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Management of an Open Ankle Fracture: A Case Report

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ABSTRACT

Ankle fracture-dislocations are severe injuries associated with substantial soft-tissue damage and higher complication rates than isolated ankle fractures. We report the case of a 16-year-old female who sustained an open ankle fracture-dislocation following a motor vehicle accident. Urgent reduction, debridement, and fixation of medial and lateral malleolar fragments were performed, followed by temporary external fixation due to extensive comminution and soft-tissue compromise. The postoperative course was uneventful, and progressive weightbearing was initiated after fixator removal at eight weeks. At one-year follow-up, the patient demonstrated excellent functional recovery with no residual pain and an AOFAS score of 90. This case highlights the importance of prompt reduction, meticulous soft-tissue management, and individualized stabilization strategies in achieving favorable outcomes in complex open ankle fracture-dislocations.

Keywords: Fracture; Ankle; Reduction; External Fixation; Case report

Highlights

- Open ankle fracture-dislocation in an adolescent managed with prompt reduction
- Severe medial and lateral malleolar comminution stabilized using external fixation
- Early debridement and fixation achieved stable alignment and protected soft tissues
- Good 1-year functional recovery despite high-risk fracture-dislocation pattern
- Case underscores need for advanced imaging and careful soft-tissue management

INTRODUCTION

Ankle fractures represent one of the most frequently encountered injuries in musculoskeletal practice, with over 250,000 cases reported annually in the United States. Concomitant tibiotalar dislocations occur in approximately 21% to 36% of these fractures. Although isolated, purely ligamentous ankle dislocations without an associated malleolar fracture have been documented, they remain relatively uncommon. Ankle fracture-dislocations deserve particular attention due to their association with higher incidences of open injuries, Osteochondral Lesions (OCLs), intra-articular loose bodies, articular malreduction, chronic pain, posttraumatic osteoarthritis, and poorer patient-reported outcomes compared to ankle fractures without dislocation. These considerations highlight the importance of thorough evaluation, often including advanced post-reduction imaging, to optimize management and improve outcomes. Despite their clinical significance, ankle fracture-dislocations remain insufficiently characterized in the existing literature.

This case report has been reported in line with the SCARE checklist [1].

CASE REPORT AND OBSERVATION

We report a case of a 16 y.o young lady who was admitted to the emergency room 4 hours after sustaining a motor vehicle accident with a direct impact on her ankle. The patient was in pain and showed a clear deformity related to an open ankle dislocation (Figure 1). The interrogatory revealed no musculoskeletal disease nor a prior hospitalization. Physical examination showed an open lateral ankle dislocation, with no range of motion and severe pain, with no pain in any other part of her body. The Neurovascular exam was normal. Radiography of the right ankle confirmed the diagnosis of an ankle fracture dislocation (Figure 2). The patient was admitted to the operation room 5 hours after the initial impact, and was put under Cefazolin 1g IV every 8h for 48h. Reduction of the dislocation was performed under general anesthesia followed by an extensive debridement and irrigation. Perioperative fluoroscopy showed a fracture of the tip of external malleolus and a comminutive fracture of the internal malleolus. The tip of EM wasn't reachable, so we extended our incision 4cm and fixed the EM using vicryl 2 since the fragment was not osteosynthesable. We then moved to the IM. We discovered a very comminutive fracture with only one big enough fragment to put 2 K-wires, and tried to reduce the remaining fragment using vicryl. We used external fixation in order to maintain a stable ankle (Figure 3) which was removed 8 weeks later (Figure 4). Fluoroscopy showed a reduced and stable ankle even under stress. Postoperative examination showed no neurovascular deficit; pain was managed with IV painkillers. Our patient was discharged 5 days after surgery. Wound examination at first post operative follow up was clean and no sign of infection or inflammation. Partial weightbearing was started after 8 weeks and total weightbearing at 5 months. One year after surgery, our young patient showed a good functional outcome since no pain or limitation was noted, and scored 90 points on the American Orthopedic Foot and Ankle Society Ankle-Hindfoot score (Table 1).

Figure 1: Clinical image of our patient open ankle dislocation.

Figure 2: AP and Lateral radiographs of our patient ankle.

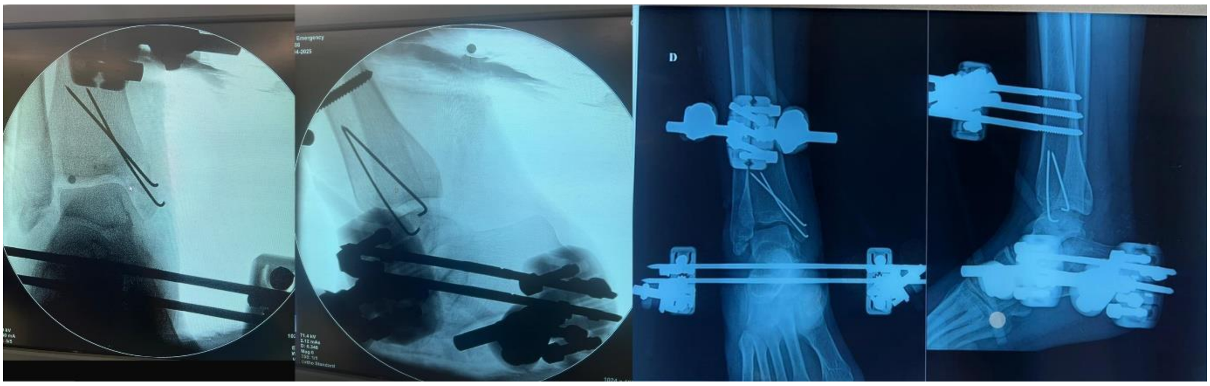

Figure 3: Peroperative and postoperative radiographs of our patient after fixation.

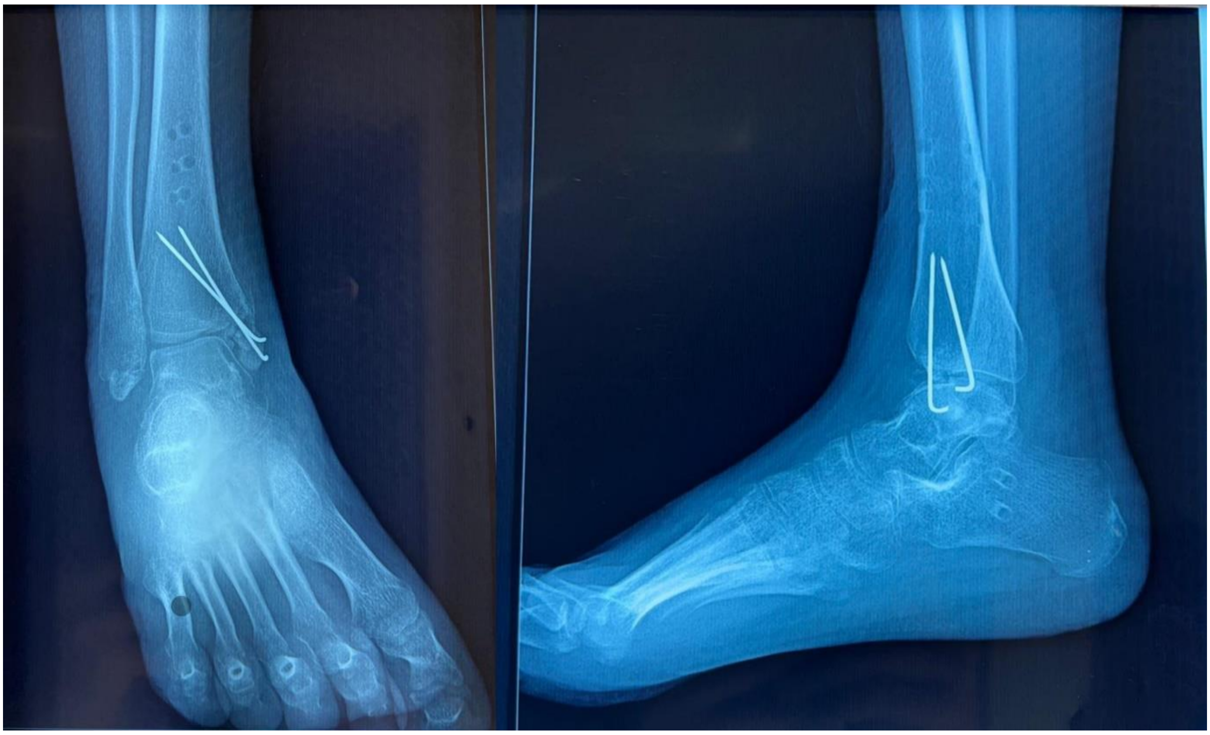

Figure 4: AP and lateral radiographs of our patient's ankle after removal of External Fixation.

Table 1: Ankle hindfoot scale.

Parameter	Points
Pain (40 points)	
None	40
Mild	30
Moderate	20
Severe	0
Function (50 points)	
Activity limitations	
None	10
Limitations on recreational activities	7
Some limitations on daily and recreational activities	4
Severe limitations on daily and recreational activities	0
Maximum continuous walking distance	
600 m or more	5

400 m to less than 600 m	4
100 m to less than 400 m	2
Less than 100m	0
Walking surfaces	
No difficulty on any surface	5
Some difficulty on uneven terrain, stairs, inclines	3
Severe difficulty or inability to walk on uneven terrain, stairs, inclines	0
Gait abnormality	
None or slight	8
Obvious (walking possible but gait abnormality obvious)	4
Marked (walking difficult and gait abnormality obvious)	0
Sagittal motion (flexion plus extension)	
Normal or mild restriction (30° or more)	8
Moderate restriction (15°–29°)	4
Severe restriction (less than 15°)	0
Hindfoot motion (inversion plus eversion)	
Normal or mild restriction (75%–100% normal)	6
Moderate restriction (25%–74% normal)	3
Severe restriction (less than 25% normal)	0
Ankle-hindfoot stability (anterior drawer, varus-valgus stress)	
Stable	8
Unstable	0
Alignment (10 points)	
Good, plantigrade foot, well aligned	10
Fair, plantigrade foot, mild to moderate degree of malalignment	5
Poor, nonplantigrade foot, severe malalignment	0

DISCUSSION

Anatomy and mechanism of injury

The ankle is a complex hinge joint whose stability depends on both osseous and ligamentous structures. Bony stability is provided by the ankle mortise, which comprises the medial and lateral malleoli and the distal tibial plafond. The medial malleolus terminates more proximally and lies anterior to the lateral malleolus, resulting in an ankle axis with approximately 15 degrees of external rotation [2]. Due to its subcutaneous position, the medial border of the tibia is particularly vulnerable to soft-tissue injury, predisposing to open fractures. Ankle fractures most commonly result from rotational mechanisms, where external forces are transmitted through the foot and talus to the malleoli. The specific fracture and ligamentous injury pattern depend on the position of the foot and the direction of the applied force at the time of injury—principles that form the basis of the Lauge-Hansen classification [3]. Ankle fracture-dislocations occur through similar mechanisms; however, the persistence of the deforming force after the fracture leads to disruption of soft-tissue stabilizers and subsequent talar dislocation. Depending on the extent of injury, some talar-hindfoot ligamentous attachments may remain intact. These injuries may result from either high- or low-energy mechanisms, influenced by the patient's bone quality and ligamentous integrity [4].

Initial evaluation and management

Initial management begins with a full detailed history, including the mechanism of injury, to help predict possible fracture and ligamentous injuries [3]. Physical examination should include neurovascular assessment and careful evaluation of soft tissues for open wounds, blanching, swelling, and skin tenting. Up to one-third of ankle fracture-dislocations present as open injuries, with an even higher incidence in pure dislocations without fracture [4]. Prompt reduction of visibly displaced fracture-dislocations is essential to minimize soft-tissue compromise and improve outcomes.Prereduction radiographs are useful for identifying associated injuries and differentiating ankle fracture-dislocations from other deformities, such as distal tibial fractures or subtalar dislocations. Reduction is typically performed under intra-articular block or conscious sedation in the emergency department [5-7]. The classic Quigley maneuver involves knee flexion to relax the gastrocnemius-soleus complex, followed by leg external rotation with foot adduction and supination [8].

Soft-tissue considerations and complications

Ankle fracture-dislocations represent a more severe insult to the surrounding soft tissues compared with isolated fractures. The force required to produce tibiotalar diastasis, along with pressure from displaced bony structures prior to reduction, increases the risk of open injury. Up to one-third of these injuries are open at presentation [9,10]. Greater soft-tissue compromise correlates with an increased risk of postoperative complications if not promptly addressed. In a review of 121 ankle fractures, cases with fracture-dislocation (n = 41; 34%) demonstrated three times the rate of major complications, including infection, compared with standard fractures (19% *vs.* 6.3%, P < .05) [4]. Delayed reduction was also associated with a significantly higher rate of major soft-tissue complications (44% *vs.* 5.3%). Another study reported that 19.6% of patients with ankle fracture-dislocations required irrigation and debridement for infection—a rate markedly higher than that observed in nondislocated fractures.

Role of external fixation

External fixation has been recommended in the management of ankle fractures associated with significant soft-tissue injury. However, its precise role in ankle fracture-dislocations remains undefined. The decision to use external fixation should be individualized, based on the extent of soft-tissue compromise and the overall condition of the limb.

Outcomes

Variable outcomes have been reported in association with ankle fracture dislocation, but recent studies have shown a higher rate of revision Open Reduction Internal Fixation (ORIF) for ankle fracture dislocations compared to non-dislocated ankle fractures. More studies have shown clear evidence of Post Traumatic Osteoarthritis (PTOA) in up to 63% of patients with ankle fracture dislocations. A prospective study evaluating Supination–External Rotation (SER) ankle fractures demonstrated that, at a mean follow-up of 21 months, patients with fracture-dislocations reported significantly greater pain (84% *vs.* 73%, P = .005) and reduced ability to perform activities of daily living (78.1 *vs.* 87.7, P = .014) on the Foot and Ankle Outcome Score (FAOS) compared with patients who sustained non-dislocated ankle fractures.

CONCLUSION

Ankle fracture-dislocations are relatively common injuries that demonstrate distinct clinical outcomes compared with ankle fractures without dislocation. Although differences in outcomes remain insufficiently studied, several factors-such as the extent of soft-tissue injury, posterior malleolar involvement, Osteochondral Lesions (OCLs), intra-articular loose bodies, and articular malreductions-have been proposed as potential contributors to the variability in clinical results. One ongoing controversy in the management of these injuries concerns the necessity of postreduction CT or MRI imaging to identify associated lesions, as conventional radiographs have been shown to miss a substantial proportion of concomitant injuries.

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