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van Dijk, C.N.; de Leeuw, P.A.J.; Scholten, P.E.

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Hindfoot Endoscopy for Posterior Ankle Impingement

Surgical Technique

By C.N. van Dijk, MD, PhD, P.A.J. de Leeuw, MD, and P.E. Scholten, MD

Investigation performed at the Department of Orthopaedic Surgery, Academic Medical Center, Amsterdam, The Netherlands

The original scientific article in which the surgical technique was presented was published in JBJS Vol. 90-A, pp. 2665-72, December 2008

ABSTRACT FROM THE ORIGINAL ARTICLE

BACKGROUND: The surgical treatment of posterior ankle impingement is associated with a high rate of complications and a substantial time to recover. An endoscopic approach to the posterior ankle (hindfoot endoscopy) may lack these disadvantages. We hypothesized that hindfoot endoscopy causes less morbidity and facilitates a quick recovery compared with open surgery.

METHODS: Fifty-five consecutive patients with posterior ankle impingement were treated with an endoscopic removal of bone fragments and/or scar tissue. The symptoms were caused by trauma (65%) or overuse (35%). All patients were enrolled in a prospective protocol. At baseline, the age, sex, work and sports activities, American Orthopaedic Foot and Ankle Society (AOFAS) hindfoot scores, and preinjury Tegner scores were determined for all patients. At the time of follow-up, AOFAS hindfoot scores and Tegner scores were assessed and the time to return to work and sports activities was determined. Complications were recorded. Patients scored the overall result as poor, fair, good, or excellent by means of a 4-point Likert scale.

RESULTS: The median duration of follow-up was thirty-six months, and no patient was lost to follow-up. The median AOFAS hindfoot score increased from 75 points preoperatively to 90 points at the time of final follow-up. The median time to return to work and sports activities was two and eight weeks, respectively. At the time of follow-up, patients in the overuse group were more satisfied than those in the posttraumatic group, and the AOFAS hindfoot scores were higher in patients in the overuse group (median, 100 points) compared with patients in the posttraumatic group (median, 90 points). A complication occurred in one patient who had a temporary loss of sensation of the posteromedial aspect of the heel.

CONCLUSIONS: The outcome after endoscopic treatment of posterior ankle impingement compares favorably with the results of open surgery reported in the literature. Hindfoot endoscopy appears to cause less morbidity than open ankle surgery and facilitates a quick recovery. Patients treated for posterior ankle impingement caused by overuse have better results than those treated following trauma.

LEVEL OF EVIDENCE: Therapeutic Level IV. See Instructions to Authors for a complete description of levels of evidence.

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INTRODUCTION

Posterior ankle pathology can be treated with posterior ankle

arthroscopy. The posteromedial and lateral hindfoot portals are anatomically proven to be

safe and reliable^{1,2} and typically provide excellent access to the posterior aspects of the ankle

FIG. 1

Patient position during posterior ankle arthroscopy. During posterior ankle arthroscopy, the patient is placed in a prone position. A tourniquet is applied proximal to the knee (II). The ankle is placed over the distal edge of the operating table with a small triangular support under the distal part of the leg (I). A support is placed at the ipsilateral side of the pelvis to permit slight rotation of the operating table in a safe manner when needed (III).

FIG. 2-A **FIG. 2-B**

Lateral (Fig. 2-A) and posterior (Fig. 2-B) views illustrating portal placement for posterior ankle arthroscopy in a left ankle. The anatomical landmarks are indicated and include the Achilles tendon (pink), the tip of the lateral malleolus (purple), and the level of the sole of the foot (horizontal black line). With the foot in the neutral position (90°), a straight line (blue line), parallel to the sole of the foot, is drawn from the tip of the lateral malleolus to the Achilles tendon and is extended over the Achilles tendon to the medial side. The posterolateral portal is located proximal to and 0.5 cm anterior to the intersection of the straight line with the lateral border of the Achilles tendon. The posteromedial portal is located at the same level as the posterolateral portal, but on the medial side of the Achilles tendon.

and subtalar joints, including the extra-articular hindfoot structures³. Since the introduction of the technique in 2000³, an increasing number of pathological conditions have been treated

successfully arthroscopically; arthroscopic treatment compares favorably to open surgery because it is associated with less overall morbidity and quicker recovery⁴⁻⁶.

SURGICAL TECHNIQUE

General Considerations

The procedure is carried out in an outpatient setting with the patient under general or spinal anesthesia. The affected side is

FIG. 3-A

FIG. 3-B

Figs. 3-A through 3-H Stepwise introduction of arthroscope and instruments for posterior ankle arthroscopy in a left ankle. The Achilles tendon is indicated in pink. **Fig. 3-A** The posterolateral portal is made as a vertical stab incision, and the subcutaneous tissue is subsequently spread with a mosquito clamp in the direction of the first web space. The ankle is in a slightly plantar-flexed position. **Fig. 3-B** The mosquito clamp is exchanged for a 4.5-mm arthroscopic shaft, again pointing in the direction of the first web space with the ankle in a slightly plantar-flexed position. The end of the shaft is situated at the level of the posterior talar process.

FIG. 3-C

Fig. 3-C The trocar is exchanged for a 4.0-mm arthroscope with a 30° inclination angle. The arthroscope points to the first web space, and the direction of view is routinely to the lateral side.

Fig. 3-D The posteromedial portal is made with a vertical stab incision, and a mosquito clamp is subsequently introduced and directed toward the arthroscope at a 90° angle.

FIG. 3-D

carefully marked preoperatively, and the patient is placed in a prone position. Prophylactic antibiotics are not routinely administered. A tourniquet is applied proximal to the knee and is inflated to a pressure of 300 mm Hg prior to instrument insertion. The ankle is positioned slightly over the distal edge of the operating table with a small triangular support under the distal part of the leg, allowing free movement of the ankle (Fig. 1). Normal saline solution or Ringer solution is used for irrigation; the flow is obtained by gravity. Typically, a 4.0-mm 30° arthroscope is used. Distraction is not routinely applied, but soft-tissue

distraction may be used when indicated⁷.

Portal Placement

The anatomical landmarks for portal placement are the sole of the foot, the lateral malleolus, and the medial and lateral borders of the Achilles tendon. With the ankle in the neutral position (90°), a straight line, parallel to the sole of the foot, is drawn from the tip of the lateral malleolus to the Achilles tendon and is extended over the Achilles tendon to the medial side.

The posterolateral portal is located just proximal to, and 5 mm anterior to, the intersection of the straight line with the

lateral border of the Achilles tendon. The posteromedial portal is located at the same level as the posterolateral portal, but on the medial side of the Achilles tendon (Figs. 2-A and 2-B).

Instrument Introduction

The posterolateral portal is made as a vertical stab incision, and the subcutaneous layer is spread with a mosquito clamp. The foot is now in a slightly (relaxed) plantar-flexed position. The clamp is directed anteriorly, toward the web space between the first and second toes (Fig. 3-A). When the tip of the clamp touches bone, it is exchanged for a 4.5-mm arthroscopic cannula,

with the blunt trocar pointing in the same direction (Fig. 3-B). The trocar is situated extra-articularly at the level of the posterior talar process and is exchanged for the 4.0-mm 30° arthroscope, directed laterally (Fig. 3-C). At this time, the arthroscope is still outside the joint with its tip in the fatty tissue overlying the capsule.

Next, the posteromedial portal is made with a vertical stab incision, and a mosquito clamp is introduced through the stab incision and is directed toward the arthroscope shaft at a right angle until the clamp contacts the arthroscope (Fig. 3-D).

The ankle is still in a slightly plantar-flexed position, and the arthroscope has remained in position through the posterolateral portal, directed toward the first web space. The arthroscope shaft is used as a guide for the mosquito clamp to travel anteriorly. While in contact with the arthroscope shaft, the clamp glides over the shaft toward the ankle joint until bone is reached (Fig. 3-E). Once the arthroscope and clamp are both touching bone, the mosquito clamp is left in position and the arthroscope is pulled slightly backward (Fig. 3-F) and is tilted until the tip of the clamp comes into view (Fig.

3-G). The soft-tissue layer covering the joints consists of fatty tissue and the deep crural fascia. At the lateral side a specialized part of the crural fascia can be recognized, which is called the Rouvière ligament.

Exchanging instruments through the posteromedial portal requires a careful step-by-step procedure. The described position of the arthroscope pointing in the direction of the first web space with the ankle in slight plantar flexion is always the starting point. Instruments introduced through the posteromedial portal are inserted perpendicular to the arthroscope until they are

Fig. 3-G With the mosquito clamp left in position, the arthroscope is tilted to the lateral side until the clamp comes into view. **Fig. 3-H** The arthroscope is used as a guide to direct the shaver toward the talus. While the arthroscope is retracted and tilted, the tip of the shaver is visualized.

FIG. 3-G

FIG. 3-H

FIG. 4

Arthroscopic images of a left ankle after penetration of the crural fascia to visualize the lateral aspect of the subtalar joint. A: The shaver is pushed through the crural fascia in a lateral and plantar direction. While the shaver is retracted, the soft tissue anterior to the crural fascia is removed and the opening of the shaver is facing bone. B: The shaver has been retracted, and thus the hole in the fascia can be visualized. C: The arthroscope is pushed through the hole in the crural fascia to visualize the posterolateral aspect of the subtalar joint. PTFL = posterior talofibular ligament.

in contact. Subsequently, the arthroscopic shaft is routinely used to guide any instrument, introduced through the posteromedial portal, toward the posterior parts of the ankle and subtalar joints. For the correct orientation, the arthroscope is always directed to the lateral side.

Surgical Procedure and Addressing the Pathology

The clamp is now directed to the lateral side in an anterior and slightly plantar direction. This movement creates an opening in the crural fascia, just lateral to the posterior talar process. The fatty tissue and the subtalar joint capsule are subsequently opened. The mosquito clamp is then exchanged for a 5-mm full-radius shaver (Fig. 3-H). With a few turns of the shaver, the subtalar joint capsule and the soft tissue are gently removed (Fig. 4, A). The opening of the shaver blade is facing bone. This part of the procedure is carried out in a blind

fashion. The shaver is then retracted (Fig. 4, B), and the arthroscope is brought anteriorly (as shown in Figure 5) through the opening in the crural fascia to visualize the posterolateral aspect of the subtalar joint (Fig. 4, C). Once the joint is recognized, the opening in the crural fascia is enlarged to create more working area.

Figure 5 shows a schematic representation of the steps described above.

The cranial part of the posterior talar process is freed from the Rouvière ligament and crural fascia (Fig. 6, A, B, and C) to identify the flexor hallucis longus tendon (Fig. 6, D). The flexor hallucis longus tendon is an important safety landmark. Since the neurovascular bundle runs just medial to this tendon, the area lateral to the flexor hallucis longus tendon is regarded as being safe.

At the level of the ankle joint, the posterior talofibular ligament is identified. Proxi-

mally, the intermalleolar ligament, also called the tibial slip, and the deep portion of the posterior tibiofibular ligament, also called the transverse ligament, are identified in turn (Fig. 6, D). A distinction between these ligaments can easily be made by dorsiflexion of the ankle⁸. The intermalleolar and transverse ligaments can be elevated with a probe in order to enter and inspect the ankle joint.

In the case of isolated flexor hallucis longus tendinitis, the flexor retinaculum can be released by detaching it from the posterior talar process or symptomatic os trigonum with an arthroscopic punch. Subsequently, the tendon sheath can be opened up to the level of the sustentaculum tali and entered with the arthroscope, allowing accurate tendon inspection. The proximal part of the tendon and the distal part of the muscle belly are inspected and débrided if inflamed or thickened or if nodules are

present. Adhesions and excessive scar tissue are removed with a shaver; however, a radiofrequency probe may also be used. Under all circumstances, care is required due to the proximity of the neurovascular bundle.

Removal of a symptomatic os trigonum, an ununited fracture of the posterior talar process, or a symptomatic large posterior talar prominence involves partial detachment of the posterior talofibular ligament,

detachment of the talocalcaneal ligament, and release of the flexor retinaculum (Fig. 6, E). All of these structures attach to the posterior talar prominence or symptomatic os trigonum, and the release of each is ideally

FIG. 5

Schematic step-by-step overview of arthroscopy and instruments for posterior ankle arthroscopy in a left ankle. The 4.0-mm arthroscope with an inclination angle of 30° is in the posterolateral portal, with the tip resting on the posterior talar process and pointing in the direction of the first web space with the ankle in slight plantar flexion. First, the shaver is introduced through the posteromedial portal and glides over the arthroscope until it is in contact with the bone. Next, the arthroscope is retracted slightly while the shaver remains in position. The arthroscope is then tilted until the shaver comes into view. The shaver is directed in a lateral and slightly plantar direction, thereby perforating the crural fascia and removing the soft tissue located immediately anterior to the fascia. The opening of the shaver is always pointing toward bone. The shaver is then tilted to remove the soft tissue adjacent to the bone while the arthroscope remains in position. The shaver is retracted. The arthroscope is moved anteriorly. The arthroscope is tilted to enter and view the posterolateral aspect of the subtalar joint.

FIG. 6

Endoscopic images of a left ankle, indicating the different steps to remove a symptomatic os trigonum. A: The red circle in the image is identical to the area as indicated in Figure 4,C. The arthroscope is in the posterolateral portal, and the shaver is introduced through the posteromedial portal. The shaver is situated proximal and just lateral to the Rouvière ligament, thereby lifting its insertion onto the top of the os trigonum (OT) (indicated with arrows). Shaving medially will release the Rouvière ligament from the os trigonum. B: Endoscopic image of the Rouvière ligament. The ligament runs from the distal part of the fibula to insert onto the top of the os trigonum. The insertion of this ligament needs to be detached and the ligament can be partially removed in order to obtain an overview of the posterior ankle compartment. C: The blue circle indicates the attachment of the Rouvière ligament and is a copy of B. The schematic transparent white cover indicates the crural fascia, which is an extension of the Rouvière ligament. It needs to be detached and partially removed to obtain the view seen in D. D: After removal of the Rouvière ligament and crural fascia, the os trigonum (OT) and flexor hallucis longus (FHL) tendon can be recognized. On the medial side, the flexor retinaculum (FR) is attached to the os trigonum. On the medial distal side, the posterior talocalcaneal ligament (PTCL) is attached to the os trigonum and, on the lateral side, the posterior talofibular ligament (PTFL) runs between the os trigonum and the fibula. Proximal to the posterior talofibular ligament, at the level of the ankle joint, the tibial slip and the deep portion of the posterior tibiofibular ligament (transverse ligament) are identified. E: Removal of the os trigonum (OT) requires a (partial) detachment of the posterior talofibular ligament (PTFL), the flexor retinaculum (FR), and the posterior talocalcaneal ligament (PTCL), respectively. The level for each incision is indicated. F: The first step in os trigonum (OT) removal is the partial detachment of the posterior talofibular ligament (PTFL) with an arthroscopic punch. G: Subsequently the flexor retinaculum (FR) and posterior talocalcaneal ligament (PTCL) are released with the arthroscopic punch. H: The os trigonum (OT) as seen after release of the retinaculum of the flexor hallucis longus (FHL) tendon and the posterior talocalcaneal ligament, and partial detachment of the posterior talofibular ligament. I: Detachment of the os trigonum from the talus with use of a 4-mm periosteal elevator. J: View after removal of the os trigonum.

performed with an arthroscopic punch or scissors (Fig. 6, F and G). The posterior talofibular ligament can also be detached with

a shaver. After release of these structures (Fig. 6, H), a small blunt periosteal elevator with a curved tip is best suited to detach

the os trigonum from the talus (Fig. 6, I and J). It can be applied both proximally and distally. A chisel is used to detach a symp-

tomatic enlarged posterior talar process. Caution is required in relation to the position of the chisel, which should not be placed too far anteriorly, in order to avoid entering the subtalar joint.

With the application of manual traction to the calcaneus, the posterior compartment of the ankle is distracted and the arthroscope and a probe or shaver can be easily introduced into the ankle joint. We prefer to apply a soft-tissue distractor at this point⁷. A synovectomy and/or capsulectomy can be performed when indicated. The talar dome as well as the com-

plete tibial plafond can be inspected over almost their entire surface. An osteochondral defect or subchondral cystic lesion can be identified and débrided, and microfracture can be performed. The posterior syndesmotomic ligaments are inspected and are débrided if fibrotic or ruptured. Syndesmotomic stability can be tested with a hook, and loose bodies in the syndesmotomic ligament complex can be released and subsequently removed.

On the medial side, the tip of the medial malleolus and the deep portion of the deltoid ligament can be visualized. Opening

the joint capsule from inside out at the level of the medial malleolus can allow the posterior tibial tendon sheath to be opened as desired. Subsequently, the arthroscope can be introduced into the tendon sheath to inspect the posterior tibial tendon.

Bleeding is controlled by means of electrocautery at the end of the procedure. To prevent sinus formation, the skin incisions are sutured with 3.0 nylon. The incisions and surrounding skin are injected with 10 mL of a 0.5% bupivacaine-morphine solution. A sterile compressive dressing is applied.

CRITICAL CONCEPTS

INDICATIONS:

The indications can be categorized according to their anatomical orientation.

Articular

- Osseous pathology includes loose bodies, ossicles, posttraumatic calcifications, avulsion fragments, and osteophytes. The osteophytes can be located either at the posterior tibial rim or at the level of the subtalar joint.
- Cartilage pathology includes chondromatosis; posterior talar, tibial, or calcaneal osteochondral defects; degenerative joint changes such as talar cystic lesions; bone spurs; and intraosseous talar ganglia.
- Soft-tissue pathology includes posttraumatic synovitis, villonodular synovitis, and syndesmotomic soft-tissue impingement.

Periarticular

- Posterior ankle impingement (osseous and/or soft-tissue impingement). Osseous impingement includes a hypertrophic posterior talar process, an os trigonum, or a talus bipartita. Soft-tissue impingement includes a partial rupture or fibrosis of the posterior talofibular ligament, the intermalleolar ligament, or the deep portion of the posterior tibiofibular ligament.
- Avulsion fragments (Cedell fracture) and posttraumatic calcifications or ossicles in the deep portion of the deltoid ligament.
- Flexor hallucis longus tendinopathy.
- Recurrent peroneal tendon dislocation.

Procedures include removal of osseous and/or soft-tissue impediments, synovectomy, débridement of an osteochondral defect, retrograde drilling of large cystic lesions, arthroscopically assisted arthrodesis, and groove deepening for the treatment of recurrent peroneal tendon dislocation.

CONTRAINDICATIONS:

- The absolute contraindication is a localized soft-tissue infection.
- Relative contraindications are severe edema, vascular diseases (including diabetic vascular disease), and moderate degenerative joint disease.

continued

CRITICAL CONCEPTS

PITFALLS:

- Correct portal placement is important in order to prevent neurovascular complications. The posteromedial and posterolateral portals must be positioned 5 mm anterior to the Achilles tendon, just proximal to the level of the tip of the lateral malleolus.
- For the correct orientation and reproducibility, the procedure is begun with the arthroscope in the posterolateral portal. Initially, it is directed toward the first web space. Instruments introduced through the posteromedial portal are inserted perpendicular to the arthroscopic shaft. The shaft is subsequently used as a guide to direct the instruments anteriorly.
- In the hindfoot, the crural fascia can be quite thick. This local thickening is called the ligament of Rouvière. It needs to be at least partially excised or sectioned, with use of an arthroscopic punch or scissors, to approach the ankle joint.
- The flexor hallucis longus tendon must always be located before addressing the pathology. Medial to this tendon, the tibial nerve and the posterior tibial artery are situated. The working area is therefore lateral to the flexor hallucis longus tendon.
- The direction of the arthroscopic view (30° angulation) is routinely to the lateral side to provide a reproducible orientation throughout the procedure.
- Posterior ankle arthroscopy is an advanced endoscopic procedure; surgeons not familiar with endoscopic surgery are advised to practice in a cadaver setting⁹.

AUTHOR UPDATE:

Since our original paper was published, no substantial changes have been made in the surgical technique.

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C.N. van Dijk, MD, PhD
P.A.J. de Leeuw, MD
Department of Orthopaedic Surgery, Academic Medical Center, P.O. Box 22700, 1100 DE Amsterdam, The Netherlands. E-mail address for C.N. van Dijk: c.n.vandijk@amc.uva.nl

P.E. Scholten, MD
Department of Orthopaedic Surgery, Kliniek Klein Rosendaal, Rosendaalselaan 30, 6891 DG Rozendaal, The Netherlands. E-mail address: pscholten@medinova.com

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