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Case Reports

The Role of Arthrodesis and Bone Grafting on Management of Malunion Talus after Avascular Necrosis in a Neglected Talus Fracture Patient: A Case Report

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Abstract

Introduction: Neglected talus fractures, complicated by avascular necrosis and subsequent malunion, present a challenging clinical scenario. The talus is a critical component of the ankle joint, and its compromised structural integrity can significantly impact a patient's functional outcomes. This case report explores the management of avascular necrosis-induced malunion of the talus, focusing on the application of arthrodesis and bone grafting as a reconstructive solution.

Case Presentation: We present a case of a neglected left talus fracture in a 20-year-old female patient with a history of delayed presentation and subsequent avascular necrosis, leading to malunion and progressive debilitating ankle pain since 4 months ago. Comprehensive clinical and radiological assessments confirmed the extent of the malunion and the necessity for intervention. Surgical treatment involved arthrodesis to restore joint stability and alignment, along with bone grafting to address the bone defect resulting from avascular necrosis. Post-operative follow-up showed significant improvements in pain relief and functional outcomes.

Conclusion: This case report highlights the effective use of arthrodesis and bone grafting in managing malunion of the talus following avascular necrosis in a neglected fracture. While challenging, a tailored surgical approach can provide patients with significant pain relief and improved functional outcomes, thus underscoring the importance of early recognition and appropriate intervention in cases of talus fractures. Further studies and long-term follow-up are necessary to evaluate the durability and success rates of such interventions.

Keywords: Arthrodesis, Avascular Necrosis, Bone Graft, Talus Fracture

Introduction

The talus, which lacks muscular attachments and is composed of 60–70% articular cartilage, articulates with neighboring osseous structures through capsuloli gamentous restraints. Anatomically, it comprises three primary components: the thorax, the neck, and the head; additionally, it comprises the flexor hallucis longus tendon-carrying lateral and posterior processes.[1]

Talus fractures constitute less than 1% of all foot and ankle fractures, with the neck hosting approxi mately 50% of these incidents. These conditions often arise as a result of high-energy trauma, and frequent injuries occur in the foot or another homolateral lower extremity region, which further complicates their treatment. As a result of its unique anatomical structure, this bone is vital to the biomechanics of the foot and ankle. It is devoid of tendon and muscular insertions, and articular cartilage covers two-thirds of its surface, leaving periosteal irrigation to function exclusively in the neck region and posterior process. The anastomotic network established by the posterior tibial, anterior tibial, and fibular arteries provides this. The irrigation of the neck and body is predominantly carried out by the arteries of the tarsal canal and sinus. The anterior tibial artery supplies the cranium and dorsal region of the neck with irrigation. The posteromedial region of the body is supplied with blood by the branches of the posterior tibial artery via the deltoid ligament. The aforementioned factors contribute to the elevated incidence of complications associated with these injuries.[2,3]

Talus fractures, despite being infrequent, pose a distinct array of difficulties within the field of orthopedics. Acute malunion and neglected talus fractures, which are further complicated by avascular necrosis, constitute an exceptionally intricate clinical situation that requires novel and individualized therapeutic approaches. The integrity of the talus is critical for the proper functioning and structure of the ankle joint as a whole; therefore, any impairment to its integrity can significantly affect the quality of life of the affected individual.[3]

The significance of promptly attending to talus fractures is widely acknowledged. However, this journal explores the consequences of postponing intervention, the pathogenesis of avascular necrosis, and reconstructive methods that can alleviate its adverse effects. The overarching goal is to disseminate information that can instruct medical professionals in attaining the most favorable results for patients through the presentation of an exhaustive case report showcasing the capabilities of bone transplantation and arthrodesis in the treatment of these exceptional instances.[4,5]

This case report contributes significantly to the field of orthopedics by emphasizing the critical importance of intervention through bone transplantation and arthrodesis in cases of malunion talus caused by avascular necrosis of neglected talus fracture.

Case Reports

We present a case of a neglected left talus fracture

Figure 1. Clinical Manifestation.

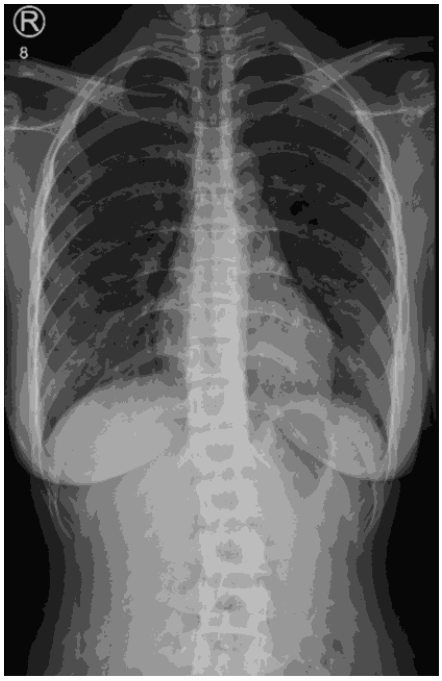

Figure 2. Chest X-Ray AP View.

Figure 3. Right Ankle X-Ray AP/Lateral View.

in a 20-year-old female patient with a history of delayed presentation and subsequent avascular necrosis, leading to malunion and progressive debilitating ankle pain since 4 months agodue to a motor vehicle accident.Notably, no family members had experienced similar symptoms. The patient, a student, had been able to walk normally before the trauma, but afterward, she was left with a slight limp. Comprehensive clinical and radiological assessments confirmed the extent of the malunion and the necessity for intervention. Surgical treatment involved arthrodesis to restore joint stability and alignment, along with bone grafting to address the bone defect resulting from avascular necrosis. Post-operative follow-up showed significant improvements in pain relief and functional outcomes.

Figure 4. Right Ankle X-Ray Mortise View.

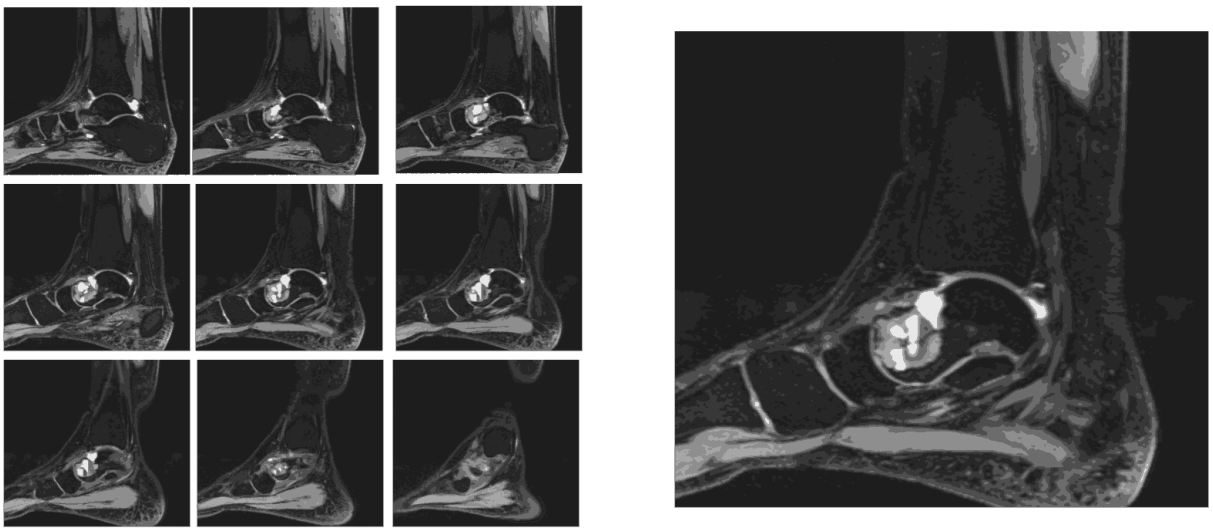

Figure 5. Right Ankle MRI T2W Sagittal View.

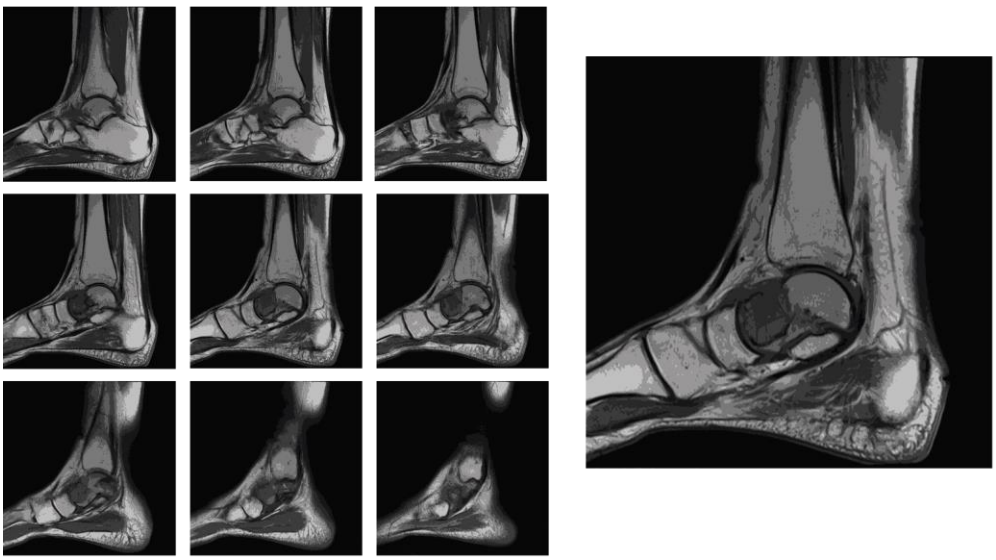

Figure 6. Right Ankle MRI T1W Sagittal View.

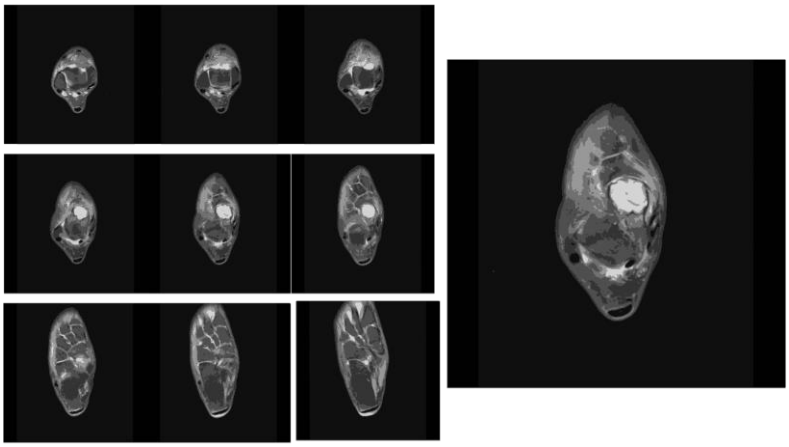

Figure 7. Right Ankle MRI T2W Axial View.

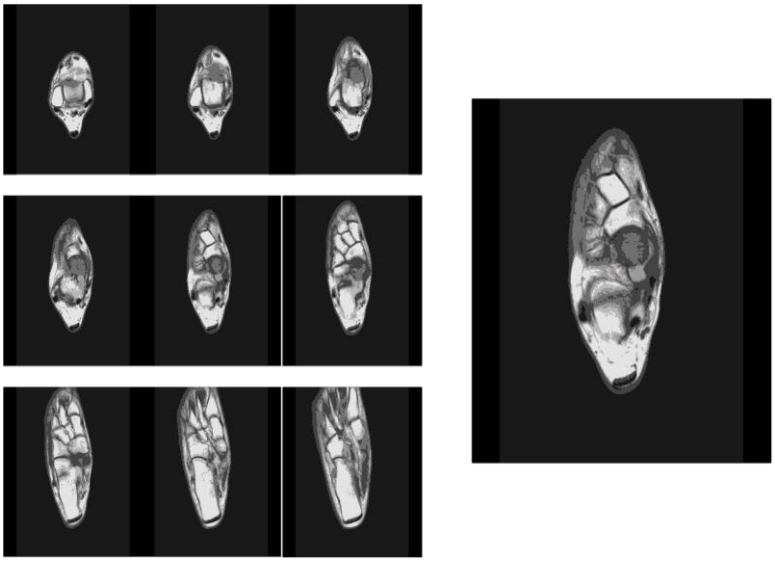

Figure 8. Right Ankle MRI T1W Axial View.

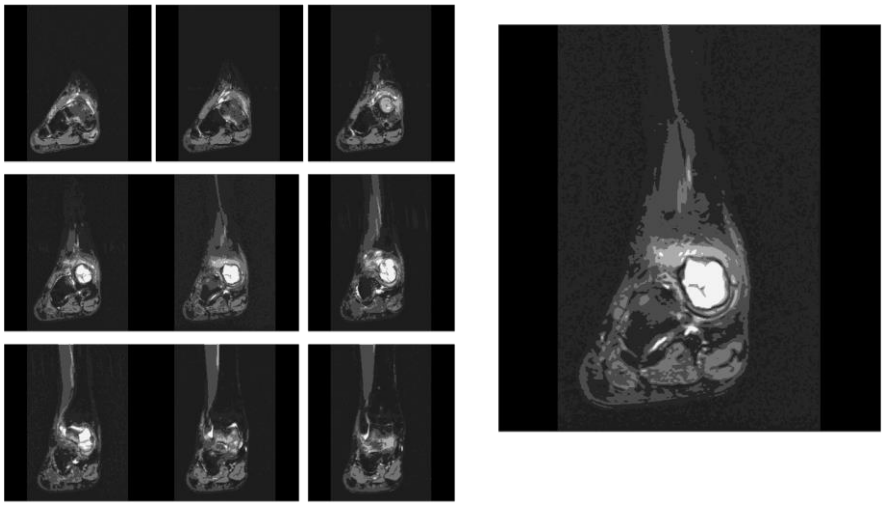

Figure 9. Right Ankle MRI T2W Coronal View.

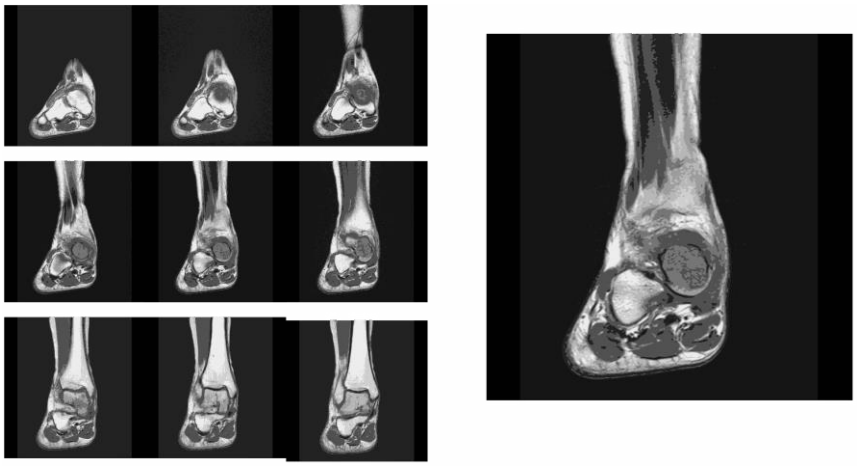

Figure 10. Right Ankle MRI T1W Coronal View.

Table 1. Laboratory Result

Examination	Result	Normal Range
WBC	7.83	4.1 - 11.0
PLT	341.00	150 - 440
HGB	13.10	13.5 - 17.5
HCT	40.70	41.0 - 53.0
PPT	10.7	10.8 - 14.4
APTT	33.0	24 - 36
INR	0.94	0.9 - 1.1
SGOT	19.0	5 - 34
SGPT	15.0	11 - 34
BUN	7.2	8 - 23
SC	0.68	0.57 - 1.11

Discussion

The talus has no muscle attachments and is more than half covered in articular cartilage. The head, neck, and body comprise the three components of the talus. Consequently, the talus serves as the focal point of several intricate articulations, including the calcaneus inferiorly (subtalar joint), the tibia superiorly (tibiotalar joint), and the navicular anteriorly (talonavicular joint). It transfers weight from the tibia to the remainder of the foot structurally. The anterior, posterior, and perforating peroneal arteries all contribute to the talus's extraosseous blood supply; however, the posterior tibial artery, with its branch to the tarsal canal, is the main source. The head of the talus is supported by the tarsal sinus artery and the dorsalis pedis. The peroneal artery, which anastomoses with the posterior tibial artery in the subtalar joint, contributes additional blood flow to the body's talus and dome. The posterior tibial artery supplies the majority of this blood flow. Research has indicated that talus fractures, which are usually high-energy events, can arise through a various of damage paths. In multiple retrospective studies of neck, talus, and body fractures, motor vehicle collisions accounted for the majority of the injury mechanisms. This was followed by falls from a height, pedestrian automobile crashes, crush injuries, and sports-related injuries.[2,3]

Talus fractures are often missed in the first assessment, either due to insufficient radiological findings or a subpar clinical examination.[6] To ascertain the nature of the injury, relevant radioimaging procedures such as anteroposterior (AP), oblique, and lateral foot pictures, ankle series, Canale and Kelly, or mortise view should be carried out.[7] Each fracture carries a significant risk of sequelae, including collapse, malunion, avascular necrosis (AVN), and secondary osteoarthritis. Therefore, if a fracture is detected, a comprehensive evaluation utilizing computed tomography (CT) or magnetic resonance imaging (MRI) should be performed. Osteonecrosis is the most common and dangerous result of neck talus fractures. In order to lower the overall risk of osteonecrosis, fixation of talus neck fractures is an urgent necessity. Any post-reduction delay in talus neck fracture repair did not influence the development of osteonecrosis. According to studies, the development of osteonecrosis is more strongly correlated with parameters associated withthe severity of the initial injury, such as the initial displacement, comminution, and open fracture.[6]

As long as the damage is minimized, the current guideline is to hold off until the soft tissue envelope is amenable to permanent repair. Infection, skin necrosis, and wound dehiscence—which, in spite of this cautious approach, can still happen in as many as 10% of cases—are reduced as a result. Arthritis is the second most common result. Elgafy et al. discovered a correlation between talus fractures and 25.3% tibiotalar arthritis and 53.3% subtalar arthritis.[8] Failing to prevent these issues can lead to incapacity, more surgeries, and chronic discomfort. Persistent symptoms of osteonecrosis may be treated surgically. Joint-sparing (core decompression and vascularized bone grafting), joint-sacrificing (talus replacement), and salvage (arthrodesis) are the three primary operation

types offered. In this instance, the patient's original diagnosis was incorrect. On the radiograph, the patient showed little edema and avascular necrosis of the talus fractures with a decent soft-tissue component. In our instance, iliac crest cancellous graft combined with subtalar and talonavicular arthrodesis demonstrated excellent alignment and ankle stabilization. The majority of surgeons who care for patients with neck talus fractures are worried about the subtalar joint developing degenerative problems.[7,8] With a sinus tarsi approach and cannulated screw fixation, subtalar arthrodesis can be used to treat specific hindfoot diseases in adults. Primary ankle arthrodesis is one kind of treatment for severely comminuted talus fractures. Tasto first described arthroscopic subtalar arthrodesis in 1992, using the conventional antero lateral, posterolateral, and related portals with the patient in the lateral decubitus position. During arthroscopic arthrodesis, the calcaneus and talus's vascularization and proprioception are preserved, which is linked to decreased soft tissue injury and may encourage union. Even while this treatment may theoretically enhance blood supply to the talus body and lower the likelihood of posttraumatic ankle arthritis, the limitation of ankle motion has a significant effect on ambulation. Fixation options include implants made especially for subtalar arthrodesis, big cannulated screws, and staples. Large cannulated screws are most often mentioned for fixation. There has been disagreement on the optimal screw count (1, 2, or 3), screw type (head or headless, totally threaded or partially threaded), and screw direction (parallel or divergent) for supporting the arthrodesis site. Two cannulated 7.5-mm fully threaded conical headless compression screws are introduced from the posterior side of the heel in the Paulo et al. investigation. That being said, any large-diameter (>6.5 mm) compression screw can effectively support the fusion site. In a diverging pattern, one screw is inserted into the talus's body and the other into its neck. Eichinger et al. found that divergent screws performed better in terms of stability than parallel screws.[9,10]

Treatment of AVN talus has benefited from the use of both vascularized and non-vascularized bone grafts. In addition to offering structural support, they cause revascularization by slowly introducing replacement from the nearby vascularized bone into the talus' avascular area. Studies conducted by Dhillon demonstrate that vascularized bone grafts can preserve joints in patients even up to Stage III of the disease and can be used in conjunction with arthrodesis for treating OA and collapse. The results are satisfactory and predictable.[11]

Various arthrodesis techniques with or without concurrent partial or total talectomy are included in salvage treatments. The primary goal of these is to establish a plantigrade foot that is painless and in alignment. They are considered the final resort, particularly for younger patients. For patients who develop aberrant gait patterns and subsequent arthritis in the surrounding joints, even after a successful fusion, these surgeries can be highly disabling (Figures 2b and 3). The talus is lined up with the tibia, the ankle is fused in neutral dorsi/plantar flexion, 0°–5° of hindfoot valgus, and 5°–10° of external rotation. Reliable substitutes in individuals without dome collapse and symptoms restricted to the individual joints include subtalar and talonavicular fusion. Such an instance is not common. Cannulated or cancellous screws are used in rigid fixation; they can be augmented with bone grafts, minifragment plates, or staples.[11]

Conclusion

This case report underscores the significant impact of employing a combination of arthrodesis and bone grafting as an effective surgical strategy for addressing malunion of the talus resulting from avascular necrosis in a neglected fracture.Challenging as these cases may be, a tailored surgical approach has been shown to provide patients with significant relief from pain and a substantial improvement in their overall functional abilities. This case report underscores the importance of early recognition and appropriate intervention in cases of talus fractures, particularly those that may lead to avascular necrosis and malunion. It is important to note that further studies and long-term follow-up are necessary to evaluate the durability and success rates of such interventions in this specific clinical context.

Conflict of Interest

The authors declare no conflicts of interest.

Ethical Consideration

The authors had gained consent from the patients to publish his case in an academic journal without revealing any personal identity and solely for academic purposes.

Acknowledgement

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