Posterior Ankle and Hindfoot Arthroscopy

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Introduction

Posterior ankle and hindfoot arthroscopy, performed with use of posteromedial and posterolateral portals with the patient in the prone position, has become an important diagnostic and therapeutic procedure for various intra-articular and extra-articular disorders¹⁻³. It has many potential advantages over open surgical procedures: decreased morbidity, less scarring and injury to the surrounding soft tissues, and faster recovery in the early postoperative phase⁴.

Posterior ankle and hindfoot arthroscopy is done in six stages:

Step 1: Position the patient prone

Step 2: Apply distraction if necessary

Step 3: Place the posterolateral and posteromedial portals under fluoroscopic guidance

Step 4: Perform the intra-articular and/or extra-articular procedure

Step 5: Close the arthroscopy portals

Step 6: Postoperative care

Step 1: Position the Patient Prone

If you are planning to use fluoroscopy for surgery and wire distraction, position the patient prone, flex the contralateral knee, and wrap the contralateral leg to a padded holder.

- Administer a prophylactic dose of intravenous antibiotics within one hour prior to the start of surgery.
- Use either spinal or general anesthesia. Apply a tourniquet on the ipsilateral thigh with the patient in the supine position before he/she is turned. However, do not inflate the tourniquet unless necessary.
- Position the patient prone on the operating table with the table end at the level of the distal part of the tibia. Pad the end of the table to

ensure that the anterior shin region is protected.

- Flex the contralateral knee to 90° and wrap the leg securely to a padded holder fastened to the side of the bed. This allows unimpeded fluoroscopic examination of the involved side.
- Prepare and drape the limb below the knee.
- If you plan to use traction, secure the patient by using the operating table's Trendelenburg position and place a safety strap across the buttocks, holding the patient so that he/she cannot be pulled down the table (Fig. 1).

Step 2: Apply Distraction If Necessary

Invasive distraction is used primarily to improve access to the ankle and subtalar joints.

- If necessary, apply invasive⁵ or noninvasive⁶ distraction—depending on your preference; however, no distraction is generally used to perform extra-articular surgery. In cases without distraction, we generally follow the technique outlined by van Dijk et al.⁷. Place a sterile bump of towels under the lower leg. Then ensure that the foot can be moved freely and a lateral fluoroscopic image can be obtained.
- Invasive distraction is used primarily to improve access to the ankle and subtalar joints; however, it does help to stabilize the leg and tension the posterior soft tissues, facilitating any intra-articular or extra-articular procedure. To achieve invasive distraction, first palpate the tuberosity of the calcaneus to identify the appropriate wire insertion point on its medial aspect. Use a 1.6 or 1.8-mm wire and position it on the inferior aspect of the tuberosity. Taking care to avoid the medial neurovascular structures, drill the wire transversally and parallel to the plantar aspect of the foot.

- Once the wire has contacted the lateral calcaneal cortex, use a mallet to complete its advancement to avoid causing thermal lesions or entrapment of the lateral soft-tissue structures. To avoid injury of the medial calcaneal branch of the tibial nerve, insert the wire posterior and inferior to the medial neurovascular bundle, approximately 1 cm from the inferior-posterior calcaneal cortex (Figs. 2-A and 2-B)⁸.
- Attach the wire to a reusable Taylor Spatial Frame foot-plate (Smith & Nephew) or to a sterile traction bow (Figs. 3-A and 3-B), and tension it to approximately 70 to 90 lb (32 to 41 kg), as measured with a calibrated spring scale. Traction can be adjusted throughout the procedure as necessary (Fig. 4).

Step 3: Place the Posterolateral and Posteromedial Portals Under Fluoroscopic Guidance

Using a mini-c-arm fluoroscopy unit to guide portal placement, place the posterolateral and posteromedial portals just lateral and medial to the Achilles tendon.

- Use a mini-c-arm fluoroscopy unit to guide portal placement, as the ideal portal position can vary slightly depending on the procedures planned. The portals are usually placed 1.5 to 2 cm proximal to the superior border of the calcaneal tuberosity⁹. In general when intra-articular procedures are to be performed, place the ankle arthroscopy portals slightly lower than the subtalar portals to accommodate the curvature of the posterior aspect of the ankle joint.
- For intra-articular ankle procedures, start first with the posterolateral portal, placing it just lateral to the Achilles tendon—outside the tendon sheath—and approximately at the level of the tip of the lateral malleolus. Confirm the position with fluoroscopy (Fig. 5), and instill sterile saline solution into the area under fluoroscopy (Figs. 6-A and 6-B).
- Make the incision only through the skin with a number-15 blade in order to avoid injury to the sural nerve¹⁰. Spread the subcutaneous tissue carefully with a straight mosquito clamp (Fig. 7). If the procedure will be intra-articular, advance the closed clamp through the posterior aspect of the capsule into that joint under c-arm guidance. Then spread the clamp and withdraw it.
- Repeat the same steps for the medial para-Achilles portal but direct the clamp more laterally to avoid the posteromedial neurovascular structures. The orientation of the lateral portal is toward the first webspace, and that of the medial portal is toward the third webspace. If the procedure is to be performed in the posterior extra-articular space, use the same steps to develop the portals without entering the joints.
- We generally use a 4.0-mm 30° arthroscope for extra-articular work and a 2.7-mm 30° arthroscope for non-fusion intra-articular procedures. When we plan to fuse a joint, we use the 4.0-mm arthroscope as it has the advantages of a greater rate of fluid flow and a wider field of vision. Through the working portal, we use a variety of ankle arthroscopic tools including a 3.5-mm full-radius shaver (either aggressive or semi-aggressive), arthroscopic curets, or a microfracture instrument. With extra-articular procedures, we use a 4.0-mm burr for bone excision.

Step 4: Perform the Intra-Articular and/or Extra-Articular Procedure

Specific procedures include posterior arthroscopic arthrodesis of the subtalar joint, ankle arthrodesis, and excision of the os trigonum with tenolysis of the flexor hallucis longus tendon.

Posterior Arthroscopic Arthrodesis of the Subtalar Joint¹

- Establish the posterolateral portal first. Inject 10 mL of normal saline solution into the subtalar joint using an 18-gauge needle; slight inversion of the foot indicates successful joint instillation. This can be confirmed with fluoroscopy.
- Use the standard portals described above and, if necessary, establish a third portal (the posterolateral ventral portal) approximately 1 cm proximal and 1 cm posterior to the tip of the lateral malleolus. Create this portal under direct visualization, using the needle first, so that the trocar will align with the joint perfectly. Place the portal immediately posterior to the peroneal tendons and anterior to the sural nerve. The nerve can be very close, and a careful blunt tissue-spreading technique is mandatory with use of this very helpful portal (Fig. 8). If you do not use distraction of the joint, you can place a blunt trocar in the acces-

sory posterolateral portal to open the joint when the debridement is performed (Fig. 9). With pin distraction, we use both the posterolateral and the posteromedial portal in an alternating fashion for viewing and for instrumentation (Fig. 10).

- Use a 3.5-mm full-radius shaver (aggressive) for the initial synovectomy and debridement. After the subtalar joint has been adequately exposed, remove the articular cartilage of the entire posterior facet with appropriate instruments such as a 4.0-mm burr, the shaver, and multi-angled curets. Also, remove the superficial layer of the subchondral bone. Perform the posterior facet debridement posterior to the interosseous ligament. Be careful not to destroy the original geometry of the osseous structures. At this point, you can place allograft or autograft under direct visualization through a small funnel via the posterolateral portal (Figs. 11-A and 11-B). Doing this actually facilitates fixation.
- For screw fixation, place the first guidewire from the posterolateral aspect of the calcaneus into the talar body. Place the second guidewire just medial and parallel to the first or slightly more anterior into the talar neck. Check the position of the wires using fluoroscopy. Obtain lateral and mortise views of the ankle and an anteroposterior view of the foot to confirm correct wire position.
- Use two cannulated 5.5 to 7.3-mm partially threaded cancellous screws for final fixation (Fig. 12). Check the clinical stability of the fixation by stressing the subtalar joint, and use fluoroscopy for final documentation of appropriate screw placement.

Ankle Arthrodesis

- Perform an ankle arthrodesis in the same way as a subtalar arthrodesis, but do not use the third portal and perform the fixation by means of separate percutaneous screw placement.
- Insert the first screw from the posterolateral aspect of the tibia straight down the neck of the talus, and the second from posteromedial and proximal to the medial malleolus into the talar body. The second screw should remain anterior to the posterior tibial tendon sheath.
- Combined ankle and subtalar fusions can be accomplished with either screw fixation as described above or with retrograde nail fixation.

Excision of the Os Trigonum with Tenolysis of the Flexor Hallucis Longus Tendon

- Create the posteromedial and posterolateral portals as described above.
- At the beginning of the procedure, the arthroscopic field of view is often limited; carefully using a shaver, debride the adipose tissue of the Kager fat pad lateral to the lateral tubercle of the posterior process of the talus until the shaver can be well visualized. If necessary, perform further debridement of fat and/or scar tissue in a lateral-to-medial direction until the following structures can be clearly identified: the posterior tibiofibular ligament, the posterior tibiotalar and subtalar joint capsules, the os trigonum, and the flexor hallucis longus tendon sheath (Fig. 13). The safest way to proceed with the debridement is by remaining close to the ankle joint capsule and working from lateral to medial.
- Obtain spot lateral fluoroscopic images to confirm the correct level of the working instruments. Make sure not to injure the flexor hallucis longus tendon. Judge your proximity to the flexor hallucis tendon by periodically moving the great toe.
- Perform debridement of the os trigonum in situ using a sheathed 4-mm arthroscopic burr or detach it from the posterior process of the talus (Fig. 14-A) and retrieve it through the arthroscopic working portal (Fig. 14-B). Identify the flexor hallucis longus by passive motion of the great toe. Open its sheath and release the tendon to the level of the sustentaculum tali. During the entire procedure, take care to remain on the lateral aspect of this tendon.

Step 5: Close the Arthroscopy Portals

Close the skin incision with nonabsorbable nylon sutures, and apply a sterile bulky dressing.

Step 6: Postoperative Care

Postoperatively, a plaster splint or walking boot with the foot in neutral is used for the first five to seven days. When a patient has undergone arthrodesis, the splint is then removed and a short leg removable cast boot applied. The patient remains non-weight-bearing for six weeks.

Results

Posterior ankle and hindfoot arthroscopy was performed in 189 ankles (186 consecutive patients with a mean age of 37.1 years)¹¹. The intra-articular procedures performed in these ankles included debridement of an osteochondral lesion of the talus (n = 44), subtalar debridement (n = 38), subtalar fusion (n = 33), ankle debridement (n = 30), partial talectomy (n = 9), fixation of a calcaneal fracture (n = 4), and revision of a subtalar nonunion (n = 1). The extra-articular procedures included excision of an os trigonum (n = 48), tenolysis of the flexor hallucis longus tendon (n = 38), and partial calcaneotomy (n = 5). No intraoperative complications were observed. Postoperative complications, which were noted in sixteen cases, included plantar numbness (n = 4), sural nerve dysesthesias (n = 3), postoperative infection (n = 2), Achilles tendon tightness (n = 4), a cyst at the posteromedial portal (n = 1), and complex regional pain syndrome (n = 2). All but two complications (one case of plantar numbness and one case of sural nerve dysesthesias) resolved over time.

What to Watch For

Indications

- Intra-articular disorders
 - Osteochondral lesion of the tibiotalar and/or subtalar joint
 - Osteoarthritis of the tibiotalar and/or subtalar joint
 - Intra-articular calcaneal fracture
 - Intraosseous talar ganglion
 - Loose bodies
 - Proliferative synovitis—e.g., pigmented villonodular synovitis— requiring synovectomy
 - Septic arthritis requiring irrigation and debridement
- Extra-articular disorders
 - Posterior ankle impingement with or without painful os trigonum and/or flexor hallucis longus tendinitis
 - Posttraumatic arthrofibrosis of the tibiotalar and/or subtalar joint
 - Chronic insertional Achilles tendinitis
 - Painful Haglund deformity
 - Painful Stieda process of the talus

Contraindications

- Absolute
 - Acute localized soft-tissue infection. (An intra-articular infection is not a contrain-

dication and may be treated with arthroscopic debridement.)

- Relative
 - Osteoarthritis of the tibiotalar and/or subtalar joint with substantial malalignment of articular surfaces and/or substantial joint space narrowing and/or severe instability
 - Extensive arthrofibrosis with a reduced range of motion
 - Failed previous tibiotalar and/or subtalar fusion
 - Severe edema
 - Tenuous vascular status
 - Complex regional pain syndrome
 - Poor posterior skin quality
 - Severe calcific insertional Achilles tendinitis, for which an extensive detachment of the Achilles tendon is required

Pitfalls & Challenges

- Incorrect portal placement. Always use mini c-arm fluoroscopy to guide portal placement. In general, place the posterolateral and posteromedial portals just lateral and medial to the Achilles tendon.
- Difficulties with portal placement. Position the patient prone. Portal placement is more challenging when the patient is in the supine or lateral position as there is a tendency to place these portals more anteriorly with these positions¹².
- Incorrect orientation. Always start the procedure with the arthroscope in the posterolateral portal. Then introduce the instruments through the posteromedial portal, perpendicular to the arthroscope.
- Sural nerve injury. Pay careful attention when creating the posterolateral portal. Always avoid sharp dissection of the subcutaneous tissue, and minimize repetitive exchange of instruments.
- Injury to the medial neurovascular bundle. Use the flexor hallucis longus tendon as an important landmark¹³. Avoid any dissection medial to the flexor hallucis longus tendon, and always be on the lookout for possible anatomic variations¹⁴.
- Difficulties with identification of the flexor hallucis longus tendon. Judge proximity to the flexor hallucis longus by periodically moving the great toe.

- Delayed wound-healing and infection. We recommend a prophylactic dose of intravenous antibiotics (e.g., cefazolin) within one hour prior to the start of surgery.
- Postoperative tightness of the Achilles tendon. Avoid using the trans-Achilles portal¹⁵, and prescribe a postoperative rehabilitation program.

Clinical Comments

- As neurological complications are major problems after this surgical technique, additional intraoperative landmarks and/or methods should be discussed to help to avoid neurovascular injuries.
- What is the extent of deformity that can be corrected during arthroscopic tibiotalar and/or subtalar fusion in patients with tibiotalar and/or subtalar osteoarthritis?

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Figures

Fig. 1

The patient is placed prone with the contralateral leg flexed at the knee and attached to a vertical post to stabilize it.

Fig. 2-A

Fig. 2-B

The wire is inserted from the medial aspect of the calcaneus transversely (**Fig. 2-A**) through the tuberosity (**Fig. 2-B**).

Fig. 3-A

The calcaneal traction pin is attached to a sterile traction bow.

Fig. 3-B

The final position with sterile draping and the mini-c-arm fluoroscopy unit in place.

Fig. 4

Lateral fluoroscopic image demonstrating the amount of distraction achieved after application of calcaneal traction.

Fig. 5

The positions of the arthroscopy portals are marked at the level of the tip of the lateral malleolus.

Fig. 6-A

Fig. 6-B

Before making a skin incision, confirm the portal position using an 18-gauge needle (**Fig. 6-A**) and injecting sterile saline solution (**Fig. 6-B**).

Fig. 7

After making the skin incision, spread the subcutaneous tissue with a straight mosquito clamp.

Fig. 8

Drawing demonstrating placement of the two standard portals (the posteromedial [PM] and posterolateral dorsal [PLD] portals) and an accessory posterolateral portal (the posterolateral ventral [PLV] portal) and their relationship to the neurovascular structures. FHL = flexor hallucis longus.

Fig. 9

Operative image demonstrating the two standard (posteromedial and posterolateral dorsal) portals and the accessory posterolateral ventral portal (with a blunt trocar).

Fig. 10

Arthroscopic view of the posterior facet of the subtalar joint (arrow).

Fig. 11-A

Arthroscopic view of the posterior facet of the subtalar joint (arrow) after cartilage debridement.

Fig. 11-B

Allograft (arrow) has been placed through a small funnel prior to screw fixation.

Fig. 12

Postoperative lateral radiograph showing solid fusion six months after posterior arthroscopic subtalar arthrodesis.

Fig. 13

The flexor hallucis longus tendon (arrow) is visualized from the posterolateral portal.

Fig. 14

Arthroscopic image demonstrating detachment of the os trigonum (**Fig. 14-A, arrow**) and its retrieval (**Fig. 14-B, arrow**) through the arthroscopic portal.

Fig. 1

Fig. 2a

Fig. 2b

Fig. 3a

Fig. 3b

Fig. 4

Fig. 5

Fig. 6a

Fig. 6b

Fig. 7

Fig. 8

Fig. 9

Fig. 10

Fig. 11a

Fig. 11b

Fig. 12

Fig. 13

Fig. 14a

Fig. 14b