Technical Note

Ankle Arthroscopy as an Adjunctive Method for Diagnosis of Nonunion After Tibiotalar Arthrodesis

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Abstract: The definition of consolidation after ankle arthrodesis can be challenging in some situations. Computed tomography has increased diagnostic accuracy; however, there are still no clear criteria for nonunion. In this context, arthroscopy with direct visualization of the arthrodesis may provide crucial data to inform the choice of treatment. The present report illustrates a case in which arthroscopy prompted a change in treatment strategy. More extensive surgery, with the potential for greater morbidity due to revision arthrodesis, could be avoided.

Ankle arthrodesis is commonly indicated for patients with advanced symptomatic arthritis. Despite advances in surgical technique in recent years, negative outcomes still occur.[1,2] Pseudoarthrosis, or nonunion, is one of the most frequent complications, occurring in up to 40% of cases.[3,4] The definition of consolidation after arthrodesis can be challenging in some scenarios.[5-8] Some factors require careful analysis, especially in cases with an equivocal outcome. The ultimate goal is clinical consolidation, which is defined by the patient's symptoms and by loss of movement. Supplemental imaging modalities, especially radiography and computed tomography, can assist in this evaluation. The criteria used to define nonunion versus consolidation on ankle imaging have changed in recent years.[6,7] One study reported an association of the percentage of osseous bridging between the arthrodesed structures with patient symptoms.[6] The authors concluded that the extent of bridging needed to obtain a good clinical outcome is lower than commonly believed.[6]

This report aims to describe a useful surgical technique with an illustrative case. A patient presented with pain around the lateral malleolus and sinus tarsi after arthroscopic ankle arthrodesis. Radiography and computed tomography were consistent with tibiotalar nonunion. Ankle arthroscopy was performed to ascertain whether any movement was possible between the tibia and the talus. As no movement or evidence of nonunion was observed, the screws were removed. Management was not changed, even though intraoperative fluoroscopy suggested a pseudoarthrosis. In the postoperative follow-up, the patient experienced rapid improvement of symptoms.

Direct arthroscopic visualization of the arthrodesis site provides several advantages and can prevent extensive surgery. It is well established that revision arthrodesis of the ankle often requires iliac graft removal and the placement of fresh synthetic graft material. In addition, the postoperative period is less painful and recovery is faster.[9,10] Diagnostic arthroscopy can be a useful adjunct for the diagnosis of consolidation in such cases. This technique also can be considered in cases of equivocal diagnosis.

Surgical Technique (With Video Illustration)

A previously healthy 22-year-old man underwent surgical fixation of an ankle fracture sustained in an automobile collision (Fig 1). He subsequently developed post-traumatic arthritis with pain and loss of function (Fig 2). Arthroscopic arthrodesis was performed with two 7.0-mm cannulated screws. Eight months after arthrodesis, the patient complained of

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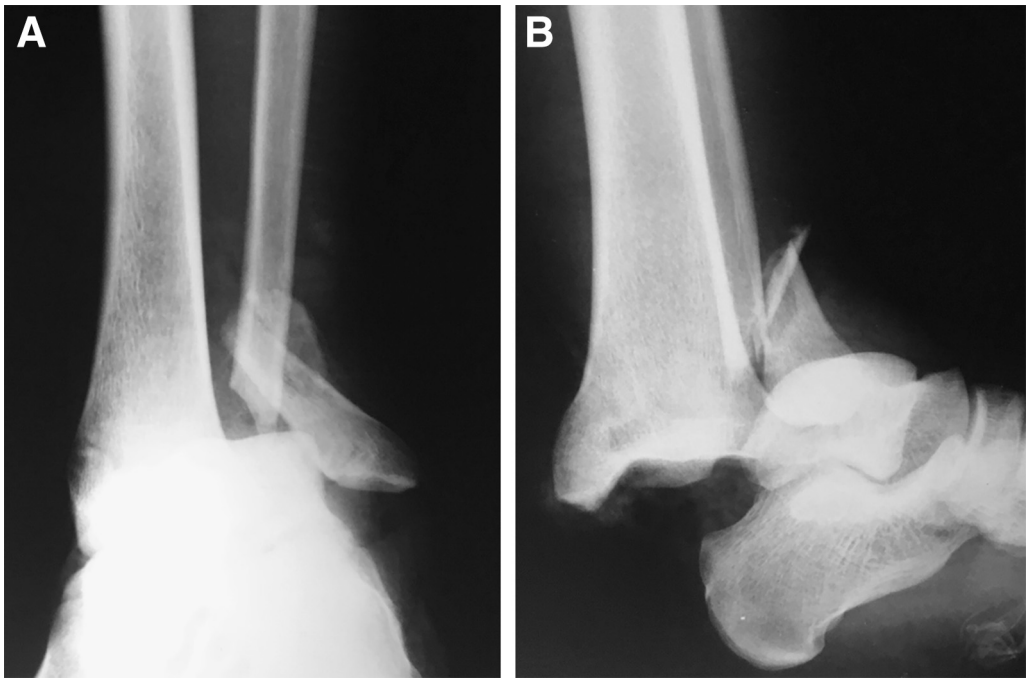

Fig 1. Initial radiographs of the left ankle. (A) Left side: anteroposterior view showing ankle fracture dislocation. (B) Right side: lateral view showing ankle fracture dislocation.

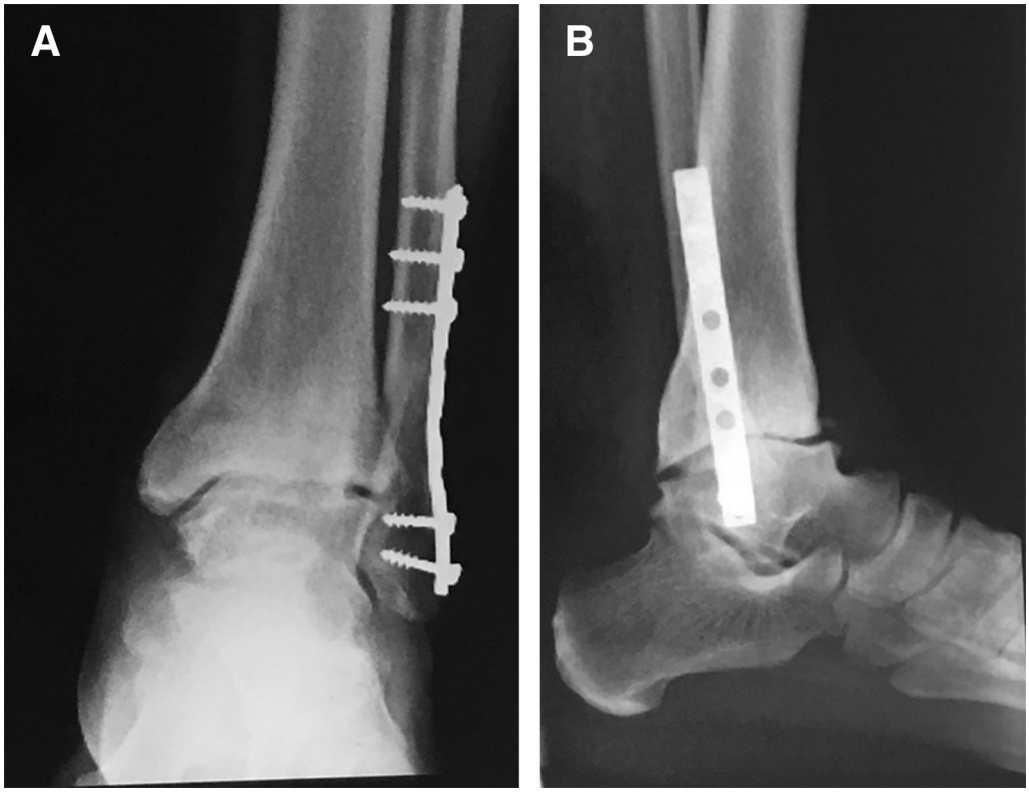

Fig 2. Preoperative radiographs of the left ankle. (A) Left side, anteroposterior view showing evidence of tibiotalar arthrosis. (B) Right side, lateral view.

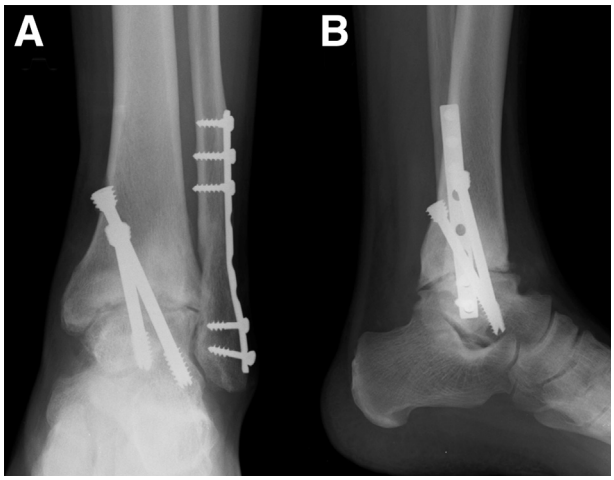

Fig 3. Imaging of left ankle showing evidence of nonunion. (A and B) Plain radiograph, anteroposterior and lateral view, respectively.

pain in the lateral malleolus and sinus tarsi. Imaging was suggestive of nonunion in the arthrodesis, although the patient did not report medial joint line tenderness (Figs 3 and 4).

As the patient's symptoms did not correlate exactly with the imaging findings, revision arthroscopy was performed to ascertain whether the arthrodesis was consolidated through direct visualization. To summarize, the patient is placed in the supine position, standard anterior-lateral and anterior-medial ankle arthroscopy portals are established, and the anterior ankle compartment viewed through a 4-mm 30° arthroscope (10k100 Arthroscopy Inflow Tube; ConMed Linvatec, Utica, NY). Careful synovectomy and debridement of fibrous scar tissue are performed with a 3.5-mm gator meniscus cutter (C9264; ConMed Linvatec), a 4.5-mm high-speed steel spherical bur (H9111; ConMed Linvatec), and a 90° 3.2-mm × 150-mm LightWave ablator (IA 2379; ConMed Linvatec) (Fig 5). Any fibrotic tissue is dissected down to the bone (Fig 6). Under direct visualization, the operator can observe whether osseous bridging has formed between the tibia and the talus (Fig 7). Visualization of the transition zone between the tibia and talus can sometimes be difficult; in these cases, fluoroscopy is a useful adjunct. In addition, through dynamic dorsiflexion and plantarflexion of the foot, the operator can observe if there is any degree of residual movement at the arthrodesis site (Fig 8). In this case, osseous bridging and complete absence of movement at the arthrodesis site were both verified under arthroscopic visualization (Video 1). Although intraoperative fluoroscopy suggested pseudoarthrosis, the decision was made to simply remove the osteosynthesis screws (Fig 9).

Postoperatively, weight-bearing was allowed as tolerated with the use of crutches, and rehabilitation started 1 week after surgery. The patient had an uneventful postoperative course, with rapid improvement of pain and excellent functional outcome at 3-year follow-up. Advantages and disadvantages of the technique are shown in Table 1, and pearls and pitfalls are presented in Table 2.

Discussion

Ankle arthroscopy has evolved considerably in recent years. Its use for the treatment of several conditions has expanded accordingly, with proven improvement in clinical outcomes. The purpose of this brief report is to discuss an indication for this procedure.

It is well known that, despite technological advances in image quality, there is still no precise method that can ensure diagnosis with reasonable certainty and guide subsequent treatment decisions. There is substantial disagreement in the literature regarding diagnostic criteria for arthrodesis nonunion. In addition, some recent articles have demonstrated clinical outcomes that diverge from the criteria commonly used in these cases.[3,5-8]

In this context, ankle arthroscopy can be useful in patients with equivocal arthrodesis outcomes, in view of the important information it provides, including the theoretical advantage of being able to visualize consolidation (or the lack thereof) directly. As in the case describe herein, patients can benefit from avoidance of unnecessary revision surgery, which is associated with a high morbidity rate.[9,10] Another potential advantage is that, when nonunion is confirmed intraoperatively, revision surgery (whether arthroscopic or open) can be performed at once.

Some risks are associated with this technique. Although rare, complications of anterior ankle arthroscopy have been reported.[11] The most common are nerve injury, infection, complex regional pain syndrome, instrument breakage, pseudoaneurysm, deep venous thrombosis, and cartilage injury. It bears stressing that these complications have been assessed and reported in other arthroscopic procedures associated with greater manipulation and longer operative time; the true risk of the technique proposed herein is still unclear. One potential risk particularly inherent to

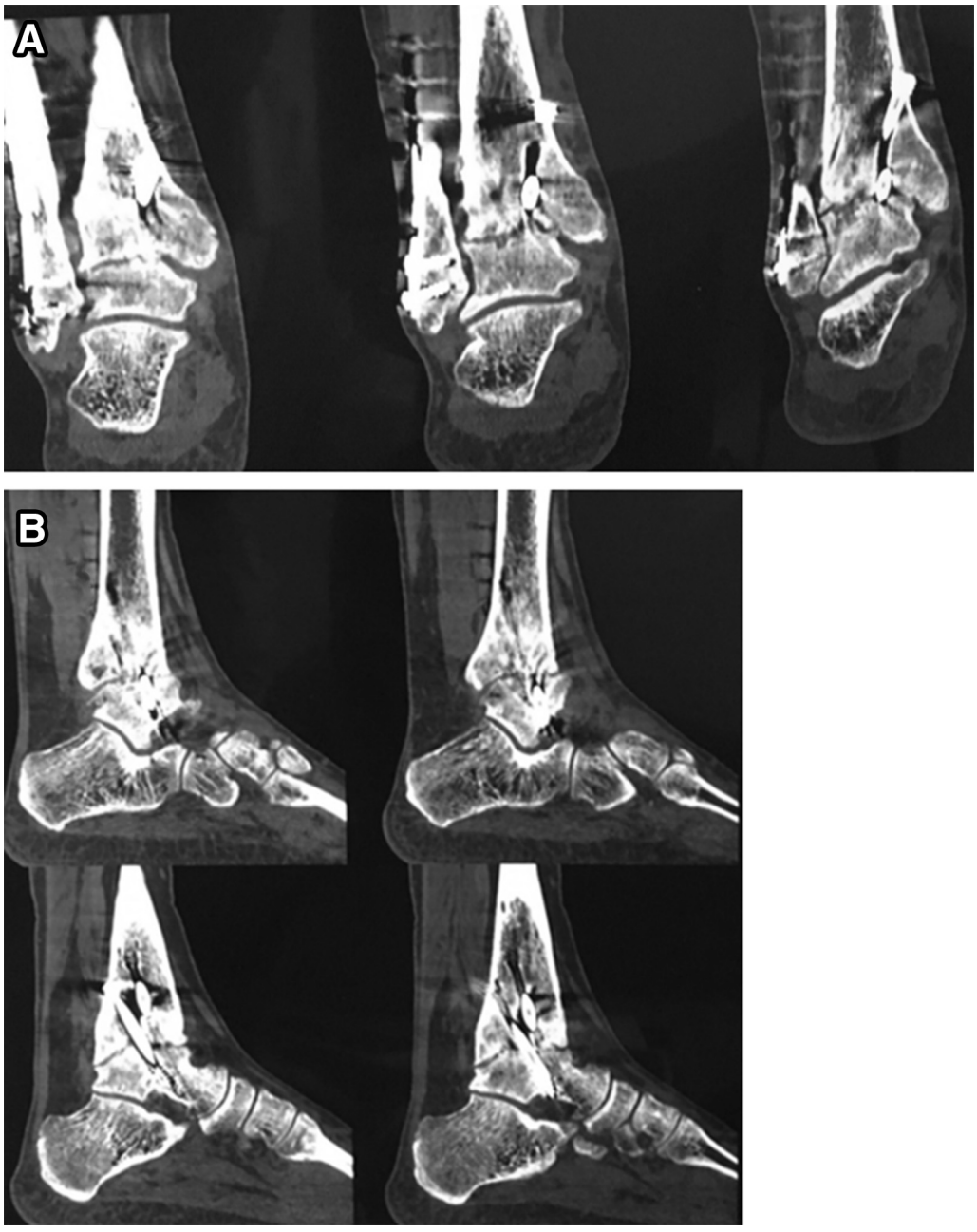

Fig 4. Imaging of left ankle showing evidence of nonunion. (A and B) Computed tomography, coronal and sagittal view, suggesting nonunion, respectively.

this method is misinterpretation of findings by the operator, which might lead to unnecessary postoperative pain and require additional invasive interventions for revision.

Late postoperative pain after tibiotalar arthrodesis may have many causes. Judicious review of imaging is advised. The physician also should consider whether any risk factors for nonunion are present. If nonunion is suspected or findings are equivocal, diagnostic arthroscopy can be a useful tool, allowing direct visualization of the joint and potentially preventing unnecessary surgical manipulation.

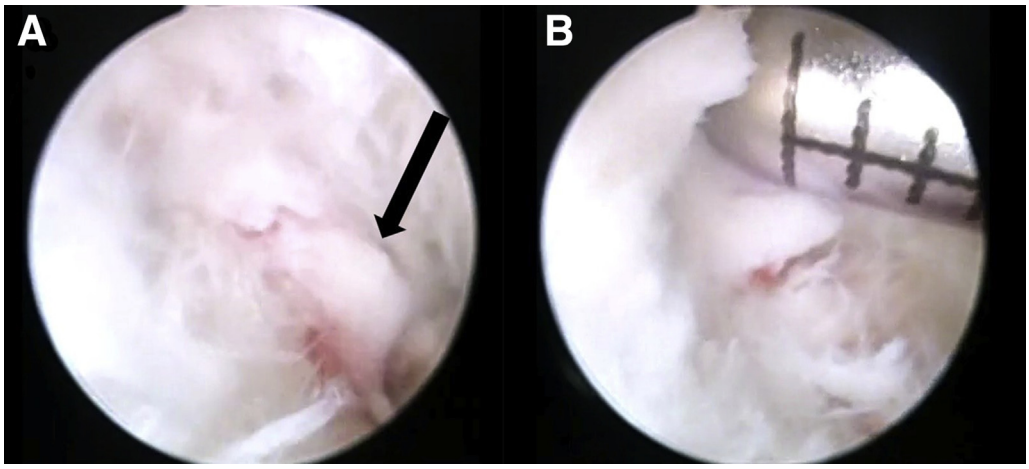

Fig 5. Arthroscopic view of a left ankle through standard anteromedial portal using a 4-mm 30° arthroscope (10k100 Arthroscopy Inflow Tube; ConMed Linvatec). Synovectomy are performed with a 3.5-mm gator meniscus cutter (C9264; Linvatec). (A) Inflamed, thickened synovium (black arrow). (B) Removal of synovial tissue with the arthroscopic shaver.

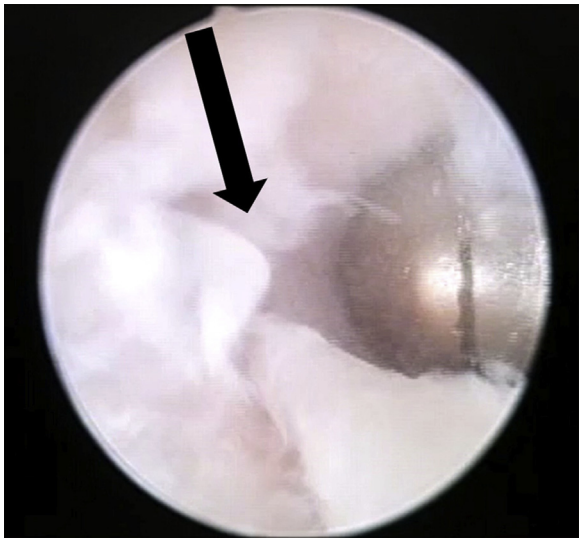

Fig 6. Arthroscopic view of a left ankle through standard anteromedial portal using a 4-mm 30° arthroscope (10k100 Arthroscopy Inflow Tube; ConMed Linvatec). Debridement of fibrous scar tissue are performed with a 3.5-mm gator meniscus cutter (C9264; ConMed Linvatec) and 4.5-mm high-speed steel spherical bur (H9111; ConMed Linvatec). Thick fibrotic tissue surrounding the arthrodesis (black arrow).

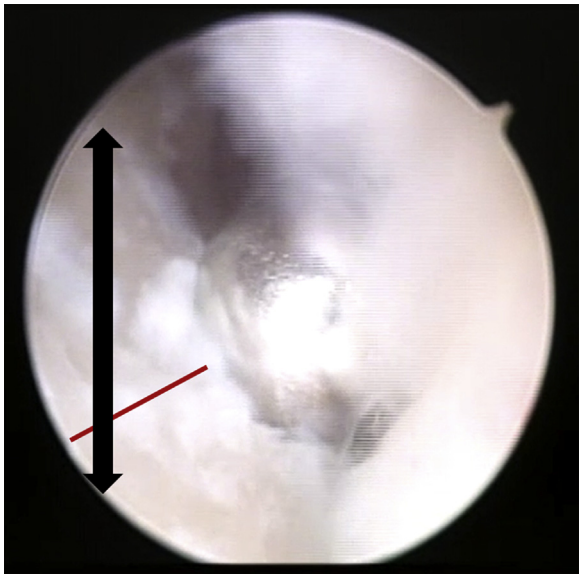

Fig 7. Arthroscopic view of a left ankle through standard anteromedial portal using a 4-mm 30° arthroscope (10k100 Arthroscopy Inflow Tube; ConMed Linvatec). Tibiotalar interface (red line). The upper arrowhead denotes the tibia, whereas the lower arrowhead denotes the talus.

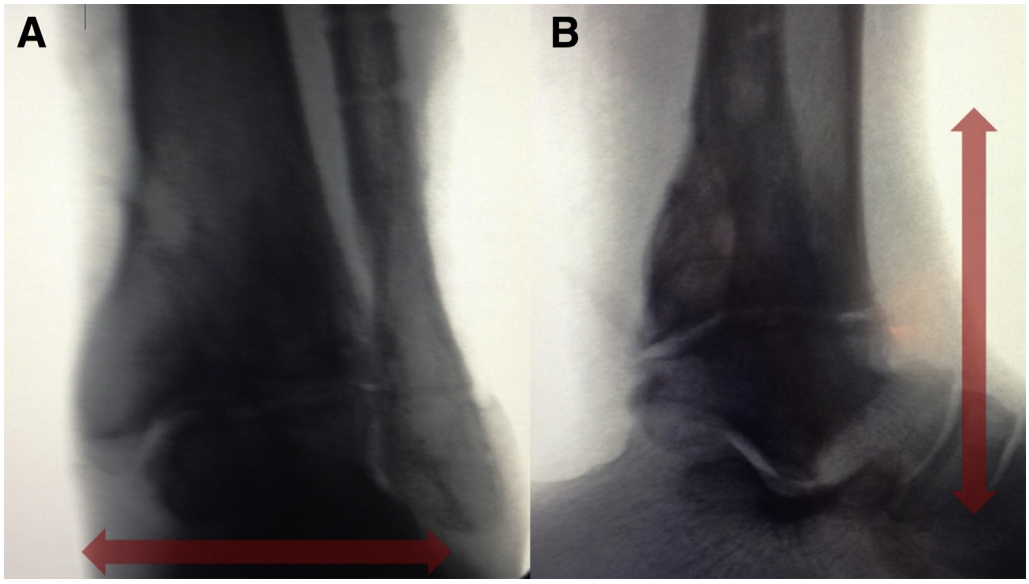

Fig 8. Intraoperative fluoroscopy image. (A) Anteroposterior view, coronal plane. Varus-valgus stress is being applied to the ankle (direction of red horizontal arrow). (B) Lateral view, sagittal plane. Dorsiflexion–plantarflexion stress is being applied to the ankle (direction of red vertical arrow).

Fig 9. Immediate postoperative radiographs of the left ankle. (A and B) Plain radiographs, anteroposterior and lateral view, showing image suggestive of nonunion.

Table 1. Advantages and Disadvantages of the Proposed Technique

Advantages	Disadvantages
Prevents extensive surgery	Invasive diagnostic procedure
Faster recovery and less postoperative pain	Risks inherent to anterior ankle arthroscopy
If nonunion is confirmed, revision surgery can be performed at once	Operator misdiagnosis may require further procedures
Consolidation can be visualized directly	Learning curve

Table 2. Pearls and Pitfalls of the Proposed Technique

Pearls	Pitfalls
Fluoroscopy helps identify the tibiotalar interface	Can be technically challenging
Remove remaining synovium and scar tissue	Failure to identify and remove all fibrotic tissue
Dissect all fibrotic tissue down to bone	

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