Allergic contact dermatitis induced by zinc pyrithione in shampoo: a case report

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KEYWORDS
Allergic contact dermatitis
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Shampoo
Zinc pyrithione

ABSTRACT
Shampoo-induced allergic contact dermatitis is difficult to diagnose clinically because it can involve multiple and variable areas where the shampoo flows. Zinc pyrithione is a common active agent in medicated shampoo that is known to have good anti-dandruff and antifungal effects. Despite its low risk of sensitization, cases of allergic contact dermatitis still occur because of the popularity of such products. We report a 33-year-old man who developed pruritic rash on his scalp, face, neck, and hands after using a new shampoo containing zinc pyrithione. A patch test revealed a positive reaction to zinc pyrithione and personal shampoo containing zinc pyrithione.

Introduction
Shampoo is the most commonly used hair product on the market. Although it is quickly rinsed away and it is not in contact with skin for a long period, shampoo-induced allergic contact dermatitis is still the third leading cause of patients’ own product-related scalp dermatitis. Numerous ingredients are added to satisfy different kinds of hair characteristics and customers’ demands.

Zinc pyrithione is a common active ingredient with a low potential of irritation and sensitization in antidandruff shampoo; it is often recommended for individuals with seborrheic dermatitis or psoriasis. Two mechanisms of antidandruff effects have been studied: (1) zinc pyrithione is an antifungal{4}{4}agent that interferes with the primary proton pump in fungus membranes; and (2) zinc pyrithione has cytotoxic effects on rapidly proliferating epidermis cells. Despite its frequent and widespread use, very few cases of zinc pyrithione-induced allergic contact dermatitis have been documented. We present a case of allergic contact dermatitis due to a shampoo containing zinc pyrithione, which was further confirmed by a positive patch test result.

Case report
A 33-year-old male cement worker who had no history of atopic diseases or drug allergy presented to our emergency room because of itching edematous erythema and erythematous papules over his scalp, forehead, eyelids, ears, nape, neck, wrists, and hands (Figure 1). This patient had been suffering from increasing dandruff for years. Before the onset of the skin rash, he had begun using a new anti-dandruff shampoo (Anti-Dandruff Conditioning Shampoo, manufactured by Procter & Gamble Co., Cincinnati, OH, USA) containing 0.45% of zinc pyrithione. He denied use of hair dye recently. Under the impression of contact dermatitis to the new shampoo or cement dust that he was exposed to at work, a topical steroid and oral hydroxyzine were given and skin lesions gradually resolved.

One month after he began taking medication, a patch test was performed with European Standard Series, common shampoo allergens (Chemotechnique Diagnostics, Malmo, Sweden), and personal shampoo. Readings were carried out on days 2, 3 and 7, according to the International Contact Dermatitis Research Group recommendations. The patient had positive reactions to zinc pyrithione, the 2% and 5% dilution of his new shampoo containing zinc pyrithione (Figure 2 and Table 1). The results of the tests with diluted shampoo (2% and 5% aq.) were negative in five healthy
volunteer controls. A positive reaction to cocamidopropyl betaine of common shampoo allergens was also noted in the patient, but his shampoo did not contain cocamidopropyl betaine. Allergic contact dermatitis to zinc pyrithione was diagnosed.

After the patient stopped using the shampoo containing zinc pyrithione, he had no recurrence of the dermatitis.

**Discussion**

The clinical diagnosis of shampoo-induced allergic contact dermatitis is difficult because of its multiple and variable distribution. It can present as either scalp dermatitis, eyelid dermatitis, facial dermatitis, neck dermatitis, dermatitis of the upper trunk, and even hand dermatitis, or a combination of these. In fact, the reaction can occur on any surface that is exposed to the shampoo. Since many shampoos are quite similar in their ingredients, changing from one suspected shampoo to another may not relieve or improve the symptoms.

The identification of definite allergens in each case is also challenging. Most shampoos contain numerous ingredients, ranging from 4 to 30 ingredients in one shampoo alone. Many ingredients are not included in routine patch test series. Patch tests with personal products may help to identify the causative allergens. Interpreting the results of patch tests also requires much care because of a high false-positive rate.
Of all products applied on the scalp, irritant and questionable patch test reactions occur most frequently in hair cleaning products because of their unusually long stay and occlusive conditions in patch tests. Selection of a proper diluted concentration and using a control group can improve the accuracy of patch tests.

The allergens most commonly present in shampoos are fragrance, cocamidopropyl betaine, methylchloroisothiazolinone/methylisothiazolinone, formaldehyde releasers, propylene glycol, vitamin E, parabens, benzophenones, iodo-propynyl butylcarbamate, and methyldibromoglutaronitrile/phenoxyethanol preservatives. Compared with the widespread and frequent use of zinc pyrithione in anti-dandruff shampoos, allergic contact dermatitis to zinc pyrithione is extremely rare. The positive patch test rate of zinc pyrithione ranges from 0.2% to 1.2%.

After reviewing the related English literature, we found nine additional reports (12 patients) of allergic contact dermatitis caused by zinc pyrithione. In all patients, the zinc pyrithione-containing products were shampoos. Most cases presented with scalp dermatitis and often there was widespread involvement of the face, neck, shoulders, upper trunk, and hands where the shampoo may come into contact. The skin lesions were generally eczematous. In two patients with psoriasis, it presented as acute exacerbated pustular psoriasis with Koebner’s phenomenon after contact dermatitis caused by zinc pyrithione. Yates and Finn reported one case of photosensitivity dermatitis and actinic reticuloid syndrome following contact dermatitis to zinc pyrithione. However, the causative relationship of photosensitivity is controversial and this phenomenon was not noted in any of the other cases.

Calnan reported the cross-reactivity of zinc pyrithione, piperazine, hydroxyzine hydrochloride, and ethylenediamine hydrochloride. In our patient, hydroxyzine was prescribed to relieve symptoms. No aggravation or new skin lesions was found.

In conclusion, dermatologists should be aware of possible shampoo-induced allergic contact dermatitis, especially diffuse dermatitis involving the scalp, face, neck, upper trunk, and hands. Patch tests should be performed with available shampoo allergens and personal shampoos to screen for possible allergens. Careful exclusion of false-positive reactions and testing with a control group may also help clarify allergens. Patients must be educated to read the ingredients of shampoos carefully and to avoid allergens. In patients allergic to zinc pyrithione, cross-reactivity with piperazine, hydroxyzine, and ethylenediamine hydrochloride may occur.

Table 1  Patch test results.

<table>
<thead>
<tr>
<th>Tested substance</th>
<th>Concentration (%)</th>
<th>Vehicle</th>
<th>Results*</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>European standard series</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shampoo allergens</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc pyrithione</td>
<td>1.0</td>
<td>pet.</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td></td>
</tr>
<tr>
<td>Resorcinol</td>
<td>1.0</td>
<td>pet.</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>Chloroacetamide</td>
<td>0.2</td>
<td>pet.</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>Cocamidopropyl betaine</td>
<td>1.0</td>
<td>aq.</td>
<td>(+)</td>
<td>(+)</td>
<td>(+)</td>
<td></td>
</tr>
<tr>
<td>2-Bromo-2-nitropropane-1,3-diol</td>
<td>0.25</td>
<td>pet.</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>Captan</td>
<td>0.5</td>
<td>pet.</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>4-Chloro-3-cresol (PCMC)</td>
<td>1.0</td>
<td>pet.</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>4-Chloro-3-xylenol (PCMX)</td>
<td>0.5</td>
<td>pet.</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>Imidazolidinyl urea (Germall 115)</td>
<td>2.0</td>
<td>aq.</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>Diazolidinyl urea (Germall II)</td>
<td>2.0</td>
<td>aq.</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
<td>(-)</td>
</tr>
<tr>
<td>Patient's shampoo containing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.45% zinc pyrithione</td>
<td>2.0</td>
<td>aq.</td>
<td>(+++)</td>
<td>(+++)</td>
<td>(+++)</td>
<td></td>
</tr>
<tr>
<td>0.45% zinc pyrithione</td>
<td>5.0</td>
<td>aq.</td>
<td>(+++)</td>
<td>(+++)</td>
<td>(+++)</td>
<td></td>
</tr>
</tbody>
</table>

*Negative reaction indicated with minus sign, weak reaction (infiltrated erythema) indicated with single plus sign, strong reaction (infiltrated erythema with papules/vesicles) indicated with double plus sign. pet. = petrolatum; aq. = aqueous.

References


