Severe generalized dermatitis in a nickel-allergic patient with a popliteal artery nitinol stent

Andres Guerra, BS, *and* Melissa Kirkwood, MD, *Dallas, Tex*

We present the case of a patient who developed a full-body desquamating macular-papular, pruritic rash after endovascular placement of a popliteal artery nitinol stent for acute limb ischemia. The rash was resistant to high-dose steroid and immunosuppressive treatment and intensive topical treatment. Patch testing revealed nickel allergy. The stented arterial segment was removed, with significant improvement in his symptoms that allowed the cessation of prednisone and topical treatments. The epidemiology, pathophysiology, and clinical effect of nickel allergy are discussed in addition to the use of nickel-alloy stents. (J Vasc Surg Cases and Innovative Techniques 2017;3:23-5.)

Nitinol stents are increasingly being placed in lower extremity arteries for peripheral vascular disease. Nickel is a common allergen in patients with contact dermatitis and is the predominant component of nitinol.[1] Allergic reaction to nitinol stents can be challenging to diagnose and has only recently been considered in the literature.[1-4] We present the case of a patient who developed a treatment-resistant full-body desquamating macular-papular, pruritic rash after endovascular placement of a popliteal artery nitinol stent for acute limb ischemia. The patient has consented to publication of this case report.

CASE REPORT

The patient is a 44-year-old man who has worked long-term in avionics. He had no known allergies. His medical history is significant for transient ischemic attacks, positive lupus anticoagulant antibody, and a patent foramen ovale (PFO) that was treated with percutaneous closure. His vascular history is significant for a presumed left popliteal artery embolus treated with an uncovered bare metal stent at another hospital. At that time the patient was prescribed Plavix (Sanofi, Bridgewater, NJ), but had multiple readmissions for recurrent stent thrombosis and acute limb ischemia.

Within 1 month of the initial stenting, the patient developed a pruritic, full-body desquamating macular-papular rash, including his palms and soles. The rash was initially diagnosed as eczema but proved resistant to high-dose oral prednisone and topical therapies. The patient underwent a bypass from the femoral artery to the below-knee popliteal artery with reversed great saphenous vein at another hospital, with the initiation of Coumadin (Bristol-Myers Squibb, Princeton, NJ). The rash continued to worsen, and he was referred to dermatology at our institution.

A previous biopsy specimen suggested a drug reaction. Medications predating the rash consisted only of alprazolam. Initially, all medications were discontinued, and he was temporarily prescribed enoxaparin sodium for his hypercoagulability. Subsequent patch testing revealed a nickel allergy. Occupational exposure was considered; however, he had no new exposures to metals and wore gloves when handling wiring. The rash worsened, requiring daily coverage with full-body petroleum and a triamcinolone layer and a special occlusive suit to be worn for 12 hours a night. In addition, he was being treated with high-dose prednisone and mycophenolic acid.

After extensive evaluation with experts in contact dermatitis, the stent was presumed to be the underlying etiology, and the stent was explanted 2 years after implantation. Intraoperative findings revealed a dense inflammatory reaction around the popliteal artery. A posterior approach was used to remove 15 cm of thrombosed popliteal artery and the stent (Figs 1 and 2). The patient had undergone a prior bypass; therefore, further revascularization was not necessary.

Pathology demonstrated fibrointimal proliferation without evidence of vasculitis. Postoperatively, the patient's dermatitis significantly improved, and he no longer required prednisone or the triamcinolone ointment occlusive suit. At the 2-year follow-up, the patient continued to a have intermittent rash recurrences that were less severe and presumptively from exposure to other nickel-containing products, including bottled alcoholic beverages and increased occupational metal exposure.

DISCUSSION

Information regarding sensitivity reactions to endovascular and cardiovascular metal implants mostly comes from case reports. These cases have demonstrated a delayed-type hypersensitivity reaction to metals, including in-stent restenosis, inflammation, or allergic contact dermatitis (ACD) after placement of devices such as cardiac pacemakers and intravascular stents.[1] ACD is the most common form of metal hypersensitivity. Metals in contact with biologic fluid release ionic compounds that function as haptens. Haptens induce the expression of intercellular adhesion molecule 1 on

From the University of Texas Southwestern Medical Center.

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Correspondence: Andres Guerra, BS, 5006 Cedar Springs Rd, Apt F, Dallas, TX 75235 (e-mail: andres.guerra@utsouthwestern.edu).

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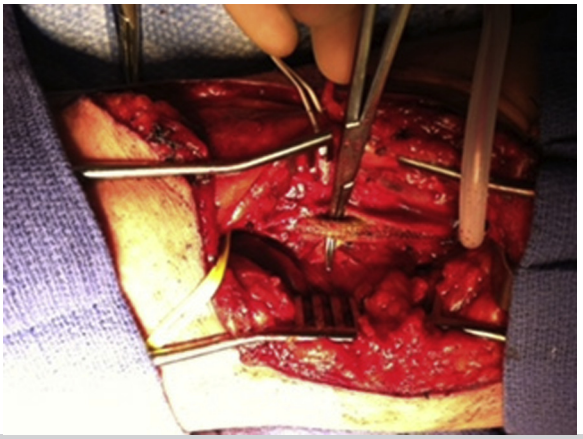

Fig 1. Overhead intraoperative view of the left popliteal fossa shows the popliteal artery and the accompanying nitinol stent.

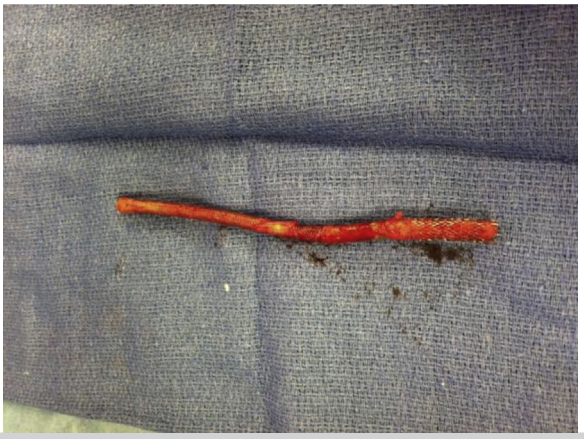

Fig 2. Gross pathology specimen consisting of 15 cm of the thrombosed left popliteal artery and the stent.

endothelial cells, which stimulates inflammatory cells and causes neointimal hyperplasia leading to intraluminal stent occlusion or stenosis.[1,2]

Nickel is the most common metal allergen, and up to 17% of women and 3% of men are allergic to nickel.[3] ACD has two phases: the induction phase, with initial sensitization to the allergen, and the elicitation phase, when re-exposure to the allergen causes cutaneous inflammation. The induction phase is usually caused by commercial products containing nickel, and the elicitation phase in some patients may be related to internal metallic implants.[2] The stents mostly used in the United States contain 316L stainless steel, which contains chromium (20%), nickel (8.3%-35%), and molybdenum (2%-3%); these stents are available as bare metal or drug eluting.[4] Nitinol (55% titanium, 45% nickel) stents and stents made of cobalt, chromium (27%-30%), molybdenum (5%-7%), and nickel (<0.5%) are also common. Although nitinol stents release the least amount of nickel compared with stents made of cobalt, chromium, and nickel alloys, or 316L stainless steel, they are more commonly used in peripheral vascular disease.[1,2] There are limited data on serum nickel levels when these individual stents are used, and a rare number of manufacturers cite the incidence or prevalence of reactions to their nickel products.

In addition, closure devices for atrial septal defects and PFOs have been developed with nitinol, and elevated blood levels of nickel in patients days after implantation of such devices have been demonstrated. Ries et al[5] evaluated patients with the Amplatzer (St. Jude Medical, St. Paul, Minn) occluder composed of nitinol and demonstrated an increased serum nickel level of 1.50 ng/mL ≤1month. Ries et al[5] and an additional case report[6] demonstrated a systemic allergic reaction after atrial septal defect closure that required device explantation. Stent reaction has also been reported in connection with in-stent stenosis. Koster et al[4] demonstrated that 100% of patients positive on a nickel patch test with 316L stainless steel coronary stents had in-stent restenosis 6 months after implantation.

Gimenez-Arnau et al[7] documented a nickel-allergic patient who developed a generalized eczematous dermatitis 3 weeks after abdominal aortic aneurysm repair with a nitinol Vanguard (Boston Scientific Corp, Marlborough, Mass) endograft. More recently, two case reports have been published detailing a localized rash with pruritus involving the ipsilateral lower extremity after placement of a nitinol stent in the femoral artery. Both patients were found to be allergic to nickel and had resolution of symptoms with stent removal.[8,9] Our patient, as these two patients,[8,9] had an early-onset reaction after stent placement.

Our patient, however, had a much more debilitating presentation, with full-body involvement that was resistant to high-dose systemic and topical therapy. Work in the avionics industry manipulating metal wiring or prior PFO closure with a possible nickel-containing device, or both, may have predisposed him to the initial phase of nickel sensitization. Because he did not develop symptoms until a few days after the popliteal artery nitinol stent and because he improved drastically after stent removal, explantation of the PFO closure device was not pursued. Our patient had such a profound reaction that he still occasionally experiences cutaneous outbreaks after small amounts of nickel exposure. However, the immediate response after stent explantation with cessation of prednisone and topical treatment in the occlusive suit supports that stent removal was therapeutic.

Although many nickel implants are used, not all patients with nickel allergy will develop contact dermatitis, as evidenced by the few case reports on the subject. Considering the rarity of such allergic events, stenting should be undertaken after these patients are informed of this as a risk during routine consent.

CONCLUSIONS

This case serves to raise awareness among vascular surgeons about the possibility of reactions from metallic stent implants, to highlight the importance of screening patients with an extensive history of hypersensitivity reactions like atopy or known metal allergies, and to promote the use of metallic patch testing in patients after stenting who develop postimplant pain, implant failure, or unexplained cutaneous reaction.[10,11]

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