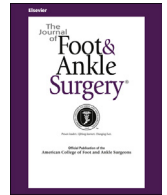




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Case Reports and Series

Long-Term Fever After Hallux Valgus Surgery Secondary to Titanium Allergy: A Case Report and Review of the Literature

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ABSTRACT

We present the case of a patient who had experienced a fever of unknown cause for >7 months after surgical treatment for hallux valgus. A patch test revealed a positive reaction to a titanium alloy. All symptoms subsequently disappeared after we removed the implanted titanium screws. Histopathologic examination of the tissue surrounding the screws showed macrophage infiltration in the tissue. For >1 year after removal of the titanium screws, the patient's body temperature remained <37°C. These results support a diagnosis of titanium allergy in our patient. To the best of our knowledge, a long-term fever caused by an allergic reaction to mini-titanium screws of such a small size has not been reported. A review of 16 cases of titanium allergy reported in the published data confirmed that titanium allergy is extremely rare and that the clinical symptoms can vary. Titanium allergy should be suspected when a patient presents with a fever of unknown cause, delayed wound healing, dermatitis, or impaired fracture healing after internal fixation with titanium materials. A patch test for titanium or the lymphocyte transformation test could offer guidance for the clinical diagnosis of titanium allergy. Finally, we recommend that all patients should be asked whether they have a history of an allergy to any metal before surgery.

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Titanium (Ti) alloys are widely used in orthopedic implants, and a few reports of hypersensitivity reactions to Ti-based materials have been published. Thus, few studies have investigated the mechanisms and outcomes of hypersensitivity to Ti (1). Ti is known to be highly corrosion resistant owing to the formation of thermodynamically stable and adherent oxide layers on the Ti surface (2,3); therefore, Ti is not expected to provoke allergic reactions (4). However, we report the case of a patient who presented with a long-term fever of unknown cause after surgical treatment for hallux valgus and was ultimately diagnosed with a Ti allergy. The purpose of the present clinical report was to demonstrate that even small Ti screws can induce an allergic reaction; thus, the patch test for Ti could be useful in the clinical diagnosis of this condition.

Case Report

An 18-year-old male patient presented with a prolonged low-grade fever that had lasted >7 months after surgical treatment for left hallux

valgus. For transfer metatarsalgia caused by left hallux valgus, the patient had undergone Scarf and Akin osteotomy with 24-mm Extremifix cannulated screws (YZB [medical device registration product standard], standard 0105-2013, as reported by the manufacturer, Double Co., Xiamen City, China) in our hospital 22 months previously. He reported the onset of fever 7 days after the first surgery without any signs of infection. The fever was intermittent, with his temperature remaining <38.5°C. By 2 weeks after surgery at suture removal, the patient had experienced good wound healing and satisfactory pain relief (Fig. 1). The radiographic examination showed that the fracture had healed by 3 months after surgery (Fig. 2A). The patient was satisfied with the deformity correction and pain relief and ignored the fever, because his body temperature never exceeded 38°C.

Because of the good curative effect of the surgical treatment of the left hallux valgus, the patient underwent surgical treatment for right hallux valgus in our hospital 5 months after the first surgery. The treating orthopedists were not aware of the patient's ongoing fever. The patient also experienced good wound healing and pain relief after the second surgery (Fig. 1). However, the fever began to occur more frequently, with the patient's temperature fluctuating from 37°C to 39°C. Anti-infection therapy with levofloxacin tablets (0.1 g given 3 times daily) had no effect on the fever, and symptomatic management had only short-term effects.

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Fig. 1. Good wound healing and deformity correction after surgical treatment for hallux valgus.

A series of related laboratory tests were conducted; however, the results of all examinations, including the erythrocyte sedimentation rate, C-reactive protein level, and levels of antibodies against cytomegalovirus IgM, were normal. Moreover, normal results were observed for the complete blood count, blood culture, urinalysis and culture, rheumatoid factor, lactate dehydrogenase, creatinine kinase, antinuclear antibodies, and appropriate region-specific serologic testing. Also, no sign of pneumonia or other infectious lung disease was seen on the chest computed tomography examination. We consulted our hematologic department and infectious disease department and conducted related examinations, including a bone marrow examination and anticytoplasmic autoantibody analysis. Because the results of these examinations were also normal, the cause of the fever remained unknown.

One day, the patient reported itching and erythema on contact with a watch or metal buttons. Thus, we questioned whether the implant material used in the surgical treatment of hallux valgus could



Fig. 3. The patch test outcome on the patient's right forearm showing a local eczematous contact allergic reaction to titanium alloy after 48 hours.

have caused an allergic reaction. We used a mini-Ti plate (obtained from Double Company, China) to perform a patch test. Patch testing was performed according to the guidelines of the German Contact Dermatitis Research Group (5), and the reaction was evaluated after 48 hours.

The patch test revealed a local eczematous contact allergic reaction to the Ti alloy after 48 hours (Fig. 3). We later repeated the patch test 2 days after the disappearance of the allergy symptoms, and the results were the same. Because the radiographic examination confirmed fracture healing (Fig. 2), the titanium screws were removed completely with consent from the patient (Fig. 4). No signs of chronic inflammation or hypotoxic infection were observed in the deep tissue during surgery (Fig. 5). A sample of the tissue surrounding the screws was collected for histopathologic examination, which showed macrophage infiltration into the tissue (Fig. 6). After the surgery, we did not administer anti-infection or corticosteroid therapy, because we wished to observe the effect of screw removal on the patient's



Fig. 2. Radiologic evaluation at 3 months after osteotomy showing bone healing in the (A) left and (B) right feet.

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