendinopathy is removal of the degenerative tendon and associated calcification, excision of the inflamed retrocalcaneal bursa, and resection of the prominent posterior calcaneal prominence.[24] In general, postoperative time to full recovery tends to be proportional to the extent of disease. A recent comparison of outcomes for surgical management of calcific insertional Achilles tendinopathy and isolated retrocalcaneal bursitis suggests that patients with calcific insertional Achilles tendinopathy take longer to achieve maximum relief of symptoms, hava a lower proportion of "satisfied outcomes," and are more limited in shoewear.[22]

Several different surgical approaches to insertional Achilles pathology have been described including: endoscopic resection of retrocalcaneal bursa and a prominent posterior calcaneal process,[11,16] vertical and J-shaped incisions medial[12,21] and lateral[22,24] to the tendon, simultaneous vertical medial and lateral peritendinous incisions,[4] transverse incisions,[3] and a single central longitudinal posterior incision.[2,9,13] We favor the central longitudinal, Achilles tendon splitting incision because it is a versatile approach which allows optimal visualization of all pathology related to insertional Achilles tendinosis including intrasubstance tendinosis and calcification, associated retrocalcaneal bursitis, and the Haglund's prominence. If necessary, the flexor hallucis longus tendon is also very accessible through this same incision should tendon augmentation be required.

The concern with postoperative scar formation and enclosed shoe irritation using the central approach is offset by the decompression of the posterior heel that occurs with this procedure that comprehensively addresses the insertional Achilles pathology. Moreover, in our opinion, the central approach represents the safest open approach to the Achilles tendon insertion. A review of anatomy and the angiosomes of the hindfoot demonstrate that the midline approach divides the peroneal angiosome from the posterior tibial angiosome, thereby preventing injury to the distal angiosome boundaries. If for any reason the incision is curved distally, is should be directed laterally so as not to injure the calcaneal branch

medially and compromise the lateral portion of the posterior tibial artery angiosome.[1] Knowledge of the anatomy of the sural nerve will prevent inadvertent injury. On average, the sural nerve crosses the lateral border of the Achilles tendon 9.8 cm from the superior margin of the calcaneus and courses 18.8 mm from the lateral border of the Achilles tendon at it's insertion onto the calcaneus.

Clinical and biomechanical investigations suggest that 50% of the Achilles tendon insertion may be elevated from the calcaneus without compromise of the insertion strength or risk of rupture.[2,10] The average insertional footprint of the Achilles tendon measures 19.8 mm in height by 23.8 mm wide proximally and 31.2 mm wide distally.[10] When greater than 50% of the Achilles tendon is detached from the calcaneus, suture anchors are recommended to reattach the residual reflected tendon.[12,21] With extensive insertional Achilles tendon disease and/or when greater than 75% of the tendon is excised, augmentation with local tissue, typically the flexor hallucis longus tendon, is advisable. Some surgeons routinely augment the Achilles tendon insertion with an FHL tendon transfer for all surgically managed cases of insertional Achilles tendinopathy.[5] Harvest of the FHL tendon through the same posterior approach to the Achilles tendon (i.e., a short harvest through a single incision) is usually adequate for augmentation of the Achilles tendon insertion. However, a cadaver study suggests that a more distal FHL harvest via a second incision in the foot (i.e., a long harvest through dual incisions) affords on average three more centimeters of FHL tendon length for augmentation if needed.[19b] With the single incision FHL harvest, the tibial nerve is at risk; with the dual incision technique, the tibial and medial plantar nerves are at risk.[14] Alternatively, with extensive insertional Achilles degeneration, complete debridement/excision of the distal Achilles tendon and V-Y advancement with direct repair may be considered.[14] Investigators popularizing this technique report that this comprehensive approach does not compromise the working capacity of the gastrocsoleus muscle.[20]

Indications

Surgical repair of insertional Achilles tendinopathy is indicated for patients who have failed nonoperative management. Contraindications include: arterial insufficiency, poor skin and soft tissues, and multiple poorly controlled comorbidities, such as diabetes, that may contribute to poor wound healing. The decision for surgery is multifactorial and patients with diabetes and tobacco dependence should not necessarily be excluded from surgery; however, they should be educated about the potential risks of surgery and interventions to decrease complications, including careful monitoring of blood glucose and smoking cessation. While insertional Achilles tendinopathy may occur bilaterally, patients typically present with unilateral posterior heel pain. Bilateral heel pain should prompt the physician to consider systemic conditions, such as seronegative inflammatory arthropathies (Reiter's syndrome), which are often most appropriately managed nonoperatively.

Surgical Technique

Regional anesthesia is performed and perioperative intravenous antibiotics are recommended prior to the procedure. In our opinion, the regional anesthetic should allow for a thigh tourniquet; a more distal anesthestic, i.e. popliteal block, necessitates use of calf tourniquet that may limit mobilization of the gastrocnemius/soleus complex. Alternatively, a popliteal block for postoperative pain control, in combination with general anesthesia, permits use of a thigh tourniquet. We routinely exanguinate the involved extremity with an elastic bandage and inflate the thigh tourniquet to 300 mmHg prior to placing the patient in a prone position on the operating room table; this facilitates proper tourniquet placement and avoids unnecessary strain on the patients lumbar spine when positioned prone. The patient is subsequently rolled into a prone position with the ankle at the end of the operating table and operative foot suspended freely. Regional anesthesia with sedation allows the patient to assume a comfortable position during the procedure. Chest and pelvis rolls are positioned perpendicular to the patient's body. The genitalia should be protected; the brachial plexi and ulnar nerves must be without tension and pressure at the elbows, respectively. A platform of sheets or block of foam is placed beneath the operative leg to slightly flex the knee. The skin is prescrubbed using sponges with bristles and chlorhexadine soap.[16a] The skin is then painted with a povidone-iodine solution and the extremity is draped to the level of the popliteal fossa.

A posterior longitudinal incision is made directly midline over the calcaneus and the distal Achilles tendon. A 10 blade is used to incise skin, subcutaneous tissue, peritenon, tendon, and retrocaleaneal bursa directly to the calcaneal tuberosity. The diseased portion of the insertion of the Achilles tendon and all Sharpey's fibers are sharply elevated from the calcaneus using a 15 blade (Figure 3).

We routinely use double prong skin hooks for soft tissue retraction. To limit tissue compromise, we use these retractors only on the deeper tissues and not directly on the skin edges. Furthermore, we limit dissection of superficial soft tissue planes, except for careful mobilization of the peritenon to facilitate a layered closure of tendon, peritenon, subcutaneous tissues, and skin. The sural nerve passes lateral to the approach and is protected by the lateral limb of the Achilles tendon. Proximally the nerve will cross the lateral border of the tendon approximately 10 cm from the calcaneus, typically outside of the operative field for this procedure. The paratenon is debrided of all inflammatory tissue and the tendon is inspected for tendinosis and calcification at the insertion of the Achilles tendon. Diseased tendon and calcification are excised until only healthy tendon remains (Figure 4). Diseased tendon may be identified by intratendinous blood vessels, brown hemosiderin deposits,

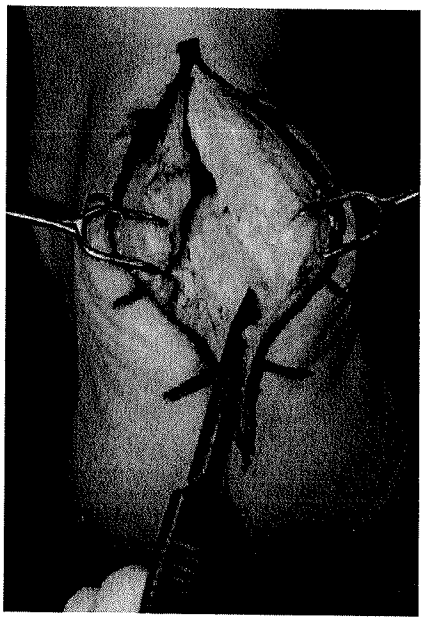

Fig. 3: Skin, peritenon, and Achilles tendon are incised longitudinally via a posterior central tendon splitting approach.

calcification, and tissue with appearance and consistency of "crabmeat." Usually this is a degenerative disorder; however, inflammatory tissue is frequently observed in the adjacent retrocalcaneal bursa and should also be debrided (Figure 5).

The prominent proximal portion of the posterosuperior calcaneal tuberosity and diseased insertion site are readily

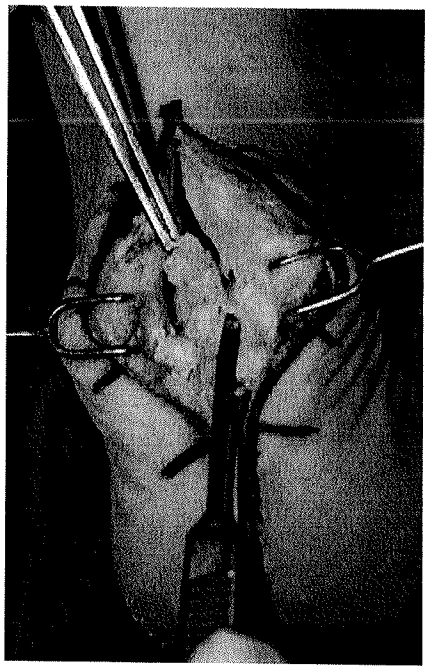

Fig. 4: Skin hooks are used to elevate the Achilles tendon. Calcific deposits and diseased tendon are sharply excised.

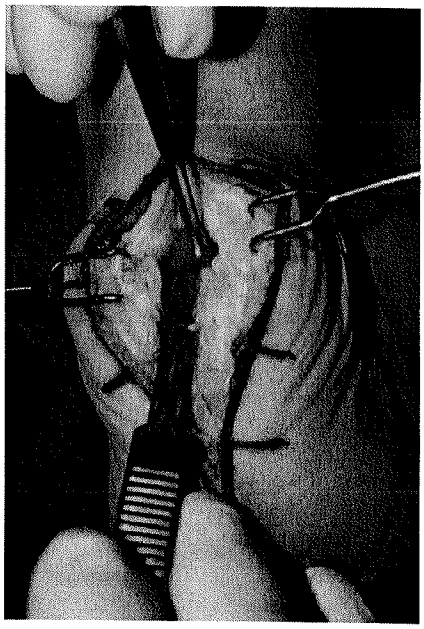

Fig. 5: Retrocalcaneal bursa and associated infla mmatory tissue is debrided.

exposed with the direct posterior approach and a calcaneal exostectomy is performed with the combination of a saw and osteotomy. Skin hooks are replaced with small Hohmann retractors placed between the remaining Achilles attachments and the calcaneus medially and laterally (Figures 6A & 6B). This maneuver facilitates exposure without producing direct skin tension. In our experience, the tendency is to perform the posterior calcaneal resection with the saw or chisel aimed excessively toward the transverse plane; the blades should be directed proximally to avoid excessive and unnecessary bony resection. When performing this procedure with limited prior experience, we recommend using fluoroscopy to confirm an appropriate resection of bone. The calcaneal exostectomy should also include medial and lateral "chamfer" resections to further decompress the posterior heel (Figure 7). Given the broad Achilles insertion, these medial and lateral resections may be performed without compromising the residual Achilles tendon attachment. After excision of diseased tendon and prominent bone, the posterior aspect of the calcaneus is sufficiently decompressed with an exposed cancellous surface ideal for tendon reattachment (Figure 8).

The elevated insertion of the Achilles tendon is then reattached to the calcaneus with suture through drill holes or with suture anchors. We prefer to use 5.0-mm corkscrew anchors, each with 2 strands of braided nonabsorbable suture.[12] To avoid potential detachment of the suture anchor from the handle during insertion, we routinely predrill the anchor insertion site with a small-diameter Kirschner wire. The anchors should fully engage the resected calcaneal surface; satisfactory fixation may be confirmed by lifting

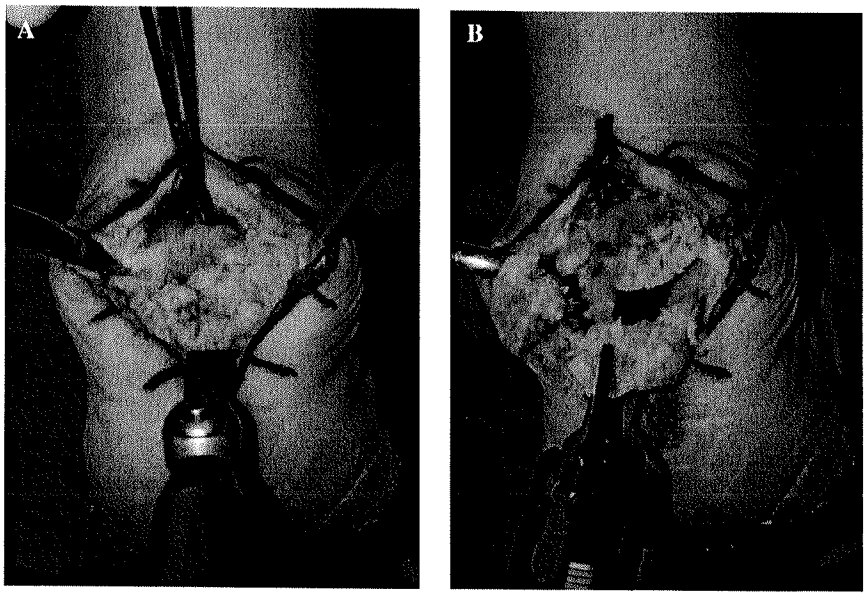

Fig. 6: Posterosuperior tuberosity is exposed, tendon limbs protected, and sagittal saw is used to perform the calcaneal exostectomy.

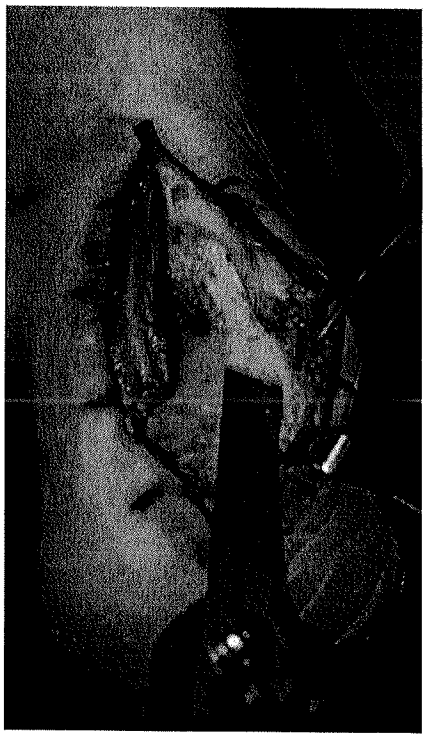

Fig. 7: Medial and lateral calcaneal ridges are removed with a microsagittal saw or osteotome to chamfer the tuberosity. Note that the broad insertion of the Achilles tendon remains attached both medially and laterally.

the lower leg by the anchors' suture. The sutures are passed through the ipsilateral medial and lateral elevated limbs of the distal Achilles tendon, preferentially in a congruent manner to facilitate a balanced Achilles tendon reattachment to the calcaneus (Figures 9 & 10).

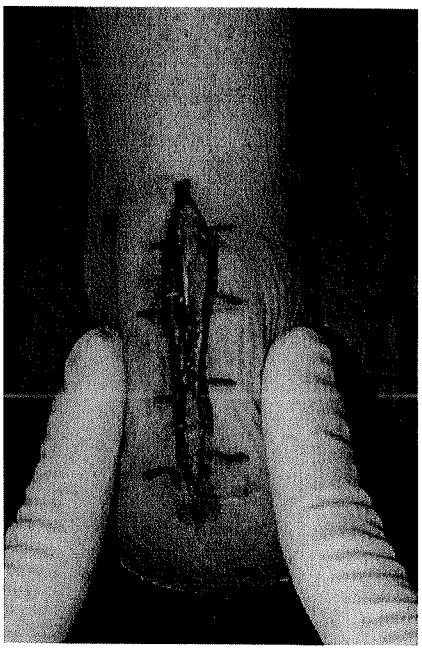

Fig. 8: The calcaneal tuberosity has been sufficiently decompressed and should not have any sharp prominences.

Equal tension is placed on the two limbs of the tendon and the tendon is secured to the calcaneus. When a substantial portion of the tendon (greater than 75%) has been detached from the calcaneus, we routinely utilize a third midline suture anchor distal to the previous anchors to further stabilize both reattached limbs of the Achilles tendon. Prior to closure of the tendon, the wound is thoroughly irrigated to make sure all resected bone fragments are removed from the subcutaneous tissue. The tendon split is repaired with 2-0 vicryl suture

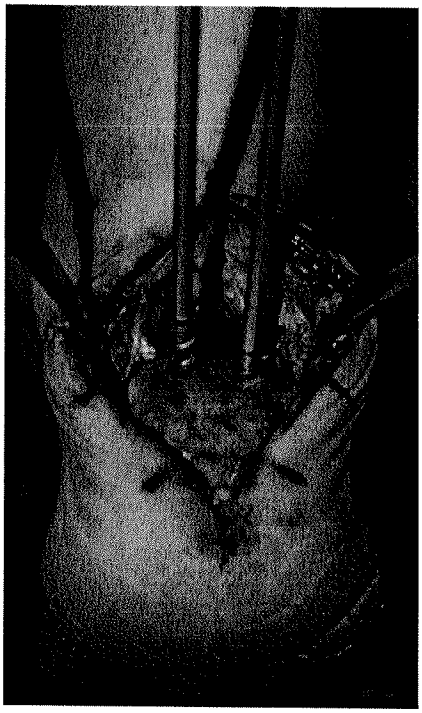

Fig. 9: The Achilles tendon may be reattached with suture through drill holes in bone.

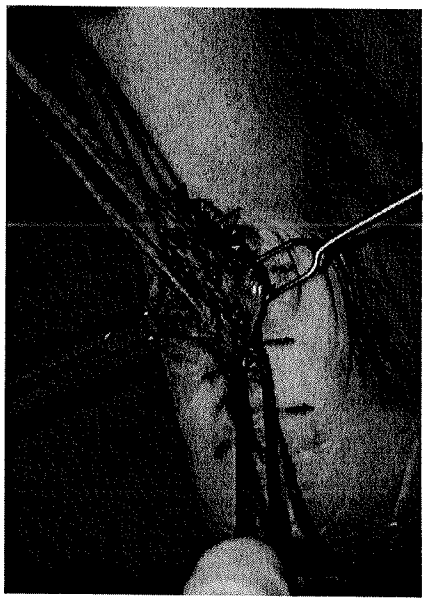

Fig. 10: The Achilles tendon may also be reattached with suture through drill holes via suture anchors.

in interrupted or running fashion. The peritenon is closed with a running 3-0 vicryl suture followed by interrupted 4-0 nylon vertical mattress sutures in the skin. Careful soft tissue handling is maintained during closure.

Postoperative Course

Patients remain nonweightbearing and the ankle remains immobilized in the posterior sugar tong splint for two weeks or more to allow satisfactory wound healing A weightbearing plantarflexed cam walker boot or cast is then applied for an additional 3 to 4 weeks to facilitate patient mobilization while still protecting the repair. The postoperative protocol may be varied depending on the treating physician's confidence in the tendon reattachment. If less than 50% of the tendon is excised, early weightbearing at 3 weeks in a plantarflexed cam walker boot or cast is allowed with transition to a removable boot with a 1/2" heel lift at 6 weeks from the date of surgery. For more severe involvement of the tendon, patients may be protected for an additional 2 to 3 weeks. In general, by 8 weeks, the patient should transition into an athletic shoe and utilize a 1/2" heel lift for 4 weeks. Physical therapy is used postoperatively for gait training, gentle ankle range of motion exercise, and a graduated gastrocnemius-soleus strengthening program. As described for nonoperative management, aggressive Achilles stretching exercises should be avoided in order to protect the repair, but an eccentric stretching protocol may prove beneficial once the repair is deemed adequately healed. Full recovery may take from 6 to 12 months. We recommend educating patients preoperatively about the prolonged recovery.

Combined Pathology

It is relatively uncommon to see pathology at multiple sites along the Achilles tendon; however, we have treated patients with tendinosis at both the insertion and midportion of the Achilles tendon. In addition to the surgical technique described above, a variety of additional methods have been used to augment the repair including flexor hallucis longus transfer, plantaris tendon augmentation, VY lengthening, and central third turndown of the Achilles tendon.

A 72-year-old female presented with severe pain along the midportion and insertion of the Achilles tendon after continued non-operative treatment for over 1 year with multiple different regimens. Radiographs demonstrated the classic finding of calcification at the insertion of the Achilles tendon (Figure 11); however, given her severe symptoms at the insertion and midportion of the Achilles tendon, an MRI was obtained which demonstrated severe disease involving both the midportion and the insertion of the Achilles tendon (Figure 12). Intraoperatively, this finding was confirmed as extensive intratendinous hemorrhage and tendinosis (Figure 13). After extensive debridement, including greater than 50% of the tendon insertion, the flexor hallucis longus (FHL) tendon was harvested through the same central posterior incision. Using a suture and Keith needle, the FHL was passed into a bone tunnel in the calcaneus and secured with a tendon interference screw (Figure 15). During harvest of the tendon, the tibial nerve and vessels were protected. The plantaris tendon was left attached distally, transected at its musculotendinous junction through a separate small

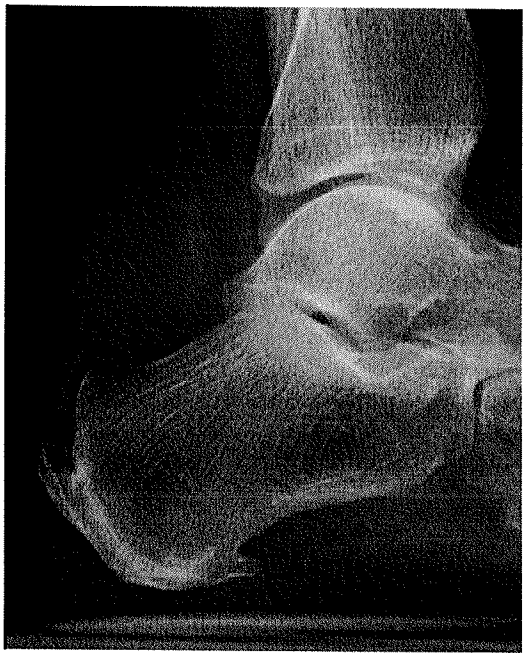

Fig. 11: Severe insertional disease evident on lateral radiograph.

Fig. 12: Sagittal MRI demonstrated severe tendinosis and hemorrhage of the midportion of the tendon.

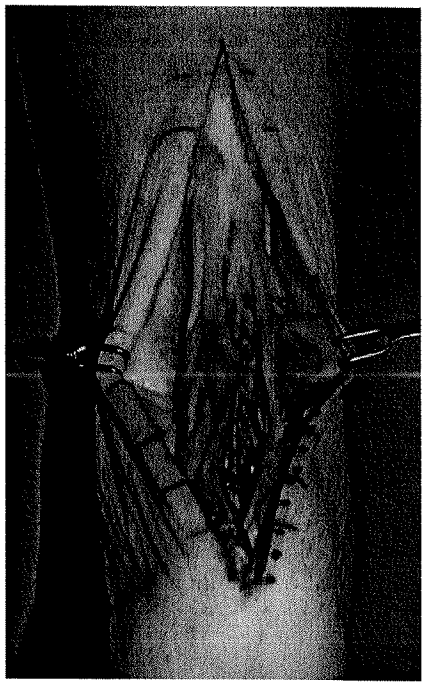

Fig. 13: Extensive intratendinous hemorrhage and tendinosis proximal to insertion of Achilles tendon.

proximal incision, and used to augment the repair. The surgical description for this augmented repair was presented in "Surgical Strategies: Delayed Diagnosis or Neglected Achilles' Tendon Rupture" by Den Hartog in the April 2008 issue of this journal. The postoperative course for this patient included 3 weeks in a splint, followed by 4 weeks of partial weightbearing in a slightly plantarflexed cast with a heel build-up, after which time she was advanced partial weightbearing in a removable boot with a 1/2" heel lift for 2 weeks, full weightbearing with the boot for 2 weeks and advanced into a regular shoe with a 1/2" heel lift at the 11^{th} to 12^{th} postoperative week.

CONCLUSION

Insertional Achilles tendinopathy may be diagnosed on clinical examination alone and is generally distinct from noninsertional Achilles tendinopathy. The diagnosis of Achilles tendinitis/tendinosis cannot be made without a histologic specimen. While several surgical approaches exist for managing insertional Achilles tendinopathy when nonoperative measures fail, we favor a central tendon-splitting approach because of the optimal exposure it affords while minimizing the risk of wound complications.

Summary Points

1. The direct posterior tendon splitting approach allows the surgeon to treat all pathology at the distal site of the Achilles tendon, including the calcification, retrocalcaneal bursitis, prominent posterosuperior calcaneus, and tendinosis.
2. Insertional Achilles tendinopathy failing nonoperative management typically requires a comprehensive procedure that includes removal of insertional calcification, debridement of degenerated Achilles tendon, excision

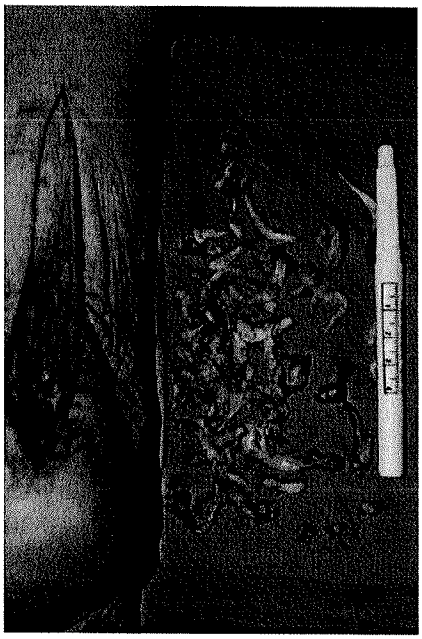

Fig. 14: Extensive debridement of diseased tendon.

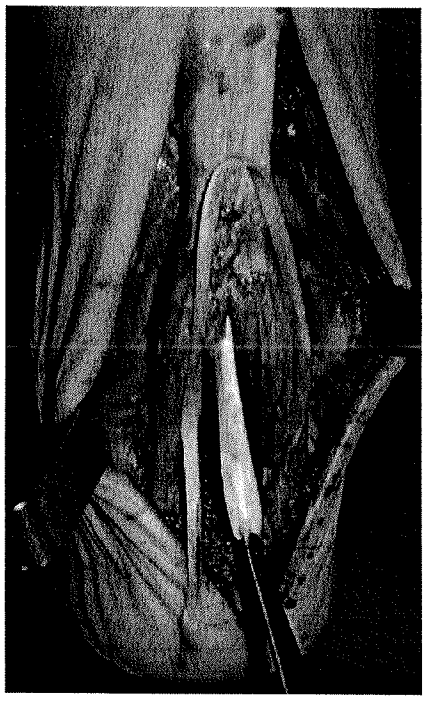

Fig. 15: Utilization of the flexor hallucis longus and plantaris tendon to augment the repair through the same posterior approach.

of the inflamed retrocalcaneal bursa, calcaneal exostectomy, and repair of the residual, healthy Achilles tendon to the calcaneus.

3. Anatomic and clinical studies have shown that if less than 50% of the tendon is excise or elevated from bone, early weightbearing and mobilization may be initiated.
4. For severe insertional disease, reconstruction with the flexor hallucis longus and plantaris tendons is possible using this approach.
5. Judicicious patient selection, careful soft tissue handling, adequate tendon and bony decompression, a layered closure, postoperative elevation, and a well padded splint minimize wound complications.

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