



CASE REPORT

Management of a Closed Pantalar Dislocation: A Rare Clinical Challenge

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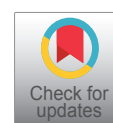
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Abstract

Background: Closed pantalar dislocations are high-energy injuries involving simultaneous dislocations of the subtalar, talonavicular, and tibiotalar joints. Being exceedingly rare, there is limited literature on their optimal management and long-term outcomes. Additionally, these injuries pose significant challenges due to potential complications. We present a case report of a 27-year-old male who sustained a closed pantalar dislocation.

Case presentation: A 27-year-old male sustained a closed pantalar dislocation following a motor vehicle collision. The patient presented with a deformed right foot associated with severe pain. Despite several attempts at closed reduction, open reduction was deemed necessary. Postoperatively, the patient was immobilized and maintained a non-weight-bearing status for six weeks, followed by progressive weight-bearing and physiotherapy. At 12 months follow up, the patient demonstrated a satisfactory recovery with no radiographic evidence of avascular necrosis or arthritic changes.

Discussion: Pantalar dislocations present predominantly as open injuries, with closed variants accounting for only 15% of cases. While closed reductions may yield favorable outcomes, open reduction is often required, as in our case. The preservation of ligamentous and capsular attachments in closed injuries may contribute to the lower incidence of avascular necrosis, though the risk remains significant, necessitating long-term follow-up. Our case demonstrates that a systematic approach to open reduction and stabilization can result in satisfactory outcomes, even in the presence of initial challenges.

Conclusion: Closed pantalar dislocations are rare injuries with a complex management pathway. This case highlights the importance of individualized care and a thorough follow-up to optimize functional and clinical outcomes. Further studies are required to formulate a standardized management protocol and assess long-term outcomes for these rare injuries.

Introduction

Closed pantalar dislocations represent high-energy injuries involving simultaneous dislocations of the subtalar, talonavicular and tibiotalar joints. Although uncommon, this complex and rare injury can be associated with potential devastating outcomes and complications [1]. The typical sequence of total talar dislocation begins with subtalar dislocation progressing to talonavicular joint dislocation and ultimately dislocation of the talus from all adjoining joint structures [2]. The occurrence of a pantalar dislocation necessitates a substantial application of force, and various theories emerged to explain this phenomenon. According to Leitner [3], the initial stage involves medial and lateral subtalar dislocation following excessive foot supination and pronation. Should this force persist, it can lead to ankle subluxation and eventually leading to ankle dislocation. An alternate theory proposes that pantalar dislocation may be seen after forceful plantar flexion and inversion, while another perspective suggests

that it can result from a simultaneous application of dual forces involving inversion and eversion or their reciprocal actions [4] hence, the pathophysiological mechanism remains a subject of controversy.

Based on the few reports in the literature, these rare injuries only comprise 3.4% of significant talar injuries and 0.06% of all dislocations, with a predominance of them occurring as open injuries [4]. Closed variants are infrequent and account for merely 15% of the documented cases [1]. Furthermore, no epidemiological studies exist regarding incidence and long-term functionality post closed pantalar dislocations. Given the paucity of this injury, this has led to limited consensus on the optimal management strategy. Yet, the primary treatment objective remains consistent; to reduce the dislocation urgently, whether through closed or open methods. The overall outlook remains guarded due to the potential complications of avascular necrosis, post-traumatic arthritis, talar collapse and eventual alteration of foot and ankle biomechanics which can ensue in limitations of normal limb function [5].

In this study, we report a case of a 27-year-old male who presented with a closed pantalar dislocation following a motor vehicle collision. With the aim of enhancing the clinical understanding of pantalar dislocation, we intend to share our clinical expertise and outcomes derived from this uncommon injury.

Case Report

A previously healthy, 27-year-old male patient presented to our emergency department subsequent to a motor vehicle collision. The incident followed a car pursuit causing a rear-end collision that resulted in his right ankle becoming entrapped between the gas and brake pedals as his body shifted towards the adjacent

passenger seat. Upon presentation, the patient complained of intense pain and exhibited deformity in his right foot. Notably, his foot was positioned in a state of equinus and supination. Distal pulses were detectable via doppler, although the assessment of his limb neurological status posed a challenge due to pain. Subsequently, the patient received sedation, muscle relaxation and analgesia, after which an attempt was made to perform closed reduction utilizing Mitchell's technique [6]. Following multiple unsuccessful attempts at closed reduction, decision was to admit the patient and proceed to the operating theatre for an open reduction. Orthogonal radiographs and a computer tomography (CT) scan were conducted to gain deeper insight to the injury's morphology (Figure 1, Figure 2 and Figure 3).

Open reduction was performed in stages. Initially, an anteromedial approach (Figure 4a) of the ankle was performed, originating 5 cm proximal to the ankle joint and extending in a linear fashion over the ankle joint towards the base of the navicular. The reduction attempt however via this approach proved unsuccessful. Successively, an anterolateral approach (Figure 4b), centered at the ankle joint and parallel to the fourth metatarsal distally was performed. The talus was delivered through the anterolateral wound and derotated into position. The tibiotalar joint was reduced initially, followed by the spontaneous reduction of the subtalar and talonavicular joints. An external fixator was subsequently applied for enhanced stability and two Kirschner wires were placed within the talonavicular joint (Figure 5).

A non-weight-bearing status was maintained postoperatively for a span of 6 weeks. Following this period, the external fixator and the Kirschner wires were removed,



Figure 1: Initial AP and lateral radiographs of the right ankle post injury.



Figure 2: AP and lateral radiographs of the right ankle following failed closed reduction.

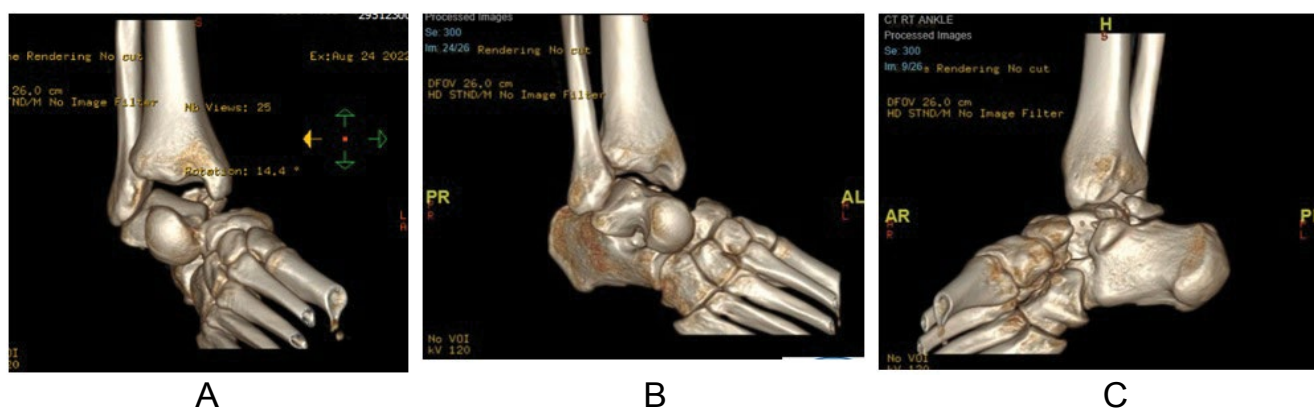


Figure 3: (a, b, c) 3D reconstructed CT images of the right ankle delineating the fracture morphology.

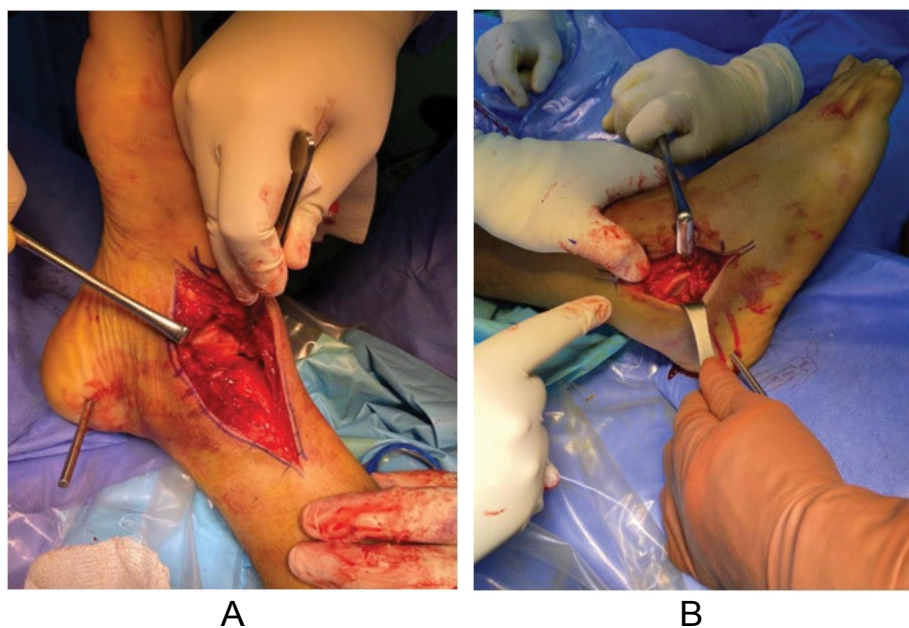


Figure 4: (a) Anteromedial approach to the right ankle; (b) Anterolateral approach to the right ankle.

after which he was advised to transition to full weight-bearing and commence physiotherapy sessions. Surgical wounds healed uneventfully. The patient underwent regular follow-up visits in the clinic, during which both radiographic and clinical evaluations were performed. At the 12-month follow-up, the patient was asymptomatic and reported being pain-free. Clinically, the patient exhibited a normal gait, near normal dorsiflexion and plantarflexion with no stiffness. Radiographic assessments revealed no evidence of arthritic degenerative changes or avascular necrosis at this time (Figure 6, Figure 7, Figure 8, Figure 9 and Figure 10).

Discussion

The talus is a pivotal osseous structure in the ankle joint, distinguished by its unique ligamentous support and absence of muscular or tendinous attachments. Given its distinctive anatomical character, injuries to the talus can significantly impact function and mobility [6]. A pantalar dislocation is a rare injury characterized by simultaneous dislocation of the talus from all of its articulations namely the subtalar, talonavicular and tibiotalar joints [7]. This type of injury is typically the result of a high energy traumatic event, with road traffic accidents and falls from significant heights being the most frequent causes

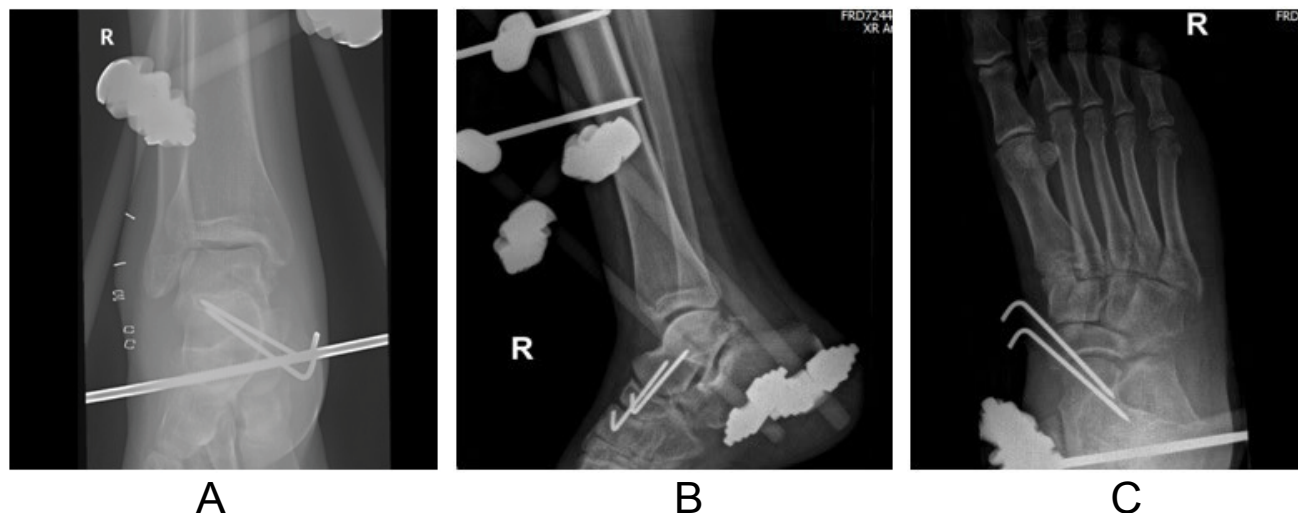


Figure 5: (a) AP view; (b) Lateral view; (c) Foot oblique view, showing concentric reduction of the tibiotalar, subtalar and talonavicular joints. Reduction was supplemented with a joint spanning external fixator and two Kirschner wires across the talonavicular joints.



Figure 6: Shows the external fixator construct and supplemental wires in addition to the anteromedial approach wound.



Figure 7: Post-operative photograph of the patient.

[2,8]. Pantalar dislocations can occur in three main directions; anterolateral, which is the most common, as well as posteromedial or posterior [8]. The majority of pantalar dislocations present as open injuries as closed dislocations are exceptionally uncommon [9].

Limited consensus in the literature on the optimal management of closed injuries, nevertheless, the aim of achieving a stable anatomic reduction of the talus within the ankle mortise remains. Successful closed reductions often yield favorable outcomes [8]. Following successful closed reduction, patients

typically undergo immobilization in a cast and remain non-weight-bearing for six weeks [10]. In cases where closed injuries necessitate an open reduction, a single or dual incision approach may be utilized, determined by the direction of the dislocation and any associated fractures [4]. Weston, et al. systematically reviewed 86 cases of open and closed pantalar dislocation across 39 articles. They reported that closed reduction was only possible in 3.5% of the cases and the remainder required an open reduction [1]. Structures such as flexor tendons, bone fragments, and the joint capsule itself



Figure 8: AP and lateral right ankle radiographs 12 months post injury. No arthritic changes or evident signs of AVN present.



Figure 9: AP and oblique right foot radiographs 12 months post injury. No arthritic changes or evident signs of AVN present.



Figure 10: (a,b) 12 month post-injury clinical photographs showing a plantigrade foot with no obvious deformities; (c,d) shows uncomplicated healing of both surgical wounds.

have been noted to hinder closed reduction [11]. In our case, unsuccessful closed reduction was followed by open attempt of reduction via an anteromedial approach which subsequently failed. Reduction was only achieved following delivery of the whole talus through an anterolateral incision and rotating it into its correct anatomical position. An external fixator application followed in addition to Kirschner wires to stabilize the talonavicular joint.

Closed pantalar dislocations often result in favorable outcomes, as reported in the literature, although limited to case reports and small case series. In one case report, Rhanim, et al. observed satisfactory ankle motion and no signs of osteonecrosis in a case of closed pantalar

dislocation [12]. Another study documented similar findings over a 9-year follow-up period [13]. Some authors have hypothesized that the preservation of capsular and ligamentous attachments in closed injuries may contribute to the absence of avascular necrosis. In contrast, requiring an open reduction for a closed dislocation increases the risk of avascular necrosis [4].

This case report outlines our approach to managing a closed pantalar dislocation. When closed reduction fails, open reduction becomes necessary. While there is no standardized postoperative protocol, our patient achieved satisfactory outcomes at 12-months follow up. The patient showed no functional limitations, clinical or radiographic signs of avascular necrosis. Since the

patient was asymptomatic and had resumed his pre-injury activity level, an MRI was deemed unnecessary. Nevertheless, we recognize that it is premature to draw final conclusions on outcomes, as avascular necrosis remains a risk for up to three years post-injury [14]. Our plan is to reassess the patient annually to evaluate functional, clinical, and radiological outcomes.

Conclusion

In conclusion, closed pantalar dislocations represent rare and complex high-energy injuries. This report highlights the complexities and challenges in managing this injury, emphasizing the importance of a tailored and comprehensive approach to mitigate long-term sequelae and optimizing outcomes. Due to literature paucity on closed pantalar dislocations, definitive conclusions about long-term outcomes are challenging, however, it is probable that these patients may experience worse outcomes than currently reported.

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