Technique Tip

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Maximum Plantarflexion Lateral Ankle Radiograph for Preoperative Planning for the Arthroscopic Treatment of Osteochondral Lesions of the Talus

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Introduction

Osteochondral lesions of the talus (OLT) are widely recognized as a common pathologic source of ankle pain and account for a large number of patient evaluations every year. Many surgical techniques have been established for both open and arthroscopic management of these lesions for patients who have failed conservative management strategies.[8,12] Because of growing interest and support for arthroscopic management of these lesions, it has become increasingly important to develop preoperative evaluation methods to determine which lesions are amenable to standard arthroscopic evaluation and treatment vs the use of alternative strategies including posterior ankle arthroscopy, open arthrotomy, or malleolar osteotomy.[12] Prior studies have focused on standard evaluation techniques including history and physical examination, weightbearing and standard radiographs, nonweightbearing computed tomography (CT) scans, magnetic resonance imaging (MRI), and bone phase scintigraphy (bone scan).[11]

More recently, a modified CT scan protocol has been developed with the ankle held in a maximum plantarflexion position to estimate which lesions are accessible by standard anterior ankle arthroscopy based on the location of the lesion relative to the anterior tibial plafond.[10] Although this study did demonstrate excellent correlation between CT and arthroscopic measurements, the authors were unable to provide clinical guidance for which approach to use for each lesion location because of the inherent variability of lesions, tissue quality, surgeon comfort and skill level with arthroscopy, and variable instrumentation. Additionally, the custom jig that they developed for this study is not readily available to most surgeons and therefore represents a barrier to widespread use of this technique. The purpose of this case presentation is to outline a simple method for preoperative planning using a maximum plantarflexion lateral ankle radiograph, which can be performed with standard radiographic equipment, to elucidate similar information as that seen in this previous CT based study.

Case Presentation

The following case is a representative example of the preoperative evaluation of an OLT using a maximum plantarflexion radiograph to determine appropriateness of using a standard anterior ankle arthroscopic approach. A 25-year-old woman presented to the clinic approximately 3 years after initial injury to the left ankle sustained while skiing. This was treated conservatively with the working diagnosis of an acute lateral ankle sprain. She had initial improvement

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Figure 1. Mortise anteroposterior and lateral weightbearing radiographs of a left ankle in a skeletally mature individual demonstrating a cystic lesion in the posteromedial talar dome consistent with an osteochondral lesion of the talus (OLT) with otherwise normal alignment and architecture of the ankle mortise without collapse.

in her pain, but after resuming normal activities, she noted persistent anteromedial ankle pain that was limiting her function. She noted some relief in her symptoms with the use of a lace-up ankle brace and intermittent oral nonsteroidal anti-inflammatory drug use, but also noted occasional painful clicking in her ankle. She had no other prior history of significant ankle injury and otherwise no pertinent medical or surgical history. She had a body mass index of 24.8.

Prior to presentation to our foot and ankle orthopaedic clinic, she had outside evaluation and imaging including weightbearing radiographs (Figure 1) and subsequent noncontrast MRI of the left ankle (Figure 2). This imaging demonstrated an OLT in the posteromedial talar dome measuring approximately 12 $\times$ 8 mm with irregular articular cartilage and mild cystic changes underlying the subchondral surface with a maximal depth of about 7 mm. There was no collapse of the subchondral plate at the talar dome. The lesion was abutting the medial shoulder without involvement of the medial articular surface, and lay within the posterior half of the talar dome as seen on the sagittal MRI (Figure 3).

On physical examination, she had no deformity and no significant limitations to motion in the bilateral feet and ankles. Of note, she had left ankle dorsiflexion (DF) to about 5 degrees with negative Silfverskiöld examination and plantarflexion (PF) to around 35 degrees at the left ankle, limited by pain. Lateral ligamentous examination of the left ankle was negative for instability with anterior drawer and talar tilt testing, compared with the uninjured contralateral limb. She had no prior surgical scars or any significant skin changes. There was no soft tissue swelling or prominent effusions. She had tenderness to palpation at the anteromedial ankle joint line as well as posterior to the medial malleolus. She had normal motor testing of all tendons about the ankle and a normal neurovascular examination. She did not have any evidence of gross ligamentous laxity or hypermobility.

Preoperative Imaging

After examination and review of available imaging, discussion was held with the patient regarding continued conservative management of her left ankle OLT vs surgical intervention with ankle arthroscopy, OLT debridement, and microfracture because of the lesion size of less than 150 mm^2 based on previously described treatment algorithms.[6] To determine the best approach for ankle arthroscopy, anterior vs posterior, a left ankle nonweightbearing maximal plantar flexion radiograph was performed in the clinic. This image was referenced against the sagittal MRI, and measurements performed on the PACS system, to show that with plantarflexion, the anterior margin of the

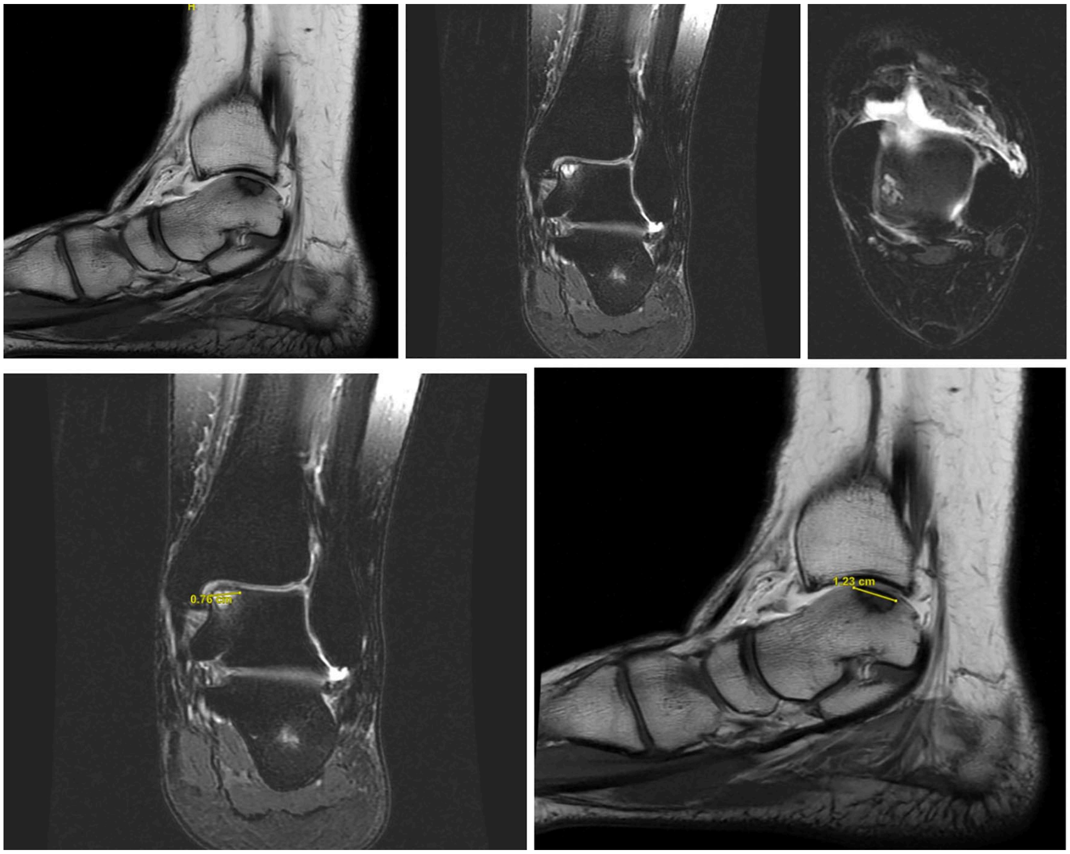

Figure 2. Select images from both fat and fluid magnetic resonance imaging (MRI) sequences of a left ankle in a skeletally mature patient in a nonweightbearing fashion without the use of contrast. These demonstrate an OLT in the posteromedial talar dome measuring approximately 12 × 8 mm with irregular articular cartilage and mild cystic changes underlying the subchondral surface with a maximal depth of about 7 mm. The remaining MRI scans did not yield any further pathology aside from this OLT.

medial-based OLT was adjacent to the anterior lip of the tibial plafond (Figure 4). Based on the clinical experience of the senior author using this evaluation method, this radiographic anatomic reference serves as an indication that the lesion can be adequately accessed using standard anterior ankle arthroscopy with plantarflexion and/or noninvasive distraction. If the leading edge of the lesion does not approximate the anterior tibial plafond with maximal plantarflexion, the senior author indicates the patient for an alternate surgical approach such as posterior ankle arthroscopy or an open approach to the lesion.

Arthroscopic Evaluation and Treatment

The patient was taken to the outpatient surgery suite and underwent general anesthesia. She was placed in the supine position with a left hip bump. She was positioned with her feet about 6 in. from the end of the radiolucent operating table. Noninvasive ankle distraction was applied using an Arthrex foot holder (Arthrex, Naples, FL) clamped to the

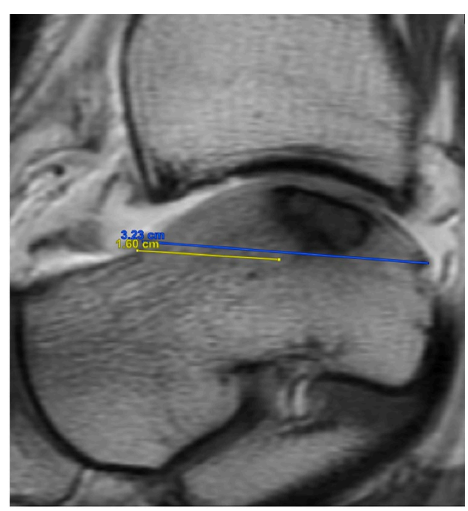

Figure 3. Cropped image of the previously displayed sagital magnetic resonance imaging showing that approximate location of the osteochondral lesion of the talus within the posterior half of the talar dome.

Figure 4. Lateral nonweightbearing radiograph of the left ankle held in a maximally plantarflexed position. The cropped second image highlights the location of the osteochondral lesion of the talus, with the leading anterior margin directly adjacent to the anterior tibial plafond. The final image is of a different patient, illustrating the technique of obtaining this image in the radiography suite with the patient lying in a lateral position with the affected limb down.

Figure 5. Photograph of a different patient to illustrate the intraoperative positioning and setup using the Arthrex foot holder clamped to the bed rail with the ankle in a neutral to slight plantarflexion position. The surgeon was positioned at the foot of the bed, with an assistant standing to the side of the operative ankle.

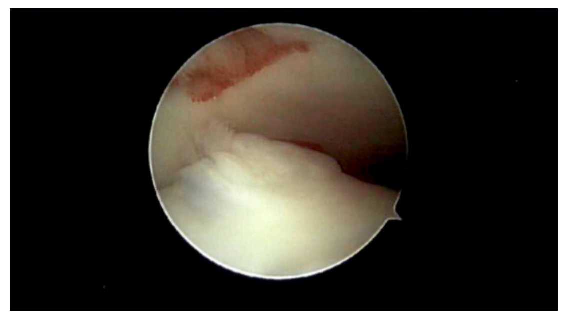

Figure 6. Arthroscopic photograph showing the irregular cartilage surface of the osteochondral lesion of the talus in the medial talar dome with adjacent synovitis in the anteromedial ankle.

bed rail with the ankle in a neutral to slight plantarflexion position (Figure 5). Similar noninvasive distraction has previously been shown in a cadaveric model to provide equivalent access to the anterior and central talus, when compared with invasive distraction.[1] The surgeon was positioned at the foot of the bed, with an assistant standing to the side of the operative ankle. Ankle arthroscopy was initiated using a standard anteromedial portal followed by anterolateral portal, taking care to protect the superficial peroneal nerve using careful dissection and direct visualization. Following diagnostic arthroscopy and limited soft tissue debridement with an arthroscopic shaver, with the ankle manually held in a maximally plantarflexed position by an assistant, the OLT leading edge was easily identified (Figure 6). The remaining joint was intact without cartilage injury. There was moderate synovitis noted anterior and medial within the joint.

Next, an arthroscopic shaver and an angled ringed curette was used to debride the unstable articular cartilage back to sharp, stable borders, and all loose cartilage fragments were removed from the joint. This left approximately 8×15 mm of exposed subchondral bone at the base of the lesion (Figure 7). The subchondral plate was intact without bone loss or evidence of collapse. Finally, using an arthroscopic microfracture awl, several microfracture holes were created through the subchondral plate and into the underlying metaphyseal bone until marrow fat was identified (Figure 8), following previously described microfracture technique.[9] Because of the posterior position of this lesion, a microfracture awl with a relatively sharp angle was required. In this case, the anterior half of the lesion was accessed with a 60-degree awl and the posterior half with a 90-degree awl. Using this type of awl can be challenging as there is a tendency to skive along the bone surface; therefore, extra care must be taken to avoid this issue. Suction was used to ensure there was adequate bleeding from the

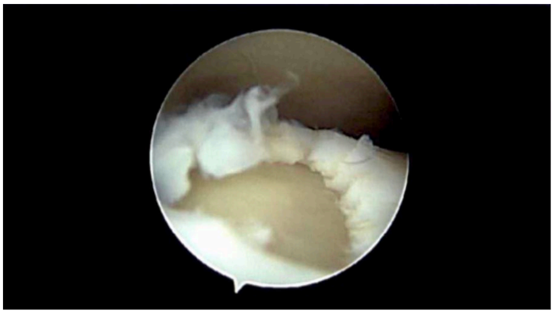

Figure 7. Arthroscopic photograph of the left ankle after debridement of the unstable cartilage lesion showing stable subchondral bone.

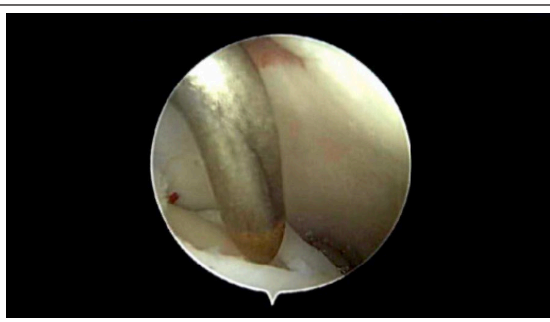

Figure 8. Arthroscopic photograph showing 60-degree arthroscopic awl being inserted through the subchondral bone under manual pressure until a depth of approximately 2-4 mm starting at the peripheral margin of the lesion.

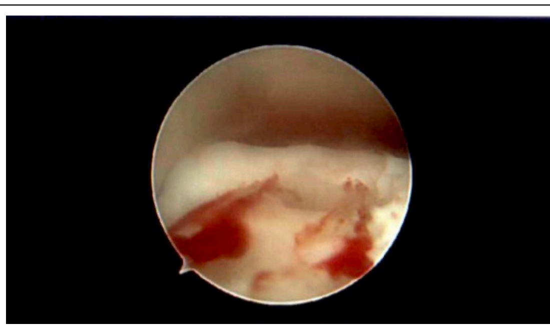

Figure 9. Arthroscopic photograph following microfracture of the talar dome lesion showing adequate marrow stimulation as evidenced by brisk bleeding from the microfracture holes while allowing irrigation fluid to drain under gentle suction.

microfracture base (Figure 9). The arthroscopic instrumentation was removed and remaining fluid drained from the joint prior to wound closure and application of a sterile bandage and walking boot.

Postoperatively, she was immobilized in the boot for 2 weeks and nonweightbearing using crutches for mobility. She was kept nonweightbearing for 6 weeks total, then allowed progressive weightbearing in the boot before transition to an ankle brace. Gentle home range of motion was started at 2 weeks, followed by physical therapy starting after the 6-week postoperative appointment. At 3 months, she was allowed to start exercising without the use of the ankle brace, and her preoperative symptoms had not recurred. The senior author's clinical management of OLT lesions following arthroscopic debridement and microfracture does not include repeat imaging, so long as the patient does not have returning symptoms or other concerns following surgery. If they are doing well at the 3-month postoperative appointment, they are offered follow-up on an as-needed basis. This patient had not returned or called with concerns at 6 months postsurgery.

Discussion

Osteochondral lesions of the talus are a frequently encountered pathology for orthopaedic surgeons, estimated to be present in 27:100 000 person years in a prior military study, with other studies showing incidence of up to 50% in ankle sprains and as much as 80% in ankle fractures.[7] Classification schema have been developed and adopted to better characterize these OLTs and guide treatment based on clinical and radiographic parameters. Many patients can be treated conservatively when lesions are deemed stable, but around 50% of these managed nonoperatively continue to have symptoms and often demonstrate radiographic progression of lesion size and subchondral changes, indicating invasive treatment.[12] Many surgical techniques have been established for open and arthroscopic management, and more recent research has focused on both the evaluation and management of OLTs to develop best practices. This includes focus on the use of noninvasive distraction vs maximal position in both dorsiflexion and plantarflexion to improve access of the talar dome articular surface during anterior ankle arthroscopy as well as posterior ankle arthroscopy.[3-5]

In the management of OLTs, the limits of anterior arthroscopy have been pushed with time, because of the added complexity and possible added morbidity associated with other techniques. Joint range of motion, ligamentous laxity, scar tissue, and other patient characteristics can all have an impact on the intra-articular access using anterior arthroscopy of the tibiotalar joint, with the posterior talus being the most challenging site to access. Because of these challenges, surgeons may be hesitant to manage some OLTs using standard anterior ankle arthroscopy, particularly in more posteriorly located lesions. VanBergen et al[10] previously outlined a CT based protocol of preoperative assessment to determine the accessibility of these lesions with plantarflexion of the ankle. This technique considers the above patient characteristics and provides useful information before proceeding to surgery, which can help the surgeon prepare for the possible use of techniques other than anterior arthroscopy alone. Unfortunately, the custom jig and imaging protocol are not widely available for most surgeons, so the clinical applicability is limited. Similarly, Choi et al recently used a preoperative radiographic assessment with maximal plantarflexion and maximal dorsiflexion to assist with preoperative planning for open management of OLT lesions, but did not relate this technique to arthroscopic management of the lesion.[2]

As illustrated in our case presentation, preoperative radiographic planning with a maximal plantarflexion radiograph is a simple clinical technique that can be employed by the clinician, among other clinical and imaging tools, to help guide appropriate surgical technique for lesions in the posterior half of the talar body. This is a similar technique to that shown by Choi et al[2], but in the context of arthroscopic management of an OLT, which is currently the predominant technique employed in surgical management of these lesions. This technique uses standard radiographic equipment, which is typically available to all surgeons managing OLTs, and requires minimal training for the technicians performing the radiographs. In addition, in the case example provided, no special equipment was used for accessing this fairly posterior lesion other than what is typically available for anterior ankle arthroscopy (2.4-mm scope and shaver, noninvasive distraction, 60-degree awl, 90-degree awl, and ringed curette).

Our study is limited by size and power, as it includes a single case example rather than a larger clinical cohort. Additionally, this study lacks long-term follow-up data and there are no objective measures of outcomes used in this study such as PROMs, postoperative imaging, or follow-up arthroscopic evaluation. As such, clinical inference is limited, and this technique tip cannot be easily clinically validated. Despite this, we hope this clinical tip and case example will provide a useful tool for treating surgeons and enhance confidence in the arthroscopic management of OLTs with relatively posterior locations within the talar dome. Additionally, it can highlight those cases in which anterior arthroscopy is unlikely to be successful, indicating the need for an alternate surgical approach.

In conclusion, based on the clinical experience of the senior author, most osteochondral lesions of the talus can successfully be managed with anterior ankle arthroscopy using non-invasive distraction to perform debridement and microfracture. For those lesions in the posterior half of the talar dome, access with standard technique can sometimes be challenging. As such, this clinical tool is utilized preoperatively to determine if these posterior lesions can be adequately accessed using maximal plantarflexion of the ankle. If the lesion does not approximate the anterior edge of the tibial plafond on preoperative maximal plantarflexion lateral radiographs, an alternate surgical technique will be employed rather than anterior arthroscopy alone.

Ethical Approval

Ethical approval for this study was waived by University of Washington Human Subjects Division Institutional Review Board because consent not required for deidentified data presented in secondary research which does not affect the treatment/outcome of the patient (Category 2.4 Exempt Determination).

Declaration of Conflicting Interests

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