

Hair colour shampoo dermatitis

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doi:10.1111/cod.12851

Key words: allergic contact dermatitis; case report; hair colour; patch test; shampoo; surfactant.

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Conflicts of interest: None of the authors has any conflict of interest, and there was no financial support or other benefits from commercial sources for this work.

Hair colour shampoos, also called hair dye shampoos, are intended to preserve the colour of dyed hair, and some contain hair dye compounds. C12–14 hydroxyalkyl hydroxyethyl sarcosine (C12–14 HHS) (CAS no. 941296-64-6) is an ampholytic surfactant used in daily products such as soaps and shampoos (1). We herein report a case of allergic contact dermatitis caused by hair colour shampoo containing C12–14 HHS as a novel allergen.

Table 1. The results of patch testing and lymphocyte transformation tests (LTTs)

	Patch test result			LTT (stimulation index)	
	Day 2	Day 3	Day 7	Present case	Range of 5 healthy volunteers
Shampoo	+	+	+	Not performed	Not performed
Basic Blue 99	++	++	++	32.18	0.92–1.81 (mean 1.22)
C12–14 hydroxyalkyl hydroxyethyl sarcosine	+	+	+	3.68	1.05–1.45 (mean 1.21)
Lauramide DEA	++	++	+	4.01	1.03–1.69 (mean 1.33)
<i>N</i> -methyl- <i>N</i> -(1-oxododecyl)- β -alaninate	+	+	+	15.75	1.13–1.57 (mean 1.34)
Phytohaemagglutinin (positive control)	–	–	–	218.72	53.26–254.93 (mean 154.67)
Without chemicals (negative control)	–	–	–	1.00 (453 cpm)	1.00 (242–701 cpm)

The hair colour shampoo (1% aq.), C12–14 hydroxyalkyl hydroxyethyl sarcosine (0.3% aq.), Basic Blue 99 (0.5% pet.), lauramide DEA (0.5% pet.) and *N*-methyl-*N*-(1-oxododecyl)- β -alaninate (0.3% aq.) were used in both tests. cpm = count per minutes

Case Report

A 54-year-old man with no history of atopic dermatitis presented with a 4-month history of itchy eruptions on the entire body. He had been diagnosed with severe dermatitis and treated with 1 mg of oral betamethasone daily at the previous dermatological clinic for 11 weeks, but without improvement. Physical examination showed pruritic erythema with thick scales on the scalp, face, and upper trunk. Laboratory findings were within normal limits, except for elevated serum IgE (918.3 IU/ml). A skin biopsy specimen from a papule on the neck showed lymphocytic infiltration with marked spongiosis. In the patient's history, the use of dye-containing hair colour shampoo for 1 years was identified; thus, we suspected contact dermatitis caused by the shampoo. Patch testing with the shampoo (1% aq.) showed positive reactions on day (D) 2, D3, and D7 (Table 1). Patch testing was performed with 'patch tester Torii' (Torii Pharmaceutical, Tokyo, Japan). The tester was attached to the upper back of the patient for 48 h. A closed patch test with components of the shampoo showed positive reactions to C12–14 HHS (0.3% aq.), Basic Blue 99 (0.5% pet.), lauramide DEA (0.5% pet.) and *N*-methyl-*N*-(1-oxododecyl)- β -alaninate (0.3% aq.) on D2, D3, and D7 (Table 1). Patch testing with the same chemicals showed no reactions in 2 healthy volunteers on D2, D3, and D7. Furthermore, a lymphocyte transformation test (LTT) with the patient's lymphocytes using the four components showed positive reactions in the patient, but negative in 5 healthy volunteers (Table 1) (1). Individual ingredients were kindly provided by the manufacturer of the hair colour shampoo.

The diagnosis of allergic contact dermatitis caused by C12–14 HHS, Basic Blue 99, lauramide DEA and *N*-methyl-*N*-(1-oxododecyl)- β -alaninate in hair colour shampoo was therefore established. Topical steroids were administered, and the patient was advised to stop using the shampoo. In just 10 days, the lesions completely

resolved, and no recurrence has been observed for 6 months.

Discussion

To the best of our knowledge, this is the first report of allergic contact dermatitis caused by a hair colour shampoo. Notably, allergic reactions to C12–14 HHS are extremely rare. C12–14 HHS is a surfactant that preserves the dye in colour-treated hair (2). According to the manufacturer, C12–14 HHS has better preservative properties than, for example, cocamidopropyl betaine, laureth sulfate, and distilled water (2). Some hair colour shampoos contain a hair dye, and the addition of C12–14 HHS is expected to increase the intensity of dyeing. This could suggest that C12–14 HHS promotes skin sensitization to hair dye compounds. In fact, our patient showed an allergic reaction to Basic Blue 99, a hair dye compound; thus, C12–14 HHS may have acted as a cofactor for sensitization and dermatitis, as well as an independent allergen.

The LTT has been reported to be a useful tool for diagnosing allergic contact dermatitis (3). In the present case, the patch test results correlated with the LTT results.

Lauramide DEA and *N*-methyl-*N*-(1-oxododecyl)- β -alaninate have similar chemical structures; therefore, cross-reactions are possible, but none have yet been reported. Moreover, it is difficult to distinguish between 'true' cross-reactions and concomitant multiple sensitizations. C12–14HHS, Basic Blue 99 and lauramide DEA (or *N*-methyl-*N*-(1-oxododecyl)- β -alaninate) do not have similar chemical structures.

In conclusion, the present case shows that the use of hair shampoo containing C12–14 HHS can cause allergic contact dermatitis.

Acknowledgements

We thank Dr Osamu Nemoto (Kojinkai Sapporo Skin Clinic) for referring this case.

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