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SYMPOSIUM: RECENT ADVANCES IN FOOT AND ANKLE SURGERY

Double Posteromedial Portals for Posterior Ankle Arthroscopy in Supine Position

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Abstract Both posterior and anterior arthroscopy of the ankle may be indicated in the same patient. With the patient supine, it is possible to reach most intraarticular structures of the ankle through the standard anterior portals, but difficult to examine the posterior compartments and to perform hindfoot endoscopy. In most patients following the anterior procedure the patient is positioned prone to operate on the posterior compartment. We describe a two-portal posteromedial hindfoot procedure that allows the surgeon to reach both the posterior joint space and the extraarticular compartment of the hindfoot with the scope and instruments, regardless of diagnosis, with the patient supine. After arthroscopy on the anterior portion of the foot using standard anterior portals, the two posteromedial portals allow endoscopic inspection and management of abnormalities in this region without repositioning the patient and without any remarkable local complication.
Level of Evidence: Level IV. See Guidelines for Authors for a complete description of levels of evidence.

Introduction

Abnormalities of the posterior compartment of the ankle and of the soft tissues of the hindfoot [1–3, 6, 10] can involve the joint space or the extraarticular soft tissues of the hindfoot. Loose bodies, osteochondral defects of the talar dome or tibial plafond, bony cystic lesions, soft tissue impingement, posterior scar tissue, and bony spurs are frequently found in this region [3, 6, 9]. Symptomatic os trigonum, posterior intermalleolar ligament impingement, and talo-calcaneal joint affections are also articular problems, and tendinopathy or impingement of the tendon of flexor hallucis longus (FHL), insertional tendinopathy of the Achilles tendon, and Haglund's disease are all extra-articular problems of the hindfoot [2, 3, 6, 10].

At arthroscopy, it is possible to reach the posterior compartment of the ankle with some difficulty only by advancing the arthroscope along the medial and lateral aspect of the talus [2, 4, 10]. Dedicated endoscopic tools make it possible to assess in a systematic fashion the joint space of the posterior aspect of the ankle from an anterior approach, although reaching this area can be sometimes difficult given the shape of the talus [4, 8]. However, visualization of the posterolateral and posteromedial gutters is often incomplete and at times impossible from anterior portals only; the posterior compartment of the ankle can be explored by posterolateral portal [3, 4]

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Each author certifies that his or her institution has approved the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.
This work was performed at the Department of Orthopaedics, Università La Sapienza, Latina, Italy.

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keeping the supine position of the patient. Furthermore, only intraarticular abnormalities of the ankle itself can be addressed from anterior portals, and the posterior aspect of the tibio-talar joint and hindfoot cannot be viewed [9].

Through posterior arthroscopic portals to the ankle, the subtalar joint and hindfoot, the tendon of FHL, the posterior aspect of the lateral malleolus, the posterior talocalcaneal joint, and the upper surface of the calcaneal tuberosity with the bony insertion of Achilles tendon are easily visualized. No anatomical structure is at risk in this area if the FHL tendon is kept medial to the arthroscope and the arthroscopic instruments, as the posteromedial neurovascular bundle is located medial to it.

When ankle abnormalities occur both anteriorly and posteriorly the surgeon either has to address them on separate sittings, exposing the patient to two operations, or the patient will be required to have an anterior ankle arthroscopy, and then be repositioned prone. Patients are prepped again, and then the posterior ankle arthroscopy and the endoscopy of the soft tissue of the hindfoot can be undertaken. This poses problems in surgical setup, as well as possible contamination of the surgical instruments and prolongation of the operating time.

We present a new arthroscopic procedure that allows the surgeon to reach the posterior compartment of the ankle and the hindfoot in supine position independently of the abnormalities, to treat both anterior and posterior ankle disorders during the same operation. We specifically asked whether: (1) all abnormalities could be visualized and treated with this approach; (2) the approach would result in minimal complications; (3) the function (AOFAS scores, return to activity) would be improved.

Patients and Methods

We prospectively followed 32 patients (17 men and 15 women; average age 43.3 (range, 34.8–53.9 years); minimum follow up: 3.2 years (average: 3.7 ± 0.5 years; range, 3.2–4.3 years) with a variety of anterior and posterior ankle abnormalities (Table 1) who underwent anterior and posterior ankle arthroscopy in the supine position from January 2001 to January 2006. None of the 32 patients was lost to follow up. All patients were symptomatic both anteriorly and posteriorly, and underwent accurate clinical examination and plain anteroposterior and lateral radiographs of the ankle. An MRI was performed in each of the 26 patients in whom an osteochondral lesion or tendon impingement was suspected.

All the procedures were performed by one surgeon (FA) under spinal anesthesia. The hip was externally rotated 15°–20° and flexed 30°–35°. The upper calf was secured in a leg holder. The operating table was rolled slightly towards the contralateral leg to keep the foot perpendicular to the floor; alternatively, a sand bag under the contralateral buttock maintains the foot in this position. The leg was prepped and draped in the usual fashion. The anterior medial portal was produced first and then the anterolateral one was produced by transillumination. The arthroscope was inserted and the procedure was performed in a routine fashion [2, 4, 6, 11]. Osteochondral lesions were débrided and microfractured or restored with an autologous osteochondral plug depending on the lesion size inferior to 15–20 square millimeters, the loose bodies were removed, the osteophytes were generously trimmed, and scar tissue gently shaved. After the anterior procedure was completed, the arthroscope and the endoscopic instruments were removed from the joint.

Table 1. Anterior and posterior conditions treated by anterior and posterior ankle arthroscopy in 32 patients

Anterior	Posterior
2 OLT	2 loose bodies
6 loose bodies	6 loose bodies
4 loose bodies	4 os trigonum
12 osteophytes	8 osteophytes + FHL impingement
2 osteophytes	2 OLT
4 loose bodies	4 FHL impingement
2 osteophytes + fibrous impingement	2 Achilles' impingement

OLT = osteochondral lesion of the talus; FHL = flexor hallucis longus.

The operated leg was slightly externally rotated. If a sand bag was used, its removal resulted in the leg being externally rotated, permitting easy access to the area where the posteromedial arthroscopic portals were to be produced. As the medial malleolus lies more anteriorly than the lateral malleolus, the direction of the transmalleolar axis helps to further expose the posteromedial compartment thanks to its physiological rotation of about 10°–15° (Fig. 1). In this way, it is possible to direct the triangular area between the posterior aspect of the tibia and the anterior margin of the Achilles tendon. This allows safe insertion of the arthroscope and of the instruments advancing them through the portals toward the posterior edge of peroneal malleolus.

For posterior ankle arthroscopy and hindfoot endoscopy, we used the nick and spread technique to produce two arthroscopic portals, just anterior to the anterior margin of the Achilles tendon, 45 to 50 mm from each other (Fig. 2). The first portal was distal and placed just medial and anterior to the Achilles tendon, just above a horizontal line parallel to the plantar aspect of the foot and passing

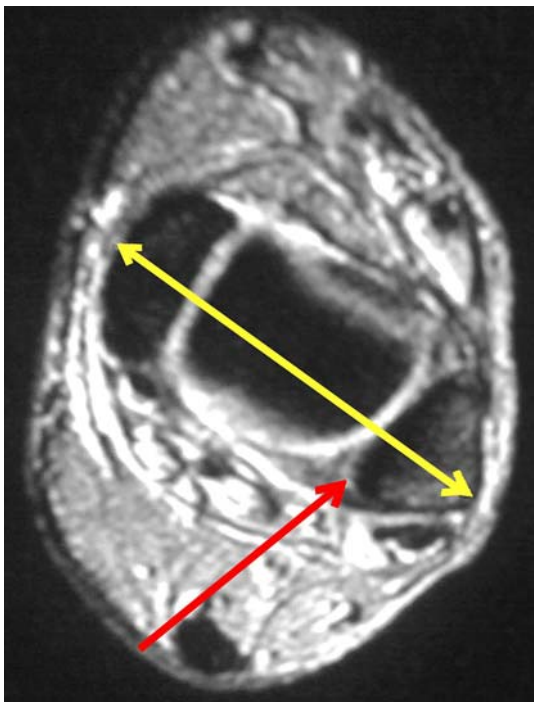

Fig. 1 The direction of the transmalleolar axis of the ankle (yellow arrow) is such that, with external rotation of the leg, the posterior compartment is better exposed because the tibial malleolus lies more anterior than the peroneal malleolus. The instrument can be safely advanced along the anterior margin of the Achilles tendon (red arrow).

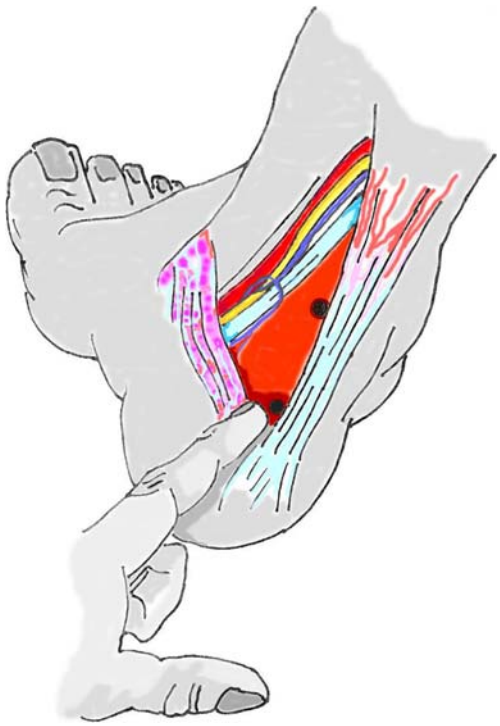

Fig. 2 The portals are placed in the triangular area between the posterior aspect of the tibia and the anterior aspect of the Achilles tendon. The borders of this area are easily palpated by a finger.

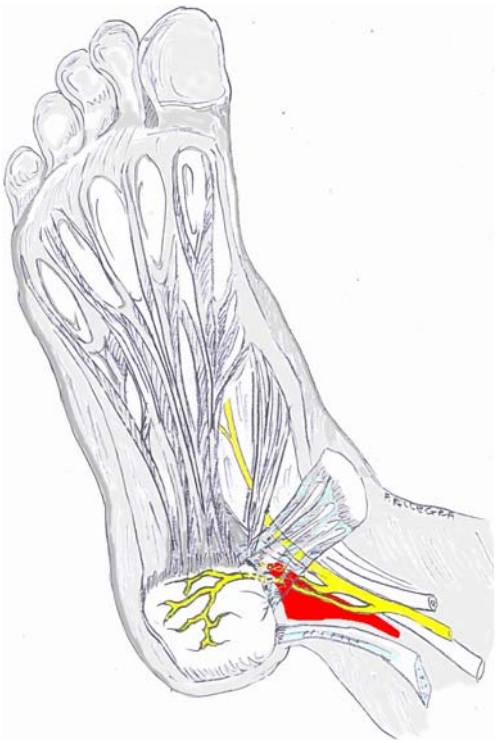

Fig. 3 The branches of the medial calcaneal nerve in the triangular area are seen from a plantar view.

through the tip of the medial malleolus. The second portal was proximal, and placed 45 to 50 mm proximal to the first one, again just medial and anterior to the Achilles tendon. The placement of the portals anterior to the medial aspect of the Achilles tendon is safe, as they are at least 12 to 15 mm posterior to the posteromedial neurovascular bundle, and 15 to 20 mm from the calcaneal sensory branch of tibial nerve (Fig. 3). A blunt arthroscopic introducer was directed anteriorly through the distal portal [4], pointing towards the fourth web space (the space between fourth and fifth toe), and gently advanced until it touched bone. The arthroscope was inserted through the distal portal. The proximal portal was established in the same fashion, and a mosquito clamp advanced in a distal and lateral direction until it touched the arthroscope. This mosquito clamp was removed, and an arthroscopic shaver introduced in its place. The arthroscopic shaver was carefully advanced in the same direction until it touched the arthroscope sheath. The shaver was then slid along the arthroscope sheath until its tip was visualized through the arthroscope (Fig. 4).

After shaving away the fat and the capsule of the posterior ankle and subtalar joints, it was possible to inspect the extra- and intraarticular space under direct visualization, keeping the tendon of the FHL as the medial border to prevent damage to the neurovascular bundle. The working path proceeded toward the great tuberosity of the calcaneus in a posteroanterior and mediolateral direction, from

Fig. 4 The figure shows the position of the instruments through the double portals during surgery.

Fig. 5 The flexor hallucis longus (FHL) tendon is in contact with the tip of the shaver.

proximal to distal. The tip of the shaver was always kept lateral to the arthroscope under direct vision, systematically uncovering the posterior talar-tibial, tibiofibular, and subtalar joints, the posterior ligament complex, and the tendon of the flexor hallucis longus. Any abnormality identified (for example, loose bodies, FHL impingement [Fig. 5], symptomatic os trigonum, posterior tibial edge bony spur, posterior subtalar joint spurs [Fig. 6], posterior calcific deposits) was reached more easily from the proximal portal. To reach the posterior aspect of the ankle and the subtalar joints to visualize the posterior portion of the peroneal malleolus, the arthroscope was inserted in the distal portal and the shaver in the proximal one, progressing from above towards the tibial-talar-calcaneal bony surfaces. To visualize the entire FHL tendon and to remove calcaneal bony spurs, the arthroscope was either introduced

Fig. 6 The posterior aspect of the subtalar joint is visualized after removal of the capsule.

in the proximal portal or through the distal portal. At the end of the procedure, the arthroscopic portals were sutured in a routine fashion, and the ankle draped with a cotton and crepe bandage. A circulating nurse recorded the duration of the anterior ankle arthroscopy, the duration of the posterior ankle arthroscopy, and the total time of the procedure.

All patients received subcutaneous low-weight heparin (enoxaparin nitrate, 4000 IU injectable solution, Aventis Pharma S.p.A, Milan, Italy for Sanofi Aventis) for 3 weeks, and routinely used elasticized stockings. Four patients underwent an ultrasound scan for a suspected deep vein thrombosis, which was not experienced by any of our patients. Dressings and sutures were removed 10 to 12 days after the procedure.

All patients underwent postoperative rehabilitation. Immediate weight bearing if tolerated was allowed with crutches and continued for 3 weeks, resting with the operated leg elevated for 1 or 2 hours at lunch and dinner. Patients were encouraged to keep their operated limb elevated on a stool when not walking. At the same time, they began muscle strengthening with close kinetic chain exercises for the dorsal and plantar flexor muscles of the foot. The exercises were repeated three times in a day, for a period of 30 minutes each, with the maximum tolerated intensity using a 0.5 kg weight. After three weeks, open kinetic chain exercises were allowed, starting with proprioception exercises for 45 minutes a day standing with either one or both feet on an oscillating platform, and gradually increasing the intensity of the strengthening exercises using 0.5–2 kg increments. If swelling appeared anteriorly and/or posteriorly at the end of the daily exercises, cryotherapy was implemented for 10 to 15 minutes three to five times per day for a total of one hour.

Two of us not involved in the surgery (FA, NM) evaluated all patients before and after the surgery using the AOFAS scores [7]. Data were entered in a commercially available database. Descriptive statistics were calculated. Pre-and postoperative AOFAS scores were compared.

Results

All the anatomic abnormalities in our patients were addressable as planned, regardless of their anterior or posterior location (Table 1). The supine position did not interfere with adequate visualization of the abnormalities. The duration of the anterior ankle arthroscopy was 28 ± 10 minutes (range, 18–37 minutes); the duration of the posterior ankle arthroscopy was 33 ± 8 minutes (range, 25–41 minutes); the total time of the procedure was 61 ± 20 minutes (range, 51–79 minutes).

No patients had any neurovascular complication in the anterior or posterior compartments. Sensation in the medial aspect of the heel was always normal immediately after surgery and 6 months later, without any paresthesias or any discomfort during ambulation. Two patients experienced ankle swelling for more than 2 months. Both had varicosities in the operated limb, and completely recovered after 5 weeks of low molecular weight heparin, elastic socks for 6 weeks, and physiotherapy. No patient presented any weakness in plantar flexion of the hallux, both in their gait and standing/walking on tip-toe.

All of the patients improved their preoperative AOFAS score from 56 ± 5 (range, 52–60) points to 87 ± 3 points (range, 84–90) 6 months after surgery. Twenty-eight (87%) patients returned to their former activity fully, and four of 32 (13%) returned to a lower level without further surgery. Among the 17 male patients, 14 participated in active sports: three were amateur tennis players, nine were soccer players (six amateur and three professional), and two were recreational cyclists. Only one of the soccer players returned to a lower level of sports activity because of incomplete restoration of joint range of motion. Of the 15 female patients, 10 participated in active sports weekly (two soccer players, three tennis players, and fiver joggers), and three of them decided to stop sport after surgery (two because of prolonged swelling, and one because of pain). Three years following the procedure, the AOFAS score was 86 ± 9 points (range, 73–90).

Discussion

Both posterior and anterior arthroscopy of the ankle may be indicated in the same patient. With the patient supine, it is possible to reach most intraarticular structures of the ankle through the standard anterior portals, but often difficult to examine the posterior compartments. Therefore in most instances the patient is positioned prone to examine and treat the posterior compartment after the anterior compartment is examined. We present a new arthroscopic procedure that allows the surgeon to reach the posterior compartment of the ankle and the hindfoot in supine position independently of the abnormalities, to treat both anterior and posterior ankle disorders during the same operation. We specifically asked whether: (1) all abnormalities could be visualized and treated with this approach; (2) the approach would result in minimal complications; (3) the function (AOFAS scores, return to activity) would be improved.

We acknowledge our study has limitations. First, all the procedures reported were performed by surgeons experienced in arthroscopic surgery of the ankle. However, in our departments, trainees, fellows and staff surgeons are exposed on a regular basis to posterior ankle endoscopy and arthroscopy using the double posteromedial portal and find the procedure easy to master. Second, we did compare the approach described in the present investigation with the other commonly used one [14]. While we placed portals both anteriorly and posteriorly some authors [1, 6, 8] discourage the use of posterior portals except the posterolateral [1, 2]. These authors believed the anatomy of the posteromedial aspect of the ankle did not allow safe passage of surgical instruments in this area given the potentially high risk of neurovascular injury [2, 5, 6]. The evaluation of posterior ankle abnormalities through anteromedial, anterolateral and posterolateral [1, 6, 8] portals can be difficult because of the shape of the talar dome and the tibial plafond, even in the presence of articular laxity. Surgery may address abnormalities in the posterior aspect of the joint, but disorders outside the posterior capsule need more dissection. More recently, several authors [8, 12–14] reported the relationship between the posterior tibial neurovascular bundle and surrounding structures. One of these authors [14] suggested the posterior aspect of the ankle could be safely approached through posteromedial and posterolateral portals with the patients prone, but that report addressed only posterior disorders. The technique reported in the present investigation safely reaches the posterior ankle compartment and hindfoot with the patient supine after anterior arthroscopy, addressing disorders of the anterior and posterior ankle at the same time.

The combined anterior and posterior arthroscopic procedures allowed us to reach the both the anterior and the posterior ankle compartment and the hindfoot in all 32 patients without changing the supine position of the patient. After addressing the anterior abnormalities, the two posteromedial portals allowed the arthroscopic instruments to safely reach all the relevant posterior articular and

extraarticular structures. This technique addressed cartilage problems, removed debris, and released posterior soft tissue impingement. The progression of the instruments in the triangular area described was always safe, and did not produce any problem in visualization of various structures. To achieve adequate visualization accurate removal of the soft tissues present in the space between the posterior tibiotalar edge and the anterior aspect of the Achilles tendon is necessary. This space contains excess adipose tissue that must be removed carefully. We suggest that radiofrequency devices should be available because occasional bleeding can obscure the view.

Recently, the safety of the posteromedial portal has been reevaluated by Pena Gomez et al. [11] and Sitler et al. [13]. They stressed the importance of producing a working space between the posterior capsule and the Achilles tendon by removing the fat tissue in the Kager's triangle. Acevedo et al. [1] proposed a posteromedial portal starting from the posterolateral portal. This procedure makes it possible to penetrate the posterior capsule through a posteromedial portal behind the medial malleolus and in contact with the posterior tibial tendon; such a portal is away from the posterior neurovascular bundle, which is displaced following distension of the joint with the fluid used for anterior arthroscopy. The patient remains supine, but any extracapsular abnormalities cannot be addressed using this portal. Sim et al. [12] described another posteromedial portal placed anteriorly to the posterior tibial tendon and behind the posterior edge of the medial malleolus: the procedure is performed with the patient prone, and again addresses only intraarticular problems. The prone position and the lack of visualization of hindfoot remain limits of this technique.

The double posteromedial hindfoot approach we suggest is located in the safe triangular region just anterior to the anterior margin of the Achilles tendon. By dorsiflexing the ankle, the neurovascular tibial bundle lies more anteriorly, and is kept safe. This approach is safe, and allows wide arthroscopic visualization of the posterior tibio-talar, talofibular, and subtalar joints, of the upper calcaneal tuberosity, of the tendons and tendon sheaths in that area, and the endoscopic treatment of abnormalities in that region with no complications in our cohort.

In conclusion, arthroscopic treatment of both anterior and posterior ankle disorders with the patient supine at the same sitting and without changing position of the patient is appealing. The double posteromedial hindfoot approach allows good visualization of the posterior compartment of the ankle and of the structures in the hindfoot without neurovascular or tendinous complications.

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