

Case Report

The hidden threat of retained rubber and radiolucent foreign bodies in extremity trauma: Diagnostic and surgical challenges

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Abstract

Penetrating extremity injuries are common among individuals involved in farming and ground-level occupations, often caused by materials such as thorns, wood, ceramics, plastic, and metal. While foreign body retention is well-documented, retained rubber fragments are rarely reported. Such foreign bodies can trigger a granulomatous inflammatory response, leading to symptoms ranging from acute pain and swelling to chronic complications, such as abscesses and discharging sinuses, if untreated. Radiological imaging is key to diagnosis. While plain radiographs detect radiopaque objects, they often miss radiolucent materials such as rubber, wood, and plastic. Ultrasound and magnetic resonance imaging are more effective in these cases, with the latter offering superior sensitivity and aiding in surgical planning. Surgical removal is the definitive treatment, but radiolucent materials pose intraoperative challenges, as C-arm imaging is ineffective. Ultrasound-guided extraction enhances precision, particularly for deeply embedded foreign bodies. In our case, despite initial challenges, intraoperative ultrasound guidance and meticulous dissection ensured successful removal, highlighting the importance of advanced imaging and surgical expertise in managing complex foreign body injuries.

Level of evidence V; Case report.

Keywords: Blast injuries; Foreign body; Rubber; Ultrasonography; Magnetic resonance imaging.

Introduction

Lower extremity injuries due to penetrating trauma resulting in retained rubber foreign body are rarely reported. If left untreated, this type of injury causes significant local inflammation and damage to important surrounding anatomic structures, thus resulting in infection and functional morbidity. Due to their radiolucent nature, it is difficult to detect these foreign bodies on plain radiographs⁽¹⁾.

As per Grocutt et al.⁽²⁾, high frequency ultrasound (> 7.5 MHz) is reported to have high sensitivity and specificity in detecting radiolucent foreign bodies, being an efficacious, readily available, and cost-effective modality compared to other soft tissue imaging options. Many times, the foreign body composition may not be known at the initial presentation, and in about 38% of cases such bodies are missed due their radiolucent nature, thus highlighting the importance of

ultrasound in the initial imaging. Also, the ability to localize the adjacent vessels and tendons reinforces the importance of a safe ultrasound-guided extraction intraoperatively.

In our study, we present the case of a 25-year-old male with retained wooden fragment and rubber foreign body in the midfoot, complicated by an abscess. Ultrasonography identified the foreign bodies, while magnetic resonance imaging (MRI) assessed inflammation and deep tissue involvement and guided surgical planning. The foreign bodies were successfully removed through meticulous layer-by-layer dissection with intraoperative ultrasound assistance.

Case description

A 25-year-old male presented with persistent pain and swelling in the right midfoot 20 days after sustaining a thorn prick through his rubber footwear. Patient attempted self-

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removal, but symptoms persisted despite apparent wound healing. Examination revealed swelling extending from the plantar to dorsal aspect with localized tenderness. Serological test was normal. A plain radiograph showed haziness over the midfoot plantar aspect. Ultrasonography confirmed a linear hypoechoic foreign body (3.7 mm × 0.7 mm) in the plantar midfoot, accompanied by a heterogeneous collection (1.8 cm × 1.1 cm) extending into the subcutaneous plane through the plantar fascia (Figure 1).

Magnetic resonance imaging of the right foot revealed an irregular collection measuring 3.2 × 1.2 × 3.2 cm (CC × TS × AP) within the intermuscular plane, at the midshaft level of the third and fourth metatarsals, extending to the plantar skin surface, with a foreign body embedded in the collection. A tear was observed in muscle fibers of the lumbricals and plantar interossei (Figure 2).

Given these findings, patient was scheduled for surgical exploration under regional nerve block. Intraoperatively, a 1-cm wooden fragment was identified and excised from the intermuscular plane. Additionally, an 8 mm × 2 mm and 3 mm × 2 mm black rubber foreign body was successfully removed under intraoperative ultrasound guidance. Postoperative recovery was uneventful.

Discussion

Retained foreign bodies from penetrating injuries, such as thorns, nails, or wooden splinters, are common among individuals in farming and ground-level occupations. Risk

factors include barefoot walking, cultural practices involving kneeling or sitting on the ground, and the widespread use of open footwear. Patients often attempt self-removal using needles or knives, delaying medical intervention. Consequently, foreign bodies frequently present late, with symptoms like swelling, severe pain, pus discharge, or persistent sinus formation indicating an ongoing inflammation or infection. In some cases, small fragments of footwear may become embedded, leading to chronic foot pain, swelling, and serious infectious complications⁽¹⁻⁴⁾.

In this case, it was initially assumed that the thorn had been fully removed. However, persistent and worsening swelling and pain prompted reconsideration of a retained foreign body, though an additional foreign body was unsuspected. Foreign body granuloma, a tissue reaction to retained material, varies based on size, type, and location, i.e. whether in soft tissue, bone, or joint. Symptoms range from acute pain and swelling to severe inflammation, infection, and chronic osteomyelitis, with abscesses or sinus formation. In prolonged cases, these pathological changes can mimic neoplastic conditions, complicating diagnosis^(1,5).

Imaging plays a crucial role in detecting retained foreign bodies, especially radiolucent materials like plastic, rubber, and wood, which are often undetectable on plain radiographs. In the present case, despite the foreign body's invisibility on radiograph, clinical suspicion based on the patient's history prompted further evaluation. Ultrasonography identified the foreign body and an associated fluid collection, while MRI confirmed its presence, assessed surrounding tissue

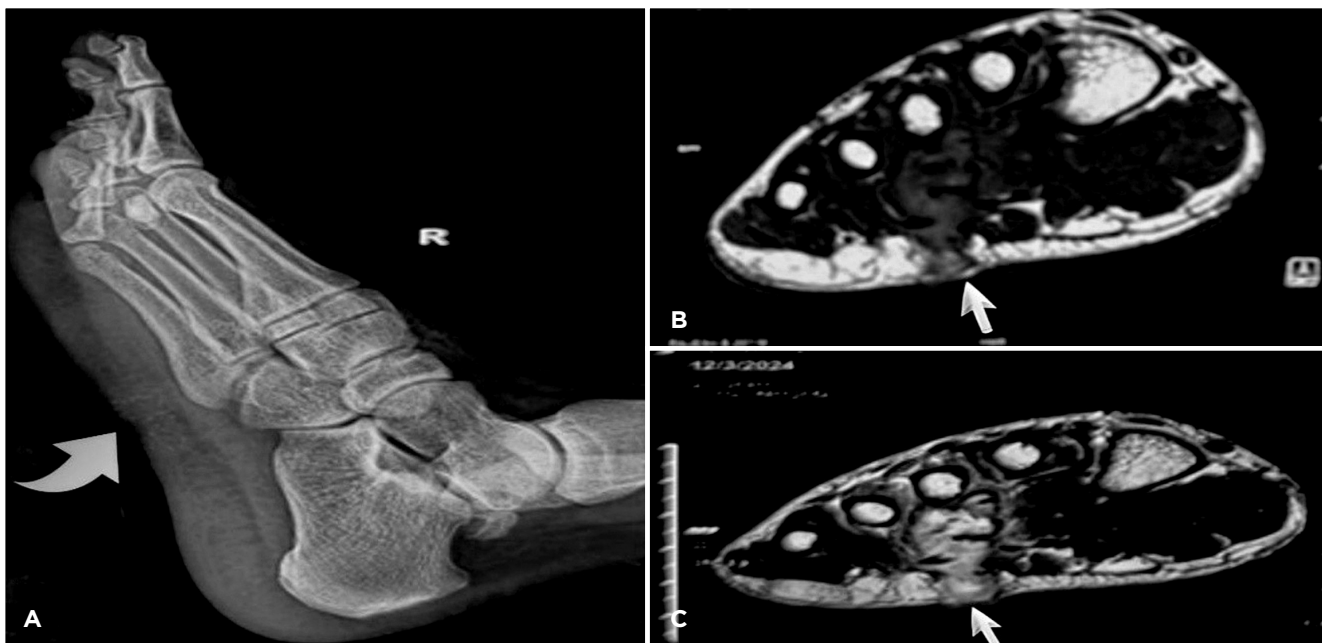


Figure 1. (A) Haziness in the midfoot region on radiograph, lateral view. (B) and (C) Magnetic resonance imaging T1 and T2 axial views showing irregular collection extending from plantar aspect to mid-shafts of third and fourth metatarsals.

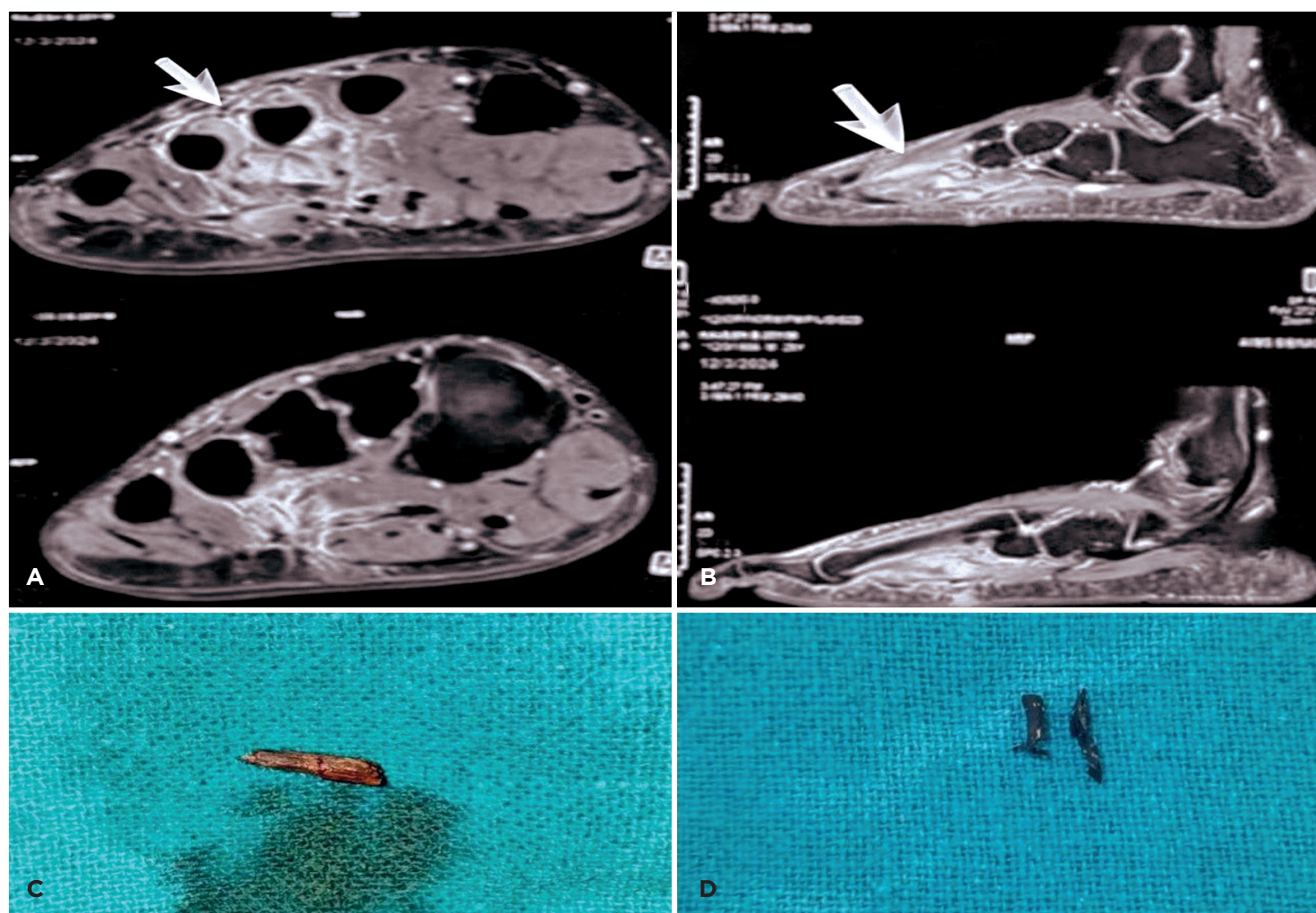


Figure 2. (A) Magnetic resonance imaging T2 short tau inversion-recovery (STIR), axial view. (B) Sagittal images showing extent of collection and tear in muscle fibres of lumbricals and plantar interossei. (C) and (D) Wooden and rubber foreign bodies.

involvement, and guided surgical planning. Magnetic resonance imaging also helps detecting complications such as abscesses and sinus tracts. Typically, foreign bodies appear as low-intensity or signal-void areas on both T1- and T2-weighted images, though detectability may still be size-dependent⁽⁵⁻¹⁰⁾.


Surgery is the primary treatment for retained foreign bodies, addressing abscess drainage, sinus tract excision, necrotic tissue removal, and specimen collection for microbiological and histopathological analysis. In the present case, surgical exploration was necessary due to the deep-seated foreign body, fluid collection, and muscle involvement. Long-standing retained rubber fragments may undergo fragmentation and pigment deposition ("tattooing") into adjacent tissues, necessitating excision of a surrounding soft tissue cuff to prevent residual fragments. Deeply embedded radiolucent foreign bodies pose intraoperative challenges, as C-arm imaging is ineffective. Ultrasound-guided removal enhances precision and improves surgical outcomes^(1-4,6). Patients with penetrating

foot trauma and symptoms such as swelling, chronic pain, or discharging sinuses require thorough evaluation for retained foreign bodies. A detailed history of injury, including type of footwear worn during injury, is crucial. In this case, while a wooden foreign body was suspected, both wood and rubber fragments were identified, and MRI played a significant role in diagnosis and surgical planning.

Penetrating injuries, particularly those occurring through footwear, should raise a high suspicion for retained radiolucent foreign bodies which may go undetected on plain radiographs. Magnetic resonance imaging plays a crucial role in diagnosis and surgical planning, while ultrasound-guided removal enhances precision. Early recognition and adequate surgical exploration with intraoperative real-time ultrasound ensures optimal recovery.

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