



Endoscopic Management of Calcaneofibular Impingement and Posterior Ankle Impingement Syndrome Caused by Malunion of Joint Depressed–Type Calcaneal Fracture

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Abstract: Identification of the correct source of symptoms is the key in formulating the correct treatment plan for heel pain after calcaneal malunion. Calcaneofibular and posterior ankle impingements can occur due to malunion of a joint depressed–type calcaneal fracture. The purpose of this Technical Note is to report the technical details of posterior and lateral decompression through the posteromedial and posterolateral portals using posterior ankle endoscopy.

There is a high chance of development of disabling malunion after a calcaneal fracture, regardless of whether a patient is treated nonoperatively or operatively.¹ Lateral heel pain is the most common symptom of calcaneal malunion. It may be the result of calcaneofibular impingement, peroneal tendon problems, subtalar arthrosis, calcaneocuboid arthrosis, symptomatic hardware, and/or sural nerve problems.¹ Displacement of the lateral wall of the calcaneus results in heel widening, which may lead to encroachment on the peroneal tendons and sural nerve. In cases of severe displacement, painful calcaneofibular impingement may occur.¹ Nonsurgical measures include activity modification, shoe-wear modification, orthoses and bracing, injections, medical pain control,

and functional rehabilitation.¹ Lateral calcaneal osteotomy is an effective surgical option to relieve the calcaneofibular impingement.¹ Classically, this is performed through an extensile lateral approach, a subtalar Ollier approach, a posterolateral longitudinal incision, or the previous surgical incision.¹ This involves extensive soft-tissue dissection and limits the possibility of early range-of-motion exercise of the foot and ankle.¹ Endoscopic lateral calcaneal osteotomy has been developed and is performed through the lateral subtalar portals. This is an effective minimally invasive approach for management of calcaneofibular impingement.^{2,3} Posterior heel pain after calcaneal malunion is less frequently reported. This may be the result of flexor hallucis longus (FHL) tendon problems, posterior ankle impingement due to a posterior calcaneal bone spike,⁴ or secondary Haglund deformity after malunion of a tongue-type calcaneal fracture.^{5,6} The calcaneal bone spike is caused by malunion of a joint depression–type calcaneal fracture.^{4,5} With the development of posterior ankle endoscopy, this bone spike can be resected endoscopically.^{4,5,7}

The purpose of this Technical Note is to report the technical details of endoscopic calcaneal osteotomy and resection of the posterior calcaneal bone spike through posterior ankle endoscopy. The technique is indicated for calcaneofibular impingement and posterior ankle impingement syndrome caused by malunion of a joint depressed–type calcaneal fracture. The major contraindications are related to other causes of lateral heel

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Table 1. Indications and Contraindications of Endoscopic Management of Calcaneofibular Impingement and Posterior Ankle Impingement Syndrome Caused by Malunion of Joint Depressed–Type Calcaneal Fracture

Indications	Calcaneofibular impingement and posterior ankle impingement syndrome caused by malunion of joint depressed–type calcaneal fracture
Contraindications	Other causes of lateral heel pain including peroneal tendon problems, calcaneocuboid arthrosis, symptomatic hardware, and/or sural nerve problems Calcaneofibular impingement due to hindfoot valgus malalignment rather than lateral calcaneal bulge Significant calcaneal deformity warranting open corrective osteotomy

pain including peroneal tendon problems, calcaneocuboid arthrosis, symptomatic hardware, and/or sural nerve problems. The technique is also contraindicated if the calcaneofibular impingement is due to hindfoot valgus malalignment⁸ rather than a lateral calcaneal bulge or there is significant associated calcaneal deformity warranting open corrective osteotomy (Table 1). Subtalar arthrosis is not a contraindication because arthroscopic subtalar arthrodesis can be performed through this posterior approach. Other causes of posterior heel pain after calcaneal malunion are also not contraindications because they can be managed through the same endoscopic approach.

Technique

Preoperative Planning and Patient Positioning

Posterior ankle impingement and calcaneofibular impingement should be shown clinically. Lateral and axial radiographs of the calcaneus can confirm the diagnosis. A computed tomogram is useful to exactly locate the posterior calcaneal bone spike and the lateral cortical bulge. Magnetic resonance imaging may be indicated if peroneal tendon problems are suspected.

The patient is in the prone position. A thigh tourniquet is applied to provide a bloodless operative field. A 4.0-mm 30° arthroscope (Dyonics; Smith & Nephew, Andover, MA) is used for this procedure. Fluid inflow is by gravity, and no arthro-pump is used.

Portal Placement

This procedure is performed with the posteromedial and posterolateral portals, which are just above the posterior calcaneal tubercle and on the medial and lateral sides of the Achilles tendon, respectively. Five-millimeter longitudinal incisions are made at the portal sites. The subcutaneous tissue is bluntly dissected and the investing fascia is penetrated by a hemostat.

Confirmation of Posterior Ankle Impingement

Posterior ankle endoscopy is performed with the posteromedial and posterolateral portals.⁷ The posterolateral portal is the viewing portal, and the posteromedial portal is the working portal (Fig 1). The FHL tendon and muscle are identified at the posterior ankle. The thick fibrotic posterior capsule of the ankle joint, lateral to the FHL tendon, is cut open with a

serrated banana knife (Acufex; Smith & Nephew) and is resected with an arthroscopic shaver (Smith & Nephew). The FHL tendon can be retracted medially by the shaver stem while the surgeon is resecting the medial portion of the posterior ankle capsule. After clearance of scar tissue of the posterior ankle, the posterior calcaneal bone spike is exposed. Posterior ankle impingement between the bone spike and distal tibia can be shown by ankle plantar flexion (Fig 2).

Endoscopic Resection of Posterior Calcaneal Bone Spike

The posterolateral portal is the viewing portal, and the posteromedial portal is the working portal. The bone spike is resected by means of an osteotome, arthroscopic acromionizer (Dyonics), and Kerrison rongeur. It should be noted that the calcaneal bone spike obscures the posterior subtalar joint and the spike is closely related to the posterior rim of the talar dome. To minimize bone resection of the posterior talar dome and posterior subtalar joint, the thickness of the bone spike should be assessed regularly during the procedure by probing the interface between the bone spike and talus by means of an arthroscopic probe (Acufex).

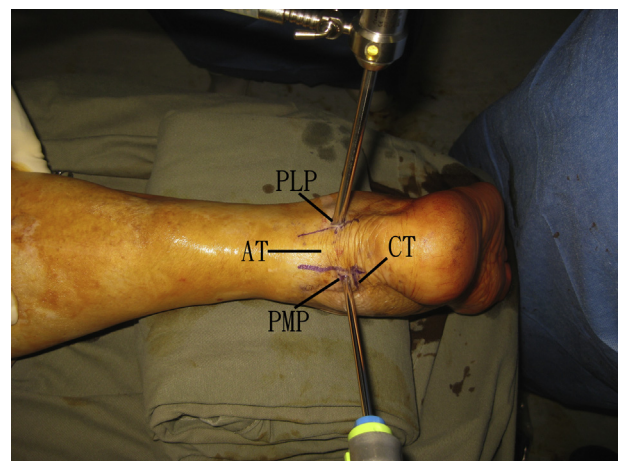
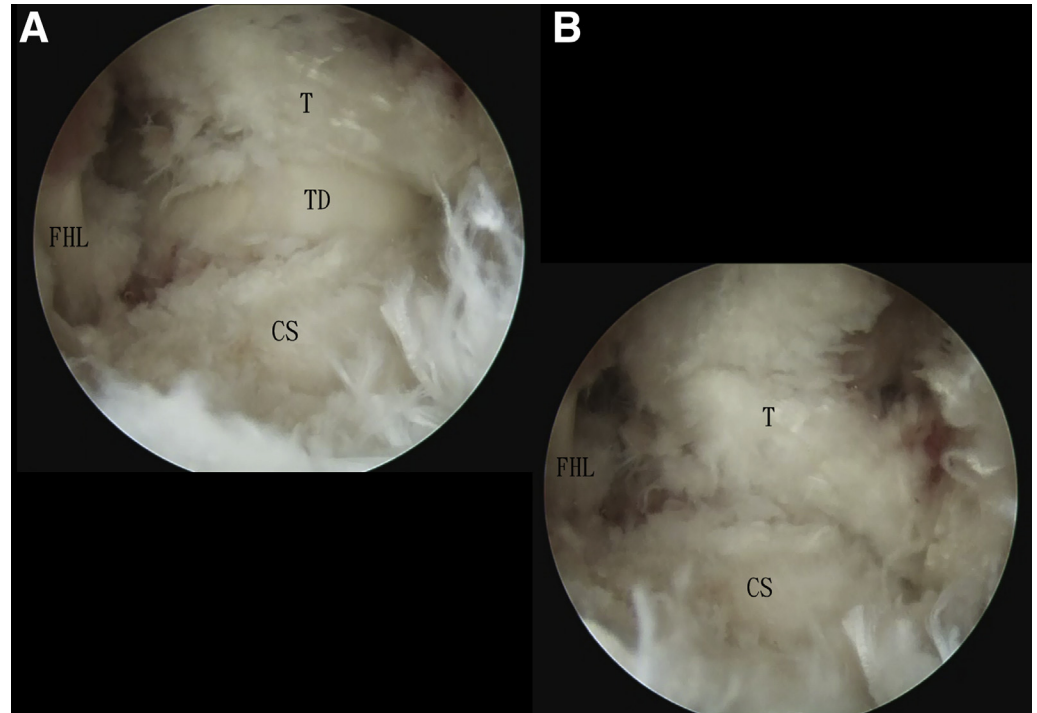


Fig 1. Endoscopic management of calcaneofibular impingement and posterior ankle impingement syndrome of right foot and ankle. The patient is in the prone position. Posterior ankle endoscopy is performed with the posteromedial portal (PMP) and posterolateral portal (PLP). The PLP is the viewing portal, and the PMP is the working portal. (AT, Achilles tendon; CT, upper border of posterior calcaneal tubercle.)

Fig 2. Endoscopic management of calcaneofibular impingement and posterior ankle impingement syndrome of right foot and ankle. The patient is in the prone position. The posterolateral portal is the viewing portal, and the posteromedial portal is the working portal. (A) After clearance of scar tissue of the posterior ankle, the posterior calcaneal bone spike, distal tibia, and talar dome are exposed. (B) Posterior ankle impingement between the bone spike and distal tibia can be shown by ankle plantar flexion. (CS, posterior calcaneal bone spike; FHL, flexion hallucis longus tendon; T, distal tibia; TD, talar dome.)



Moreover, passive ankle plantar flexion should be performed regularly to assess any residual posterior impingement especially at the medial and lateral edges of the bone spike. The resection of the bone spike is considered adequate if there is no more posterior impingement on ankle plantar flexion and the posterior

subtalar joint line is completely exposed from the FHL tendon to the lateral talar tubercle (Fig 3).

Confirmation of Calcaneofibular Impingement

The posteromedial portal is the viewing portal, and the posterolateral portal is the working portal. The

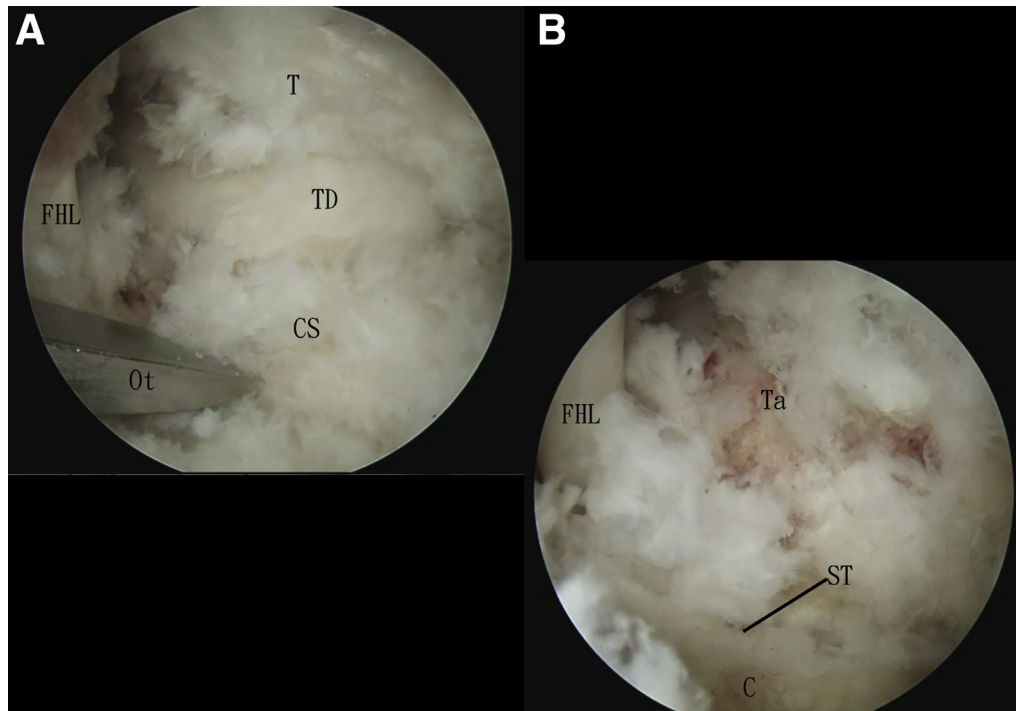


Fig 3. Endoscopic management of calcaneofibular impingement and posterior ankle impingement syndrome of right foot and ankle. The patient is in the prone position. The posterolateral portal is the viewing portal, and the posteromedial portal is the working portal. (A) The posterior calcaneal bone spike is resected with an osteotome. (B) After resection of the bone spike, the posterior joint line of the posterior subtalar joint is exposed. (C, calcaneus; CS, posterior calcaneal bone spike; FHL, flexion hallucis longus tendon; Ot, osteotome; ST, posterior subtalar joint; T, distal tibia; Ta, talus with the posterior talar tubercle resected; TD, talar dome.)

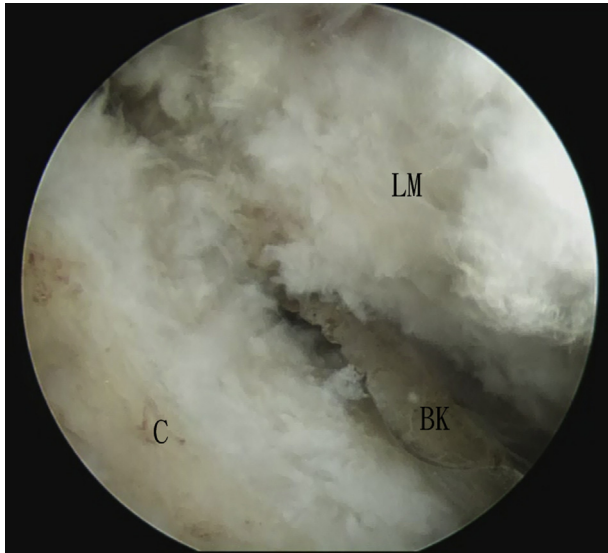


Fig 4. Endoscopic management of calcaneofibular impingement and posterior ankle impingement syndrome of right foot and ankle. The patient is in the prone position. The posteromedial portal is the viewing portal, and the posterolateral portal is the working portal. Impingement between the lateral malleolus (LM) and lateral calcaneal bulge is shown with a banana knife (BK) between the bones. (C, calcaneus.)

thick fibrous tissue around the lateral malleolus and lateral calcaneal wall is resected with an arthroscopic shaver. After clearance of scar tissue, impingement between the lateral malleolus and lateral calcaneal bulge can be shown (Fig 4).

Endoscopic Lateral Calcaneal Osteotomy and Postoperative Protocol

The posteromedial portal is the viewing portal, and the posterolateral portal is the working portal. The soft tissue is stripped from the lateral calcaneal cortex by an arthroscopic shaver. The lateral calcaneal cortical bulge is then resected with an arthroscopic acromionizer. The soft-tissue stripping and bone resection are repeated from a posterior-to-anterior direction until the cortical bulge anterior to the lateral malleolus is resected. The extent of bone resection should span proximally to the posterior subtalar joint and distally beyond the tip of the lateral malleolus. The bone resection is considered adequate if there is no more impingement between the calcaneus and lateral malleolus even with passive eversion of the hindfoot (Figs 5 and 6, Video 1, Table 2).

Postoperatively, the patient is allowed weight-bearing walking as tolerated based on pain. Active mobilization of the foot and ankle is allowed. Instructions on passive ankle dorsiflexion and hindfoot inversion exercises are given.

Discussion

Identification of the correct source of symptoms is the key in formulating the correct treatment plan for heel pain after calcaneal malunion. This may be a difficult task because symptomatic malunion often has multiple components. The patient should be asked to point to the area of worst pain on his or her own foot to focus the physical examination.¹ Concerning lateral heel pain, it is important to exclude associated peroneal tendon

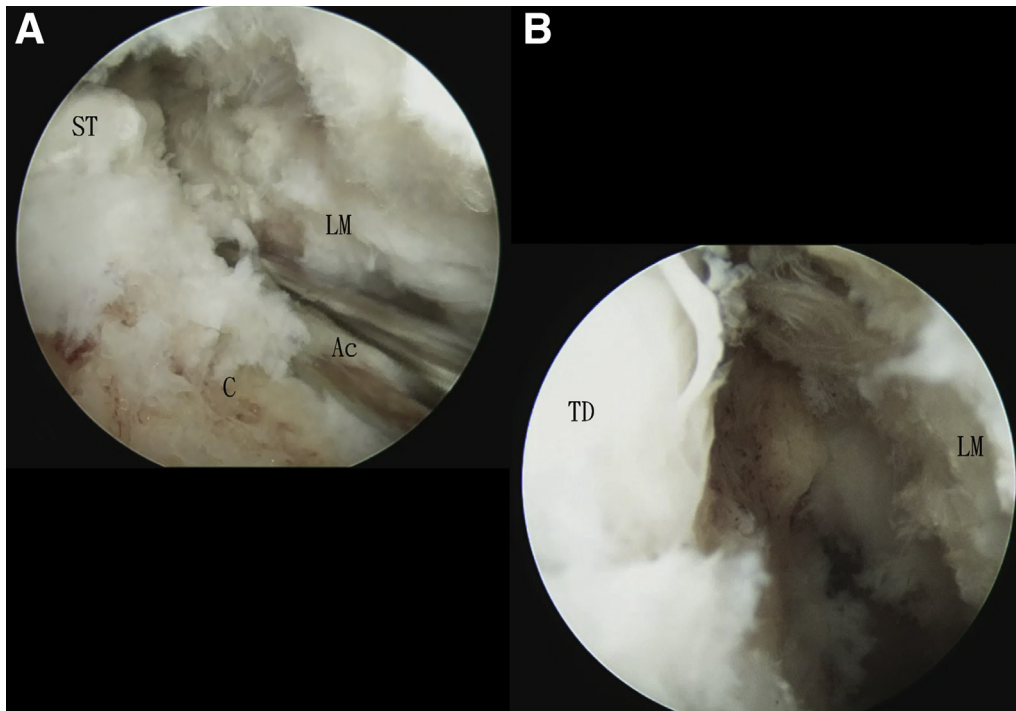
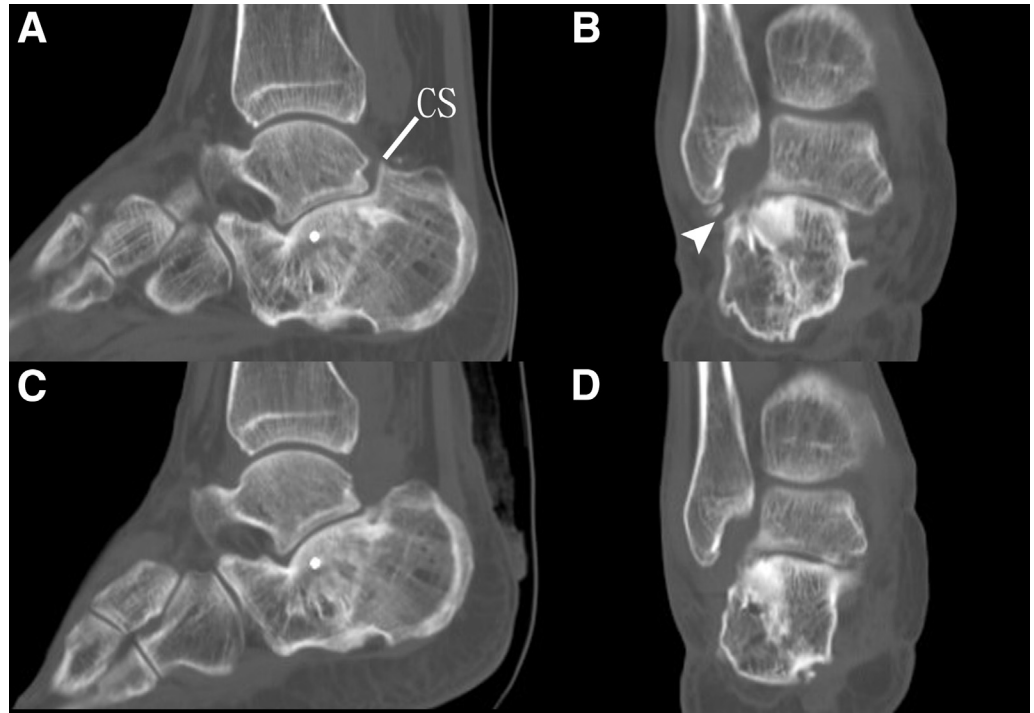


Fig 5. Endoscopic management of calcaneofibular impingement and posterior ankle impingement syndrome of right foot and ankle. The patient is in the prone position. The posteromedial portal is the viewing portal, and the posterolateral portal is the working portal. (A) The lateral calcaneal bulge is resected with an arthroscopic acromionizer. (B) After lateral decompression, there is no more impingement between the calcaneus and lateral malleolus. (Ac, arthroscopic acromionizer; C, calcaneus; LM, lateral malleolus; ST, posterior subtalar joint; TD, talar dome [posterior part].)

Fig 6. Endoscopic management of calcaneofibular impingement and posterior ankle impingement syndrome of right foot and ankle. The patient is in the prone position. Preoperative and postoperative computed tomograms (CTs) of the right foot are shown for the illustrated case. (A) The preoperative sagittal CT view shows the posterior calcaneal bone spike (CS). (B) The preoperative sagittal CT view shows calcaneofibular impingement (arrowhead). (C) The postoperative sagittal CT view shows that the posterior calcaneal bone spike has been resected. (D) The postoperative coronal CT view shows adequate lateral decompression.



pathologies. Even moderate bulging of the lateral calcaneal cortex can cause peroneal impingement, tendinitis, and tears.¹ High-energy injury may cause frank dislocation of the peroneal tendons. Although decompression of the lateral calcaneal wall may relieve peroneal tendon impingement, separate peroneal tenolysis or exploration may be required.¹ If an associated peroneal tendon problem is present, peroneal tenoscopy should be performed together with posterior ankle endoscopy.⁵ Injury to the sural nerve may be caused by tension or impingement. In patients with sural nerve symptoms, sural neurolysis may be performed in conjunction with lateral wall decompression.¹

Early range-of-motion exercise is important to prevent ankle and hindfoot stiffness after posterior and lateral decompression. An arthroscopic procedure is beneficial in this aspect. Two arthroscopic approaches to lateral decompression have been reported. Ankle arthroscopy portals can be used if the impingement is above the level of the posterior subtalar joint.⁹ Lateral subtalar portals

are used if the impingement is below the level of the posterior subtalar joint (e.g., after calcaneal malunion).^{2,3} The calcaneofibular impingement makes the space between the calcaneus and lateral malleolus markedly limited, and the space is always filled up with thick fibrous tissue. Therefore, the initial working space for endoscopic lateral calcaneal decompression through a lateral approach is the lateral gutter of the posterior subtalar joint. The space between the calcaneus and lateral malleolus can be reached after lateral capsulotomy and resection of the thick fibrous tissue. The posterior impingement cannot be dealt with by this lateral approach. In this reported technique, both the posterior and lateral impingement can be managed by the same posterior approach. The spacious retrocalcaneal space allows use of a larger arthroscope and arthroscopic acromionizer for lateral calcaneal decompression.

The advantages of our minimally invasive approach include better cosmesis, less soft-tissue dissection, and

Table 2. Pearls and Pitfalls of Endoscopic Management of Calcaneofibular Impingement and Posterior Ankle Impingement Syndrome Caused by Malunion of Joint Depressed—Type Calcaneal Fracture

Pearls

- The thickness of the bone spike should be regularly assessed with an arthroscopic probe during resection.
- The medial and lateral edges of the bone spike should be visualized for any residual posterior impingement.
- Lateral decompression should span from posterior to anterior to the lateral malleolus.
- Lateral decompression should span proximally to the subtalar joint and distally beyond the tip of the lateral malleolus.

Pitfalls

- Concomitant peroneal tendon or sural nerve problems should be detected preoperatively because a separate approach besides posterior ankle endoscopy is needed.
- The sinus tarsi cannot be assessed well through posterior ankle endoscopy. If there is sinus tarsi pain or tenderness, an anterolateral subtalar portal should be made to assess and debride the sinus tarsi.

Table 3. Advantages and Risks of Endoscopic Management of Calcaneofibular Impingement and Posterior Ankle Impingement Syndrome Caused by Malunion of Joint Depressed—Type Calcaneal Fracture

Advantages

- Fewer wound complications
- Less soft-tissue trauma
- Better cosmesis
- Ability to assess condition of subtalar joint

Risks

- Sural nerve injury
- Peroneal tendon injury
- FHL tendon injury
- Posterior subtalar joint injury
- Residual impingement

FHL, flexor hallucis longus.

the ability to assess the condition of the subtalar joint. The potential risks of this procedure include injury to the sural nerve, peroneal tendons, FHL tendon, or posterior subtalar joint and residual impingement (Table 3).

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