Case Report

Nickel Allergy Requiring Plate Removal after Implantation of Stainless Steel and Titanium Plates after Polytrauma

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Abstract

The patient was a 23-year-old female involved in a motor vehicle collision. She sustained a left humerus fracture and a left posterior wall acetabular fracture, for which she underwent open reduction and internal fixation with stainless steel implants and titanium implants, respectively. At her postoperative visits, she had erythema and itching along the humeral incision. She returned to the operating room for revision fixation with a titanium implant and reported the resolution of her symptoms. Metal hypersensitivities (MHSs) resulting in surgical complications in orthopedic trauma are rare. Patients should be screened for a history of MHS before implant selection.

Keywords: Metal hypersensitivity, nickel allergy, polytrauma

Introduction

The challenges regarding metal hypersensitivity (MHS) in orthopedic surgery patients are increasingly important to understand because the incidence of MHS and usage of metallic implants continue to increase.[1,2] Evidence suggests that up to 25% of arthroplasty patients have nickel-related allergic contact dermatitis, which is the most common MHS.[1] However, the clinical consequence and treatment of MHS regarding metallic orthopedic implants remain controversial and unknown, as surgical complications directly attributable to MHS represent a diagnostic challenge and are typically a diagnosis of exclusion.[3] Evidence of MHS resulting in postoperative complications following orthopedic trauma surgery remains extremely rare.

In this article, we describe a polytrauma patient with a documented nickel allergy who sustained concomitant ipsilateral humerus and acetabular fractures that underwent open reduction internal fixation (ORIF) with stainless steel and titanium plates, respectively. Ultimately, she required the replacement of the stainless steel plate due to symptoms related to suspect MHS.

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Case Report

The patient was a 23-year-old female who presented with trauma activation after involvement as an unrestrained driver of a motor vehicle that struck a tree at high speed. Following clinical and radiographic evaluation by the general surgery trauma service, the patient was found to have two orthopedic injuries: a left mid-shaft humerus fracture and a left posterior wall acetabular fracture. Otherwise, the patient was hemodynamically stable without oxygen requirements, and there was no clinical or radiographic evidence of intracranial or solid organ injury. Evaluation by both the general surgery trauma and orthopedic surgery services on hospital day 0 resulted in similar records of the patient's past medical history, which included attention deficit hyperactivity disorder,

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gastroesophageal reflux disorder, and no known allergies. Given the patient's time of presentation late in the evening, she was scheduled for a left humerus ORIF and left hip evaluation under anesthesia (EUA) the following morning. The anesthesia service evaluated the patient on hospital day 0 after the surgery was scheduled, and records indicated that the patient noted a hive reaction to nickel at that time. Neither the general surgery trauma nor the orthopedic surgery services were notified.

On hospital day 1, the patient was taken to the operating room (OR) as scheduled. During the OR timeout, the orthopedic surgery service became aware of the patient's reported nickel allergy for the first time. The decision was made to proceed and the left hip EUA demonstrated a grossly unstable hip joint, while the left humerus ORIF was completed using stainless steel implants based on the availability of implant types at the time of surgery. After recovery from anesthesia, the patient confirmed a hive reaction to nickel-containing jewelry to the orthopedic service. The patient underwent ORIF of her acetabular fracture on hospital day 2, and titanium implants were acquired and utilized. She was then discharged on hospital day 6 with a follow-up scheduled for 2 weeks. The patient did not have any documented complaints and the physical examination was unremarkable before discharge.

Thirteen days following fixation of her humerus, the patient called the on-call orthopedic surgery resident stating that she had been having left upper extremity swelling and pain. She denied wound dehiscence or drainage and constitutional symptoms but specifically expressed concern that her symptoms might be related to her nickel allergy. Reassurance was offered, and the patient agreed to wait for clinical evaluation at her scheduled clinic appointment. At her appointment, she was continuing to complain of left arm pain, redness, and swelling. It was recorded that she had superficial dehiscence of her left upper extremity wound, while her left lower extremity incision was well-healed. After shared decision-making with the patient, the plan was to continue to monitor the left arm wound with repeat follow-up in 4 weeks. At this appointment (approximately 7 weeks postoperatively), her left upper xtremity incision had healed, however, there was reported urticaria as well as notable erythema and keloid formation [Figure 1]. X-rays of the left humerus demonstrated a healing humeral shaft fracture without hardware complication. Her acetabular incision healed without complications; there was no erythema, drainage, or keloid formation [Figure 2]. Again, shared decision-making concluded a plan for continued observation.

Two weeks later (approximately 9 weeks postoperatively), the patient again called and now reported intermittent drainage from her left arm wound with continued urticaria and edema, but no constitutional symptoms. A follow-up appointment was promptly arranged. At her appointment several days later, she had a keloid scar on her left upper extremity with erythema and reported urticaria, although no active drainage. Given the patient's continued signs of erythema, keloid formation, symptoms of urticaria, and reported drainage, she was taken to the OR approximately 10 weeks postoperatively for plate removal, scar excision, and possible titanium implant replacement.

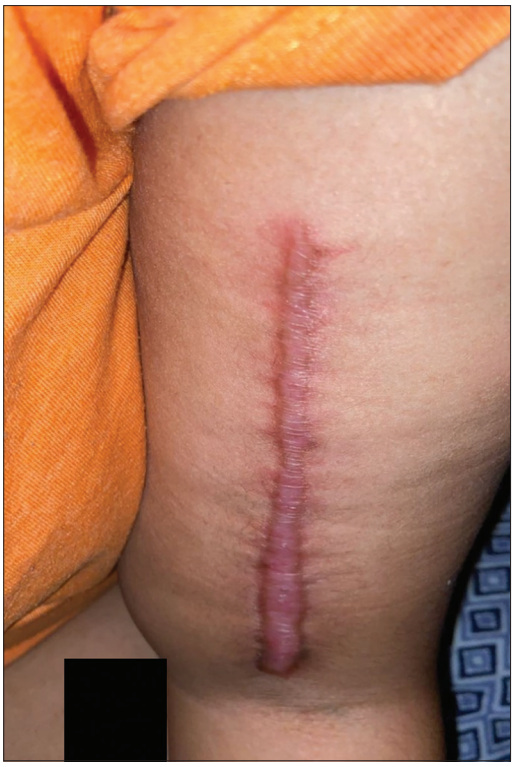

Figure 1: Left arm wound at 6-week follow-up appointment with edema and mild superficial dehiscence

During this procedure, no fluid collections were encountered and all encountered tissues were viable. The humerus fracture was healed primarily across the medial border with persistent fracture lines around the remaining humerus circumference with a small amount of associated callous. A titanium plate was placed due to the evidence of incomplete healing. Aerobic and anaerobic tissue cultures were obtained from surrounding callous, which were ultimately negative. At her first follow-up appointment 2 weeks later, she reported that she was doing very well and that her recovery from this surgery was much easier and there were no wound healing issues. She was seen again 3 months after the revision procedure, and she noted complete resolution of her previous symptoms and the clinical examination demonstrated a well-healed surgical incision [Figure 3]. Radiographs demonstrated a humeral shaft fracture with routine healing and no hardware complication.

Discussion

The typical presentation of MHS to orthopedic implants includes persistent postoperative pain, swelling, and skin changes that may mimic postoperative infection.[3-5] Although 10%–25% of the population exhibit metal-related allergic contact dermatitis,[1,6] documented cases of postoperative complications relating to MHS are exceptionally rare.[3,4] Within the orthopedic trauma literature, a recent case series

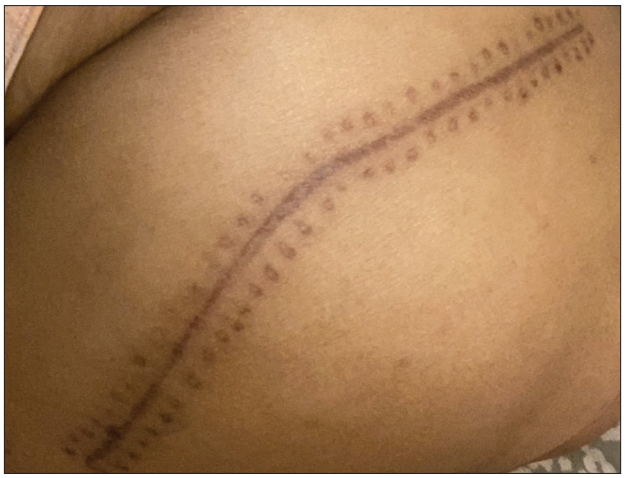

Figure 2: Left hip wound at 6-week follow-up appointment with appropriate healing

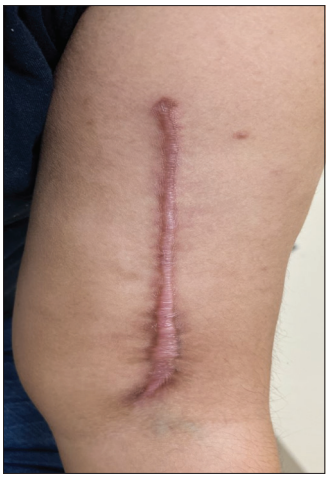

Figure 3: Left arm wound 3 months following revision procedure

highlighted four patients with complications of orthopedic implants that were suspected to be due to MHS.[4] Only one patient had a documented nickel allergy, which was discovered after the implantation of a stainless steel plate as in our case. Similar to our case, one patient underwent fixation of two different fractures (tibia and clavicle), but fixation of both fractures was performed with a stainless steel plate. In this instance, only the tibial plate developed symptoms of dermatitis 4 years postoperatively, which improved with plate removal and intraoperative cultures were negative. Furthermore, there was a wide range in postoperative timing of symptom onset, with two patients noting pain or skin changes at 5–9 weeks, and the two others noting changes >2 years postoperatively.[4]

Our case highlights the importance of appropriately screening patients for any history of MHS. A recent survey of orthopedic surgeons found that only 11% of respondents frequently screen patients for MHS, which was defined as directly questioning the patient or reviewing the patient's medical record for the history of MHS.[7] Baumann and Crist[4] noted that the optimal method for avoiding postoperative issues relating to MHS is to routinely question patients preoperatively if they have any known MHS or reactions to cosmetic jewelry. Furthermore, trauma surgeons might consider incorporating this screening question into the series of questions posed to patients upon entering the OR since metal-related allergies reviewed during the surgical time out obviate the opportunity to directly question the patient and shorten the time available to acquire titanium or carbon fiber implants.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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