CASE REPORT

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Post-traumatic avascular necrosis of the talus

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Abstract

In this comprehensive case report, we examine a 29-year-old male who suffered a high-energy vehicular accident, resulting in a type III Hawkins fracture of the talus. This specific fracture type is critically associated with a greater than 90% risk of progressing to avascular necrosis (AVN) of the talus, a severe and debilitating condition. Alongside this, the patient sustained fractures of the medial and lateral malleolus. Due to extensive swelling and severe circulatory disorders, an immediate emergency surgical procedure was necessitated, employing nail fixation as a stabilizing intervention. Over the course of 12 months following the surgery, despite routine post-operative imaging including X-rays and computed tomography (CT) scans, the patient continued to experience significant pain and impairment. This condition led to further investigations, culminating in a magnetic resonance imaging (MRI) that revealed an area of 19.8/20.9 mm of AVN on the talus dome's upper-lateral facet. Interestingly, earlier CT scans had indicated multiple osteitic lesions, but these findings lacked a clear clinical correspondence, presenting a diagnostic challenge. To resolve this ambiguity and to definitively distinguish between necrosis and infection, a targeted histopathological analysis was deemed necessary. This analysis was conducted on a bone fragment extracted during a follow-up surgical procedure for nail removal. The results from this analysis present an area of bone and myeloid tissue necrosis unequivocally confirming the presence of AVN, effectively ruling out osteitis as a potential diagnosis. This critical diagnostic clarification allowed for a shift in therapeutic strategy, enabling the initiation of a more focused and potentially curative treatment regimen.

Keywords: avascular, necrosis, talus, osteitic, fracture.

Introduction

Avascular necrosis (AVN) of the talus, a condition characterized by the death of bone tissue due to lack of blood supply, emerges as a critical complication following severe traumas, particularly type III and IV Hawkins fractures [1, 2]. This case report focuses on a 29-year-old male patient who experienced this debilitating condition subsequent to a high-energy vehicular accident. The intricate relationship between major talus fractures and the development of AVN, especially in young adults, presents both diagnostic and therapeutic challenges, necessitating a multidisciplinary approach for effective management [3, 4].

The pathophysiology of post-traumatic talus AVN involves interruption of blood supply by displacement of the talar neck leading to bone ischemia and eventual necrosis of the talus's dome [5]. Type III and IV Hawkins fractures, characterized by tibio-talar, talo-navicular displacement and comminution of the talus neck, are particularly notorious for leading to AVN, with incidences reported to be between 70% and 90% [6, 7]. The complexity of these injuries often requires immediate and aggressive surgical intervention with stable fixation using screws or nails, followed by vigilant post-operative monitoring to identify early signs of complications. The use of computed tomography (CT) scans and magnetic resonance imaging (MRI) is considered as standard in diagnosing post-traumatic talus AVN, especially when both techniques provide corroborative conclusions.

This case presentation aims to elucidate the challenging journey from the initial talus fracture to the definitive diagnosis of AVN, highlighting the critical role of MRI and the indispensable value of histological analyses [8, 9]. Through this case, we seek to contribute to the growing body of literature on AVN following talus fractures, a rather rare pathology.

Aim

The primary aim of this case report was to provide a comprehensive analysis of the diagnostic challenges in managing a case of AVN of the talus following a type III Hawkins fracture [10]. This includes a detailed examination of the patient's clinical presentation, the subsequent surgical interventions undertaken, and the definitive role of advanced diagnostic techniques [11]. By documenting and analyzing

this case, the report seeks to enhance the understanding of the evolution from the primary injury to development of talus AVN. We seek to highlight the critical aspects of differentiating AVN from other post-traumatic complications such as infection or non-union. Ultimately, the goal was to contribute to improving diagnostic accuracy for talus AVN by use of histopathological (HP) examinations as a tiebreaker.

Case presentation

The subject of this report is a 29-year-old male who was involved in a high-energy car accident while driving. Upon admission to the emergency room (ER) the patient presented deformity, abnormal mobility and intense swelling of the left ankle. Following frontal and lateral X-rays of the left ankle the patient was diagnosed with a type III comminuted and displaced talus neck fracture. This injury was compounded by fractures of both the internal and external malleolus (Figure 1, A and B).

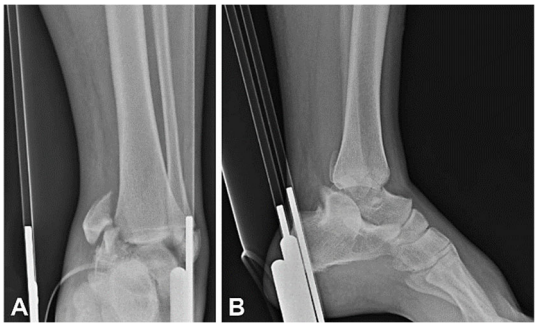

Figure 1 – ***Left ankle X-ray shows comminuted and displaced talar neck fracture, internal and external malleolus fracture: (A) Anterior view; (B) Lateral view.***

Upon arrival at the ER, there was a notable delay (approximately two hours) before surgical intervention could be initiated. This delay was due to the need for comprehensive evaluations addressing cranial, thoracic, abdominal, and pelvic injuries to rule out other potential pathologies. Once these were infirmed, an open reduction and internal fixation using nails was performed.

The decision to use nail fixation, as opposed to screws and plates, was influenced by the severity of the crushing, swelling, and comminution observed in the injuries (Figure 2, A and B).

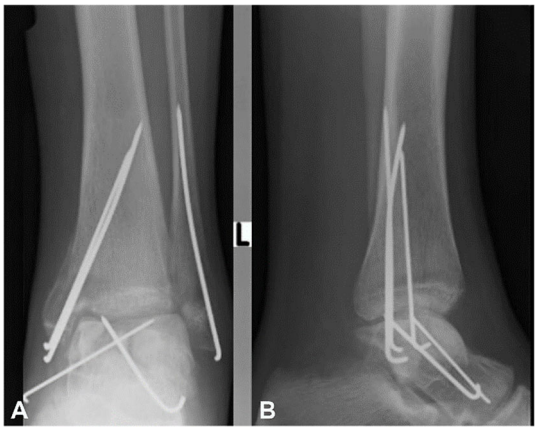

Figure 2 – ***(A and B) Post-operative left (L) ankle X-ray showed a good alignment and fixation of the talar neck and of the internal and external malleolus.***

Post-surgery, the patient was placed on a regimen of antibiotics, anticoagulants, and anti-inflammatory treatments. The complexity of his condition necessitated an extended hospital stay of two and a half weeks in the orthopedic and traumatology clinic. This prolonged admission was primarily due to complicated skin necrosis on the interior aspect of the calcaneus, which required additional medical attention.

In the initial post-operative phase, the patient exhibited promising signs of recovery, characterized by a notable reduction in swelling and alleviation of pain. However, despite these positive developments, a CT scan conducted four months post-operatively painted a more complex picture. The scan revealed a partial non-union of the fracture fragments, coupled with multiple focal osteitic lesions. These findings were particularly alarming given the patient's continued complaints of pain in the ankle, as well as a noticeable impairment in walking ability, suggesting that the healing process was not proceeding as hoped.

Given the complexity of the situation, and the need to rule out or confirm the development of AVN, and the possibility of infection, a more detailed diagnostic approach was deemed necessary. An MRI was planned to provide a comprehensive evaluation of the talus's condition. However, the presence of metal nails from the initial surgery rendered the MRI impossible. Consequently, a surgical procedure was scheduled to remove these nails, facilitating the MRI examination.

During this nail removal surgery, the opportunity was taken to extract a bone fragment from the area of the talus suspected to be affected by AVN. This fragment was carefully preserved in a formalin solution, earmarked for in-depth histological analysis. This analysis was critical not only for diagnosing AVN but also for understanding the relationship between the observed osteitic lesions and the patient's ongoing clinical outcome.

The MRI, conducted subsequent to the surgery for nail removal, revealed a substantial lesion, measuring 19.8/20.9 mm, located on the upper-lateral facet of the talus's dome. The lesions presented posed as necrotic lesions were suggestive for talus AVN opposing the osteitic lesions from the CT scans that suggested infection.

This significant finding heightened the need for a definitive diagnosis (Figure 3, A and B). Histological studies were thus imperative to determine whether this lesion was indeed necrotic, indicative of AVN, or infectious, pointing to a completely different therapeutic management.

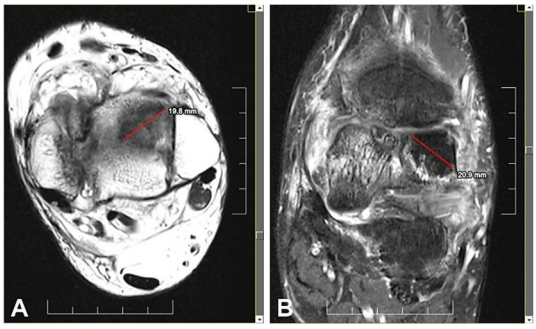

Figure 3 – ***Left ankle MRI revealed a lesion on the upper lateral facet of the talus's dome: (A) Axial view, a 19.9 mm lesion; (B) Coronal view, a 20.9 mm lesion. MRI: Magnetic resonance imaging.***

The HP examination of the fragments of bone tissue, surgically extracted from the focus of astragalus bone necrosis, stained with Hematoxylin–Eosin (HE), showed areas of normal bone tissue with bone cavities with red bone marrow of normal appearance (Figure 4), but also areas of bone necrosis and necrosis of myeloid tissue (Figure 5).

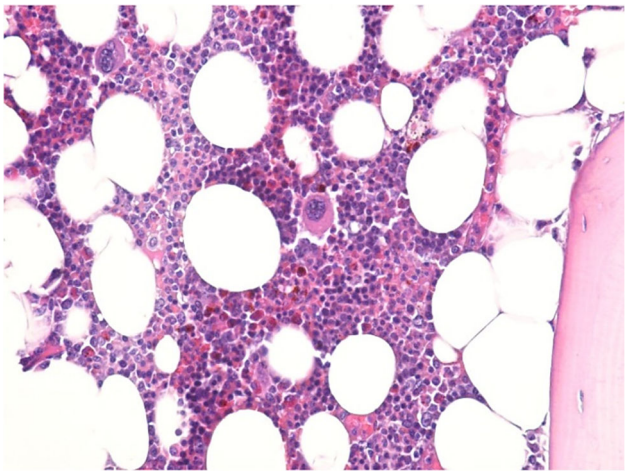

Figure 4 – ***Myeloid tissue and bone of normal appearance. Hematoxylin–Eosin (HE) staining, ×200.***

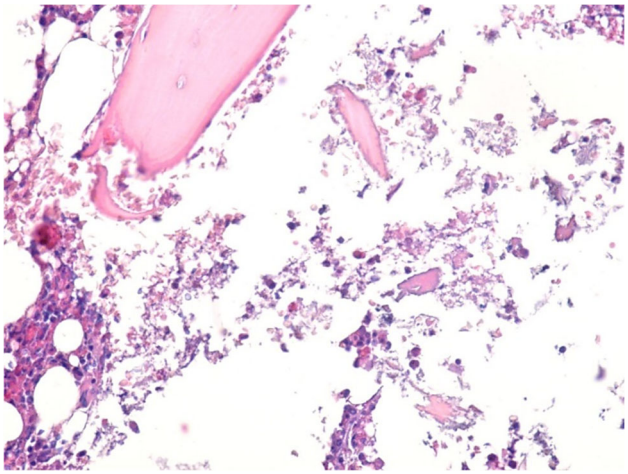

Figure 5 – ***Area of bone and myeloid tissue necrosis. HE staining, ×200.***

Discussions

Considering the clinical presentation, and the comprehensive imagistic findings, the prognosis of this particular talus fracture appears daunting. The partial non-union presented by the CT scan advocates for surgical intervention using a single or multiple screws in combination with an autogenous bone graft [12]. Ruling out the presence of infection through MRI imaging and HP analysis clears the path for future surgical interventions [13]. The subsequent histological analyses have unequivocally confirmed the diagnosis of talus AVN, a condition which also necessitates a surgical approach [14]. Given the small area of 19.8/20.9 mm of confirmed necrosis on the upper lateral face of the talus dome, a core decompression surgical procedure is being deliberated, considering the patient's early stage of necrosis. It must be taken into consideration that any type of surgery procedure must preserve the articular surface of the talus dome in order to obtain a good range of motion. The combination between partial non-union and the confirmed AVN significantly complicates the patient's recovery trajectory [15]. This complete diagnosis underscores the imperative for rigorous, ongoing monitoring and therapeutic planning for both complications. The decision regarding the surgical timeline on whether to treat both secondary conditions in a single intervention or by follow up surgical procedures will be a challenge. The dynamic nature of AVN necessitates such vigilance, as any expansion of the lesion could decisively influence the treatment's result [16, 17].

Even though the progress in orthopedics has offered multiple treatment plans for early stage post-traumatic AVN there is no ideal therapy. The ongoing lesion progression can lead in some cases to major surgical procedures such as total ankle replacement when the extent of the necrosis covers most of the articular surface, and most recent total talus replacement when the talus dome is totally collapsed [18]. Our case is unfortunately a possible future candidate for one of these types of surgical procedures, given the cumulative negative risk factors [19]. Considering the early stage of talus AVN and the patient's age, ankle fusion will not represent a therapeutic option for the time being. The best way to determine the optimal treatment plan is by carefully monitoring the ongoing symptoms and repeat clinical evaluations considering range of motion, pain and circulatory disorders. Nonetheless, repeated MRI scans to ascertain the lesion's evolution will be performed [20].

Conclusions

Considering the comminuted aspect, circulatory disorders and the type III talus fracture by Hawkins's classification, the presence of AVN was surely expected. Nonetheless, the promising early post-operative evolution of the patient indicated a slight possibility of full recovery without developing AVN. MRI imaging, as opposed to the CT scan, has proven effective in ruling out the possibility of infection. The bone necrosis and myeloid tissue necrosis shown in the HP examinations confirmed the diagnosis of AVN of the talus, thus placing the patient's therapeutic trajectory on a clear but challenging path. This case presentation reveals the importance of HP examination in early stages of talus AVN, especially when clinical examination, CT and MRI scans present different pathological aspects that pose a challenge in determining a definitive diagnosis. Considering the presence of both normal and necrotic areas within the same bony fragment, we conclude that the HP examination is a valid determination for the presence of AVN and a possible means for determining its evolution and prognosis. In light of this case, we conclude that the management of post-traumatic AVN of the talus requires a preventive strategy that includes consistent patient communication, along with repeated clinical examinations and imaging investigations in order to determine the optimal treatment plan and ensure the best possible outcomes.

Conflict of interests

The authors declare that they have no conflict of interests.

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