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CASE REPORT

Titanium hypersensitivity in a patient with a titanium medical implant

Hipersensibilidade ao titânio num doente com um implante médico de titânio

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Abstract

A 53-year-old male patient with priors of psoriasis suffered a left tibial plateau fracture and underwent open reduction and internal fixation with a titanium plating system. He had no history of atopy or contact-hypersensitivity reactions to metals. Almost 1 year later, the patient continued to have chronic pain and edema at the site of the implant. On examination, the patient had a well-healed surgical incision on the left leg without erythema or induration but with tenderness to touch and two fluctuating nodular lesions. Subsequent allergy patch testing revealed an allergy-positive reaction to nickel sulfate, titanium oxalate and sodium tetrachloropalladate. The patient was diagnosed with titanium hypersensitivity secondary to recent implantation. The patient underwent hardware removal with a resolution of the complaints. The allergic risk of titanium material is smaller than that of other metal materials. Positive patch test reactions to titanium are rare and a negative patch does not exclude the diagnosis. Preimplant patients should be asked about a history of hypersensitivity reactions to metals and patch testing should be recommended for those who have experienced such reactions.

Keywords: Allergy. Medical implant. Patch testing. Titanium. Titanium hypersensitivity.

Resumo

Descreve-se o caso de um doente do sexo masculino de 53 anos, com antecedentes pessoais de psoríase, que sofreu uma fratura do prato tibial esquerdo, e foi submetido a uma redução aberta e fixação interna fixação interna com um implante de titânio. O doente não referia história prévia de atopia ou reações de hipersensibilidade a metais.

Um ano após a cirurgia, o doente mantinha queixas de dor crónica e edema no local do implante. Ao exame dermatológico, era visível uma incisão cirúrgica linear bem cicatrizada na perna esquerda, sem eritema ou endurecimento, mas com aumento da sensibilidade ao toque e com 2 lesões nodulares móveis. Testes epicutâneos revelaram uma reação alérgica positiva ao sulfato de níquel, oxalato de titânio e tetracloropaladato de sódio. O doente foi diagnosticado com hipersensibilidade ao titânio secundário à recente colocação do implante de titânio na perna. O doente foi submetido a extração do material, com resolução das queixas. O risco de alergia ao titânio é mais pequeno do que com qualquer outro metal. Reações positivas nos testes epicutâneos são raras e um teste negativo não exclui o diagnóstico. Os doentes que vão ser submetidos a cirurgias

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para colocação de implantes metálicos devem ser questionados acerca de história pessoal passada de reações de hipersensibilidade a metais e os testes epicutâneos pré-operatórios devem ser recomendados àqueles que têm estes antecedentes.

Palavras-chave: Alergia. Hipersensibilidade ao titânio. Implante médico. Testes epicutâneos. Titânio.

Introduction

Titanium has been considered to be a nonallergenic material, so it has been used in orthopaedic and spinal surgery, pacemakers, clips, coils and dental implants. Recent studies have reported rare cases of metal allergy caused by titanium-containing materials.

There are no standardized diagnostic tests and titanium allergy is often a diagnosis of exclusion.

We present a rare case of a confirmed metal allergy to a titanium plating system.

Case report

We describe the case of a 53-year-old male patient with priors of psoriasis, controlled with topical therapy. He had no history of atopy or contact reactions to metals.

The patient suffered a left tibial plateau fracture after a fall and underwent orthopedic surgery for open reduction and internal fixation with a titanium plating system. There were no complications during surgery or in the immediate postoperatory period. The patient was discharged, with indications to complete a physiotherapy treatment plan which he began right away and completed after a few months, with regained mobility and muscle strength.

Almost 1 year later, the patient was referred to the dermatology department as he continued to complain of chronic pain and edema at the site of the implant on the left leg with two subcutaneous nodules that had developed 3 months after the surgery.

On dermatological examination, the patient had a linear surgical scar on the left leg without erythema or induration but with tenderness to touch and two fluctuating soft and elastic subcutaneous skin-colored nodules beneath the distal part of the scar. These nodules were mobile with the movements of the leg muscles (Fig. 1). There was no evidence of infection, loosening or failure of the metal plate.

In order to exclude a hypersensitivity reaction, patch testing was performed with the baseline series and an extended metal series (Chemotechnique diagnostics, Vellinge, Sweden). Readings were performed on the day (D) 3 and D7, according to European Society of Contact Dermatitis guidelines.

On D3, there were positive reactions to nickel sulfate 5% pet (++), titanium (IV) oxalate hydrate 5% pet (++), sodium tetrachloropalladate (II) hydrate 3% pet (+) and rhodium (III) chloride hydrate 2% pet (++). At D7 persisted the positive reactions to nickel sulfate 5% pet (++), titanium (IV) oxalate hydrate 5% pet (++) and sodium tetrachloropalladate (II) hydrate 3% pet (+), supporting the hypothesis of titanium hypersensitivity secondary to the recent implantation (Fig. 2-3).

Figure 1. Well-healed linear surgical incision on the left leg with two fluctuating subcutaneous nodular lesions beneath the distal part of the incision.

The patient underwent removal of the titanium plating system on the left leg and 1 month after surgery, there was complete healing with no inflammatory signs, no pain or functional limitations, and the nodular lesions are no longer perceptible.

Discussion

Titanium is considered the most biocompatible metal due to its corrosion resistance, bio-inertness, osseointegration capacity and high fatigue limit. Therefore,

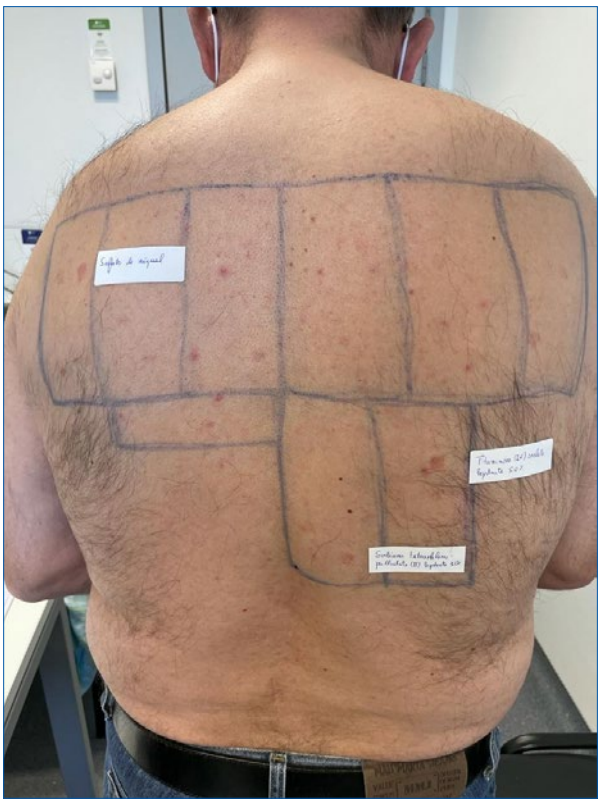

Figure 2. Result of patch testing at D7-allergy-positive reaction to nickel sulfate, titanium (IV) oxalate hydrate 5% and sodium tetrachloropalladate (II) hydrate.

Figure 3. Result of patch testing at D7-allergy-positive reaction to titanium (IV) oxalate hydrate 5% and sodium tetrachloropalladate (II) hydrate.

it is widely used in the medical field, such as plastic surgery, dental implants, pacemakers, neurosurgery and orthopedic surgery, significantly increasing exposure to this rare metal[1,2].

Despite its known biocompatibility, several studies have reported cases of suspected and confirmed allergic reactions to titanium salts, including two Portuguese case reports[3-12]. Most are related to dental implant prostheses and screw fixation systems. One case occurred in a patient with allergic contact dermatitis who had dental implant prostheses and who exhibited allergic symptoms after orthopedic surgery[2].

In our case, the patient had no priors of atopy or contact reactions to metals and developed the symptoms after an orthopaedic surgery with the implantation of a titanium plating system.

Allergic reactions to titanium described in the literature are varied and include rash, urticaria, pruritus, oedema, eczematous lesions, hyperplastic lesions of soft tissue, impaired healing fractures, pain, and necrosis around the implants[9]. However, most instances of titanium allergy appear as dermatitis around titanium products and symptoms resolve after the removal of the offending agent[13].

In this case, the patient displayed pain, oedema and subcutaneous lesions on the site of the titanium implant, which raised the suspicion of titanium allergy.

Diagnosing titanium allergy is complicated because of the low sensitivity and specificity of the diagnostic tests available. The skin patch test has not yet been developed as the valid standardized test for titanium allergy and positive reactions to titanium have only rarely been demonstrated with skin testing[14]. The most widely used patch test preparation is titanium dioxide, but some studies suggest using other titanium salts as alternative reagents, such as 0.1 and 0.2% titanium sulfate in water solution or 0.1 and 0.2% titanium chloride pet[15], 0.1% titanium tetrachloride[2] or titanium oxalate hydrate 5% pet, but it is yet to be confirmed which is the most adequate.

In this case, we used titanium oxalate hydrate 5% pet and obtained a positive test reaction at D3 that persisted at D7, ruling out irritation.

Before surgical implants, patients should be asked about a history of reactions to metals and patch testing should be recommended for those who have experienced such reactions.

Funding

None.

Conflicts of interest

None.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

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