

Countering Staphylococcus Overgrowth During Patch Testing in Children with Moderate to Severe Atopic Dermatitis

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Abstract

Background: Patients with moderate to severe atopic dermatitis (AD) often have a concurrent diagnosis of contact dermatitis, but patch testing in these patients presents a unique set of challenges. Barrier impairment and *Staphylococcus aureus* colonization and infection, along with the sealed occlusion that takes place during the patch testing procedure, can create an optimal environment for bacterial overgrowth.

Aims: To identify patients at risk for *S. aureus* overgrowth during patch testing and provide pre- and peripatch testing interventions to aid clinicians in obtaining the best possible patch test results in this complicated population.

Materials and Methods: A retrospective review was performed of five patients with moderate to severe AD for which *S. aureus* overgrowth and superinfection complicated patch test evaluation.

Results: All five patients were able to complete the patch test procedure and all had relevant positive patch test reactions. Complications during patch testing included erythema, oozing, foul odor under the patches, and purulent material at the patch sites. One patient had a culture performed during patch testing that showed methicillin-sensitive *S. aureus*.

Discussion: Patch testing can play an important role in the examination and management of patients with refractory AD.

Conclusions: Moderate to severe AD and concern regarding *S. aureus* overgrowth should not preclude patch testing.

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Atopic dermatitis (AD) results from the disruption of skin barrier and immune function. As the disease progresses, the ability to differentiate between AD and contact dermatitis (CD) (irritant and allergic types) becomes exceedingly difficult because these eczematous states frequently coexist. Furthermore, the impaired barrier function seen in AD predisposes to the development of CD. Numerous studies have shown that clinically relevant contact allergies are not uncommon in children and adolescents with AD. For this reason, patch testing “should be considered in the management of dermatitis in individuals with atopic disease” (1).

Approximately 90% of patients with AD are known to be colonized with *Staphylococcus aureus* (2,3). The occlusive environment inherently established by epicutaneous patch testing, along with barrier impairment and *S. aureus* colonization can create an optimal environment for bacterial overgrowth and secondary infection, resulting in more complicated patch test evaluation. Herein we discuss a retrospective review of five patients with moderate to severe AD with complications of *S. aureus* overgrowth and the management interventions needed to complete their patch test evaluations.

METHODS

A retrospective chart review was performed of five children with moderate to severe AD, suspected allergic CD and patch testing complicated by staphylococcal superinfection. The same team of providers, who had completed intensive training in patch testing, performed all patch testing at Rady Children’s Hospital, San Diego. Patient characteristics including age,

sex, severity of AD, and history of skin infection were recorded. Further relevant data points included clinical features suggesting staphylococcal overgrowth, any culture results, interventions, and positive patch test reactions.

RESULTS

Patient 1

n 8-year-old girl with moderate to severe AD presented for evaluation of coexistent CD. Patch testing was performed using the methodology established by the International Contact Dermatitis Research Group, with application of the patch test and removal and performance of a preliminary reading at 48 hours followed by an additional delayed reading at 72 to 120 hours (4). At the time of patch removal at 48 hours, she was noted to have significant erythema, oozing, and foul odor under the patches without fever or systemic symptoms (Fig. 1). A culture was performed and cephalexin (350 mg three times a day, 50 mg/kg/day for 10 days) was pre-emptively started. It was also recommended that she wear loose cotton clothing (no nylon or polyester), use aseptic soaks (Table 1), and treat the areas of flare (not patch sites) using topical corticosteroids and emollients. The resulting culture showed methicillin-sensitive *S. aureus* (MSSA). The patient completed patch testing and had significant improvement in erythema and crusting at the time of the delayed read at 120 hours. She was found to have positive reactions to fragrances, formaldehyde, colophony, cocamidopropyl betaine, wool wax alcohols, and bronopol. With avoidance measures of confirmed allergens in place, she had

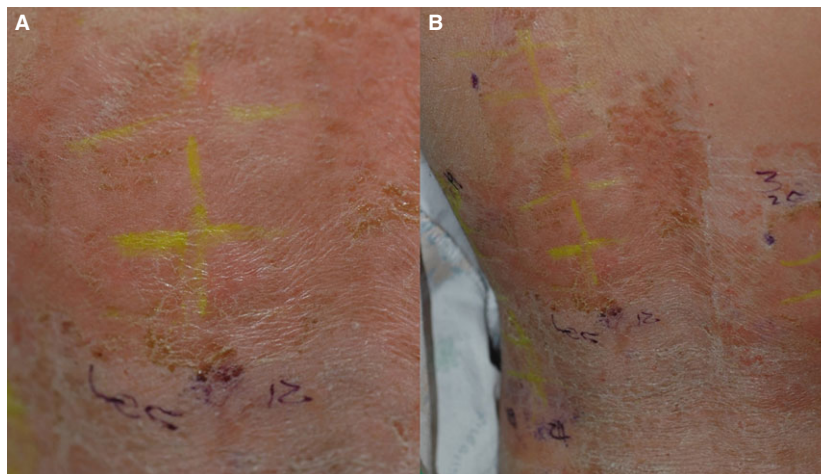


Figure 1. Erythema and crusting at the 48-hour patch removal visit.

TABLE 1. Patient Characteristics and Results of Patch Testing

Age, yrs	Sex	Atopic dermatitis severity	Eczema area and severity index score	History of infection	Culture-proven colonization	Evidence of overgrowth*	Intervention†	Reactions
8	Female	Moderate to severe	N/A	Superinfected and colonization	MSSA	Erythema and crusting	Cephalexin, aseptic soak‡	Fragrance, formaldehyde, colophony, cocamidopropyl betaine, wool wax alcohols, bronopol
13	Female	Severe	44.8	Superinfected	MSSA	Erythema, oozing, foul odor, crusting	Cephalexin, aseptic soak‡	Quaternium-15, bronopol, parthenolide
10	Female	Moderate	N/A	Superinfected	No	Erythema, oozing, foul odor	Cephalexin, aseptic soak‡	Nickel, potassium dichromate
11	Male	Moderate	6.4	Superinfected	<i>Staphylococcus aureus</i> , unknown sensitivity	Erythema and crusting	Clinical monitoring	Nickel, neomycin
14	Female	Moderate to severe	20.6	Folliculitis	No	Erythema, oozing, foul odor, crusting	Cephalexin, fresh-water rinse	Nickel, quaternium-15, paraphenylenediamine, formaldehyde, bacitracin, parthenolide, bronopol, fragrance

MSSA, methicillin-sensitive *Staphylococcus aureus*; N/A, not available.

**Staphylococcus aureus* overgrowth in these cases did not interfere with patch testing.

†All patients were advised to treat areas of flare (not patch sites) with topical corticosteroids and emollients and to wear loose cotton clothing, no nylon or polyester.

‡Aseptic soak in 0.0005% to 0.025% bleach bath for 10 minutes (no soap) with a freshwater rinse, no soap after the 48-hour patch removal visit.

some improvement but required systemic therapy with azathioprine to ultimately clear her dermatitis.

Patient 2

A 13-year-old girl with chronic severe AD was evaluated for CD. At the 48-hour patch removal visit, she was noted to have oozing, foul odor, and purulent material at the patch site. Because she had had a remote (>6 mos) history of MSSA, she was empirically treated with oral cephalexin and advised to take dilute bleach baths, which consisted of a gentle soak in a bath solution of one-quarter cup of bleach in a full bath tub of water (a concentration of approximately 0.0025%) for 10 minutes/day on days 3 and 4 of the patch testing. She was instructed not to soap or scrub her back but was permitted to soak in a dilute bleach bath, followed by a freshwater rinse, with instructions to pat dry gently (not to rub). She was able to continue with the patch testing and was found to have clinically relevant positive reactions to quaternium-15, bronopol, and parthenolide. Institution of avoidance measures correlated with overall dermatitis improvement.

Patients 3 to 5

Three additional patients with similar presentations and management during patch testing are described in Table 1.

DISCUSSION

Patch testing can play an important role in the examination and management of patients with refractory AD. Moderate to severe AD and concern regarding *S. aureus* overgrowth should not preclude patch testing. A recommended approach to patch testing in such patients is shown in Fig. 2. To allow for more effective patch testing in these patients, measures should be taken to decrease bacterial load and improve the skin barrier before patch application (5–8).

The cleansing regimen should include the use of nonalkaline soaps to maintain acidic pH and retain the acid mantle (5) (see Table 2 for examples of nonalkaline soaps). Patients with AD may have a lower threshold for irritancy (9). Likewise, decreasing chronic barrier insult from potentially irritating substances in the personal care regimen can be an

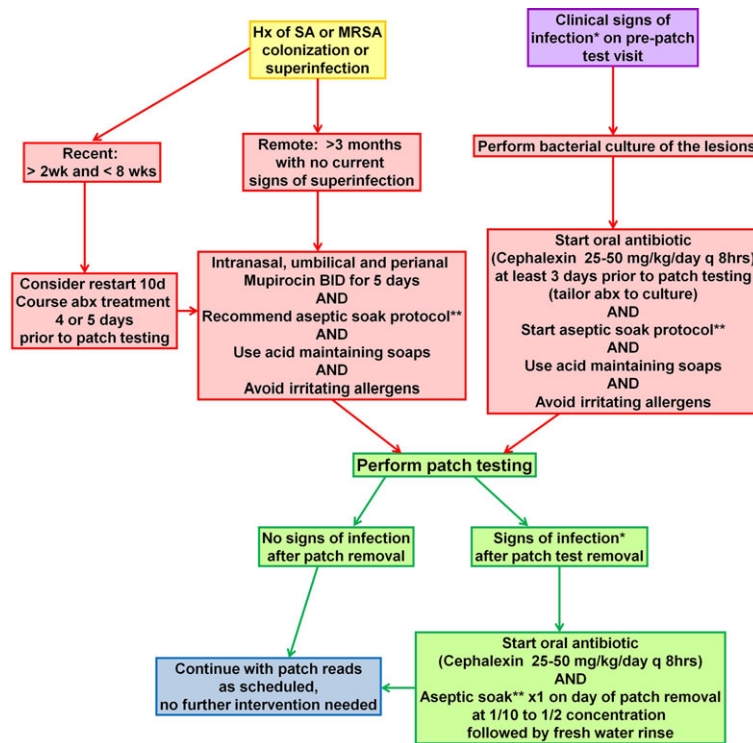


Figure 2. Flow chart for management of suspected/confirmed *Staphylococcus aureus* superinfection or colonization prior to patch testing patients with atopic dermatitis. *Signs of superinfection: weeping, oozing, crusting, pustules, furuncles. **Aseptic soak protocol: 0.005% bleach bath or sodium hypochloride wash three times a week and stop 4 days prior to patch testing. NOTE: Back can also be submerged in aseptic soak; however, no soaping or scrubbing the back and follow with a freshwater rinse and patch dry.

TABLE 2. Prepatch Recommendations

For 3 wks before patch testing	Preemptively avoid “irritating allergens” Fragrances Cocamidopropyl betaine Formaldehyde Use lipid-replenishing emollients (containing ceramides, pseudoceramides, filaggrin degradation) all over the body, including the back (not day of test) Use nonalkaline soaps to maintain acidic pH and retain the acid mantle (e.g., Cetaphil Gentle Cleansing Bar, Dove Sensitive Skin Bar Soap, Aveeno Moisturizing Bar Soap) Treat dermatitis areas with adequate topical corticosteroid therapy before patch testing (no steroids to patch area for 7 days)
Other	History of methicillin-sensitive <i>Staphylococcus aureus</i> colonization, see algorithm in (Fig. 2) In patients undergoing ultraviolet treatment, hold for 2 wks at patch site, all other sites okay Consider antifungal treatment for head and neck atopic dermatitis in adolescents

important adjunct measure. In the “supersensitive skin care regimen,” the irritating allergens cocamidopropyl betaine, fragrance, and formaldehyde are preemptively avoided for a minimum of 3 weeks before

patch testing (10). Barrier repair should be supported by incorporating lipid-replenishing emollients (containing ceramides, pseudoceramides, or filaggrin-degradation products) all over the body, including the back, preferably for a minimum of 3 weeks before patch testing, although not on the day of testing (6).

Before patch testing, it is important to ask about any prior history of infection or colonization with *S. aureus* and to evaluate clinically for any possible signs of superinfection that would require antibiotic therapy. The authors also recommend that patients with a history of superinfected AD be evaluated for nasal carriage of *S. aureus* and treated with intranasal mupirocin twice daily for the first 5 days of each month (see algorithm in Fig. 2) (11). Aseptic soaks using sodium hypochlorite at a concentration of 0.005% for 10 minutes/day three times per week at least 1 week before patch testing can also be used to decrease bacterial load (8). Because of the potential for xerosis and irritation, these should be stopped 4 days before patch testing. At the time of aseptic soaks, all towels, sheets, and pajamas should also be disinfected with high-temperature washing and bleach



Figure 3. Outline areas of dermatitis before applying patch tests.

to prevent recolonization from these items. Another consideration for patients with head and neck lesions, especially adolescents (and adults), is the potential for colonization and immune reactivity to *Malassezia* (12,13). In these cases, a preemptive trial of topical antifungal using ketoconazole shampoo can be considered.

To minimize false-negative and -positive results, it is imperative to treat the dermatitis before patch testing with adequate topical corticosteroid therapy. Before initiating steroid therapy, it can be beneficial to document and photograph the most-active dermatitis areas; although these may clear before patch testing, when possible, avoid applying allergen patches to these focal points because of the potential for flare in these areas. Requirement of oral corticosteroids for control of dermatitis should not preclude patch testing, but the lowest dose possible should be used,

because a dose of 20 mg in a 75-kg male is known to significantly suppress patch test reactions (14). Application of mid- to high-potency topical steroids should be continued on “hot spots” during patch testing, ideally 2.5 cm away from patches, and preferably a total body surface area of less than 15% to 20% should be treated to minimize systemic effects. Systemic absorption of topical steroids has been shown to lead to rapid and sustained suppression of endogenous cortisol production, increase fasting insulin levels, and elevate levels of polymorphonuclear leukocytes in otherwise healthy individuals with psoriasis treated with potent topical corticosteroids on as little as 40% of the body surface area (15).

Evaluation of the final patch test reactions can be difficult in patients with moderate to severe AD because of baseline dermatitis and, as previously discussed, potential overgrowth of *S. aureus*, both of which can obscure patch test reactions. When evaluating these patients, it is important to have marked the areas of the most intense dermatitis at the time of patch application (so as to avoid putting patches near a potential flare site) and then evaluate these again at patch removal and the final evaluation to look for progression and flare (Fig. 3). It is also necessary to monitor the baseline dermatitis. When evaluating patch test reactions, palpation for induration is critical. First, the baseline dermatitis should be palpated, then the patch application squares, looking for areas of induration and effectively “subtracting background.” When there is background baseline dermatitis, relying on erythema and scale as markers of patch site inflammation may be problematic. Induration is the most reliable feature.

Moisture under the patches can also lead to fading and even complete disappearance of the markings used to indicate patch locations. In such

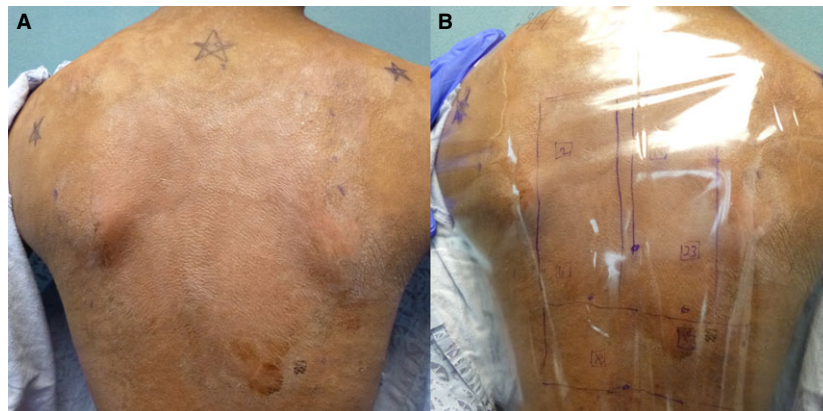


Figure 4. Use of a nonadherent translucent scribing sheet.

patients, it can be helpful to use a nonadherent transparent scribing sheet to indicate the location of the patches in relation to natural or drawn-in landmarks (Fig. 4) (16). Photographs and outline grid markings can also be useful in identifying patch locations at follow-up visits. Lastly, because patients with AD can have a lower irritant threshold, it is important to perform delayed reads (>96 hours) to reduce the likelihood of reading irritant reactions as positives (9).

The diagnosis of coexisting CD can play a significant role in the management of patients with moderate to severe AD. Although the potential for *S. aureus* overgrowth can complicate patch testing, the use of appropriate preemptive measures and peripatch interventions can allow for more effective patch testing in this population.

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