(iii) Arthroscopy of the foot and ankle

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Abstract

The role of arthroscopy in the management of articular pathology is now well established. Its use in the management of foot and ankle pathology is relatively new, but with innovative techniques and modern equipment, the indications are expanding. Procedures that were previously performed through an open approach can now be done using a pure arthroscopic, or arthroscopically assisted, method with the aim of earlier rehabilitation, reducing complications and scarring, and improving outcome. We describe the history, current role and potential future uses of arthroscopy in the treatment of foot and ankle conditions.

Keywords ankle; arthroscopy; endoscopy; foot

History of arthroscopy

Endoscopes were first used in ancient times to examine ears, noses and the vagina using natural light. In the nineteenth century cystoscopes were developed, which used mirrors and light from combustion to see into the bladder. Modern arthroscopy is ultimately a development of this early cystoscopy, with the first recorded joint arthroscopy being performed on cadaveric knees in the early 20th century by a Dane, Dr. Severin Nordentoft. Burman was the first to report the endoscopic examination of joints other than the knee when he published his work on cadavers in the Journal of Bone and Joint Surgery in 1931.[1] He examined three ankles using a 4.0 mm sheath without distraction and he found it too tight for satisfactory visualization. He also tried to look into smaller joints such as the 1st metatarsophalangeal joint and tarsal joints, without success.

In 1933, Professor Kenji Takagi presented his 3.5 mm arthroscope to the Japanese Orthopaedic Association and continued to work in this field, designing different sized arthroscopes, with and without lenses. He developed a standard method of arthroscopic examination of the ankle that was published in the Journal of the Japanese Orthopaedic Association in 1939[2] and he is often referred to as the 'father of arthroscopy'. Another pioneer of arthroscopy, Dr Masaki Watanabe, described the standard portals several years later. In 1976, Chen[3] reported his experience with ankle arthroscopy in cadavers, describing the compartments within the ankle and their surgical anatomy. Since the 1970s many papers have been published regarding arthroscopy of the foot and ankle, describing alternative techniques and new distraction methods. Guhl[4] wrote one of many texts on the subject in 1988, recording his experience and describing the use of a skeletal distractor in ankle arthroscopy, with work published later the same year concerning the first non-invasive distraction techniques.

Ankle arthroscopy came of age in the 1990s with the development of cheaper, smaller arthroscopes, non-invasive distraction techniques and modern irrigation systems. Improved instrumentation, combined with novel techniques, has led to arthroscopy having an expanding role in the management of foot and ankle pathology.

Ankle joint arthroscopy

Ankle arthroscopy is no longer considered a new addition to the armamentarium of the foot and ankle surgeon. The most important advantage of ankle arthroscopy is that it permits the direct visualization of intra-articular pathology. Arthroscopically performed surgical procedures in the ankle are generally linked to faster rehabilitation, lower morbidity and better cosmetic results, as compared with conventional open surgical methods. Ankle arthroscopy can be categorized into anterior and posterior ankle arthroscopy, with the ability to visualize different compartments of the joint providing opportunities for therapy beyond its diagnostic role.

Anterior ankle arthroscopy

A number of specific conditions are amenable to this particular route of investigation and treatment. The most common indications include soft tissue impingement, anterior bony impingement, ankle degeneration being treated by arthrodesis, osteochondral lesions and loose bodies. Anterior ankle arthroscopy can also be used for arthroscopy-assisted (open) reduction of ankle fractures, offering the advantage of direct visualization and treatment of concomitant intra-articular injuries.[5] Contraindications include infection, vascular disease and severe oedema.

Positioning: several patient positions are described in the literature. The three most commonly used are supine, lateral and prone, depending on the site of pathology and intended portal placement. Anterior ankle arthroscopy is the most common of the foot and ankle arthroscopic procedures. The patient is positioned supine and often the thigh is secured by a nonsterile thigh holder, as is commonly used with knee arthroscopy, with the knee flexed 90° over the end of the table.[6] For posterior ankle arthroscopy, the patient is placed in a prone or lateral position.

Portals and preparation: further considerations are pertinent to the technical aspects and set up for ankle arthroscopy. Firstly an ankle distractor (Figure 1), though not mandatory, is often used.

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Figure 1 Positioning for ankle arthroscopy with a non-invasive distractor.

Non-invasive distraction methods are the norm. An ankle strap is placed around the hindfoot and then attached to a tensioning apparatus that is normally secured to the operating table. Some surgeons find a sterile belt attached directly to the ankle strap more convenient. A distractor improves ankle visualization by increasing the space between the tibia and the talus. Without the distractor, some areas of the ankle are poorly seen including: the talar dome and central tibial plafond, the posterior talofibular ligament and the calcaneofibular ligament. Joint distension, as with other joint arthroscopy, is performed using saline solution. A tourniquet is usually applied to the exsanguinated limb.

Access to the joint itself is achieved through short, superficial incisions followed by cautious spreading of underlying soft tissues to avoid neurovascular injury. The locations of these incisions determine the structures and compartments that can be most readily visualized (Figures 2 and 3).

Anteromedial portal — this is placed in the soft spot just medial to the tibialis anterior tendon and lateral to the medial malleolus at the level of the joint line. Care must be taken not to injure the saphenous vein and the saphenous nerve traversing the ankle joint along the anterior edge of the medial malleolus. This constitutes one of two primary viewing portals.

Anterolateral portal — the anterolateral portal is placed just lateral to the peroneus tertius tendon and superficial peroneal nerve, medial to the lateral malleolus. The primary risk of anterior ankle arthroscopy is injury to the superficial peroneal nerve or, more frequently, its intermediate dividing branch. The course of the main nerve can be clinically demarcated by plantar flexion of the 4th toe. This is commonly also a primary viewing portal.

Anterocentral portal — between the anteromedial and anterolateral portals lies the anterocentral portal. This is established between the tendons of the extensor digitorum communis (lateral) and extensor hallucis longus (medial) forming the anterior viewing portal. Particular care is taken to avoid injury to the neurovascular structures including the dorsalis pedis artery and the deep branch of the peroneal nerve, which are usually more closely related to the tibialis anterior tendon at this level.

Indications:

Soft tissue impingement — anterolateral soft tissue impingement of the ankle usually occurs after an inversion ankle sprain

Figure 2 Anterior arthroscopy portal sites (black), highlighting vessels (red and blue), nerves (orange) and tendons (green).

and was first described by Bassett et al. in 1990.[7] In this study the Bassett's ligament was described. It is not thought to be a pathologic structure; it is present in most ankles and is seen routinely during ankle arthroscopy. In severe injuries the hypertrophic response of this ligament can lead to erosion of the underlying lateral dome of the talus. Resection of this ligament usually results in pain relief. Anterior talofibular ligament and antero-inferior tibiofibular ligament impingement resulting from scarring of the respective structures can also be arthroscopically debrided with varying clinical results.

Anterior bony impingement — osteophytes of the anterior ankle joint cause a condition known as the 'Footballer's ankle' or are described as an 'anterior kissing lesion'. In 1966 O'Donoghue reported a 45% incidence of this condition in American football players.[8] There is an even higher incidence of 59.3% in dancers, according to Stoller.[9] Scranton and McDermott[10] proposed a classification of ankle spurs with four grades (Table 1). Patients with 'footballer's ankle' present with pain, catching, restricted dorsiflexion and swelling around the ankle joint. Tol et al.[11] showed 77% excellent or good results in patients with Grade 1 disease and 53% good or excellent results in patients with Grade 2 disease after arthroscopic debridement of the spurs and associated soft tissue (Figure 4). Recurrence of the spurs, according to Tol and Van Dijk, is common but recurrence of symptoms is unusual after adequate debridement.

Osteochondral lesions — osteochondral lesions (osteochondral defects, OCD) of the talus are perhaps the most common indication for ankle arthroscopy. They are usually located either posteromedially or anterolaterally. Inappropriate treatment of OCDs may eventually result in osteoarthritis of the ankle. The lesions are usually related to trauma, although non-traumatic

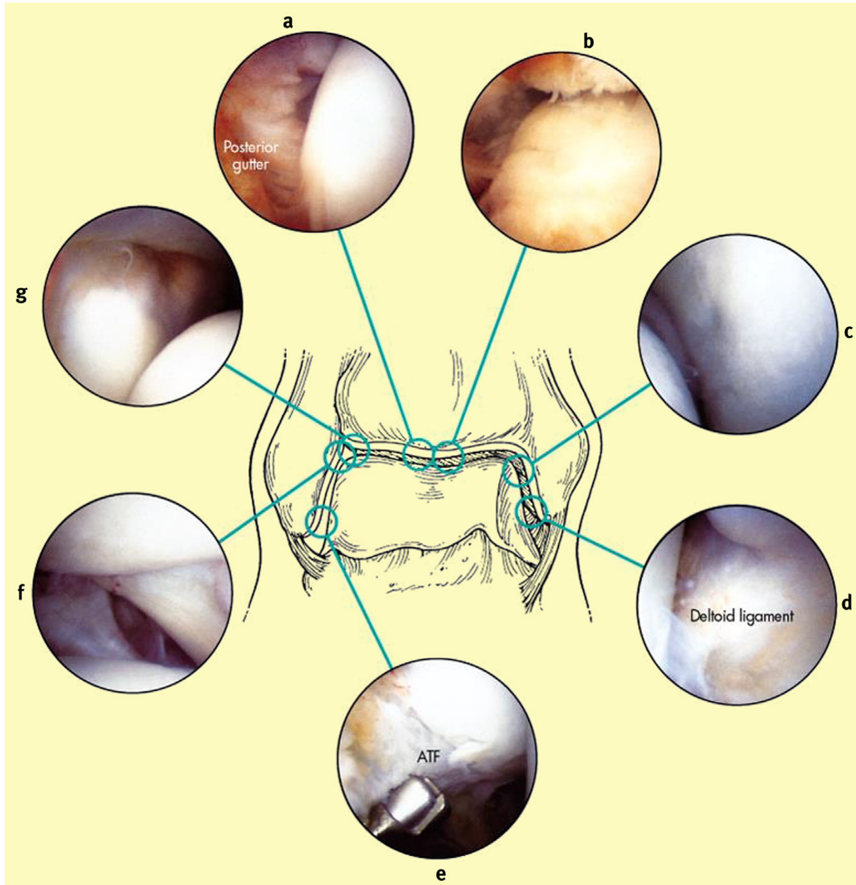

Figure 3 The regions to visualise during an ankle arthroscopy include. (**a**) Posterior gutter viewed from posterior portal. (**b**) Central talus. (**c**), Medial tibiotalar artriculation. (**d**) Deltoid ligament and medial gutter. (**e**) Lateral gutter. (**f**) Tibiofibular articulation showing posteroinferior ligament, and more inferiorly and laterally, transverse ligament. (**g**) Lateral talomalleolar articulation. ATF, anterior talofibular ligament (reproduced with kind permission Campbell's operative orthopaedics, 11th edn, vol. 3, p. 2898 fig 48—66. Mosby Publishing). Mosby, Inc. items and derived items copyright © 2003, Mosby, Inc. All rights reserved.

OCDs can occur with potential causes being genetic, metabolic, vascular, endocrine, or degenerative. Patients typically present with persistent or intermittent deep ankle pain during or after activity, sometimes accompanied by swelling and limited range of motion. Plain radiographs, CT and MRI are routinely used for diagnosis.

Classification for Anterior ankle bony impingement[11]

Grade I	Synovial impingement. Radiographs show inflammatory reaction with spurs <3 mm.
Grade II	Osteochondral reaction exostosis. Radiographs show spurs larger than 3 mm. No talar spur.
Grade III	Severe exostosis with or without fragmentation. Secondary spur is noted on dorsum of talus, often with fragmentation of osteophytes.
Grade IV	Pantalocrural osteoarthrotic destruction. Radiographs suggest degenerative osteoarthritic changes medially, laterally, or posteriorly.

Table 1

Depending on the location of the osteochondral lesion, either posterior or anterior ankle arthroscopy can be performed. Arthroscopic treatment can be accomplished using wide-angle 2.7-mm arthroscopes with a 30° viewing angle, though some surgeons will use a larger 4 mm arthroscope and keep the instrument in the anterior recess of the joint. Non-invasive joint distraction techniques and hyper plantar flexion can be used to access most of the talar dome. Preoperative radiographs or CT scans with the foot in maximum plantar flexion will indicate whether the lesion can be accessed without resorting to open techniques and osteotomies.

Treatment options for OCD include primary repair, debridement, reparative techniques and restorative techniques (Figure 5). Each technique has its own merits and shortcomings. Primary repair can be used for acute traumatic and symptomatic OCD with an adequate bony bed. Palliative measures include debridement and lavage, whilst marrow-inducing reparative treatments include abrasion arthroplasty, microfracture and drilling techniques.[12,13] Since the turn of the century, there has been a surge in the volume of literature on restorative techniques. These include autologous chondrocyte implantation, collagen-covered autologous chondrocyte implantation, osteochondral autologous transfer system (OATS and mosaicplasty), fresh osteochondral allograft, stem cell—mediated cartilage

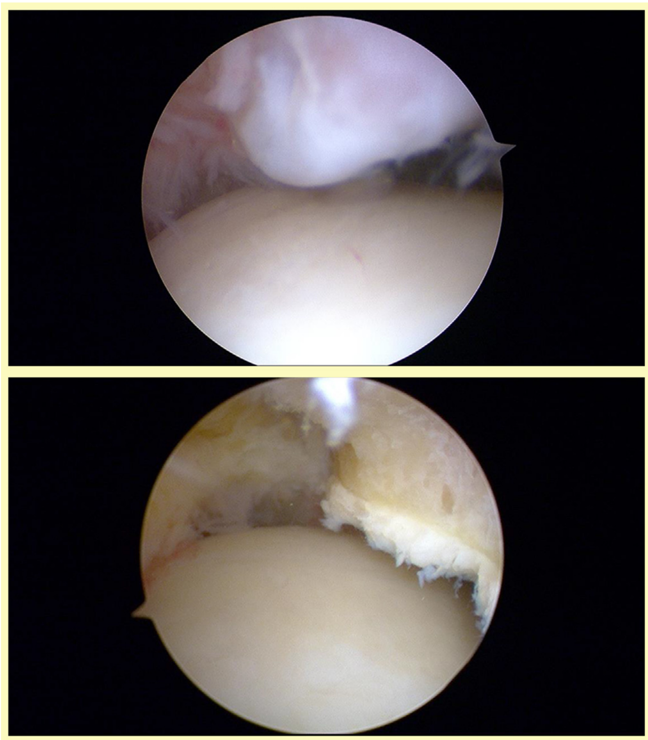

Figure 4 Anterior impingement spur before and after debridement.

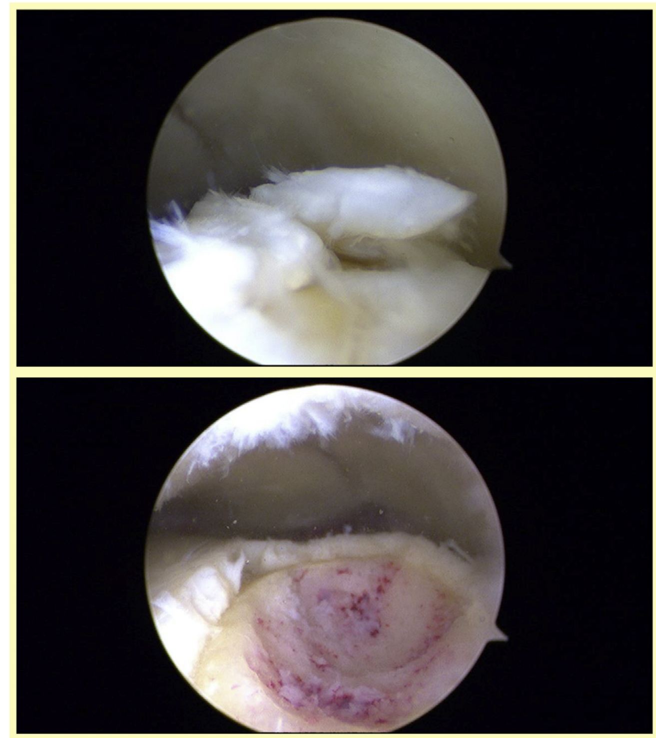

Figure 5 Osteochondral defect before and after debridement.

implants and contoured metal implants. Consensus from the International Organisation of Sports Medicine (FIMS) recommends debridement and bone marrow stimulation (drilling or microfracture) of lesions less than 15 mm that are not amenable to fixation. Other techniques should be reserved for secondary cases or lesions larger than 15 mm.[14]

Ankle arthrodesis — the use of arthroscopic debridement of the ankle followed by arthrodesis using percutaneous screw fixation has been advocated for more than 25 years. The advantages of an arthroscopic arthrodesis are: shorter hospital stay, reduced morbidity, faster fusion rate, better cosmesis and lower complication rates. Against these has to be weighed the learning curve for the surgeon and theatre staff; the fact that it is a longer procedure; it requires expensive arthroscopic equipment and it may be difficult to correct large deformities. The relative contraindications for an arthroscopic fusion are >15° deformity, a previously failed fusion, the presence of infection, complex regional pain syndrome or a neuropathic joint. In 1991 Myerson compared open and closed techniques of ankle arthrodesis and reported a shorter time to fusion using arthroscopic methods of 8.7 versus 14.5 weeks.[15] The authors suggested that this was due to less soft tissue disruption and therefore retention of a better blood supply to the fusing surfaces. In 2005 Ferkel reported a fusion rate of 97% in a group of 35 patients with no major complications. More recent studies have shown that larger deformities can be corrected successfully and they have confirmed the benefits of arthroscopic over open fusion.[16]

The patient is set up as for anterior arthroscopy. The joint surfaces are prepared by removal of cartilage and subchondral bone with curettes, shavers and burrs. Once the required position is achieved and checked with image intensifier, two cannulated screws are passed from the posteromedial distal tibia into the talus, aiming 10–15° anteriorly towards the sinus tarsi. A third screw can be used from the lateral side if required. Patients are kept in plaster for 2–12 weeks depending on surgeons' preference.

Posterior ankle arthroscopy

Posterior ankle arthroscopy, also known as hindfoot endoscopy, gives excellent access to the posterior ankle compartment, the subtalar joint and extra-articular structures such as the deep portion of the deltoid ligament, the os trigonum, the posterior syndesmotic ligaments, the tendons of the tarsal tunnel, the retrocalcaneal bursa and the Achilles tendon. The patient is placed in a prone or floppy lateral position. There are some common indications shared with anterior arthroscopy, such as the debridement and drilling of osteochondral defects located in the posterior ankle joint, loose body removal, resection of posterior tibial osteophytes and treatment of chronic synovitis.

Portals (Figure 6):

Posterolateral portal — the posterolateral portal is established in the soft spot just lateral to the Achilles tendon, approximately 1 cm proximal to the tip of the fibula. The portal should be directly adjacent to the Achilles tendon or in close proximity to the peroneal tendons in order to avoid the branches of the sural nerve and the small saphenous vein.

Posteromedial portal — along with the posterolateral portal, this provides access to the posterior ankle and particularly the os trigonum. When using the posteromedial portal the tendons of the flexor hallucis longus (FHL) and flexor digitorum longus (FDL) should also be recognized and protected. The tibialis posterior artery and the tibial nerve, with its branches, must be avoided. The calcaneal nerve branches off of the tibial nerve proximal to the ankle joint and traverses the interval between the

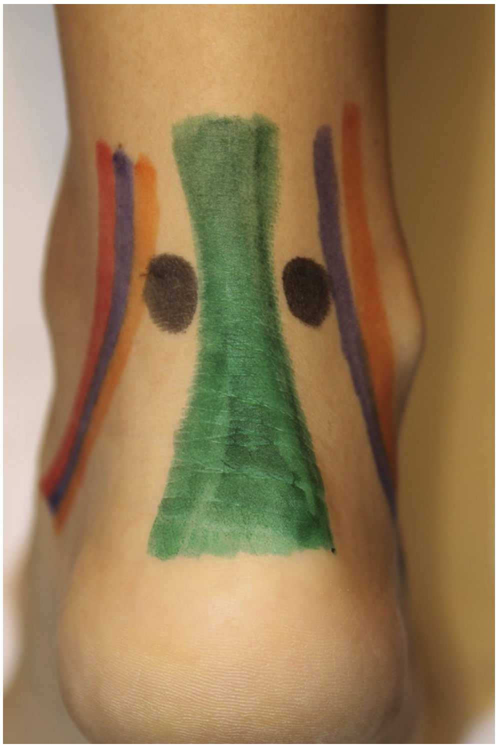

Figure 6 Posterior arthroscopy portal sites (black), highlighting vessels (red and blue), nerves (orange) and tendons (green).

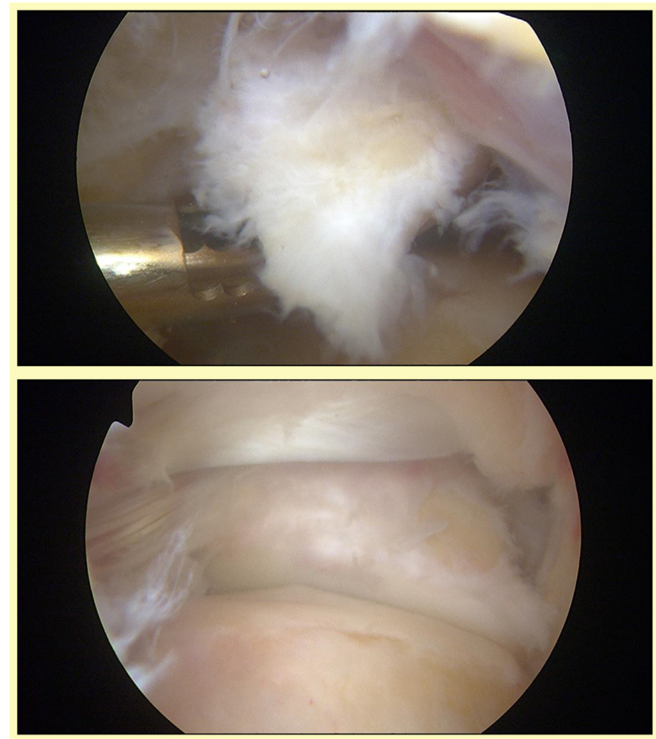

Figure 7 Os trigonum before and after excision.

tibial nerve and the medial border of the Achilles tendon. When inserting instruments through this portal care must be taken to direct the instruments laterally, or under direct vision, to avoid the neurovascular structures.

Indications:

Posterior ankle impingement-os trigonum — posterior ankle impingement is a painful condition often caused by overuse or trauma, commonly in ballet dancers and runners. In the presence of a prominent posterior talar process (Stieda process) or an os trigonum, forceful plantar flexion may cause impingement and pain. When the pain does not resolve with conservative treatment, the enlarged or fractured process or the os trigonum can be excised (Figure 7). Motion at the fibrous attachment of the nonunion of the os trigonum may be seen along the posterior talus.

The bony prominence is removed using a small beaver blade, shaver, burr and/or grasper. Caution is needed in order to avoid any injury to the flexor hallucis longus tendon and posteromedial neurovascular structures during excision. Marumoto and Ferkel[17] described this technique and found 11 patients at 3 year follow-up to have a measured improvement in their AOFAS Score from 45 to 86 points. Van Dijk has recommended a different approach using the prone position and posteromedial and posterolateral portals.[18] This technique requires removal of much of the posterior ankle and subtalar capsule.

Flexor hallucis longus (FHL) tendinopathy — flexor hallucis longus tendinopathy is another cause of posteromedial ankle pain. In ballet dancers, it presents when they attempt plie and/or grand plie exercises. By asking the patient to repetitively flex the big toe with the ankle in 10°—20° of plantar flexion, the flexor hallucis longus tendon can be palpated in its gliding channel behind the medial malleolus. There is often swelling and tenderness and the diagnosis can be confirmed with ultrasound or magnetic resonance scanning.

Arthroscopy of the FHL tendon may be performed for tenosynovitis after failed conservative treatment. The FHL tendon passes posteromedially from the distal tibia, through the posterior gutter of the ankle. It then passes through the bifurcate ligament between the medial and lateral tubercles of the talus within a fibro-osseous tunnel and continues under the sustentaculum tali of the calcaneus. The FHL tendon may be accessed during ankle or subtalar arthroscopy through the standard posterior portals.

Tarsal tunnel syndrome — tarsal tunnel syndrome is caused by entrapment of the posterior tibial nerve within the tarsal tunnel. Clinical examination and nerve conduction studies are usually enough to differentiate this disorder from an isolated posterior tibial tendon disorder. Endoscopic release of the nerve is an alternative technique for treating tarsal tunnel syndrome if conservative treatment fails. Day and Naples describe a two-incision technique using a specially designed retrograde cutting knife in a cannulated endoscope to release the flexor retinaculum. They reported a 90% success rate with an earlier three-incision technique and a 100% success rate with a modified two-incision technique.[19]

Other indications for ankle arthroscopy

Arthroscopy can be used in several other conditions for therapeutic or diagnostic reasons. Arthrofibrosis can be treated by arthroscopic resection of the fibrous bands and early physiotherapy. Septic arthritis may be treated by arthroscopic washout and irrigation followed by appropriate antibiotic therapy, whilst arthroscopic synovectomy can be performed in the treatment of inflammatory arthritides. There have been several recent publications concerning the role of ankle arthroscopy in the diagnosis and treatment of combined intra-articular fractures of the ankle, with arthroscopy allowing a more accurate assessment of the articular surfaces, removal of osteochondral loose fragments and removal of clot and early arthrofibrotic tissue.[20]

Subtalar joint arthroscopy

Introduction

The development of subtalar joint arthroscopy is relatively new. Indications for the procedure have become clearer over the last few years and currently the most common include chronic post-traumatic pain and the evaluation of chondral or osteochondral lesions. The complex anatomy of the subtalar joint makes arthroscopic and radiographic evaluation difficult. Arthroscopic visualization of the subtalar joint includes the posterior, middle and anterior facets and the sinus tarsi. Some authors divide the joint into anterior (talocalcaneonavicular) and posterior (talocalcaneal) articulations. These compartments are separated by the tarsal canal, which opens laterally as the sinus tarsi. CT and MRI form useful adjuncts to arthroscopy. CT can demonstrate the degree of intra-articular degeneration, bony architecture and pathology, while MRI may detect chronic inflammation or fibrosis, ligament injury, bone contusions, osteochondral lesions, impingement and tarsal coalitions.

Portals & preparation: the patient is placed in a supine or lateral position. Three primary portals and two accessory portals are used for subtalar arthroscopy (Figure 8). The anterolateral, posterolateral and a 'central' portal form the primary portals. The central portal (sometimes called the middle portal) is located one thumb's-breadth anterior and inferior to the tip of the fibula, directly over the sinus tarsi. The anterior portal lies approximately 1 cm distal and 2 cm anterior to the fibula tip and the posterior portal lies approximately one finger's width or 2 cm posterior to the lateral malleolus. Accessory anterior and posterior portals can also be made and are sometimes useful when removing loose bodies or debriding the posterior facet. The same skin incision is usually used for both the posterolateral ankle and posterior subtalar portals. Structures to avoid are the peroneal nerve branches when placing the anterior portal and the sural nerve and peroneal tendons with placement of the posterior portal.

A distractor can be applied if the joint is tight, or if being performed at the same time as ankle arthroscopy. The foot can be inverted and everted as necessary to facilitate visualization: often, inverting the hindfoot over a kidney dish is helpful.

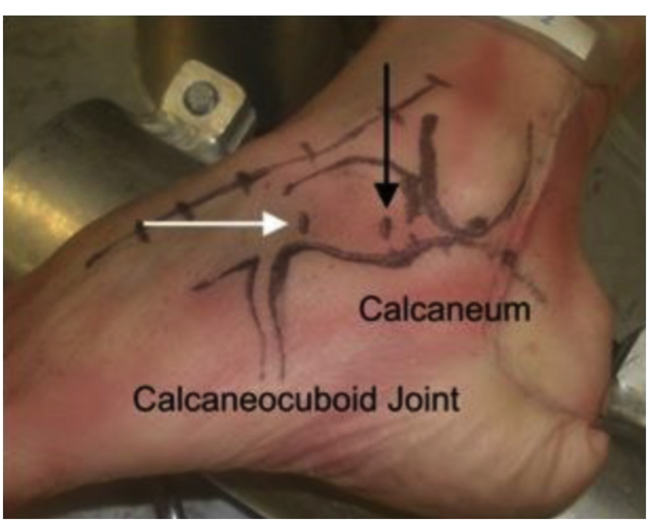

Figure 8 Subtalar arthroscopy portal positioning.

Indications:

Synovitis, loose bodies and OCD treatment – debridement, synovectomy and loose body removal can be performed using all three portals. The anterior aspect of the posterior subtalar joint is best approached through the central and anterolateral portals. The posterior aspect of the joint is best approached through the posterolateral portal for instruments and the central or anterolateral portals for visualization. Smaller osteochondral defects are managed in a similar manner to those found in the tibiotalar joint.

Sinus tarsi syndrome – sinus tarsi syndrome describes a variety of complex subtalar pathologies, which are usually secondary to a significant ankle sprain. Tears of the interosseous ligament, diffuse arthrofibrosis and degenerative changes have been documented in patients with post-traumatic sinus tarsi pain. Using an arthroscope, debridement of scar tissue, osteophytes and the torn segment of the interosseous ligament can be performed. Only case series are available and good or excellent results in more than 80% of the patients have been reported.[21]

Calcaneal exostectomy – arthroscopy of the subtalar joint can be helpful after calcaneal fractures. Debridement and removal of adhesions and scar tissue can be performed. The procedure can be very difficult with the presence of arthrofibrosis and narrowing of the joint making specialized instrumentation necessary. Elgafy and Ebraheim reported 10 patients treated by arthroscopy after calcaneal fracture, with improvement in the AOFAS Score from 70 to 77 after surgery.[22] Arthroscopy can also facilitate minimally invasive fixation of os calcis fractures by direct visualization of the posterior facet and sinus tarsi.

Subtalar fusion – arthrodesis of the subtalar joint is an accepted form of salvage for painful arthritis or progressive deformity. Arthroscopic arthrodesis of the subtalar joint was first reported 11 years after the corresponding procedure for the ankle joint. The most common indications are post-traumatic arthritis, failed management of tarsal coalitions and inflammatory arthropathy.

The principles and techniques are the same as for arthroscopic ankle arthrodesis. Two or three portals are used for debridement of the majority of the articular surface of the posterior facet. Shaver, burr and curettes can be used. The burr is used to debride the surface to bleeding bone and small microfractures can be made in the talus and calcaneus. The sinus tarsi and other facets can be similarly prepared to provide a larger surface area for fusion. The hindfoot is positioned in approximately 5° of valgus. Standard fixation is with one or two large (6.5 mm) cannulated screws from the calcaneus into the neck of the talus. The screws should provide stable fixation and compression.

Arthroscopic fusion was first described by Tatso in 1992 and he reported his series in 2003.[23] All 25 patients united with a mean union time of 9 weeks. The first series reported by Scranton[24] compared a mini open technique of placing an iliac crest graft into a groove cut in the subtalar joint to arthroscopic preparation with instillation of osteoinductive gel, with 100% fusion in both groups. The largest prospective series of 41 patients is by Glanzmann.[25] He excluded valgus >20°, varus >5°, or patients who required hardware removal at the time of surgery. He took a corticocancellous graft from the medial tibial plateau and inserted this into any gaps in the sinus tarsi. Patients were followed up for 55 months (24–89) and the AOFAS improved from 53 to 84. Union rate was 100% at average 11 weeks (7–36), assessed by plain radiographs. Three patients had persistent ankle pain or tendinitis and 24% had screw removal to alleviate mild local tenderness.

There is no study comparing arthroscopic versus open subtalar fusion. The literature suggests that arthroscopic subtalar fusion patients have a shorter recovery time and better fusion rates, but these studies include low numbers of selected patients with minimal deformity, so the results are not directly comparable. Most studies have used only plain films and clinical examination to detect fusion.

Triple fusion – arthroscopic techniques to fuse the subtalar, calcaneocuboid and talonavicular joints have been published, describing fewer complications than seen with standard open surgery. Some authors use up to five portals, though more recently a two lateral portal technique has been described. The potential for deformity correction is limited, but in patients with compromised soft tissues, arthroscopic triple fusion may reduce the risk of wound complications that are seen in up to 25% of patients.[26]

Tarsal coalition excision – symptomatic tarsal coalitions that have failed conservative management are commonly excised using open techniques. Small series of successful arthroscopic approaches have been described for talocalcaneal and calcaneonavicular bar resection citing the potential advantages of better wound healing and earlier mobilization.

Contraindications

Relative contraindications include severe oedema, vascular insufficiency and poor skin quality, the absolute contra-indication being overlying soft tissue infection. Current arthroscopic subtalar fusion techniques can improve only small degrees of malalignment, so correction of significant hindfoot deformity will usually require an open procedure.

1st metatarsophalangeal joint arthroscopy

Arthroscopic assessment of the first metatarsophalangeal joint (MTPJ) was first described by Watanabe in 1972,[27] with proponents suggesting reduced bleeding and infection with improved cosmesis and recovery. The most common indications include degenerative joint disease, osteochondral defects, loose bodies, and synovitis. Contraindications include large osteophytes, severe swelling, vascular insufficiency, or soft tissue infection. Preoperative assessment includes plain films, as well as MRI or CT to detect focal cartilage defects.

Portals & preparation

The two most commonly used portals are the dorsomedial and dorsolateral portals, which are placed either side of the extensor hallucis longus (EHL) tendon at the joint line. Structures at risk include the medial dorsal cutaneous nerve branch and the main digital nerve that lies beneath the transverse metatarsal ligament. A medial portal can be placed through the medial capsule midway between the dorsal and plantar aspects of the joint and is usually made under direct vision. Traction may be placed manually or with a sterile finger trap device. The most useful scope sizes are 1.9 mm and 2.7 mm, using 2 mm instruments.

Procedures: common procedures include dorsal osteophyte excision, chondroplasty with microfracture, synovectomy and arthrodesis. Although small case series have reported favourable results,[28] there are no comparative series comparing open versus arthroscopic procedures. Arthroscopic techniques are being augmented and in some cases superseded by minimally invasive surgery using small burrs under image intensifier control to treat many small joint conditions.

Tendoscopy

Tendoscopy can be used as a primary procedure, or to augment an open or mini open procedure. Surgery is indicated when conservative management fails for inflammatory and adhesive tenosynovitis, as well as degenerative tendinopathy or acute ruptures that need debridement or repair. Portals can be placed with care anywhere along the length of the tendon. A 2.7 mm 30° arthroscope is normally used.

Peroneal tendon tendoscopy

Tenosynovitis, dislocation, rupture and snapping of the peroneal tendons are common sources of posterolateral ankle pain. Peroneal pathology is often associated with ankle instability and there is an increased stress placed on the tendons, as they function as secondary stabilizers of the ankle. This can lead to tendinopathy, tenosynovitis, and tendon tears.

Portals & preparation: the patient is placed supine or lateral. Although access can be made anywhere along the tendon: the first portal is usually made 2 cm distal to the posterior edge of the lateral malleolus. A second portal is placed 2 cm proximal to the lateral malleolus, identified with a needle under direct vision.

Procedures: the peroneal tendons can be debrided and repaired, and for cases of recurrent dislocation fibular groove deepening can be performed. A total synovectomy of the tendon sheath can be done with the addition of an extra portal.

Posterior tibial tendon tendoscopy

The posterior tibial tendon (PTT) can be subject to a number of pathologic conditions, including peritendinitis, which can be due to overuse or part of a generalized inflammatory disorder. In the early stages of disease, patients feel a discomfort to the medial side of the foot along the course of the tendon in addition to weakness and tenderness on the plantar medial aspect of their ankle. There can also be swelling around the tendon in case of tenosynovitis. The tendon has a hypovascular zone approximately 40 mm proximal to its insertion, and pain often is localized to this portion of the tendon just distal to the medial malleolus.

Portals and preparation: the patient is placed supine with a sandbag under the contralateral buttock. Prior to anaesthesia the posterior tibial tendon can be palpated and the two portals marked onto the skin. The two main portals are located directly over the tendon 2 cm distal and 2–4 cm proximal to the posterior edge of the medial malleolus. The distal portal is made first: the incision is made through the skin only and the tendon sheath is penetrated by the arthroscopy cannula with a blunt trocar. The arthroscope is introduced and the tendon sheath is filled with saline.

Procedures: the tendon can be debrided or repaired. Synovectomy can be performed with a view of the tendon from the insertion on the navicular to some 6 cm above the tip of the medial malleolus. Tendoscopy of the posterior tibial tendon has been shown to be successful for tendon sheath release, synovectomy, and removal of pathologic thickened vincula. Good results have been reported in the treatment of stage one posterior tibial tendon dysfunction.[29]

Achilles tendoscopy

Arthroscopic techniques provide good access to the narrow space around the Achilles tendon, the paratenon and the tendon insertion. The diagnostic process and decision making for surgical intervention are the same as for conventional open surgery. The most common indication is chronic tendinopathy and the differential diagnosis should include pathology from other tendons, or degenerative pain from the ankle or hindfoot. It is useful to determine clinically and radiologically if the pathology is from the insertion, the tendon or the paratenon. Imaging is also useful to illustrate calcification, Haglund's deformity or retrocalcaneal bursitis.

Portals and preparation: the patient is prone or in a 'floppy lateral' position, with the affected foot at the end of the table to allow ankle movement. Two portals are created. The first portal is made 2 cm distal to the lesion on the lateral side of the tendon, with the second being made 2 cm proximal to the lesion but this time on the medial side. Care must be taken in order to avoid injury to the sural nerve as it passes across the lateral border of the Achilles tendon approximately 10 cm from the insertion on the os calcis. If debridement of the insertion and Haglund's lesion is indicated then the portals may be placed distally a few millimetres either side of the Achilles tendon.

Procedures: when treating non-insertional tendinopathy, the initial goals are to separate inflamed paratenon and plantaris from the Achilles tendon, followed by resection of any inflamed paratenon which is often on the anterior surface. Any areas of tendon degeneration can be debrided. Again, small case series have shown encouraging results.[30] Haglund's deformity and the retrocalcaneal space can be debrided relatively easily under direct vision. We suggest that radiographs are used during the learning curve to ensure adequate resection of the bursal projection.

Future trends in foot and ankle arthroscopy

Arthroscopy and tendoscopy in the foot and ankle are now well recognized as useful surgical tools. New techniques are being introduced to deal with more complex pathology and modern equipment allows access to almost any joint. Other elective conditions that can be treated include first ray and lesser toe deformities, first MTPJ instability, first TMTJ hypermobility, midfoot arthritis, tarsal coalitions, and ganglia. In trauma, arthroscopic assistance has been used to repair Achilles tendon ruptures and reduce calcaneal fractures, whilst sports injuries with lateral ligament instability or peroneal subluxation have also been managed arthroscopically.

There is no doubt that for some of the procedures the learning curve is steep and they are not for the occasional arthroscopist. Whilst case series show encouraging results for several procedures, the numbers studied are often small, without a comparative series of patients having open surgery. As surgeons seek to improve outcomes and speed up rehabilitation, minimally invasive and arthroscopic surgery is likely to become more popular. Evidence will emerge as the procedures become more widely used, and with a sound knowledge regarding the indications, merits, and potential risks, many of these techniques are likely to become the gold standard treatment. ◆

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