

Eosinophilic Cellulitis and Panniculitis with Generalized Vesicular Pustular Id Reaction after a Molten Aluminum Burn

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Hypersensitivity reactions to aluminum are rare. Sensitization has been reported during the continuous application of aluminum-containing antiperspirants or after the injection of aluminum-adsorbed vaccines and allergen extracts containing aluminum. We report a rare case of a nonhealing ulcer at the site of an accidental molten aluminum burn that showed changes of eosinophilic cellulitis and panniculitis histologically. This process was followed by a generalized vesicular and pustular id reaction. The reactions resolved after 1 month of systemic corticosteroid therapy. Two months later, there was a relapse with bullae over the burn scar, accompanied by a pruritic oozing rash on the ears and face; the lesions were controlled again with systemic corticosteroid treatment. The clinicopathologic features suggest that the eosinophilic cellulitis with panniculitis and id reaction in the present case represents an unusual allergic reaction to aluminum. Aluminum allergy may be considered as a possible underlying process in the setting of eosinophilic cellulitis with panniculitis and id reaction.

ALUMINUM is a fairly inert metal with a multitude of uses based on its strength and light weight. Hypersensitivity reactions to aluminum are rare. Sensitization may occur following the topical use of aluminum-containing antiperspirants^{1,2} or after the injection of aluminum-adsorbed vaccines³⁻⁶ or aluminum-containing allergen extracts.⁷ The allergic reaction manifests either as persistent granuloma at the injection site or as recurrent eczema. We are not aware of reported cases of eosinophilic cellulitis (EC) following local aluminum exposure. In this report, we describe a case of EC with panniculitis following an accidental molten aluminum burn to the patient's left foot and the subsequent development of a generalized vesicular and pustular id reaction.

Case Report

A 40-year-old Taiwanese man presented to our dermatology clinic with a 2-month history of a 4 × 4 cm ulcerated plaque (Fig 1) on the dorsal aspect of his left foot and a

6-week history of generalized vesicles and pustules. The ulcer was caused by a molten aluminum burn while he was



Figure 1. A 40-year-old Taiwanese man presented with a 4 × 4 cm ulcerated plaque on the dorsum of the left foot.

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Figure 2. Generalized vesiculopustular eruption.

working at an aluminum factory. The wound was treated with normal saline and povidone-iodine ointment at local clinics. Unfortunately, the wound healing was poor; 2 to 3 weeks later, pruritic vesicles and pustules began to appear on his legs and feet, later spreading to the whole body (Fig 2). He was otherwise healthy and had no history of allergy or recent exposure to drugs or vaccines.

Routine hematologic and biochemical investigations revealed mild leukocytosis (9700/cmm) with eosinophilia (17.3%). Wound cultures yielded coagulase (–) *Staphylococcus*. A skin biopsy specimen from the large ulcer on the left foot showed an ulcer covered by a purulent and fibrinous crust containing abundant eosinophils mixed with multiple oval-shaped particles with a grayish blue metallic sheen (Fig 3). The dermis showed a dense perivascular and interstitial infiltrate of eosinophils, lymphocytes, and neutrophils, with flame figures surrounded by multinucleated histiocytes and eosinophils (Fig 4). A similar infiltrate was present in the subcutaneous tissue. No lymphoid follicles were present. EC with panniculitis was diagnosed. The biopsy specimen from a pustular lesion on the patient's back

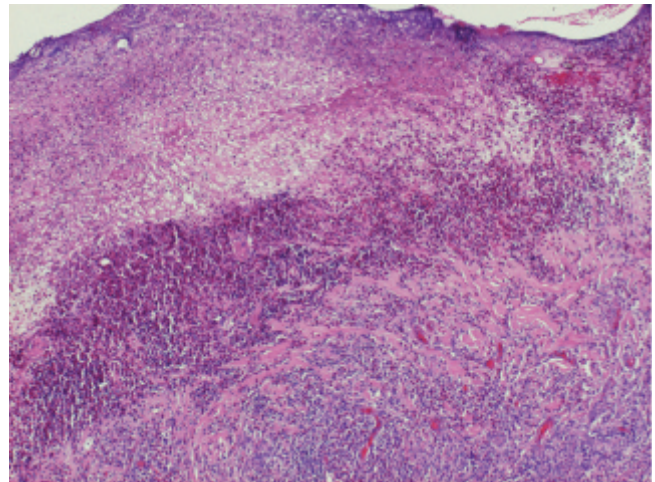


Figure 3. A skin biopsy specimen from the ulcerated plaque on the patient's left foot, revealing an ulcer with dense perivascular and interstitial infiltrate of lymphocytes, and neutrophils with abundant eosinophils in the dermis (hematoxylin and eosin staining, $\times 40$ original magnification).

showed eosinophil-rich perifollicular infiltrate with a subcorneal pustule containing neutrophils and eosinophils (Fig 5).

Together with the histopathology findings, the clinical features suggest that the EC and panniculitis and the vesicular and pustular id reaction might represent an unusual hypersensitivity reaction to aluminum. The reaction and the ulcer improved with systemic steroid therapy (dexamethasone 10 mg intramuscularly per week for 8 weeks and prednisolone 10 mg qd for 3 weeks and 5 mg qd for 1 week) and antihistamines as well as topical betamethasone cream. There were episodes of minor flare-

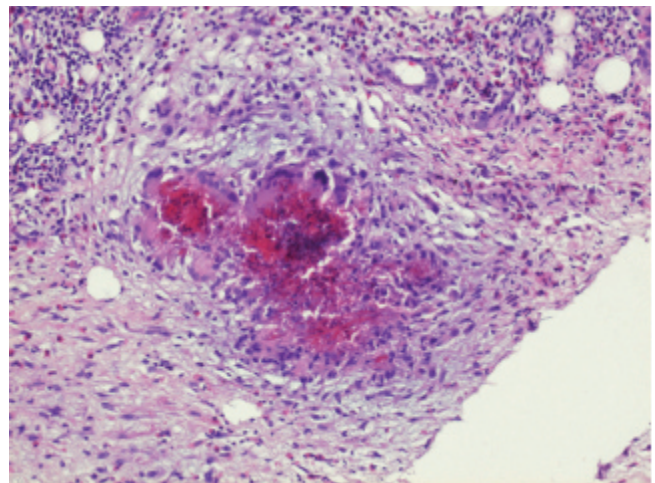


Figure 4. Flame figures surrounded by multinucleated histiocytes and eosinophils in the skin biopsy specimen (hematoxylin and eosin staining, $\times 100$ original magnification).

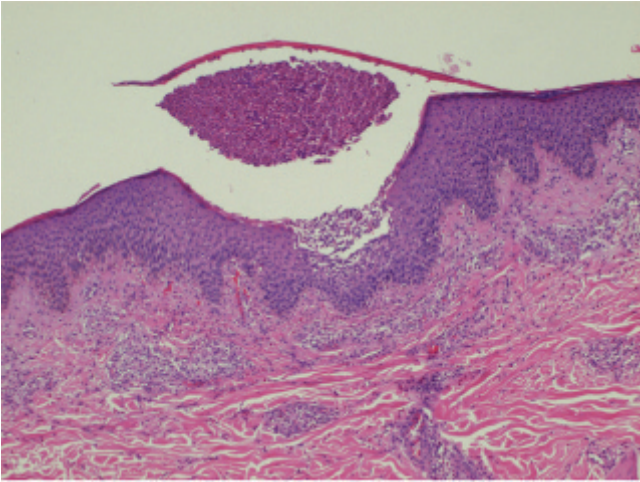


Figure 5. The biopsy specimen from a pustular lesion on the patient's back shows an eosinophil-rich perifollicular infiltrate with a subcorneal pustule containing neutrophils and eosinophils (hematoxylin and eosin staining, $\times 40$ original magnification).

up during the course of treatment, responding to short-term increment of oral prednisolone. The patient was lost to follow-up for 2 months but returned to the clinic when he experienced a recurrence of bullae over the previous burn scar, accompanied by a pruritic oozing rash on the ears and face. The lesions again improved after systemic steroid and antihistamine treatment. A patch test had been arranged but was not performed because the patient had left the country to work overseas. A follow-up interview by telephone confirmed that there was no recurrence during the ensuing 6 years.

Discussion

We report a case of EC and panniculitis with vesiculopustular id reaction following an accidental molten aluminum burn. Except for vaccination site granulomas, allergic reactions to aluminum and its salts are uncommon. We are not aware of reports of EC after local aluminum exposure. In the present case, however, history of exposure to aluminum, the time course, and the known ability of aluminum to cause allergic reactions led us to suspect that the EC and panniculitis with vesiculopustular id reaction represented an unusual allergic reaction to aluminum. Although topical povidone-iodine is known to cause contact dermatitis, we did not consider povidone-iodine allergy to be the cause of the reaction in the present case for several reasons. First, this patient had no history of povidone-iodine allergy, and this agent was used only for the initial wound care. Second, the ulcer on the left foot was not surrounded by eczematous changes, which

are typically seen in cases of allergic contact dermatitis caused by topical agents. Third, the allergic reaction lasted several months, much longer than contact dermatitis caused by povidone-iodine lasts. Such cases usually resolve quickly after a couple of weeks of systemic corticosteroid therapy.

Reactions to aluminum metals and their salts range from irritant dermatitis caused by topical antiperspirants to allergic reactions.⁸ The latter occur either (1) as persistent granulomas after the injection of aluminum-absorbed vaccines or aluminum-containing pollen extracts or (2) as recurrent eczema. The purpose of using aluminum adjuvant in vaccines is to prolong the absorption process. The vaccine-induced granulomas usually last only a few weeks.³⁻⁵ Similar granulomas have been induced experimentally in guinea pigs by fine-grained aluminum oxide alone or combined with vaccines. However, no granulomas were induced when either large-grained salt or vaccine was used alone.⁹ In a review of 31 patients with vaccine-induced persistent granulomas, patch tests were performed in only four cases; of those, only one had a positive result.⁴

The histology of allergic granulomas from aluminum has been studied in animals and humans. In guinea pigs, granulomas that were induced by the injection of colloidal (aluminum hydroxide) showed a mixed infiltrate of lymphocytes, histiocytes, eosinophils and giant cells, fibrotic bands, and eosinophilic necrosis in the center of the granuloma.¹⁰ Injection-site granulomas in humans are characterized by lymphoid follicles and granuloma formation with central granular debris surrounded by lymphocytes, histiocytes, plasma cells and eosinophils, and fibrosis in the deep dermis and subcutaneous tissue.^{3,5,11,12} An unusual reaction manifesting angiolymphoid hyperplasia with eosinophilia has also been reported as following tetanus toxoid vaccination.¹³

The first case of contact allergy to aluminum was reported by Clemmensen and Knudsen.¹ The allergy manifested as recurrent axillary eczema caused by a topical antiperspirant, and the eczema flared up when the patient was undergoing hyposensitization with aluminum-precipitated pollens. This patient had a positive patch-test reaction to aluminum salt powder, and red infiltrated rings to the Finn Chambers (Epitest Ltd Oy, Tuusula, Finland) were observed. Veien and colleagues described three children who had a generalized itchy rash and a positive patch-test reaction to aluminum chloride 2% aqueous.¹⁴ All three children used the same kind of toothpaste, which contained 30 to 40% aluminum oxide. Contact sensitivity to aluminum acetate ear drops has also been reported.¹⁵

The allergic reaction in our case is unique in several ways. Although aluminum has been reported to cause ordinary thermal burn at foundries¹⁶ and to cause eczematous lesions in workers exposed to aluminum dust and filings in an aircraft manufacturing plant,¹⁷ the accidental burn by molten aluminum in the present case resulted in a nonhealing ulcer, with subsequent development of a generalized vesiculopustular id reaction 2 weeks after the initial burn. The time course was consistent with a hypersensitivity reaction following an initial sensitization to aluminum. Histopathologically, eosinophilic infiltrate is commonly observed in aluminum granulomas as well as in eosinophilic interstitial lung disease following environmental exposure to aluminum salts and hard metals.¹⁸ The eosinophilic infiltrate in the present case, however, was particularly dense and extensive in the dermis and in the subcutaneous tissue, with the formation of flame figures. These findings are consistent with EC and panniculitis.

EC is a hypersensitivity response to various antigens. It has been observed in association with various disorders (including dermatophytosis¹⁹ and myeloproliferative disorders), insect bites, and drugs.²⁰ Hypersensitivity with mixed inflammatory infiltrate containing eosinophils has been reported in patients who have a second-generation metal-on-metal hip-joint prosthesis.²¹ EC has also been reported as a recurrent dermatitis overlying a Zimmer modular hip prosthesis.²² Eosinophilic panniculitis is characterized by a prominent infiltration of subcutaneous fat with eosinophils. Gnathostomiasis, leukocytoclastic vasculitis, and erythema nodosum appear to be the most common conditions associated with eosinophilic panniculitis. Other associated disorders include atopic dermatitis, contact dermatitis, EC, injection granuloma, arthropod bites, streptococcal and other bacterial infections, toxocariasis, and B-cell and T-cell lymphomas.²³

Conclusion

We report an unusual case of a nonhealing ulcer with a severe generalized vesiculopustular id reaction following an accidental molten aluminum burn. The ulcer showed eosinophilic cellulitis (EC) and panniculitis histopathologically. The clinicopathologic features suggest that the EC with panniculitis and id reaction in our case represents an unusual allergic reaction to aluminum. Aluminum allergy should be included among the potential causes in the setting of EC and id reaction.

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