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Allergic Contact Dermatitis to Paraphenylenediamine in Black Henna

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We present a case of a 19-year-old woman presenting with a blistering eruption on the bilateral dorsal forearms and dorsal hands. Two weeks prior, the patient applied black henna to her skin without an adverse reaction. One week after the application of the black henna, the patient developed a pruritic, erythematous bullous eruption, confined to the area of henna placement (Fig 1.)

Paraphenylenediamine (PPDA) is a chemical additive used to create a dye used in black rubber, dark textiles and cosmetics, photographic ink, and black henna. PPDA in its fully oxidized form is not an allergen sensitizer. For PPDA to convert from its odorless, colorless form to the darkened hue

used as a dye, the base must undergo oxidation which creates free radicals in the epidermis [1]. Upon exposure to the offending byproduct, previously sensitized individuals develop a type IV hypersensitivity reaction, typically within 48-72 hours after repeated exposure.

Reactivity to PPDA is thought to be approximately 4-6.2% with variation seen between different regions of the world. The prevalence of PPDA allergy is highest in hairdressers, hairdressing clients undergoing dye application, and photographic film developers due to repeated exposure. Cosmetic practices, such as black henna and hair darkening, make up the majority of reported cases of PPDA allergic contact dermatitis. “Black henna” combines natural henna with various amounts of PPDA ranging from 0.6% to 29.5%, well above the 2.0-6.0% recommended for use in hair dyes. Among users of black henna, induction of allergic contact dermatitis is an estimated 2.5% per application [2].

Patients with allergies to PPDA may have co-sensitization to chemicals containing amide groups fixated in the para position on a benzene ring. Sulfonamides and sulfonylureas are the most common class of medications shown to have cross-reactivity potential, with 6.0% of PPDA-sensitized patients reacting to these medication classes [3]. In addition to these medical treatments, cross-reactivity has been seen in local anesthetizing agents containing benzocaine and similar amino ester group topical anesthetics. Para-aminobenzoic acid, also known as PABA, has historically been used in sunscreen for its UVB-absorbing properties but has fallen out of favor due to its sensitization potential. Additionally, paraben-containing products have been shown to rarely cause cross-reactivity, with less than 3% of all PPDA sensitized patients showing a reaction to parabens on patch testing [4].

The use of synthetic hair dye and black henna has increased over the past 15 years. Increased PPDA concentration in products has been shown to increase sensitization potential, severity of an allergic reaction, and the risk of co-sensitization. In patients with PPDA sensitivity, patch testing is recommended to determine cross-reactivity. PPDA-free hair dyes may contain para-toluenediamine sulfate (PTDS), an alternative that is tolerated by only 50% of PPDA-sensitive patients. It is important to educate patients on the potential side effects of these cosmetic alterations and provide alternatives to decrease morbidity.

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