Cutaneous delayed-type hypersensitivity in patients with atopic dermatitis

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Background: Literature on the relationship between atopic dermatitis (AD) and cutaneous delayed-type hypersensitivity is inconclusive.

Objective: We sought to compare the rates of positive patch test reactions to allergens on the North American Contact Dermatitis Group (NACDG) standard tray among patients with and without AD, and, to assess whether atopic patients in our database were more likely to patch test positive to certain classes of allergens.

Methods: A total of 2305 patients underwent patch testing to the NACDG standard screening series. The incidence of positive patch test reactions among patients with AD (n = 297) and without AD (n = 2008) was assessed. Statistical analysis was done using a χ^2 test with Yates continuity correction.

Results: Compared with nonatopic patients, those with AD were statistically more likely to have positive patch tests. AD was associated with contact hypersensitivity to nickel, cobalt, and chromium, but was not associated with contact sensitization to fragrances.

Limitations: Only patients suspected of having allergic contact dermatitis were tested. Our population was geographically limited to metropolitan Kansas City (including Kansas City, MO, Kansas City, KS, and the adjoining suburbs).

Conclusion: Compared with nonatopics, patients with AD are significantly more likely to have at least 1 positive patch test reaction and to develop contact hypersensitivity to metal allergens. (J Am Acad Dermatol 2013;69:232-7.)

Key words: allergy; atopic eczema; chromium; cobalt; contact dermatitis; hypersensitivity; nickel; patch testing.

Atopic dermatitis (AD), also known as atopic eczema, is a chronic inflammatory skin condition whose prevalence is increasing in the general population.[1] It has been reported that up to 30% of children and between 2% and 10% of adults experience AD.[2] In addition, 50% to 80% of those with AD will go on to develop asthma or allergic rhinitis later in life; these conditions are termed the "atopic triad," and are believed to be T helper cell type 2 (Th2)-mediated processes.[3,4]

Cutaneous delayed-type hypersensitivity (CDTH) is a T cell–mediated hypersensitivity response that presents as allergic contact dermatitis with pruritic, eczematous lesions. Nickel is the most common nonplant allergen to cause contact sensitization in

Abbreviations used:

AD:	atopic dermatitis
CDTH:	cutaneous delayed-type hypersensitivity
FLG:	filaggrin
NACDG:	North American Contact Dermatitis Group
Th:	T helper cell
TLR:	Toll-like receptor

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the general population, with an estimated prevalence of 8.6% worldwide.[5]

There is ongoing debate in the literature regarding the relationship between AD and contact dermatitis.[6-8] A literature review by Spiewak[6] found numerous contradictory statements on the relationship between atopy and contact dermatitis; several studies have found that patients with AD have reduced contact sensitivity to allergens,[8-12] whereas others have found a positive relationship between AD and contact sensitivity.[7,13-15] Still other studies, including that by Spiewak,[6] have found atopy and contact dermatitis to be independent.[16-18]

Those who have found a positive relationship between AD and CDTH suggest that the dry, inflamed skin of people with atopic eczema requires frequent application of emollients, corticosteroids, and antibacterial creams that may result in contact sensitization to those allergens.[19] In addition, disruption of the cutaneous barrier, as is present in AD, may promote the inflammatory conditions that lead to contact sensitization. Those whose findings support that people with AD are less likely to develop delayed-type hypersensitivity response believe that, in AD, the balance between Th1 and Th2 immune responses is skewed in favor of Th2, thus decreasing the ability of the immune system to mount a Th1-mediated, delayed hypersensitivity response to contact allergens.[20]

There have also been reports that certain allergens are more likely to generate CDTH responses in atopic populations.[19,21,22] Danish[19] and German[22] studies have noted that fragrances were statistically more likely to result in a positive patch test in people with AD. Thus, it is often suggested that atopic patients minimize their exposure to fragrances.

Given the current understanding of the relationship between AD and CDTH, we were curious to examine 3 areas of study. First, we aimed to further assess the relationship between AD and CDTH as measured by positive allergic patch test reactions, regardless of relevance, in patients undergoing patch testing for suspected allergic contact dermatitis. Second, we wanted to determine the most common allergens to generate positive patch tests among those with and without AD in our study population. And finally, we assessed trends in the incidence of positive reactions to allergens found in patients with and without AD.

CAPSULE SUMMARY

- The relationship between atopic dermatitis and cutaneous delayed-type hypersensitivity is currently in dispute.
- We found that, compared with nonatopic patients, those with atopic dermatitis have a higher incidence of at least 1 positive patch test reaction to a standard screening series. Atopic individuals were significantly more likely to exhibit cutaneous delayed-type hypersensitivity to metal allergens.
- Health care practitioners should counsel atopic patients to minimize cutaneous contact with metals and, especially, to avoid piercing and tattooing.

METHODS

Between July 1, 1994, and June 30, 2012, a total of 2305 patients, who presented with a clinical suspicion of allergic contact dermatitis, underwent patch testing to the NACDG's standard allergen series by the senior author in both Kansas City, KS, and New York, NY. Before patch testing, all patients completed a standardized questionnaire regarding demographic, medical, and occupational data. Atopic status (dermatitis, asthma, hay fever) was assessed in all patients; the diagnosis of AD was established using the criteria of Hanifin and Rajka.[23]

Patients were patch tested in a standardized manner using Finn Chambers (Epitest Ltd Oy, Tuusula, Finland) on Scanpor tape (Bard Medical, Covington, GA).[24] Patch tests were applied to areas of the back free of dermatitis. In general, patients with active dermatitis involving 25% or more of body surface area were not patch tested because of the enhanced possibility of false-positive ("angry back") reactions. Test allergens were purchased from Chemotechnique Diagnostics AB, Malmö, Sweden (1994–2007), or from SmartPractice, Calgary, Alberta, Canada (2008–2012). Allergens were applied on Mondays, and patients were examined at days 2 and 4 after placement. Reactions were assessed based on morphology as previously described.[24] Reactions scored as a 1+, 2+, or 3+ were considered a positive allergic response.

All deidentified Health Insurance Portability and Accountability Act–compliant data were entered, retrieved, and evaluated using a computer database (Access 2010, Microsoft Corp, Seattle, WA) and this study was therefore considered exempt from institutional review board approval at Columbia University Medical Center, New York, NY. The incidence of contact sensitization to any allergen, to metal allergens (nickel sulfate, cobalt chloride, and potassium dichromate), and to fragrances (fragrance mix I and balsam of Peru) among patients with AD (n = 297) and without AD (n = 2008) was assessed. A χ^2 test was conducted to test whether the difference