Management of a dislocated talar dome fracture with ankle arthrodiastasis and open reduction internal fixation: A case report

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Osteochondral lesions of the talus (OLT) can be acute or chronic with mechanisms of injury and treatment protocols that have been well-described. Current treatment options for OLT depend on severity and chronicity. Treatment options for OLT consist of bracing, steroid injections, arthroscopic debridement with microfracture, osteochondral transfer, structural allograft, arthrodiastasis, arthrodesis or total ankle arthroplasty. Although mechanisms are similar, talar dome fractures have been less frequently presented in our literature. Displaced intra-articular fractures often require operative management although these procedures have not been detailed in the literature due to the rarity of the injury. This case report describes the surgical management of a 19-year-old male who sustained a dislocated and rotated lateral talar dome fracture after an inversion ankle injury while playing basketball. Long-term follow-up of our patient show an excellent, asymptomatic outcome without limitations at his 18-month follow-up visit.

Keywords: arthrodiastasis, external fixation, osteochondritis, syndesmosis, talus fracture, transchondral fracture

Osteochondral lesions of the talus (OLT) have been thoroughly discussed throughout the literature and describe pathologies to include transchondral lesions, osteochondral lesions, and talar dome fractures. These lesions typically involve the talar cartilage and subchondral bone and are typically caused by a single or multiple traumatic events, leading to partial or complete detachment of the fragment [1]. These fractures comprise approximately 0.1-0.85% of all fractures and most occur as a result of high-energy trauma, such as motor vehicle accidents [2-3]. Talar dome lesions or osteochondritis dissecans were first described by Berntd and Hardy in the ankle in 1959 [4]. Current treatment options for OLT range from non-surgical treatment with cast immobilization to surgical excision and microfracturing. Newer techniques include osteochondral autograft transplantation and autologous chondrocyte implantation. The goal of these treatments is to restore the anatomic alignment of the articular surfaces in order to diminish long-term pain and swelling, and to improve function. The surgical management of large, displaced talar dome fractures is difficult in that with the tight joint confines, anatomic reduction may require ankle joint distraction to achieve proper reduction. Both arthroscopic and open exposures are considered regardless of whether ankle arthrodiastasis is utilized. Then, once reduced, optimal fixation placement is also challenging due to the tight joint confines and since fixation must not be

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detrimental to the articular surfaces or prominent or impinge the ankle joint.

In this case, we present the surgical management we utilized to achieve open reduction internal fixation of a dislocated lateral talar dome fracture with external fixation arthrodiastasis. Since anatomic reduction was achieved and our patient had an excellent long-term outcome, here, we present the surgical technique employed which may be useful in similar, future displaced lateral talar dome cases as these are rarely described in our literature [5-6]. Our case is unique in that we described the surgical management of a completely dislocated talar dome fracture with the use of bioabsorbable pins and ankle joint distraction.

Case Report

A healthy 19-year-old male inverted his ankle while playing basketball, when landing after jumping. Immediately afterwards, he was unable to bear weight. He went to the emergency department where radiographs demonstrated a dislocated lateral talar dome fracture (Figure 1). A CT scan was ordered which confirmed that the fracture segment, which measured 2.2 x 1.3 x 0.6 cm, was dislocated and rotated 180 degrees (Figure 2). The patient was made non-weight bearing while soft tissues were managed for 2 weeks.

Surgical management of the lateral talar dome fracture dislocation started with application of a delta frame external fixation construct to manually distract the ankle joint and maintain distraction during the postoperative period. The tibial tuberosity was palpated and four fingerbreadths were measured and this was the entry point of the first trans-tibial pin (Arthrex, Naples, FL). A 1 cm longitudinal skin incision was made using a #15 blade. Blunt dissection was then carried down to the level of bone using a curved hemostat. Next, the tibia was pre-drilled and a 5.0 mm tibial Schanz pin was inserted using a T-handle. The multi-pin clamp was then applied to the tibial Schanz pin and used as a drill guide to insert the second tibial Schanz pin which was inserted next. Utilizing fluoroscopic imaging, the trans-tibial pins were noted to be bi-cortical and of appropriate length and orientation. Next, attention was directed to the medial aspect of the calcaneus where 1 cm longitudinal skin incision was made using a #15 blade.

Blunt dissection was carried down to the level of bone using a curved hemostat. Utilizing fluoroscopic imaging, a 6.0 mm trans-calcaneal pin was then inserted. The tibial and calcaneal clamps were then connected with carbon fiber bars. While the ankle was maximally distracted, with manual distraction of the transcalcaneal pin, the assistant surgeon locked the construct into place.

Next, an open incisional approach allowed for visualization, reduction and fracture stabilization. We created a 10 cm longitudinal skin incision over the anterolateral ankle gutter. The incision started 2 cm proximal to the syndesmosis, traversing the ankle joint, and curving medially over the lateral border of the talus. As expected, the superficial peroneal nerve and its terminal divisions were encountered and subsequently protected throughout the entirety of the case. Next, the deep fascia was incised utilizing dissection scissors. The extensor digitorum longus tendon was retracted laterally and a capsular incision was made into the ankle joint, exposing the displaced talar dome fracture fragment. The fragment was then excised and prepared for reinsertion (Figure 3).

Figure 1 Preoperative radiograph showing a completely displaced talar dome fracture.
Fracture hematoma and any loose, overhanging soft tissues were excised. The ankle was then flushed with copious amounts of sterile saline. The fragment was reinserted into the ankle joint, and delicately placed in its anatomical position. Two 18 mm x 1.3 mm bioabsorbable poly-L-lactic acid Chondral Darts (Arthrex, Naples, FL) were then inserted in the anterior and posterior aspects of the fracture. With the limited access in the ankle joint, the pins were still placed in a diverging manner to provide greater capture and stability (Figure 4).

Intraoperative imaging confirmed clinical findings that the fracture was reduced and the talar dome restored.

Preoperative radiographs were suspicious for a distal tibiofibular diastasis which could not be ruled out given the rotational mechanism of injury. We tested the stability of the syndesmosis intra-operatively utilizing the Cotton hook test [7].
Successful application of suture button and external fixator.

This was done by applying a laterally-directed force on the fibula with a towel clamp which resulted in lateral translation of the fibula with respect to the tibia. Therefore, we made an intraoperative decision to transfix the syndesmosis. First, a periarticular clamp was placed perpendicular to the axis of the ankle joint, reducing the syndesmosis which was confirmed on fluoroscopy. Next, the syndesmosis was stabilized using knotless, trans-syndesmotic Tightrope® fixation (Arthrex, Naples, Florida).

Final images were taken and the ankle was noted to be maintained in distraction, the syndesmosis reduced with the Suture Button system applied appropriately and the fragment restored to anatomic position (Figure 5). The incision was closed with vicryl sutures.
and stability was maintained through the external fixation.

He went on to heal uneventfully, without soft tissue complications, paresthesias or limitations in range of motion. The external fixator was removed after 6 weeks. Immediately thereafter, the patient began home physical therapy with ankle strengthening and range of motion exercises. By postoperative week 9, he started placing more pressure on his foot, partial-weight bearing in a pneumatic boot as he transitioned off crutches. By 12 weeks, he was completely off crutches and partial weight bearing in his boot.

Radiographs demonstrated progression of bone consolidation and maintained alignment (Figure 6). At 16 weeks he was back in his shoes and without pain or limitations. Radiographs appear normal but bony exostoses were beginning to form at the medial malleolus and medial talus.

There were no restrictions of motion upon physical exam (Figure 7). At the 18-month follow-up he stated he had been back to his regular daily activities, including basketball, with no reports of pain. Radiographs show excellent restoration of the talar dome and ankle mortise. Bony exostoses are noted but incidental and asymptomatic (Figure 8). According to the AOFAS Ankle-Hindfoot Scale (AHS) the patient scored 100 points and the patient is very pleased with his outcome, lack of pain and level of function.

**Discussion**

Osteochondral lesions (OCLs) of the talus are rare in terms of overall fracture type in the lower extremity, however, they can be present in more ways than one might think. Lambers et al. retrospectively reviewed data of a prospective cohort of 59 patients and showed the prevalence of OCLs of the talus in ankle fractures with syndesmotic instability was 14% with most lesions located on the lateral talar dome [8]. This is consistent with the mechanism of injury and location of fracture of the case presented. Conversely, Raikin, et al., reviewed 428 ankle MRIs and found that the medial talar dome was most involved 62% of the time and, of those, the medial and mid zone was affected 53% [9]. Whereas these lesions are typically more superficial, the case presentation here focused on a dislocated, larger fracture segment of the lateral talar dome and this has not been explained much in our literature.

![Figure 8 Radiographs one year postoperative.](image)

Diagnosis of OCLs may be elusive during the early stages of patient complaints and can result in a delayed diagnosis [10]. In our case, the patient had a completely detached and 180-degree rotated large fracture so diagnosis was clear and straightforward. In addition to the standard preoperative radiographs, we ordered a CT scan to get a more accurate depiction of the lesion. CT scans can help identify the amount of bone involvement in an OCL and help in determining ideal fixation methods [10].

Multiple treatment options are available for OCLs of the talus and arthrodiastasis is among the preferred options. Arthrodiastasis has been shown to benefit patients significantly in the short- and long-term in prevention of post-traumatic ankle arthritis. However, ankle arthrodiastasis is considered a salvage procedure and most often a last-ditch effort prior to fusion or ankle implant arthroplasty [11-12]. Although the present case did not have a patient with ankle arthritis, we used this option to slow the progression of future osteoarthritis.

Joint distraction is not only used in the ankle, it is also used in the hip and knee with good long-term outcomes [13-14]. Furthermore, joint distraction is also used in other aspects of the foot and ankle. Dayton, et al., published a review describing a
percuteaneous technique for calcaneal fractures. They concluded that their patients’ return to function was similar or better than after open reduction, and their soft tissue complication rate was much lower [15]. In ankle joint distraction, it’s recommended to obtain at least 5 mm of distraction [11]. We achieved 2.7 mm of joint distraction which was measured from the calibrated from the postoperative radiographs via the PACS program.

Arthrodiastasis is based on the theory that osteoarthritic cartilage has healing capacity. The chondrocyte repair is nourished by intra-articular fluid pressure changes within the joint by movement with the use of hinges in the external fixator or by allowing the patient to walk with the frame in place. This allows intermittent increases in hydrostatic pressure, creating a supportive environment for cartilage repair [11]. In our case we used a static external fixator and made the patient non-weight bearing due to the fact that the patient had a displaced talus fracture that was reduced using open reduction internal fixation. The arthrodiastasis effect is difficult to evaluate individually. The authors believe the external fixation provided added benefit of maximal ankle immobilization as the bioabsorbable pins maintained position but did not affect much compression or maximum fracture stability.

In conclusion, our case report describes the use of open reduction and internal fixation of a large, completely dislocated lateral talar dome fracture fixed with bioabsorbable fixation and further stabilized with external fixation ankle arthrodiastasis. Valderrabano, et al., completed a study of 390 patients and found that talus fractures accounted for 2% of patients acquiring post traumatic ankle arthritis [17]. Lastly, Nakasa, et al., showed favorable outcomes utilizing bioabsorbable PLLA pins even in those patients who had disruption of the subchondral plate (18). We supplemented our fixation with a delta frame in order to provide the patient with greater stability and to allow for ankle joint distraction. We felt that this was appropriate for a patient of his age to slow the progression of ankle osteoarthritis. At 1.5 years postoperative assessment, our patient is without pain, functioning without limitation and pleased. This treatment approach may be beneficial in patients presenting with similar pathology. Further research investigating the risk of post traumatic ankle arthritis is needed to better understand long-term outcomes with this procedure.

References