

Severe Neck and Face Edema in an Adolescent—Delayed Hypersensitivity Reaction to Hair Dye

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Abstract: Allergic contact reactions to hair dyes arise mostly due to sensitization to para-phenylenediamine (PPD). Para-phenylenediamine, a derivative of p-nitroaniline, is widely used as an oxydizable hair dye and is also found in black henna tattoo. Subsequent exposure to PPD may lead to delayed type IV hypersensitivity reaction manifesting as acute contact dermatitis. Here, a 15-year-old girl is presented, who developed a hypersensitivity reaction after first exposure to hair dye. She was found to have been sensitized to PPD before, through application of black henna tattoo.

Key Words: adolescent, angioedema, delayed hypersensitivity, hair dye, para-phenylenediamine, patch test

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Allergic contact reactions to hair dyes arise mostly due to the sensitization to para-phenylenediamine (PPD). Para-phenylenediamine, a derivative of p-nitroaniline, is widely used as an oxidizable hair dye and is also found in black henna tattoo.¹ Para-phenylenediamine is used in henna and hair dye to make the color darker and accelerate the dyeing procedure.^{2,3} Para-phenylenediamine causes local and systemic toxic effects when applied topically or ingested.⁴ Subsequent local exposure to PPD may lead to delayed type IV hypersensitivity reaction manifesting as allergic contact dermatitis (ACD). The reaction usually occurs one or more days after the exposure to the hair dyes.^{3,5,6} Here, we present a 15-year-old girl with delayed hypersensitivity reaction after the first exposure to hair dye and who was found to have been sensitized before to PPD by black henna tattoo.

CASE

A 15-year-old girl was admitted to the hospital with complaint of neck and facial swelling 3 days after applying hair dye. She was diagnosed as having angioedema initially and referred to our pediatric allergy clinic. In her physical examination, severe edema beginning from the neck and involving the ears, eyelids, forehead, and scalp, and a slight eczematous reaction limited to the frontal hairline was present (Figs. 1 and 2). The patient also had a medical history of ACD after use of temporary black henna tattoo 3 years before. At that time, her skin lesions resolved by topical steroid therapy, but she had not been investigated for this condition. Her laboratory tests including C3, C4 levels were unremarkable. Treatment with oral 1 mg/kg methylprednisolone and second-generation H1 antihistaminic (desloratadine) was started. After clinical improvement was observed, methylprednisolone dose was reduced gradually and discontinued after the eighth day of treatment. Patch test with European standard series was applied after the neck and facial edema was recovered completely. The results of the patch test were assessed after 48,

72, and 96 hours. A strong positive reaction (++++) to PPD was observed (Fig. 3). The patient was informed about avoiding hair dye products and black henna tattoo that may contain PPD or para-dye ingredients. A list of products that may contain PPD was given to the patient.

DISCUSSION

Allergic contact dermatitis is a T cell–mediated, delayed-type hypersensitivity response to exogenous agents. Contact allergens are widely present in the environment and may include plastics, rubber, fragrances, metals, glues, topical antibiotics, preservatives, and chemicals used in hair dyes and cosmetic products.⁷ Allergic contact reactions to hair dyes and black henna tattoo arise mostly due to the sensitization to PPD. Para-phenylenediamine intensifies dark color and makes the dye and tattoo last longer. Para-phenylenediamine is a derivative of p-nitroaniline, which is allergic, mutagenic, and highly toxic. Ingestion of PPD results in intravascular hemolysis, acute renal failure, respiratory distress, rhabdomyolysis, hepatic necrosis, and myocarditis.⁴

Subsequent local exposure to PPD can lead to a delayed type IV hypersensitivity reaction manifesting as ACD, and these reactions may occur one or more days after the second exposure.^{3,5,6} In our patient, the reaction occurred 3 days later after exposure to hair dye containing PPD. Our patient was exposed to hair dye only once in her life, but had been previously sensitized to a black henna tattoo 2 years earlier.

Skin lesions of ACD from PPD have been reported to be in various forms like bullous contact dermatitis; exudative erythema; pruritic, edematous, erythematous, scaly patches; and plaques or vesicular lesions.^{2,8} In our patient, only severe neck and facial edema was marked and was misdiagnosed as angioedema at first. Although in our patient, severe neck and facial edema was present, the presence of subtle eczematous change in the scalp was a clue that this was an “outside job,” meaning that the reaction was due to an exogenous agent rather than an internal force. In addition, presence of eczematous changes such as erythematous, scaly papules and vesicles in the scalp relatively specific for contact dermatitis, and these findings are useful to differentiate angioedema from



FIGURE 1. Neck and face edema of the patient.

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FIGURE 2. Eczematous reaction the frontal hairline of the patient.



FIGURE 3. Positive patch test result for PPD (black arrow) (96 hours).

contact dermatitis. Allergic contact dermatitis mimicking angioedema after hair dye has been previously reported in a 27-year-old woman.⁹ As far as we know, our patient is the first pediatric patient with ACD mimicking angioedema due to PPD.

Patch testing is essential in a patient with ACD because the allergen must be identified and avoided to prevent recurrence. The most commonly accepted technique for patch testing involves the application of test allergens to the skin of the upper back under occlusion for 2 days. Our patient was patch tested with European Standard series, which included 28 allergens. Strong positive (+++) reaction to PPD was observed.

Allergic contact dermatitis is best controlled with corticosteroids, as the first-line therapy.^{10,11} Through various mechanisms,

corticosteroids decrease lymphocyte proliferation and the production of cytokines and limit the inflammatory response to contact allergens.¹² Localized lesions may be treated with corticosteroid ointments of moderate potency applied 2 times daily for 2 to 3 weeks. When dermatitis involves greater than 10% of the skin surface, systemic steroids are indicated. A single morning dose of prednisone (1 to 2 mg/kg) for 7 to 10 days, followed by tapering over the next 7 to 10 days, is usually sufficient. Antihistaminic therapy and wet dressings are also soothing and help relieve itching and reduce redness. Identification of the offending allergen is important because allergen avoidance is the key to preventing recurrence.

CONCLUSION

Para-phenylenediamine is a potent allergen especially for children and adolescents because of increasing use of hair dye and temporary henna tattoo in this age group. Physicians and parents should be informed about the risk of formulations that contain PPD. In patients who have had allergic reactions after use of hair dye, patch testing should be performed to determine the allergens and prevent further severe reactions. Finally, emergency physicians must be aware of the possibility of ACD from hair dyes and temporary henna tattoos. To differentiate angioedema from contact dermatitis, they should seek the presence of eczematous changes in the scalp that is relatively specific for contact dermatitis.

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