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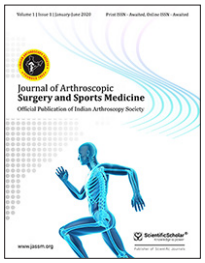

Arthoscopic Techniques

Arthroscopic ankle arthrodesis – Surgical technique

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ABSTRACT

End-stage ankle arthritis causes significant pain, disability, and reduction in the quality of life. The common causes of ankle arthritis are post-traumatic (70%), secondary to rheumatoid arthritis (12%), and idiopathic (7%). Surgical arthrodesis of the tibiotalar joint is used to help alleviate the symptoms and signs of end-stage ankle arthritis. The first documented description of ankle arthrodesis is by Albert of Vienna in 1879 who reported curettage of the articular cartilage to enable fusion of the ankle joint. Since that time, this process has been refined significantly culminating in the introduction of arthroscopic ankle arthrodesis (AAA) by Schneider in 1983. AAA is now considered as the current gold standard to help achieve effective and predictable pain relief and improved function for patients who suffer with end-stage ankle arthritis.

Keywords: Ankle, Arthritis, Fusion, Arthroscopic, Technique

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The first documented description of ankle arthrodesis is by Albert of Vienna in 1879[2] who reported curettage of the articular cartilage to enable fusion of the ankle joint. Since that time, this process has been refined significantly culminating in the introduction of arthroscopic ankle arthrodesis (AAA) by Schneider in 1983.[3] AAA is now considered as the current gold standard to help achieve effective and predictable pain relief and improved function for patients who suffer with end-stage ankle arthritis.

INDICATIONS

- The indications for arthroscopic ankle fusion (AAA) are for the most part the same as those for an open ankle fusion
- AAA is used to treat an arthritic stiff and painful ankle joint that has failed conservative management
- The arthroscopic technique lends itself particularly well to patients who may have a poor soft-tissue envelope, are at risk of wound complications due to comorbidities such as diabetes, peripheral vascular diseases, and/or have mild-to-moderate talocrural joint deformity.

CONTRAINDICATIONS

- Significant malrotation
- Significant bone loss
- Failed previous fusion
- Active infection
- Concomitant and significant subtalar/hindfoot joints arthritis.

Relative contraindication – Deformity varus/valgus/equinus> 10–15°

OUTCOMES

AAA offers a safe and effective way of achieving pain relief and improved function for patients who suffer with end stage ankle arthritis. A snap shot of AAA outcomes is presented below.

- Fusion rate 90.3–97%
- Average time to fusion 9.32–11.8 weeks
- 74% good to excellent results (Mazur grading) and 83% good to excellent (Morgan grading)
- Mean AOFAS improvement before and after surgery increased from 39.71 to 83.3, respectively.[4-6]

Although open ankle fusion remains a highly effective procedure, AAA appears to deliver certain advantages over and above open fusion. Townshend *et al*.[7] showed that AAA when compared to open ankle fusion showed shorter hospital length of stay and better outcomes at 1 and 2 years. SF-36 scores for AAA versus open at 1 and 2 years, respectively, were 46.3 versus 37.9 and 45.0 versus 38.2, and length of hospital stay was 2.5 versus 3.7 days.

Similar findings were echoed by Park *et al*. who reported that AAA was superior to open ankle fusion in offering better clinical scores, fewer complications, shorter hospital length of stay, and less blood loss. Union and revision rates were, however, similar in both groups.[8]

Quayle *et al*., however, reported that fusion rate for AAA was higher than for open ankle fusion; 98% versus 83%, respectively. Time to fusion was also shorter for AAA at 146 days versus 196 days. Interestingly, they also reported that there was no significant difference between the two groups in their ability to correct severe deformity (>10°), with both techniques able to achieve correction to within 5° of neutral.[9]

Adjacent joint disease as a consequence of fusing the ankle joint is commonly an additional point of concern. Reassuringly, Sinclair *et al*. at an average of 12-year follow-up reported that 22% of patients were found to require a secondary procedure after AAA. Four out of 111 patients required an additional arthrodesis with three being of the subtalar joint.[10]

CONSENT BENEFITS AND RISKS

Benefits

- Pain relief
- Improved overall function and quality of life.

Note

- After ankle fusion, the patient may notice a subtle limp to their gait. This is because the heel strike and tibial progression phases of the gait cycle have been eliminated
- After ankle fusion, patients should be counseled that they will be able to walk, jog, and be able to drive a car.

Risks

- Bleeding, infection, scar, pain, ankle and leg swelling, venous thromboembolism, neurovascular injury, complex regional pain syndrome, non-union, malunion, delayed union, metal work irritation, anesthetic risks.

ALTERNATIVES TO AAA

Non-operative alternatives

- Ankle bracing
- Steroid and local anesthetic injection
- Long term analgesia
- Activity modification
- Maintaining a healthy BMI.

Surgical alternatives

- Open ankle fusion
- Ankle replacement
- Supramalleolar osteotomy (in the presence of varus/valgus deformity and mild-to-moderate ankle arthritis only).

AAA VERSUS OPEN ANKLE FUSION

Research comparing arthroscopic ankle fusion versus open ankle fusion suggests that AAA may have the following advantages:

- Shorter hospital length of stay
- Better outcomes at 1 and 2 years
- Higher fusion rate
- Shorter tourniquet time
- Shorter hospital length of stay.

But no significant difference in

- Infection rate
- Overall complication rate
- Operating time.[11,12]

OPERATIVE SET UP FOR AAA

- The patient is positioned supine on the theatre table
- A thigh tourniquet is applied and inflated to 300 mmHg
- The knee is flexed to 30–45ºwith the aid of a knee bolster, being careful to keep the popliteal fossa free to avoid compression of the neurovascular bundle
- A sandbag is placed under the ipsilateral buttock so that "toes point to the ceiling"
- The limb is prepped using an appropriate skin antiseptic agent and waterproof drapes are applied
- GUHL non-invasive ankle distractor system (Smith and Nephew) is applied to the foot and ankle with the sling connected to the sterile support bars and table clamp
- The ankle arthroscopy stack is prepared and positioned on the contralateral side of the operated limb, including camera, saline irrigation, shaver, and suction
- [Figure 1] illustrates the steps involved in ankle arthroscopy set up.

SURGICAL TECHNIQUE

Landmarks [Figure 2] including the ankle joint, medial malleolus, lateral malleolus, tibialis anterior tendon, and the superficial peroneal nerve (SPN) which is in line with the 4th metatarsal, are highlighted using a surgical skin marker pen .

The structures at risk are the SPN, saphenous nerve, saphenous vein, and anterior and posteromedial neurovascular bundle.

Twenty milliliters of normal saline are insufflated into the ankle joint through the medial soft spot subtended by the interval formed by the tibialis anterior tendon and the medial malleolus.

An anteromedial portal is created using an 11 blade scalpel, being mindful to cut the skin and superficial fascia only to avoid injury to the saphenous nerve and vein. A small artery clip is inserted closed through the joint capsule and into the ankle. This artery clip is opened inside the joint. A saline flashback should be obtained if the artery clip is correctly placed within the insufflated joint capsule. The artery clip is withdrawn in the open position to enlarge the portal and avoid catching the nerve. An anterolateral (AL) portal is then created under direct vision with the arthroscope in the joint, and a needle introduced into the joint through first to mark the AL portal, being careful to avoid the SPN.

The anterior tibial lip osteophyte is removed using a burr under direct vision. Occasionally, a fine small osteotome may be required to remove a large anterior osteophyte. It is necessary to remove this osteophyte to eliminate the mechanical block to dorsiflexion and achieve a plantigrade position of the tibiotalar joint.

To prepare the articulating surfaces, the required instruments are a 3.5/4.2 mm soft-tissue shaver, 4 mm burr, and curved curettes. Step one is to debride the florid synovitis with the soft-tissue shaver and obtain clear visual field of the whole ankle joint, including both gutters.

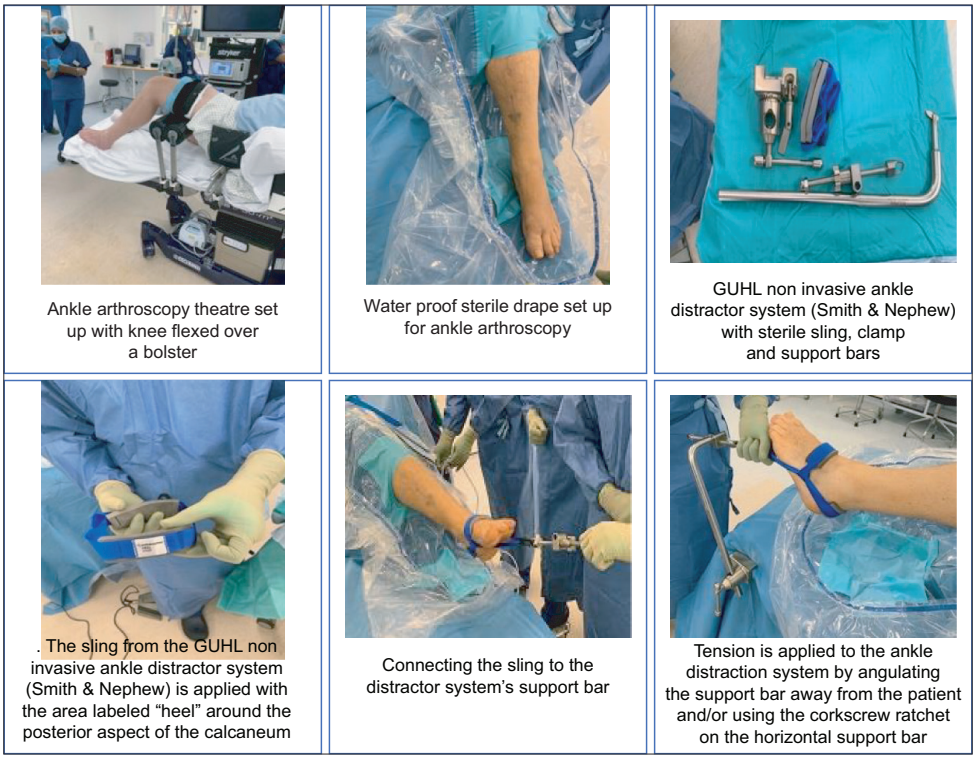

Figure 1: Ankle arthroscopy theater set up.

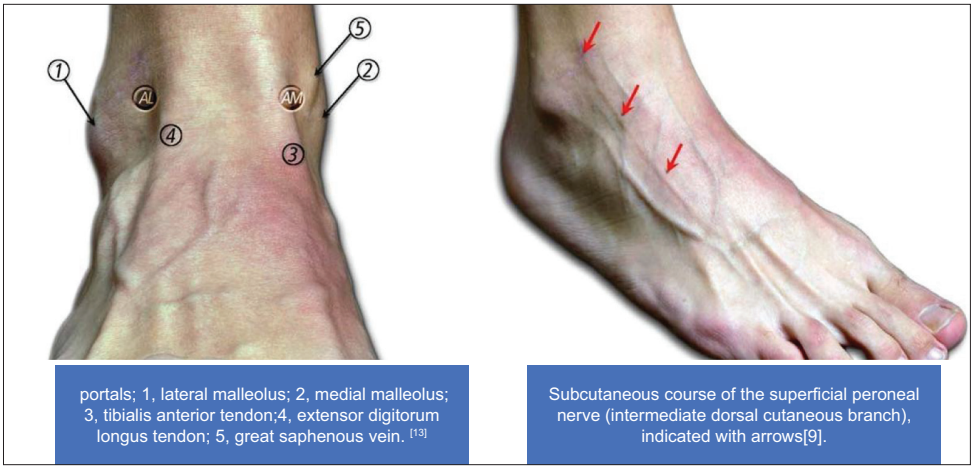

Figure 2: Surface anatomy of relevant landmarks in ankle arthroscopy.[13]

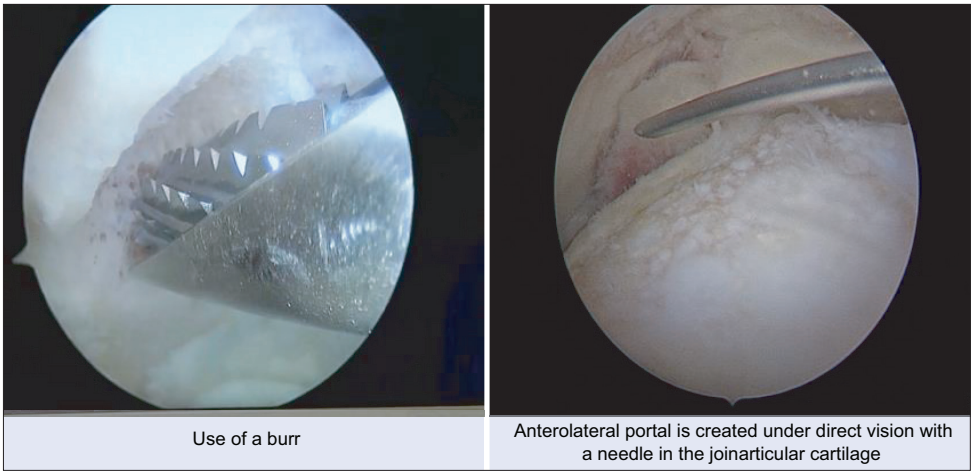

Figure 3: Intraoperative photographs demonstrating portal creation and articular surface preparation techniques.

Figure 4: An image intensifier, in this case a mini C-arm, is used to confirm cannulated screw position.

The articulating surfaces are then prepared sequentially. It is common to start with the talus. The talus's propensity for limited bleeding means that the surgical field of view will be obscured less. The tibial plafond and medial gutter are then prepared next. The 4 mm burr [Figure 3] and curettes are used to remove any remaining cartilage and subchondral bone. The goal is to reach bleeding subchondral bone on either side of the joint and maximize the surface area across which fusion can take place. The appearance of fat bubbles emanating from the bone on stopping irrigation is another useful sign that the appropriate bone depth has been achieved.

It is important to withdraw the scope appropriately to achieve a maximal field of view, as well as switching portals to make sure all sides of the joint are visualized and adequately prepared.

Once the joint surfaces are adequately prepared, the ankle is placed in the optimal functional position. For ankle

Figure 5: Radiographs demonstrating typical screw configuration in both AP and LAT views.

fusion, this position is accepted to be neutral dorsiflexion (plantigrade), 0–5° valgus, 5–10°external rotation, and/or symmetrical to the healthy joint, and the talus positioned directly under the anatomic axis of the tibia on the lateral view. Care is taken to avoid anterior translation of the talus on the tibia by placing a gown pack or a metal bowl underneath the distal tibia to off-load the heel and aid posterior translation of talus in the mortise.

The tibiotalar joint is compressed with either 8.0 mm or 6.5/6.7 mm cannulated partially threaded screws, which are inserted percutaneously over guide wires under X-ray control [Figure 4].

A typical wire placement configuration consists of two parallel wires placed medial to lateral and starting approximately 10 cm above the distal tip of the medial malleolus. The most medial screw is aimed at the shoulder of the talus and, in a valgus deformity, it is inserted first to achieve maximal compression medially and correct the talar tilt deformity. In a varus ankle deformity, the lateral screw is inserted first. Care is taken to ensure the screw threads are across the tibiotalar joint line but not penetrating into the subtalar joint/sinus tarsi [Figure 5] other screw configurations and combinations are also possible including cross screws, anterior posterior screws, and placement of screws distal to proximal.

POST-OPERATIVE CARE

- Below-knee backslab for 2 weeks
- Change backslab to full cast at 2 weeks
- Total duration in cast immobilization is 12 weeks from day of surgery
- Patient to be non-weight-bearing (NWB) for 2/52 post-surgery
- Patient can start to gradually weight bear in a full cast from 2/52 onward
- Follow-up time intervals are 2 weeks, 6 weeks (with X-ray of ankle), and 12 weeks (with X-ray ankle)
- Consider two post-operative antibiotic doses and thromboprophylaxis as per local hospital guidelines.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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