

Chronic Non-Healing Wound After Ankle ORIF Resolved by Implant Removal: Suspected Metal Hypersensitivity

Hatim AlShareef^{1*}, Mohammed Ahmed Altorki², Ibrahim Lutf Abumunaser³, Dr. Abdulrahman Moeed A AlShamrani⁵, Mrs. Sarah Moeed A AlShamrani⁶ and Ahmed Abdelfattah Essa Elbarbary⁴

¹Orthopedic Consultant, Sports Medicine and Arthroscopic Surgery, Arthroplasty and Lower Limb Reconstruction Surgery, King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia

²Orthopedic Resident, King Abdulaziz Medical City, Jeddah, Saudi Arabia

³Orthopedic Resident, King Khalid Hospital, Tabuk, Saudi Arabia

⁴Orthopedic Senior Registrar, King Fahad Army Force Hospital, Jeddah, Saudi Arabia

⁵Consultant of Orthopedic Surgery, Sport & Arthroscopic Surgery, Joint Preservation Surgery, King Fahad Armed Forces Hospital-Jeddah

⁶Medical Student, King Abdulaziz University-Jeddah

***Corresponding Author:** Hatim Mohammed AlShareef, Orthopedic Consultant, Sports Medicine and Arthroscopic Surgery, Arthroplasty and Lower Limb Reconstruction Surgery, King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia.

Received: July 15, 2026; **Published:** September 17, 2026

Abstract

Background: Persistent wound complications following ankle open reduction and internal fixation (ORIF) are typically attributed to infection, soft-tissue compromise, or mechanical irritation. Metal hypersensitivity is an uncommon and often overlooked cause of delayed wound healing, representing a diagnosis of exclusion.

Case Presentation: A 44-year-old woman with asthma, but no history of diabetes, smoking, or known metal allergy, underwent ORIF for a distal fibular fracture. Despite radiographic fracture union, she developed a chronic non-healing wound with distal wound dehiscence and exposed hardware for approximately six months postoperatively. Clinical examination, laboratory investigations, and intraoperative findings demonstrated no evidence of infection, implant loosening, or tissue necrosis. Following confirmation of fracture union, the plate and screws were removed. The wound healed uneventfully within three weeks, with complete resolution of symptoms and restoration of function.

Discussion: This case highlights suspected implant-related metal hypersensitivity as a potential cause of persistent wound complications after ankle ORIF when common etiologies have been excluded. The absence of infection, normal inflammatory markers, and rapid clinical improvement after implant removal support this diagnosis. Although definitive diagnostic testing was not performed, the clinical course is consistent with previous reports describing metal hypersensitivity as a delayed type IV immune reaction to orthopedic implants.

Conclusion: Metal hypersensitivity should be considered in patients with unexplained chronic wound dehiscence following fracture fixation after exclusion of infection and mechanical causes. Implant removal after confirmed fracture union may provide both diagnostic confirmation and definitive treatment, leading to successful wound healing.

Keywords: Ankle Fracture; Open Reduction and Internal Fixation; Metal Hypersensitivity; Wound Dehiscence; Implant Removal; Orthopedic Implants; Case Report

Introduction

Ankle fractures are among the most common orthopedic injuries and are frequently managed with open reduction and internal fixation (ORIF) to restore anatomical alignment and allow early mobilization [1]. Although outcomes are generally favorable, postoperative wound complications remain a significant concern, particularly in procedures involving the lateral malleolus due to the limited soft tissue envelope in this region [2]. Reported wound complication rates following ankle ORIF vary widely, ranging from approximately 1.4% to 18.8% in the literature, and include delayed wound healing, wound dehiscence, and surgical site infection [1].

Several patient-related and surgical factors have been associated with an increased risk of wound complications following ankle fixation, including advanced age, diabetes mellitus, smoking, obesity, and compromised soft tissue conditions [2]. Operative factors such as prolonged surgical time and excessive soft tissue handling have also been implicated [2]. In most cases, impaired wound healing can be attributed to identifiable causes such as infection, vascular compromise, or mechanical irritation from hardware [3].

However, a subset of patients may develop persistent or unexplained wound complications despite the absence of these common etiologies, posing a diagnostic challenge [3]. In such cases, less common causes must be considered. Metal hypersensitivity is an uncommon but increasingly recognized cause of adverse reactions to orthopedic implants [3]. It represents a delayed type IV hypersensitivity reaction mediated by T lymphocytes in response to metal ions released from implanted hardware [3]. Clinically, it may present with nonspecific findings such as chronic wound problems, delayed healing, or localized inflammatory reactions, often mimicking infection or mechanical failure [4].

Given its nonspecific presentation and lack of definitive diagnostic criteria, metal hypersensitivity remains a diagnosis of exclusion and is typically considered only after more common causes have been ruled out [4]. In this report, we present a case of chronic non-healing wound following ankle ORIF in a low-risk patient, with resolution after implant removal, raising suspicion of metal hypersensitivity as a potential underlying etiology.

Case Presentation

A 44-year-old female, known case of asthma managed with inhalers, with no history of diabetes, smoking, or other significant comorbidities, presented to the emergency department on 29 September 2025 with right ankle pain following a twisting injury. On examination, there was localized tenderness over the lateral malleolus associated with mild swelling. There were no open wounds, and distal neurovascular status was intact.

Plain radiographs of the ankle demonstrated a distal fibula fracture. The patient subsequently underwent open reduction and internal fixation (ORIF) of the right lateral malleolus using plate and screws on 30 September 2025 via a standard lateral approach and standard wound closure was performed.

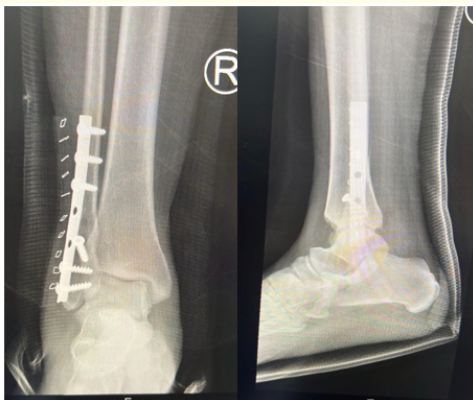


Figure 1: Anteroposterior and lateral radiographs of the right ankle obtained immediately postoperatively demonstrating open reduction and internal fixation of a distal fibula fracture using a lateral plate and screws. Alignment is satisfactory with appropriate hardware positioning and restoration of the ankle mortise.

Postoperatively, at the six-week follow-up (17 November 2025), the patient reported limited range of motion but denied pain or tenderness at the fracture site. On examination, the wound had not fully healed; however, there were no clinical signs of infection. Radiographs continued to show a well-reduced fracture with the implant *in situ* and stable alignment. The patient was managed conservatively with a short course of oral Amoxicillin-clavulanate for seven days, immobilization with a backslab, and further laboratory evaluation.

Subsequently, on 6 April 2026, she presented ambulating full weight-bearing without support. Clinical examination revealed wound dehiscence in two areas over the distal aspect of the surgical incision with exposed hardware. There were no documented systemic signs of infection, and distal neurovascular examination remained intact.



Figure 2: Clinical photograph obtained on 6 April 2026 demonstrating wound dehiscence over the distal aspect of the surgical incision with exposed hardware and no obvious signs of surrounding infection.

Laboratory investigations at that time showed a white blood cell count of $5.62 \times 10^9/\text{L}$ and hemoglobin level of 119 g/L, with no laboratory evidence suggestive of systemic infection.

Radiographic evaluation demonstrated maintained fracture alignment with the implant in appropriate position, consistent with fracture healing.

Given the clinical findings and radiographic evidence of fracture healing, the patient underwent removal of plate and screws on 15 April 2026 as a day-case procedure. Intraoperatively, the hardware was found to be well-positioned with no evidence of loosening. There were no signs of infection, including absence of purulence, necrotic tissue, or foul odor. The surrounding soft tissues appeared viable, and the fracture site demonstrated evidence of union. The implants were removed without difficulty. The patient was discharged on the same day with oral antibiotics, analgesia, and anticoagulation.



Figure 3: Intraoperative photographs demonstrating exposed plate and screws at the distal fibula through the dehiscid surgical incision.



Figure 4: Intraoperative photograph following removal of plate and screws, demonstrating viable underlying bone and surrounding soft tissues without evidence of purulence or necrosis.



Figure 5: Intraoperative photograph demonstrating wound closure following implant removal.



Figure 6: Anteroposterior and lateral radiographs of the right ankle following implant removal, demonstrating maintained alignment and evidence of fracture union after removal of plate and screws.

At the three-week postoperative follow-up after implant removal, the patient was clinically improving and reported no significant pain or functional limitation. Examination demonstrated satisfactory wound healing with no evidence of recurrent dehiscence, drainage, erythema, or infection. The patient remained neurovascularly intact and was ambulating without significant difficulty.



Figure 7: Clinical photograph obtained three weeks following implant removal.

Discussion

This case highlights a rare but clinically important cause of persistent wound complications after ankle open reduction and internal fixation (ORIF): suspected metal hypersensitivity [1-3]. In routine ankle fracture practice, delayed wound healing and wound dehiscence are usually first attributed to infection, soft-tissue compromise, or mechanical irritation from prominent hardware [1,2]. However, the present patient was relatively low risk, had no diabetes or smoking history, demonstrated normal inflammatory markers, and had no intraoperative evidence of purulence, necrosis, or loosening despite exposed distal fibular hardware after fracture union, raising suspicion for an implant-related biological reaction rather than the more common infectious or mechanical causes [2,3].

Pathophysiology and diagnostic challenges

Metal hypersensitivity is generally considered a delayed type IV, T-cell-mediated immune response to metal ions released from implanted devices [3,4]. In orthopedics, the most commonly implicated metals are nickel, cobalt, chromium, and, less commonly, titanium [3,4]. Diagnosis remains difficult because the manifestations are heterogeneous and often overlap with infection, implant prominence, aseptic loosening, dermatitis, pain, edema, or delayed wound healing [4]. Recent foot and ankle literature emphasizes that these reactions are uncommon, easily overlooked, and largely remain diagnoses of exclusion [5]. A 2023 systematic review concluded that metal hypersensitivity in foot and ankle surgery is challenging to diagnose and not widely reported, and suggested that preoperative patch testing is most useful only in patients with a strong history of metal allergy rather than as a routine screening tool [5].

Our case is notable because the presentation was localized and delayed [3,5]. Unlike the ankle fracture case reported by Kruckeberg, *et al.* in which a 67-year-old woman developed systemic hives, oral swelling, and breathing difficulty within 10 days postoperatively, our patient had no systemic allergic manifestations and instead developed a chronic, non-healing wound with exposed hardware several months later [6]. In both cases, symptoms resolved after implant removal, supporting implant hypersensitivity as a plausible explanation once other causes were excluded [6].

Our case also differs from the report by Thomas, *et al.* who described impaired wound healing, local eczema, and chronic inflammation following titanium osteosynthesis in a patient with known metal allergy [7]. Their case had a stronger pre-existing allergic background and a more overt dermatologic phenotype, whereas our patient had no known history of metal allergy and presented primarily with wound dehiscence and hardware exposure rather than eczema [7]. This suggests that implant hypersensitivity may occur even without prior allergy and may present purely as a wound complication [7].

A further comparison can be made with the case reported by Phedy, *et al.* in which a patient developed generalized erythroderma and systemic skin involvement following orthopedic fixation [8]. Compared to that case, our patient demonstrated a localized reaction confined to the surgical site without systemic dermatologic manifestations, highlighting the broad spectrum of implant hypersensitivity presentations [8].

Similarly, Ajarrag and Torchon described persistent sterile inflammation and wound dehiscence following titanium screw fixation in hallux valgus surgery [9]. Although involving a different anatomical site, their case shares key similarities with ours, including absence of infection and eventual suspicion of biomaterial hypersensitivity, supporting that this phenomenon may occur across different procedures and implant types [9].

Management considerations

Management of suspected implant hypersensitivity requires exclusion of infection and mechanical causes as a first step [3]. In our case, infection was unlikely due to normal laboratory findings, absence of systemic signs, and viable intraoperative tissues, while mechanical causes were excluded by stable fixation and confirmed fracture union [2,3].

This differs from cases with early systemic hypersensitivity, such as that reported by Kruckeberg, *et al.* where hardware removal was performed early due to acute allergic manifestations [6]. In contrast, our patient underwent implant removal only after fracture healing was confirmed, allowing definitive treatment without compromising stability [6].

Implant removal is considered the mainstay of treatment once union is achieved, and resolution of symptoms following removal further supports the diagnosis of hypersensitivity [3,8]. In cases where fixation is still required, alternative materials such as titanium or hypoallergenic implants may be considered [5]. However, in our case, fracture union allowed definitive management with simple implant removal without need for revision fixation [3].

Clinical implications

The main clinical implication is that implant hypersensitivity should be considered in cases of persistent or unexplained wound complications when common causes do not adequately explain the clinical picture [4,5]. Although uncommon, the literature consistently highlights diagnostic delay due to its nonspecific presentation [5].

Comparison with previous reports demonstrates that implant hypersensitivity may present in multiple patterns: early systemic allergic reactions, dermatologic manifestations, or localized wound complications as seen in our patient [6-9]. Recognizing these patterns may help clinicians consider the diagnosis earlier and avoid unnecessary prolonged antibiotic use or repeated interventions [5].

Limitations and Future Directions

The main limitation of this case is the absence of confirmatory diagnostic testing such as patch testing [4]. However, current evidence suggests that such tests lack reliability and should be interpreted cautiously [4,5]. The clinical course, particularly symptom resolution following implant removal, remains the strongest indicator supporting the diagnosis [3].

Future research is needed to establish standardized diagnostic criteria and to determine the role of preoperative screening in selected patients, particularly those with known metal allergies or prior unexplained implant complications [5].

Conclusion

Persistent wound complications following ankle ORIF in the absence of infection or mechanical failure should raise suspicion for less common etiologies such as metal hypersensitivity [4,5]. Compared with previously reported cases, our patient demonstrated a delayed and localized presentation without systemic features, expanding the clinical spectrum of this condition [6-9]. Implant removal following fracture union may serve both diagnostic and therapeutic roles, leading to resolution of symptoms and improved outcomes [3].

Ethics Statement

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Conflict of Interest

The authors declare no conflicts of interest.

Bibliography

1. Schepers T, *et al.* "The timing of ankle fracture surgery and the effect on infectious complications: A case series and systematic review of the literature". *International Orthopaedics* 37.3 (2013): 489-494.
2. Zhang Y, *et al.* "Risk factors for wound complications following open reduction and internal fixation of ankle fractures". *Journal of Orthopaedic Surgery and Research* 19 (2024): 96.
3. Teo WZW, *et al.* "Metal hypersensitivity reactions to orthopedic implants: A review". *Dermatitis* 34.1 (2023): 12-20.
4. Thomas P, *et al.* "Hypersensitivity to orthopedic implants: A review of the literature". *Allergy* 77.2 (2022): 385-399.
5. Cristofaro C, *et al.* "Metal hypersensitivity in foot and ankle orthopaedic surgery: A systematic review". *Journal of Clinical Orthopaedics and Trauma* 44 (2023): 102249.
6. Kruckeberg BM, *et al.* "Severe metal hypersensitivity following internal fixation of an ankle fracture: A case report". *JBJS Case Connector* 7.2 (2017): e38.

Citation: Hatim AlShareef, *et al.* "Chronic Non-Healing Wound After Ankle ORIF Resolved by Implant Removal: Suspected Metal Hypersensitivity". *EC Orthopaedics* 17.6 (2026): 01-08.

7. Thomas P, *et al.* "Impaired wound-healing, local eczema, and chronic inflammation following titanium osteosynthesis in a nickel- and cobalt-allergic patient: A case report and review of the literature". *The Journal of Bone and Joint Surgery. American Volume* 93.11 (2011): e61.
8. Phedy P, *et al.* "Hypersensitivity to orthopaedic implant manifested as erythroderma: Timing of implant removal". *International Journal of Surgery Case Reports* 49 (2018): 110-114.
9. Ajarrag S and Torchon M. "Suspected hypersensitivity reaction to titanium screws following Kalish osteotomy for hallux valgus". *Cureus* 18.3 (2026): e104709.

Volume 17 Issue 6 August 2026

©All rights reserved by Hatim AlShareef, *et al.*