INVITED ARTICLE

Hindfoot Endoscopic Treatments for the Pathologies of the Flexor Hallucis Longus and Achilles Tendons

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Abstract

Background: Hindfoot pathologies and injuries are commonly encountered in foot and ankle orthopedic practice. Despite the growing number of related studies on these topics, the knowledge on the development of key aspects of endoscopic surgeries for these conditions is still lacking.
Review: This review aimed to present the current concepts and techniques of endoscopic surgery and related treatments for these pathologies and injuries, with a focus on flexor hallucis longus (FHL) and Achilles tendon pathologies or injuries.

Keywords: Achilles tendon, Flexor hallucis longus, Hindfoot endoscopy.
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Background

Achilles tendon pathologies are commonly encountered in foot and ankle orthopedic practice. In addition, FHL tendon pathologies can occur alone or accompany the aforementioned pathologies. These pathologies are challenging to treat in terms of satisfactory results due to their location and the limitation of blood supply owing to the relative incongruence of the tendon with the tunnel.[1] Traditionally, open procedures have been proposed to manage these pathologies with acceptable results. However, it is difficult to access the pathologies, especially on the posterior ankle area, and such procedures are invasive and increase the risk of soft-tissue complications.[2] At the time of writing, hindfoot endoscopic treatments have been introduced to solve these problems and potentially produce better results than those of the conventionally open procedure.[2,3] Here, we propose hindfoot endoscopic treatments in terms of novel techniques, results, pearls, and pitfalls, with evidence-based recommendations.

Reviews of Pathologies and Associated Injuries

The Achilles tendon is a large tendon commonly associated with injury and inflammation. Blood supply was less in the area 2–7 cm from its insertion.[4] This area has a high risk of rupture and inflammation. In addition, its insertion can be easily inflamed as patients get older.[4] Therefore, pathologies can occur at the insertional and noninsertional areas of the Achilles tendon. Common pathologies are insertional and noninsertional Achilles tendinopathy. Further treatment sessions, wherein hindfoot endoscopy plays a role, focus on triple pathologies, such as Achilles tendon rupture and insertional and noninsertional Achilles tendinopathy.

Flexor hallucis longus tendon pathologies are less common than Achilles tendon pathologies, but they can be difficult to treat due to the location at the posterior ankle and the relation of the FHL tendon with the posteromedial neurovascular bundles.[5] This tendon can develop tenosynovitis and/or posterior impingement at the bones of the posterior ankle, such as the talus or distal tibia.[1] Hindfoot endoscopic treatments will be discussed in the section on further treatments for the major pathologies of the FHL tendon, such as FHL tenosynovitis and posterior ankle impingement.

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Treatments

Achilles Tendon Rupture

Conservative treatments could be considered for incomplete and complete ruptures; however, this method yields a high rate of rerupture in cases of complete rupture.[6] Operative treatments have been proposed for open, mini-open, and endoscopic techniques. Although the open technique causes a higher risk of soft-tissue complications than other treatments, there is no consensus to date on the best technique for tendon repair. This article focuses on endoscopic techniques to treat this injury, especially chronic rupture. Since endoscopic treatment has a lower need for a large incision, there is no need to wait for the reduction of swelling before the surgery in case of acute rupture. This treatment should be performed within a few days following the injury since a delay could complicate the attachment of the proximal and distal segments of the tendon. Although this procedure generates good results, sural nerve injury is a potential complication.[7,8] The authors of the present study preferred to focus on the endoscopic treatment of chronic rupture that could be safely treated

via endoscopic-assisted FHL transfer, which has a lower risk of sural nerve injury during surgery. The chronic injury often presents later than 4 weeks with gaps greater than 4 cm, necessitating more complex reconstructions using local tissues, such as turn-down flaps and V-Y plasty, and requiring large incisions in an unfavorable area of the leg.[9] The authors described a step-by-step technique of endoscopic-assisted FHL transfer for the reconstruction treatment of FHL tendons with this condition as the technique can reduce soft-tissue complications.

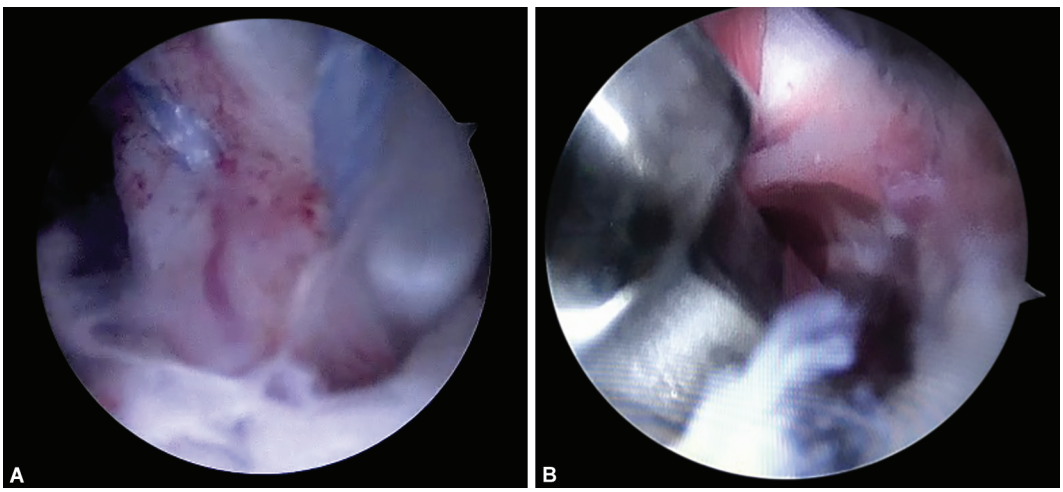
First, the patient is placed in the prone position. The tendon gap can be outlined before the incision (Fig. 1). A midline incision is made to explore the proximal and distal fragments of the Achilles tendon. Debridement should be performed to clear debris in the gap. Hindfoot endoscopic portals are then created at both the proximal–medial and proximal–lateral areas of the insertion of the Achilles tendon. Endoscopic debridement is performed to identify the FHL tendon, plantar flexion of the big toe is carried out, and a gauze strip is introduced to pull the FHL in full plantar flexion. It is cut at the most distal segment to harvest for the transfer to the posterior tuberosity of the calcaneus, which is anterior to the native insertion of the Achilles tendon *via* interference screw fixation during ankle plantar flexion at approximately 10–15° (Fig. 2). At the tendon gap, the proximal and distal segments of the tendon can be attached to each other as close together as possible, and repair can be done using direct four-strand core sutures. If the tendon gap could not be completely closed, the proximal and distal segments could be directly repaired side-to-side with the FHL muscle belly and/or tendon. The skin is then closed in layers, and the anterior short leg slab is applied. This is replaced by a controlled ankle motion walker with some degree of heel lifting at 2 weeks postoperation. The patient is allowed to walk with the immobilizers for 6 weeks with no weight-bearing. They can be permitted to bear weight as tolerated on the surgical foot for 6 weeks thereafter. Finally, walking with full weight-bearing is allowed with other accompanying programs of related physiotherapy.

Fig. 1: The tendon gap is identified and outlined before the incision

Insertional Achilles Tendinopathy

Preoperative magnetic resonance imaging (MRI) is required in the planning of this treatment option. There are a few pathologies that can be treated differently using the proposed techniques. The first is insertional tendinopathy with anterior peripheral inflammation with or without retrocalcaneal bursitis and/or Haglund exostosis. The second is insertional tendinopathy with intrasubstance inflammation with or without retrocalcaneal bursitis and/or Haglund exostosis (Fig. 3).

Conservative treatments take place over 3–6 months. The surgical treatments can be performed in patients without symptom improvement postconservative treatments. For the operation, the settings are adjusted for the patients as in the previously mentioned treatment for chronic Achilles tendon rupture. Endoscopic debridement is very useful for the debridement and removal of the anterior debris of the Achilles tendon from tenosynovitis, retrocalcaneal bursitis, and/or Haglund exostosis (Fig. 4). In case of intrasubstance or posterior tenosynovitis of the Achilles tendon, a mini-open is created longitudinally at the posterior heel for debridement. The Achilles tendon insertion should be reattached following debridement. This is done using the inside-out technique *via* suture lasso or loop suture to retrieve two-pair suture materials of a few suture anchors that were inserted into the posterior tuberosity of the calcaneus just anterior to the native insertion of the Achilles tendon earlier in the procedure (Fig. 5). These sutures are tied to reattach the tendon to the calcaneus during ankle plantar flexion at 10–15° (Fig. 6). A surgeon could augment the reattachment



Figs 2A and B: The FHL transfer to the posterior tuberosity of the calcaneus (A) *via* interference screw fixation (B) during ankle plantar flexion at approximately 10–15°

using a knotless anchor with a pair of residual suture materials from both knots (Fig. 6). In cases of severe intrasubstance tenosynovitis that require debridement of over 50% of the tendon area on cross-sectional view and that can be observed in the preoperative MRI, one can perform endoscopic-assisted FHL tendon transfer using the same technique as mentioned. Endoscopic FHL transfer was proposed to provide a higher outcome score than that of open procedure.[10] Other treatment steps are similar to those previously mentioned.

Noninsertional Achilles Tendinopathy

Overall, preoperative planning is needed as in the treatment for insertional Achilles tendinopathy. The appropriate indication for endoscopic debridement is peripheral tenosynovitis of the Achilles tendon. The endoscopic portals might be more proximal than previously described and should be sufficient to approach the pathological area; however, they should be created in the area just lateral and medial to the Achilles tendon to prevent iatrogenic injury to the sural nerve and to other neurovascular bundles. Endoscopic debridement can be performed at the peripheral area of the tendon. Posterior debridement should stay on the plane just close to the paratenon, which is a safe area in relation to the sural nerve. In cases of severe intrasubstance tenosynovitis that require debridement of over 50% of the tendon area on cross-sectional view and that can be observed in the preoperative MRI, one could perform endoscopic-assisted FHL tendon transfer using the same technique mentioned. The other treatment steps are similar to those previously described.

Flexor Hallucis Longus Tenosynovitis and Posterior Ankle Impingement

Flexor hallucis longus tenosynovitis and posterior ankle impingement are the major causes of posterior ankle pain. Preoperative planning is needed as in the treatment for insertional Achilles tendinopathy. There are a few pathologies that can be treated differently using the proposed techniques. The first is

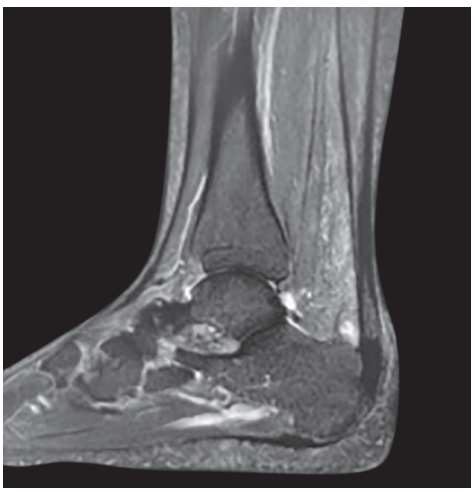


Fig. 3: Magnetic resonance imaging shows the insertional tendinopathy with intrasubstance inflammation with retrocalcaneal bursitis and Haglund exostosis

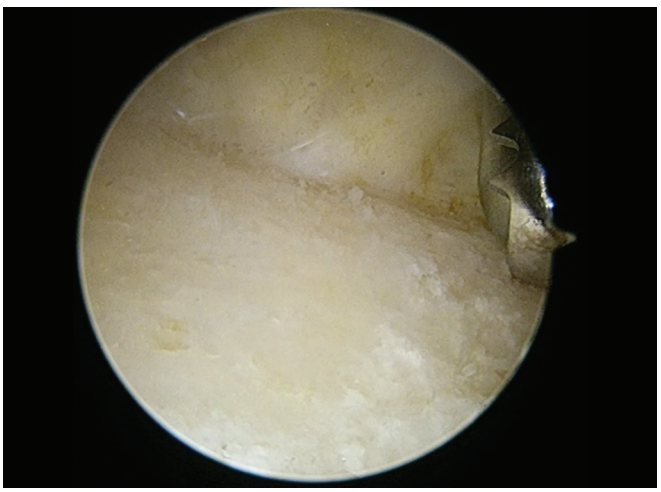
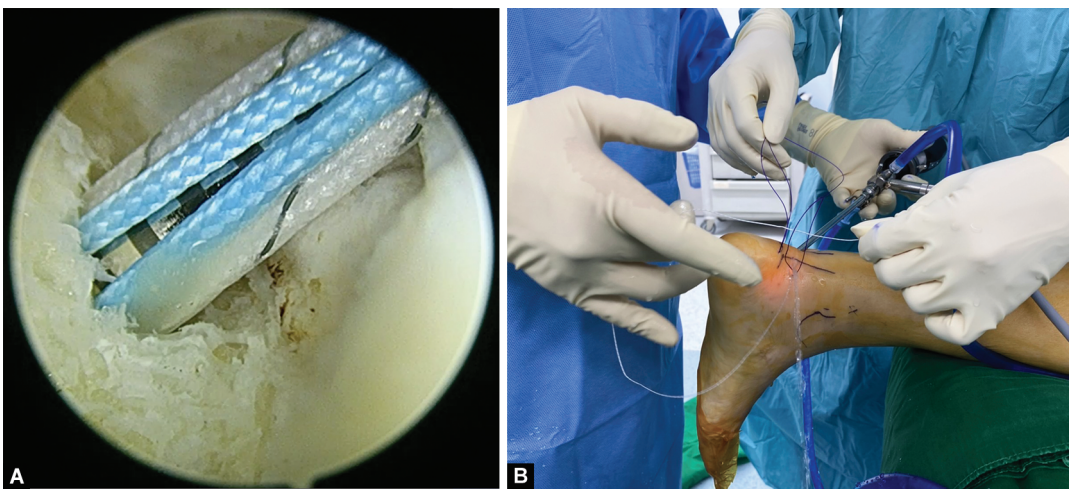


Fig. 4: Endoscopic debridement is performed for the debridement and removal of the anterior debris of the Achilles tendon from tenosynovitis, retrocalcaneal bursitis, and Haglund exostosis



Figs 5A and B: The Achilles tendon insertion is reattached following debridement using the inside-out technique. (A) The suture anchors are inserted into the posterior tuberosity of the calcaneus just anterior to the native insertion of the Achilles tendon; (B) The two-pair suture materials of a few suture anchors are retrieved *via* suture lasso or loop suture then the suture knots are created to finalize the reattachment

FHL tenosynovitis with or without posterior impingement (Fig. 7). The second is posterior impingement with or without os trigonum and/or FHL tenosynovitis.

Conservative treatments take place over 3–6 months. The surgical treatments can be performed in patients without symptom improvement postconservative treatments.

For the operation, the settings are adjusted for the patients as in the treatment for chronic Achilles tendon rupture. Endoscopic debridement can be effectively done to remove debris due to tenosynovitis around the FHL (Fig. 8). Posterior impingement from the prominent bone/s in the area or from the os trigonum, including inflamed tissue or fibrosis, can be debrided and removed to allow the FHL to move freely with no compression among these structures during ankle plantar flexion. During this debridement, the shaver and/or acromionizer should not be manipulated anteriorly beyond the FHL tendon because of the possible risk of injury at the posteromedial neurovascular bundles. The findings of the previous MRI-based study suggested that endoscopic instruments oriented toward the fibula on the lateral side may be safely introduced into the posterior ankle without injuring the neurovascular structures.[5] The endoscopic blades should not be directly attached to the tendon to prevent iatrogenic injury.[3] Meticulous trimming of tenosynovitis and/or fibrosis is recommended instead of having the aforementioned blades directly face the tendon. These surgical techniques can produce satisfactory results with less postoperative pain and quicker recovery than open procedures can.[11,12]

Pearls and Pitfalls

The pearls of hindfoot endoscopic treatments are useful and effective in treating the pathologies of the FHL and Achilles tendon provided that they are performed on appropriately indicated patients, preoperatively planned, and applied with proper operative techniques. The pitfalls are as follows: the first is the improper position of endoscopic and associated portals. This can lead to a difficult approach in the pathological area and unsatisfactory results of endoscopic surgery. The second is the consideration of the

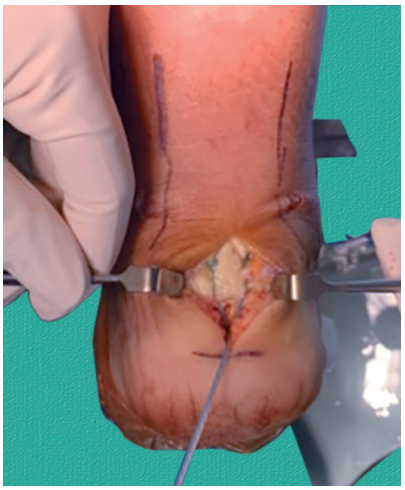


Fig. 6: The Achilles tendon reattachment is augmented using a knotless anchor with a pair of residual suture materials from both knots

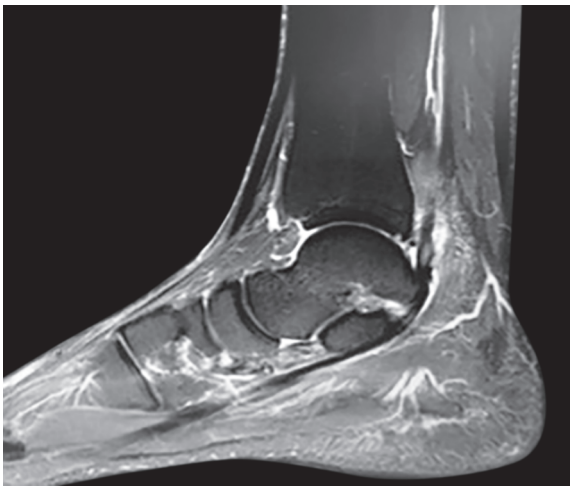
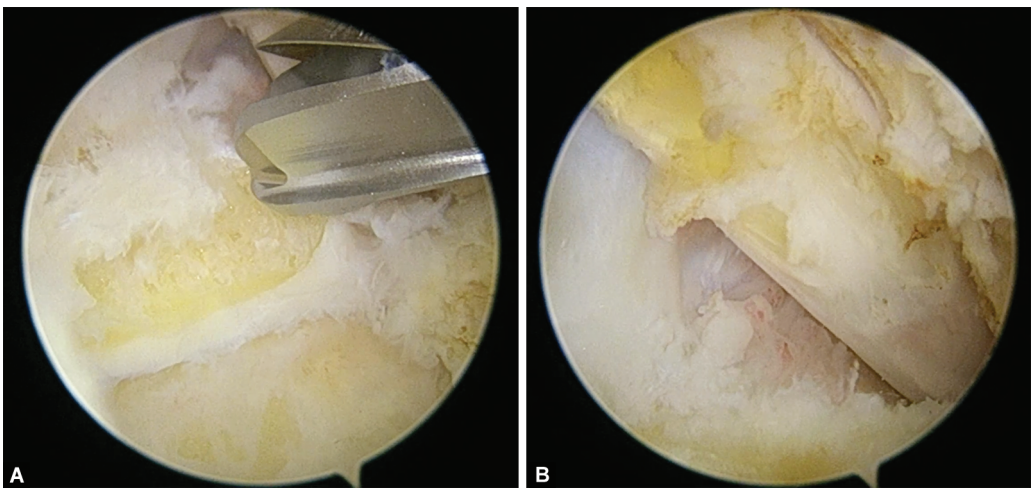


Fig. 7: Magnetic resonance imaging shows the FHL tenosynovitis with posterior impingement



Figs 8A and B: Endoscopic debridement is done to remove bony impingement (A) and debris due to tenosynovitis around the FHL (B)

simultaneous need for additional small or mini-open incisions with endoscopic surgery. Some specific conditions, such as peripheral and intrasubstance tendinopathy, cannot be treated with endoscopic surgery alone at the insertional and noninsertional areas of the Achilles tendon. These conditions require an additional open incision to approach, debride, and/or repair the intrasubstance abnormality.

Summary

Hindfoot endoscopic treatments could provide promising results for pathologies of the FHL tendon and Achilles tendon, including Achilles tendon rupture. This technique could outperform the open procedure in terms of less postoperative pain, quicker recovery, and comparable or superior effectiveness.

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