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Ankle Arthroscopy

Dr. Uttam Saini, *Dr. Dinshaw Pardiwala,*
Arthroscopy & Sports Medicine Service
Department of Orthopaedics
King Edward VII Memorial Hospital, Mumbai.

Ankle arthroscopy allows direct visualization and access of all intra-articular ankle structures without an arthrotomy or malleolar osteotomy. A thorough understanding of anatomy and advances in optics and equipment have resulted in an improved ability to perform arthroscopic interventions of the ankle. The decreased morbidity and faster recovery times have revolutionized the treatment of common ankle problems.

Arthroscopic Setup And Instrumentation

Ankle arthroscopy may be performed with general, regional, or local anesthesia. A tourniquet may be used at the surgeon's discretion.

The patient position varies, depending on pathology to be treated and surgeon preference. I prefer a supine position, with a thigh support proximal to the popliteal fossa, with flexion of the knee over the end of the operating table [Fig. 1]. Access to posterior portals is difficult with this technique and for posterior compartment pathology sometimes the patient may be changed to a prone position with the foot and ankle extending beyond the table.

Fig. 1 : Optimum position for ankle arthroscopy - supine position, with a thigh support proximal to the popliteal fossa, with flexion of the knee over the end of the operating table. This position allows direct access to anterior portals with limited access to posterior portals. It also allows manual controlled intraoperative distraction and unrestricted ankle movements during arthroscopy.

The decision to perform invasive or noninvasive distraction generally is made at the time of surgery and depends on both the laxity of the ankle joint and the location of the pathologic tissue that is to be addressed. With invasive distraction, a tibial pin and a calcaneal pin are placed from the medial or lateral side with a mechanical distractor device. Noninvasive distractors include a clove-hitch-type device wrapped over the anterior aspect of the midfoot and the posterior aspect of the heel. Distraction should not exceed 8 mm for more than 1 hour. Periodic release is recommended in long procedures.

Arthroscopic Equipment : A 2.7 mm, 30-degree short arthroscope is preferred because of the shorter lever arm, easier accessibility to the joint, and availability of interchangeable cannulae. A standard 4.0-mm, 30-degree arthroscope may be used for exclusive anterior compartment pathology. Small-joint arthroscopic instruments including 2.7-mm graspers, miniprobes, and small joint burrs and shavers are helpful. Gravity assisted fluid inflow is adequate. An arthroscopic pump can also be used, but extreme caution must be exercised to avoid complications.

Portals

Before portal placement, the ankle joint is distended with 10 ml of normal saline injected into the joint medial to the tibialis anterior tendon. This

not only indicates the exact location of the portal, but also prevents chondral shaving during initial entry. To prevent injury to neurovascular structures, the incisions for the portals should be made vertically and through the skin only. The deeper layers should be penetrated with a hemostatic artery clamp followed by a blunt obturator. The antero-lateral, anteromedial, and postero-lateral portals are most commonly used.

The anteromedial portal is made just medial to the tibialis anterior tendon at the joint line. This portal is made first because it is easy to establish and is located in a region devoid of any major neurovascular structures. The greater saphenous vein and nerve are at greatest risk when establishing this portal. The portal is, on average, 9 mm lateral to the greater saphenous vein and 7.4 mm lateral to the greater saphenous nerve.

The anterolateral portal is used as an instrument portal and is established under direct visualization with the use of an 18 gauge needle. It is usually made just lateral to the tendon of the peroneus tertius at the level of the joint line. However, its location is also determined on the basis of the type and location of the pathologic tissue. Transilluminating the skin with the arthroscope prior to portal penetration assists in avoiding neurovascular struc-tures and injuries. The branches of the superficial peroneal nerve are most at risk. The mean distance of the anterolateral portal from the intermediate branch of the superficial peroneal nerve is 6.2 mm.

An anterocentral portal may be created between the tendons of the extensor digitorum communis, however, use of this portal is discouraged because of the inherent risk of neurovascular injury (dorsalis pedis artery and the deep branch of the peroneal nerve).

A posterolateral portal is established just lateral to the Achilles tendon 1.5 cm proximal to the distal tip of the fibula. The portal is made under direct visualization from the anteromedial portal looking posteriorly. An 18 gauge needle is inserted just lateral to the Achilles tendon at a 45 degree angle toward the medial malleolus. The posterior aspect of the capsule is punctured just medial to the transverse tibiofibular ligament. The lesser saphenous vein and the sural nerve are at risk in establishing this portal. The posterolateral portal is 6 mm posterior to the sural nerve.

The posterocentral portal is made just below the joint line through the middle of the Achilles tendon. This portal is not recommended because of its potential associated morbidity. The posteromedial portal is generally contraindicated because of the proximity of the posterior tibial artery and nerve. The flexor hallucis and flexor digitorum longus tendons are also at risk, along with branches of the calcaneal nerve.

A transmalleolar portal may be necessary to drill osteochondral lesions of the talus. These portals are made by creating small incisions over the medial or lateral malleolus and using a small-joint drill guide to direct the tip of the Kirschner wire to the lesion.

Arthroscopic Anatomy

A thorough, systematic evaluation of all areas of the ankle should be performed using the 21 point system [Table 1]. The use of this system allows reproducible documentation of the arthroscopic findings and accurate diagnosis of any intra-articular pathologic changes. The arthroscopic examination is always done initially through the anteromedial portal [Fig. 2] and subsequently through the anterolateral and posterolateral portals.

Table 1 : The 21-point arthroscopic examination of the ankle.

Anterior	Anterior gutter
	Medial gutter
	Medial talus
	Deltoid ligament
	Central talus and overhang
	Lateral talus
	Trifurcation of the talus, tibia, and fibula
	Lateral gutter

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Central	Medial tibia and talus
	Central tibia and talus
	Lateral tibiofibular or talofibular articulation
	Posterior inferior tibiofibular ligament
	Transverse ligament
	Reflection of the flexor hallucis longus
Posterior	Posteromedial gutter
	Posteromedial talus
	Posterocentral talus
	Posterolateral talus
	Posterior talofibular articulation
	Posterolateral gutter
	Posterior gutter

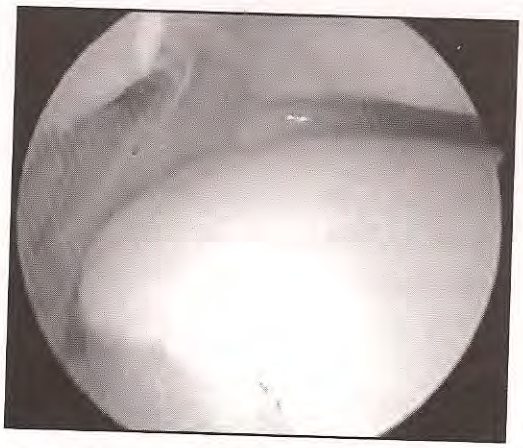


Fig. 2 : Arthroscopic view through anteromedial portal.

Postoperative Management

Portal closure is important in ankle arthroscopy. The joint is subjected to markedly increased hydrostatic pressure as compared to other joints and lacks the wound-sealing effect of soft tissue. The fluid that has extravasated about the ankle into the subcutaneous tissues usually is absorbed or leaks out of the portals over a short period of time. Edema, intra-articular hemorrhage, and effusion of the joint pose greater postoperative problems, and a compression dressing is mandatory following surgery. An ankle compression stocking or a posterior splint may also be indicated depending on the type of pathologic disorder encountered and the extent of the surgery. Postoperatively, rest with elevation of the limb and ankle immobilization are necessary for 3 to 5 days. The patient can start partial weight-bearing with crutches and gentle range-of-motion and strengthening exercises as per the indication for arthroscopy.

Indications And Contraindications

The diagnostic indications include unexplained pain, swelling, stiffness, instability, hemarthrosis, locking, and popping. An additional indication for ankle arthroscopy is a negative workup in a patient with significant ankle symptoms unresponsive to conservative care. Often, an unsuspected chondral fracture or soft-tissue lesion not detected on radiographic, clinical, or laboratory evaluation or on bone scanning or MRI can become obvious on arthroscopic examination. Therapeutic indications include debridement of injuries of the articular cartilage and soft tissue, bone impingement, synovectomy, loose-body removal, arthrofibrosis, ankle fractures, and osteochondral defects. Arthroscopy can also be used in ankle-stabilization procedures and arthrodesis, as well as for irrigation and debridement of septic arthritis.

Relative contraindications for arthroscopy of the ankle include moderate degenerative joint disease with a restricted range of motion, a markedly reduced joint space, severe edema, reflex sympathetic dystrophy, and a tenuous vascular status. More absolute contraindications include localized soft-tissue infection and severe degenerative joint disease.

Soft-tissue Lesions : Painful lesions in the ankle may be due to congenital bands, posttraumatic or postoperative scar tissue, synovitis, rheumatoid arthritis, pigmented villonodular synovitis, gouty arthritis, synovial chondromatosis, infection, ganglions, and arthrofibrosis.

Anterior Soft-tissue Impingement : Anterolateral impingement of the ankle, is believed to be caused by one or more inversion injuries to the ankle joint, and often results in chronic lateral ankle pain that persists despite adequate rest, healing, and

Impinging synovial tissue and redundant ligamentous tissue most commonly occurs in the superior portion of the anterior talofibular ligament [Fig. 3], but it can also be localized to the distal portion of the anteroinferior tibiofibular ligament (AITFL). In such cases arthroscopic debridement of the inflamed synovium and inflamed capsular or ligamentous tissue may be accomplished with either basket forceps or a power shaver.

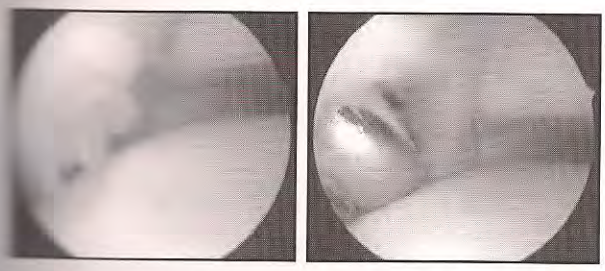
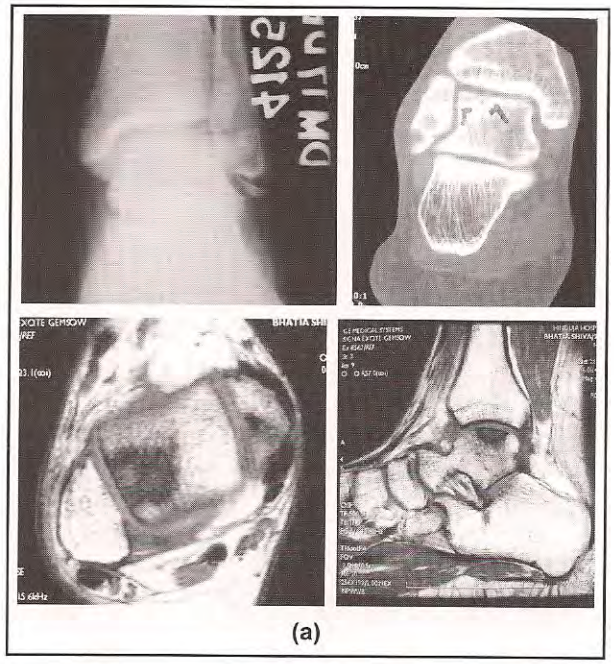


Fig. 3 : Anterior soft-tissue impingement. Arthroscopic debridement of the inflamed synovium and inflamed capsular or ligamentous tissue may be accomplished with either basket forceps or a power shaver.

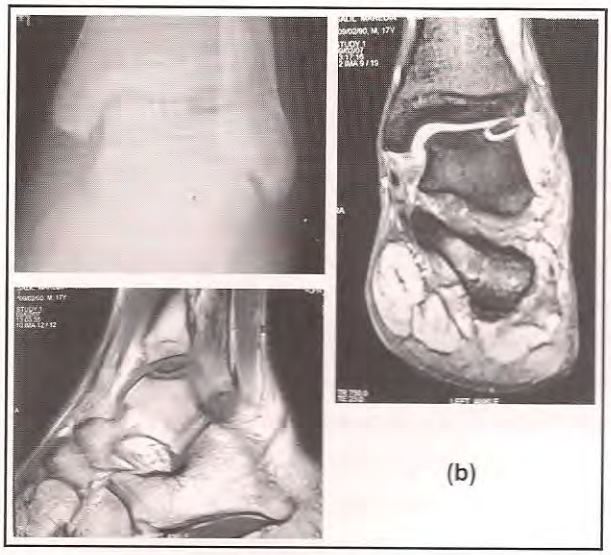
Posterior Soft-tissue Impingement : Generalized synovitis, fibrosis, and capsulitis are found in the posterolateral corner of the ankle joint over the posteroinferior tibiofibular ligament (PITFL). Posterior impingement may occur with hypertrophy or tearing of the PITFL, transverse tibiofibular ligament, tibial slip, or pathologic labrum of the posterior ankle joint.

Syndesmotic Impingement : Syndesmotic impingement and injuries to the syndesmosis can lead to prolonged pain and disability after ankle injuries. On physical examination, patients with syndesmotic impingement have focal tenderness along the syndesmosis and more proximally on the interosseous membrane. They may have positive squeeze and external rotation tests.

Osteochondral Lesions of the Talus : Lesions may range from a small defect in the talar articular surface to subchondral cysts or osteochondral fragments [Fig. 4]. Lesions of the dome of the talus have been described by a variety of names, including osteochondritis dissecans, transchondral dome fracture, and osteochondral fracture. These chondral lesions may be the result of acute trauma, such as an ankle sprain, or degenerative changes due to repetitive microtrauma. Idiopathic osteonecrosis may be another factor; many patients have no history of trauma, and 10% have bilateral involvement without a history of trauma.



(a)



(b)

Fig. 4 : Osteochondral lesions of the talus may range from a small undisplaced lesion in the talar articular surface (a) to large displaced / flipped osteochondral fragments (b).

Medial lesions are more common than lateral lesions. Medial lesions tend to be nondisplaced, cup-shaped, and deeper than lateral lesions. Lateral lesions, in general, are more commonly induced by

trauma and are usually shallow, wafer-shaped, and displaced from their bed.

Symptoms may be subtle but often include swelling, pain, and occasional catching or locking. On physical examination, there may be either medial or lateral tenderness, pain, limited range of motion, ankle swelling, and evidence of instability.

Surgery is advocated for all symptomatic stage III and IV lesions, except in children whose growth plates have not closed at the distal tibial and fibular epiphyses. In these cases, initial conservative treatment with casting is recommended before surgical intervention. During arthroscopy, osteochondral lesions of the talus can be debrided, and loose bodies and small osteochondral fragments can be removed.

Arthroscopic treatment is based on the location and extent of osteochondral injury and on whether the lesion is acute or chronic. For acute lesions, CT or MR imaging may be utilized to further visualize the appearance and stage. If an acute lesion is displaced, arthroscopy should be done immediately. If the lesion is primarily chondral, excision is recommended, with subsequent debridement and drilling of the base to promote formation of a fibrocartilaginous surface. Chronic osteochondral lesions should be assessed for size, location, and stability. If the lesion is not loose, transmalleolar drilling can be accomplished. If the lesion is loose and the articular cartilage is healthy, fixation can be accomplished with absorbable pins, or screws. Most commonly, chronic lesions are loose, nonviable, and occasionally displaced and must be excised. After excision, curettage and abrasion or drilling is done. If the crater is large, osteochondral peg grafting should be considered.

Loose Bodies : Loose bodies may be of chondral or osteochondral origin and may be the result of trauma. Multiple loose bodies can occur with synovial chondromatosis or synovial osteochondromatosis [Fig. 5]. Loose bodies may float freely within the joint or may be fixed to synovium or scar tissue. Loose bodies often cause catching or locking, swelling, pain, and decreased range of motion. After the loose bodies have been arthroscopically retrieved, a careful evaluation of the joint surfaces should be performed to find their source.

Fig. 5 : Ankle synovial osteochondromatosis.

Osteophytes : The occurrence of osteophytes is usually secondary to trauma or degenerative changes. The most common location is the anterior lip of the distal tibia, but they may occur anywhere in the ankle joint. A reciprocal lesion may form on the anterior neck of the talus. Termed "athlete's ankle" [Fig. 6], it is commonly observed in sportsmen who use repetitive and forceful dorsiflexion movements of the ankle and is usually termed "anterior impingement syndrome." It is a significant problem in football players, martial arts and dancers. Patients present with limited ankle range of motion.

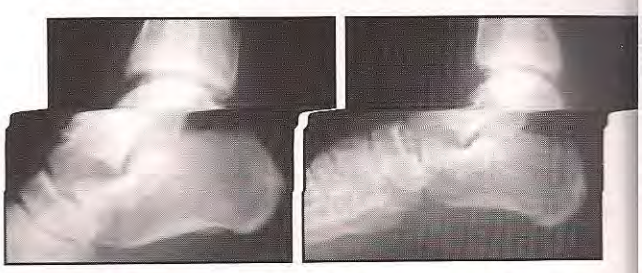


Fig. 6 : "Athlete's ankle" or "footballer's ankle" : anterior bony impingement caused by traction osteophyte arising from the anterior lip of the distal tibia, with reciprocal lesion on the anterior neck of the talus - (a) preoperative, (b) following ankle arthroscopic spur excision.

and swelling. If there is persistent pain after conservative treatment and a positive bone scan showing increased uptake, arthroscopic resection of the spur should be performed.

Traumatic and Degenerative Arthritis : Arthroscopy offers little benefit in cases of generalized joint degeneration. Contraindications to arthroscopic intervention include advanced destruction, marked joint-line narrowing, extensive varus, and a significant degree of instability or deformity. However, patients with limited ankle motion due to capsulitis, a minimal to moderate degree of hemarthrosis, the presence of osteophytes, chondral defects, or loose bodies, or only a minimal degree of swelling can be candidates for arthroscopic surgery. Arthroscopy can also be indicated to evaluate the relative degree of degenerative change suggested on radiographic studies. In addition, patients with pain, stiffness, swelling, and restriction of activities after healing of an ankle fracture can be examined arthroscopically if conservative methods have failed to decrease the severity of symptoms.

Ankle Arthrodesis : In the osteoarthritic ankle joint with minimal deformity, arthroscopic ankle arthrodesis appears to give fusion rates that are comparable with those of open procedures, with faster healing times, less pain, better cosmetic results, and shorter hospital stays. Fusion rates of 96% with time to fusion of 9 weeks have been reported. The technique is particularly appealing in elderly patients and in patients with rheumatoid arthritis who are unable to tolerate prolonged non-weight bearing postoperatively. The arthroscopic technique is not suitable for the correction of varus or valgus deformity of the ankle greater than 15 degrees, malrotation of the ankle, or anterior-posterior translation of the tibiotalar joint. Neither is it suitable in the presence of significant bone loss, active infection, reflex sympathetic dystrophy, or a neuropathic destructive process in the tibiotalar joint.

The principles of arthroscopic ankle arthrodesis include debridement of all hyaline cartilage and underlying avascular subchondral bone from the talus, tibial plafond, and medial and lateral gutters; reduction in an appropriate position for fusion; and rigid internal fixation accomplished with insertion of percutaneous transarticular 6.5 mm cannulated screws through the medial and lateral malleoli [Fig. 7]. A potential disadvantage of the arthroscopic technique is that it makes posterior displacement of the talus to improve foot biomechanics difficult.

Fig. 7 : Arthroscopic ankle arthrodesis : rigid internal fixation is accomplished with insertion of percutaneous transarticular 6.5 mm cannulated screws through the medial and lateral malleoli.

Acute ankle Fractures : Arthroscopy for acute ankle fractures facilitaes anatomic reduction of joint incongruity, allows assessment of the articular surfaces of the tibia and talus, and enables treatment of chondral and osteochondral lesions in the talar dome. A fluoroscopic table should be used to allow radiographic evaluation for subsequent open reduction and internal fixation. Even in ankle fractures that require conventional open reduction and internal fixation, ankle arthroscopy allows thorough inspection of the joint and attention to the intra-articular pathologic changes. A study of 33 consecutive ankle

fractures undertaken to look for unsuspected lesions identified osteochondral lesions were in 79%, loose bodies in 55%, and chondromalacia in 21%.

Lateral Ankle Instability : Recurrent lateral ankle sprains resulting in chronic instability [Fig. 8] does not respond to conservative management, and surgical repair of the ATFL / CFL is often necessary. Ankle arthroscopy is a useful method for diagnosis of ankle instability. The procedure also enables concomitant evaluation of the articular cartilage and loose body removal if any.

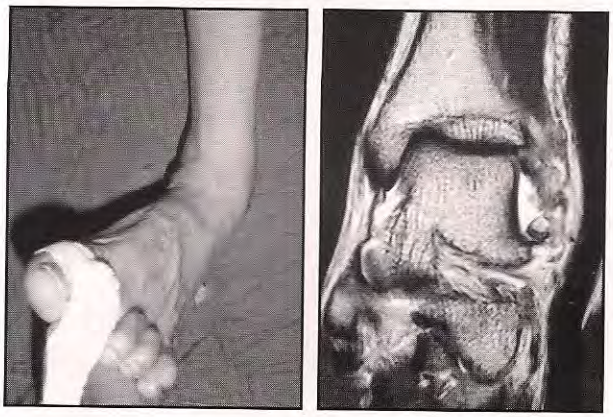


Fig. 8 : Lateral ankle instability. Ankle arthroscopy is a useful method for diagnosis of ankle instability. The procedure also enables concomitant evaluation of the articular cartilage and loose body removal prior to surgical rereconstruction of the anterior talofibular ligament (ATFL) / calcaneofibular ligament (CFL).

Complications

There are many potential complications with ankle arthroscopy [Table 3], however most can be avoided with a thorough knowledge of the surface anatomy of the region, careful preoperative planning, the use of appropriate distraction and instrumentation techniques including suitable small-joint instrumentation, and appropriate postoperative care.

Most reported complications with ankle arthroscopy involve neurologic injury (superficial branch of the peroneal nerve, sural nerve, greater saphenous nerve, deep peroneal nerve).

Table 3 : Complications of ankle arthroscopy.

Tendon injury
Ligament injury
Wound complications
Infection
Articular cartilage damage
Compartment syndrome
Hemarthrosis
Postoperative effusion
Reflex sympathetic dystrophy
Distraction-related complications (e.g., skin necrosis, pin problems) Instrument breakage.

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