CHAPTER **21**

ANKLE ARTHROSCOPY: A Review of Current Trends

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INTRODUCTION

It has been well established that ankle pain negatively impacts the lives of patients. In fact, several recent quality of life studies have compared patients with degenerative joint disease (DJD) of the ankle and those with other large joint DJD. One study compared groups of 130 patients with ankle or hip DJD. There was no difference noted between groups in terms of pain or disability (1).

While less frequently reported in literature than large joint DJD, it is now apparent that ankle pathology equally impairs our patients' quality of life. It is critical that research continue to focus on improving treatments for ankle pathology. Surgical techniques for ankle pain have evolved dramatically over the past decade as arthroscopic equipment has improved to allow excellent exposure to the ankle joint and surrounding anatomic areas. In fact, many historically open procedures are now commonly performed through arthroscopic methods.

With arthroscopy proven as a successful surgical option for various ankle pathologies, treatment has expanded to include correction of ankle ligament injury and extra-articular joint pathology, in addition to established treatments for impingement and osteochondral lesions of the talus (OLT) (2-11). Arthroscopic success rates are consistently shown to be as efficacious as open techniques, with shorter hospitalization periods and lower overall cost (12). A recent comparison between open versus arthroscopic debridement for osseous anterior ankle impingement demonstrated similarly improved pain scores with faster recovery in the arthroscopic group (13). There are many studies involving various procedures that also support this conclusion (5,14).

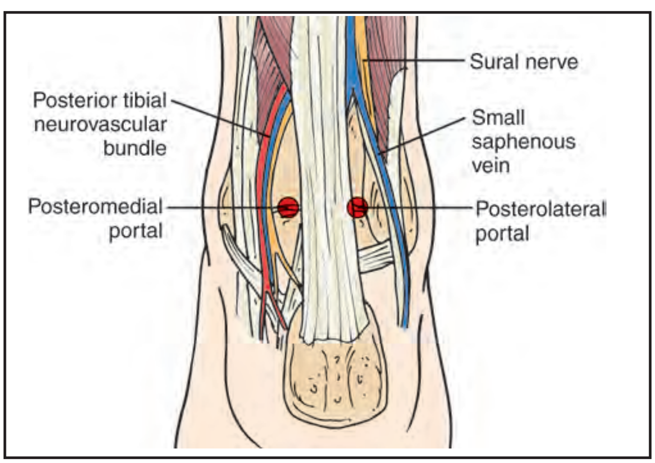

Figure 1. Posterolateral portal is placed at or slightly above the level of the tip of the lateral malleolus just lateral to the Achilles tendon, and the posteromedial portal is medial to the Achilles tendon at the same level as the lateral portal.

As the usefulness of ankle arthroscopy has been established, it is the aim of this article to demonstrate evidence-based medicine treatments and outcomes for various arthroscopic surgeries, as well as novel advancements to address ankle pathology through arthroscopic means.

SURGICAL TECHNIQUES

Posterior Portal Techniques

Van Dijk et al described the first 2-portal endoscopic technique for hindfoot pathology, utilizing the Achilles tendon for placement (15). Most surgeons use the technique described in this study for posterior portal placement. The posterolateral portal is placed at or slightly above the level of the tip of the lateral malleolus just lateral to the Achilles tendon, and the posteromedial portal is made just medial to the Achilles tendon at the same level as the lateral portal (Figure 1). The most important structures to avoid include the sural nerve, and the medial neurovascular bundle.

The flexor hallucis longus (FHL) tendon is a vital landmark to protect the medial neurovascular bundle and is easily identified through flexion of the great toe intra-operatively. Yoshimura et al investigated position of portals and the distance and angulations associated with vital neurovascular structures using cadaveric limbs and magnetic resonance imaging (MRI) (16). The study found a distance from the posteromedial portal to the tibial neurovascular bundle of 18 ± 3 mm, and the posterolateral portal to the sural nerve of 15 ± 3 mm. The authors deemed that surgeons would benefit from starting the procedure with instrumentation in the posterior medial portal directed toward the fibula, and then navigating medially as structures were identified.

Other portal combinations include using a posterolateral and anterolateral portal, two posterolateral portals, or a posterolateral and trans-Achilles portal. The trans-Achilles portal is currently not recommended due to unnecessary trauma to the tendon.

Anterior-Posterior Combination Portals

Combined portal arthroscopy usually includes an anteromedial, anterolateral, and posterolateral portal, where the posterior portal serves as an accessory portal instead of a primary working portal. This three portal technique allows for adequate exposure of the anterior ankle, however there is limited access to the posterior joint. Surgeons treating patients with combined anterior and posterior ankle pathology must decide between open arthrotomy versus arthroscopic treatment or a combination of these techniques. Any open procedure increases the risk of scarring and stiffness. Scholten and van Dijk described a case report with combined anterior and posterior ankle arthroscopy for a patient with FHL tendinitis, synovitis and a nonunion tibial fracture (17). The patient began in the prone position to address the posterior pathology and was turned supine for the anterior portion of the procedure. The patient had no symptoms at a 4.5-year follow up, and was able to return to full athletic activity at 8 weeks postoperatively. The authors state the combined procedure can be completed with the patient in the prone position by flexing the knee for the anterior portion, but caution surgeons with the difficulty in orientation with this position.

In one of the largest studies of synovial chondromatosis and arthroscopy, Bojanic et al showed combined anterior and posterior portals as a safe treatment option (18). The authors also began with the patient in the prone position followed by the supine position, and achieved successful results with an average increase in American Orthopaedic Foot and Ankle Score (AOFAS) from 67 preoperatively to 94 postoperatively.

Acute Injuries In Athletes

The role of ankle arthroscopy in acute injuries is not well established. Philbin et al have recommended arthroscopic treatment for chronic ankle pathology (19). Arthroscopic surgery is beneficial in athletes, as it decreases both rehabilitation time and return to sport time, therefore research is currently evaluating its role in an acute setting.

Hepple and Guha identified the following acute ankle injuries in athletes appropriate for arthroscopy: ligament injury, osteochondral injury, malleolar fractures, distal tibial fractures, talar body or neck fractures, talar process fractures, and peri-ankle tendon injury (20). The authors found arthroscopy successful in diagnosing injuries not visible on imaging, and undiagnosed before the surgery. Ankle sprains often result in chondral lesions on the talus or peroneal tendon tears that are not diagnosed or treated. Arthroscopy allows identification and treatment of these injuries. Most recommendations for early arthroscopy involve individuals in high-level athletics, with a requirement to return to activity soon after injury. Many ankle injuries can be treated conservatively at first, followed by surgery if necessary. This study also found improved visualization of distal tibial or talar process fractures, syndesmotic injury, and chondral (or osteochondral) lesions with arthroscopy.

Ankle Instability

Ankle instability is successfully treated with anatomic reconstruction through the modified Brostrom-Gould technique (21). Open techniques have been shown to be very successful, but may increase certain complication rates due to increased soft tissue dissection (such as subtalar joint stiffness). Recent literature has demonstrated equal results using arthroscopy, with an added ability to address intra-articular pathology and reduce certain complications (22-25). Ventura et al recently published a four-step approach to arthroscopic treatment for chronic ankle instability (26). The four-step protocol consists of synovectomy, anterior talofibular ligament (ATFL) remnant debridement, capsular shrinkage, and immobilization with bracing. Good to excellent outcome, were reported by 96.6% of the patients.

A recent study by Cottom et al discusses a technique termed the all inside arthroscopic Brostrom procedure (27). The technique allows percutaneous primary suture placement through the ATFL, capsule and inferior extensor retinaculum with anchor placement into the fibula. The authors found an improvement in AOFAS from 41.2 preoperatively to 95.4 postoperatively, and Visual Analog Scale (VAS) scores from 8.2 to 1.1. This represents a new, successful technique in application of arthroscopy for treatment of lateral ankle instability.

Preoperative Imaging

The use of MRI has been established as a useful technique in preoperative planning for arthroscopy. For many surgeons, MRI represents the preferred method to assess OLT and other pathology. Of interest, a recent study evaluated the use of computed tomography (CT) in full ankle plantar flexion to evaluate OLT. In the 20 patients studied, the measured distance between the anterior border of the OLT and the anterior tibial rim were highly accurate and reliable for in situ locations of OLT during arthroscopy (28). While some surgeons may remain averse to CT in patients, this technique of maximal plantarflexion of the ankle during imaging could be applied to other advanced imaging methods, such as MRI. This technique may serve as a valuable tool in more precisely locating lesions during arthroscopy. In turn, this could improve patient outcomes post-osseous debridement, which have been shown less successful than other arthroscopic procedure outcomes (such as synovectomy).

Preoperative Assessment and Planning

Preoperative assessment of anatomic landmarks has been shown to benefit patients by reducing incidence of nerve impingement and other complications associated with arthroscopy. The authors have found success with consistently marking all anatomic landmarks in a pre-operative setting. This technique allows patients to activate tendons as directed, permitting extremely accurate marking of tendon borders as well as nerves coursing near portal incisions. This technique provides superior accuracy in comparison to marking anatomic landmarks once the patient has been anesthetized.

A recent study evaluated preoperative marking of the superficial peroneal nerve before ankle arthroscopy. The incidence of post-arthroscopy injury to the superficial peroneal nerve was found to occur in 1% of patients. This was compared to evidence reported in similar literature and found to be an effective method to reduce iatrogenic nerve injury risk (29).

The use of distraction for arthroscopy is a decision most often made preoperatively. Reports have suggested that this technique may be unnecessary for many procedures, and in fact may increase risk of nerve injury. A recent study compared both techniques while evaluating anatomic structures according to Ferkel's ankle arthroscopy criteria (30). Non-invasive distraction techniques allowed for visualization of all structures in over 90% of cases, except for the anterior compartment and lateral gutters, which were best visualized without distraction. Depending on the anatomic area to be addressed, each surgeon can benefit from improved visualization as this study demonstrates. It should be noted that the study authors suggest planning for distraction to insure adequate visulation during arthroscopy.

Anterior Impingement

Anterior osseous or soft tissue ankle impingement arguably represents the most common reason to perform ankle arthroscopy. Recent reports have highlighted that preoperative imaging of patients suffering from this condition may demonstrate normal advanced imaging results. One study demonstrated an increased VAS Foot and Ankle score from 44.5 to 78.3 postoperatively in symptomatic patients with negative MRI findings. MRI findings were noted to consistently under-report soft tissue impingement and synovitis (31).

Posterior Impingement

Posterior ankle impingement is clinically defined as posterior ankle pain arising from a plantarflexed position of the ankle (32). Structures associated with the syndrome include os trigonum, Steida's process, FHL tendon, posterior ankle capsule and synovium, tibial labrum, posterior inferior tibiofibular ligament, intramalleolar ligament, and transverse tibiofibular ligament.

Abramowitz et al reported complication rates up to 24% with open surgical excision of os trigonum (33). Arthroscopic intervention is cited in multiple studies with lower complication rates. Nickisch et al found an 8.5% complication rate associated with arthroscopic treatment (34). Arthroscopy offers decreased scarring, soft tissue injury, postoperative pain, and rehabilitation time. Multiple studies also support hindfoot arthroscopic treatments as safe and effective, with less complication than open surgery. Posterior impingement can be successfully approached utilizing the posterior portal technique described by van Dijk et al above (15).

Park et al recently described a technique to address symptomatic os trigonum with surgical removal in a lateral decubitus position (35). The authors utilized anterolateral, centrolateral, and posterolateral portals in 23 patients. AOFAS scores improved from 71.3 preoperatively to 94.7 postoperatively. The authors deemed this a safe and effective method of treatment for os trigonum syndrome.

Arthroscopy With Concomitant Procedures

Many surgeons favor performing arthroscopy of the ankle when performing related procedures about the ankle joint. In cases such as post-traumatic ankle injuries, there is often ankle pathology, which can benefit from arthroscopy. A recent study evaluated patients undergoing hardware removal after ankle fracture (36). One group of patients went through traditional hardware removal without additional procedures while the second group underwent hardware removal with arthroscopy of the ankle. Median AOFAS scores were found to improve 74 to 76 in the first group (hardware removal only) and from 75 to 85 in the second group (arthroscopy and hardware removal). This difference was statistically different and demonstrates the value of evaluating patients for potential pathology while other ankle procedures are being performed.

Ankle Arthrodesis

Over the past few years, arthroscopic ankle arthrodesis has been increasingly performed in place of the traditional open technique. While both techniques offer reliable fusion rates, one question often raised is whether arthroscopic fusion could offer correction of severe angular deformities. In a recent study, this question was addressed and the study authors report similar correction from both arthroscopic and open techniques in regard to postoperative sagittal and coronal plane alignment. This study also found shorter hospitalization periods in arthroscopic ankle fusions, with similar complications and surgical times (12).

Long-Term Arthroscopic Outcomes

Little information is available to demonstrate the long-term prognosis post ankle arthroscopy in regard to pain relief, length of improvement, and avoidance of further major surgery. One such study evaluated the above parameters in 80 consecutive patients over 5 years (37). A total of 69% of patients presented with soft tissue impingement and 31% with DJD; 9% of patients underwent further major surgery and 8% underwent repeat arthroscopy within 5 years. No patients with soft tissue impingement underwent further major surgery. Arthroscopic treatment for soft tissue impingement shows excellent future prognosis while patients with DJD have an increased chance of progressing to further surgery.

Long-term outcomes of OLT were also recently researched (38). Fifty patients who underwent arthroscopic debridement and bone marrow stimulation were evaluated after a mean follow-up of 12 years. At this time, 20% rated their outcome as excellent, 58% as good, 22% as fair and 0% as poor. A total of 94% had resumed work and 88% resumed sports; 67% of follow-up radiographs show no DJD progression with 33% increasing by one grade. These results suggest long-term improvement is maintained in repair of OLT.

Wound Closure

Traditional wound closure post ankle arthroscopy commonly involves skin closure with non-absorbable suture. The senior author (JR) commonly performs deep closure with absorbable suture in addition to non-absorbable suture for skin closure. A recent study evaluated the use of either a single 3-0 nylon suture or steri-strip (adhesive tape) for skin closure post arthroscopy (39). Both techniques demonstrated no statistical difference in wound description, infection grade, infection treatment, or cosmetic appearance. The rate of good to excellent cosmetic result was 72% for all patients. Two infection cases were reported, one from each group. While many surgeons may not feel comfortable closing with just steri-strips, deep absorbable suture could be combined with this technique to eliminate the need for suture removal in certain patients.

NEW EQUIPMENT

Equipment advancements over the last decade have allowed surgeons the ability to develop arthroscopic procedures that address a wide array of ankle pathology. While many of these advancements are specific to certain, technically difficult procedures, the authors would like to highlight new equipment that benefits many commonly performed procedures (40).

The Micro Vector drill and aiming device (Smith & Nephew) allows surgeons to perform precise transtalar or transmalleolar drilling of OLT, while also assisting in proper guide pin placement for arthroscopic arthrodesis (Figure 2). This device is simple to use and can benefit surgeons across a large number of cases. Additionally, Smith & Nephew has also produced a suction-assisted tissue grasper (Suction Punch, Figure 3), which allows surgeons to automatically evacuate debris during synovectomy without needing to repeatedly withdrawal instrumentation from a portal.

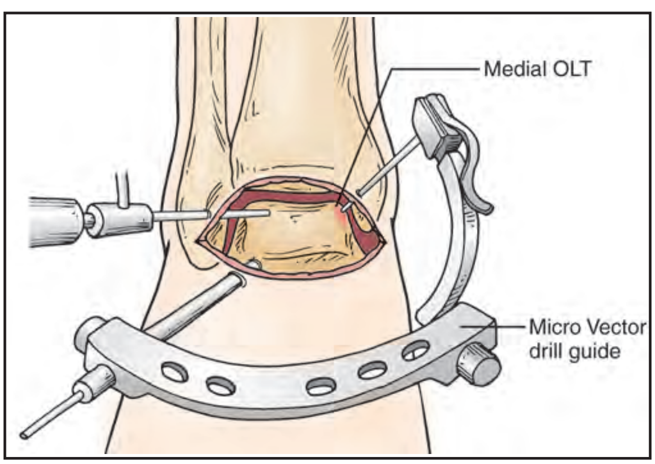

Figure 2. Micro Vector drill and aiming device (Smith & Nephew).

Figure 3. Suction Punch (Smith & Nephew).

These simple devices save a tremendous amount of time intraoperatively, but also may benefit patient outcomes and help limit complication rates. Many other manufactures have produced similarly beneficial products. The devices mentioned above are merely to demonstrate the simple, yet effective, nature of arthroscopy equipment advancements.

COMPLICATIONS

A recent study by Zengerink and van Dijk reviewed 1,305 cases from 1987 to 2006 performed by 33 surgeons at one surgery center (41). Complications were found in 3.5% of patients, of these 1.9% were nerve related. The most serious complication reported was a pulmonary embolism (one occurrence).

Another recent study by Deng et al found an overall complication rate of 7.69%, with 45% of these complications due to nerve injury (42). Within this subset, the superficial peroneal nerve was the most commonly affected at 1.92%, followed by the deep peroneal nerve at 0.77%, and the sural and saphenous nerves at 0.38% each. The second most common complication was superficial infection. The authors were unable to identify predictive factors for complications with arthroscopy.

As shown, nerve complications occur most often in ankle arthroscopy. Continuous distraction techniques have been implicated in increasing nerve related complications postoperatively. Zengerink and Van Dijk demonstrated a nerve related complication rate of 5.4% (41). The authors recommend placing the foot in a dorsiflexed position by resting the foot on the surgeon's abdomen, hypothesizing that in this position the nerves and vessels are relaxed and malleable to the blunt instruments used for portal placement. De Leeuw et al also demonstrated that the superficial peroneal nerve moves laterally while in this dorsiflexed position, allowing for less damage during portal placement (43).

Posterior portal complications can be minimized with knowledge of the normal ankle joint anatomy, as well as anatomic variants. Phisitkul et al identified 2 case reports of a peroneocalcaneus internus muscle that mimicked the FHL tendon, and therefore put the neurovascular bundle at risk (44). The study authors advised surgeons to be aware of this variant during posterior approaches.

Superficial and deep infection may also arise from arthroscopy. The most important factors in preventing this are sinus tract formation and subcutaneous tissue removal. The subcutaneous tissue is left intact when the foot remains in the dorsiflexed position (41).

CONCLUSION

The past decade has shown dramatic improvement in arthroscopic techniques. Many historically open procedures are now successfully performed through arthroscopic or endoscopic means. We have demonstrated many novel techniques to address ankle pathology, as well as evidence based medicine to support certain arthroscopic techniques and management of patients both pre and postoperatively. Arthroscopic equipment advancements were also demonstrated. As arthroscopy continues to advance, the degree of technical difficulty increases, and we strongly recommend proficiency in arthroscopy before performing these procedures.

The authors have no reported conflicts of interest or financial disclosures of any kind. All figures are copyrighted by Smith and Nephew, the authors were granted permission for reproduction.

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