

SHORT COMMUNICATION

AIRBORNE CONTACT
DERMATITIS FROM
2-AMINO-2-METHYL-
1-PROPANOL IN A
COSMETIC COMPANY

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The authors described two cases of airborne contact dermatitis caused by 2-amino-2-methyl-1-propanol (AMP 100) in two subjects with periorbital erythema and itching skin. The AMP 100 has been used to replace ammonia as a hair dye component in the cosmetic industry with the purpose to eliminate its smell. Patch tests proved positive only to dilutions of 10% and 20% in the two described patients, as well as in other six asymptomatic subjects operating in the same working environment. The authors have diagnosed an irritative airborne contact dermatitis by AMP 100.

Key terms:
allergy, AMP 100, cosmetic industry, irritation, periorbital erythema, itch

The cosmetic industry uses 2-amino-2-methyl-1-propanol in hair dye production to achieve an alkalinity (pH 9–9.5) which opens up the surface layer of the hair and facilitates penetration of the oxidising colorant molecules. Until recently, the substances usually used for hair dyes were either ammonia or monoethanolamine (MEA). While the latter two have been reported to cause airborne contact dermatitis, there were no reports of skin diseases resulting from the use of AMP 100 (1–5).

This paper describes two cases (a man and a woman) of airborne contact dermatitis noted in a cosmetic company during the hair dye production using AMP 100.

SUBJECTS AND METHODS

Two subjects had been suffering for several months from periorbital oedema and facial erythema which worsened during work hours and improved during weekends and holidays. During the study, eight more subjects from the same company were

also examined. Two of these were working on the same production line but were asymptomatic, the other six, also completely asymptomatic, were working on different production lines.

The allergological investigation was carried out as follows: personal and work history, skin prick tests with the most common inhalant allergens according to the Guidelines of Allergological and Immunological Italian Society (6), patch tests with the G.I.R.D.C.A. (Gruppo italiano ricerche dermatiti da contatto e ambientali - Italian Group for Research of Contact and Ambient Dermatitis) series (7), patch tests with 2-amino-2-methyl-1-propanol and oleic acid that were present in the production line, using appropriate dilutions obtained from the published data.

As the literature contained no relevant indications regarding AMP 100, the product was solved in both distilled water and ethyl alcohol at the following dilutions: distilled water: 0.1%, 0.5%, 1%, 2%, 5%, 10%, 20%; ethyl alcohol: 0.1%, 0.5%, 1%, 2%, 5%, 10%, 20%. The patch tests (TROLAB series with hypoallergenic plaster) were applied on the back and read after 48 and 72 hours. Positive results were expressed as follows: erythema one cross (+), erythema plus oedema, two crosses (++), erythema plus oedema plus blisters, three crosses (+++) (7).

Description of the production line

AMP 100 is a 2-amino-2-methyl-1-propanol (otherwise known as isobutanol amine) belonging to the alkamine group. It is a colourless liquid, soluble in water and characterised by a mild amine smell. As the product irritates the skin and conjunctivae, it is recommended to use rubber gloves, goggles, and a mask to prevent gas and vapour inhalation (vapour forms are present only at very high temperatures). The product is non-inflammable. Sensitisation tests on guinea pigs resulted negative and the AMES test showed no mutagenesis. The threshold limit value-time weighted average (TLV-TWA) and the threshold limit value-short term exposure limit (TLV-STEL) are not known (8). Its structural formula is $(\text{CH}_3)_2\text{C}(\text{NH}_2)\text{CH}_2\text{OH}$. The dyes are first prepared by weighing all the formula components in appropriate receptacles. Next, the fatty components (fatty acids and derivatives) are placed in a steam heated mixer and brought to a temperature of about 75 °C. When the temperature is reached, the emulsion process begins by adding the colorant intermediates, active substances, reducing substances (anti-oxidant) and alkalinisers into the mixer. The solution is then heated to 75 °C. Once the emulsion has been formed, a turboemulsifier is applied for several minutes after which the mixture is cooled by cold water circulating in the mixer cavity. Once the temperature has dropped to 50 or 55 °C, the correct quantity of alcaliniser (usually ammonia), and eventually of scent are added. The cooling is resumed, accompanied by slow stirring, until the room temperature is reached. At this point, the mixer is emptied or connected to the packing machines. All mixers are equipped with air-tight closing and suction inlets for the suction of gas and vapour during phases in which the loading hatch is open.

The two subjects whose job was to pour the alkaliniser into the turboemulsifier had no symptoms when the work phase involved ammonia. The symptoms, however, appeared when it was replaced by AMP 100.

RESULTS

The prick tests and G.I.R.D.C.A. series patch tests were all negative apart from one positive reaction to *Dermatophagoides pteronyssinus* in a worker who worked in a different production line.

All patch tests carried out with substances used in the production line proved negative except for AMP 100 at 10% and 20% dilutions in both water and ethyl alcohol. All positive results manifested erythema with oedema without blistering (++) (Table 1, 2).

Table 1. Results of the patch tests in four subjects occupationally exposed to AMP 100; two with symptoms and two without symptoms

Test substances	Subjects			
	With symptoms		Without symptoms	
	1	2	3	4
G.I.R.D.C.A. series				
Oleic acid				
AMP 100 in distilled water: 10%	+	+	++	+
AMP 100 in distilled water: 20%	++	++	++	+
AMP 100 in ethyl alcohol: 10%	+	++	++	++
AMP 100 in ethyl alcohol: 20%	++	++	++	++

Table 2. Results of the patch tests in the six subjects not exposed to AMP 100 without symptoms

Test substances	Subjects					
	1	2	3	4	5	6
G.I.R.D.C.A. series						
Oleic acid						
AMP 100 in distilled water: 10%	+	+	++	+	+	+
AMP 100 in distilled water: 20%	++	++	+	+	+	+
AMP 100 in ethyl alcohol: 10%	+	+	+	++	++	++
AMP 100 in ethyl alcohol: 20%	++	++	++	++	+	++

DISCUSSION

Airborne contact dermatitis can assume either an irritative or an allergic form. Airborne irritative contact dermatitis can be caused by numerous agents, almost all of them common for the working environment. Generally, they are highly alkaline sub-

stances and the irritation is therefore the result of a chemical rather than of a mechanical action. The allergic form is relatively frequent, particularly in the working environment. The main lesions are almost always symmetrical and located on the face, neck and hands or in the folds of the armpits or groins (1-5).

As far as 2-amino-2-methyl-1-propanol is concerned, however, no cases of airborne contact dermatitis have been reported in literature by now. The cosmetic industry has been using this substance in hair spray production for some time. It has also been used as an ammonia-substitute in the preparation of hair dyes to achieve a certain level of alkalinity in products which, for marketing reasons, must not smell of ammonia.

It may be curious to note that not a single case of airborne contact dermatitis was reported while our subjects used ammonia, even though ammonia is airborne. The first symptoms (itching on the face) appeared several months after the ammonia had been replaced with AMP 100. These symptoms gradually worsened until they determined the profile we observed.

The scale dilutions of AMP 100 we used are those generally recommended for differentiation between irritative concentrations and allergy-inducing concentrations. The positive results after exposure to dilutions of 10% and 20% may be considered as irritative responses. The response to weaker dilutions of the substance which may be considered to have the allergenic potential were negative, both in two subjects with symptoms and in two subjects without symptoms. Considering just two subjects with symptoms, we can therefore conclude that the AMP 100 causes airborne irritative contact dermatitis. This situation may have been favoured by temperatures reached locally by the emulsion (50-55 °C) and by humidity generated through the release of fumes and/or vapour.

In conclusion, we believe that AMP can be considered a cause of airborne contact dermatitis and must be added to the long list of products responsible for this skin condition. Furthermore, according to our experience, airborne contact dermatitis caused by 2-amino-2-methyl-1-propanol can occur upon application of the hairdresser's series of allergens, that is, in common life and not only as a result of occupational exposure to this irritant as well as an allergen.

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Sažetak

AEROGENI KONTAKTNI DERMATITIS UZROKOVAN 2-AMINO-2-METIL-1-PROPANOLOM U TVORNICI KOZMETIKE

Aerogeni kontaktni dermatitis pojavljuje se kao iritacija ili kao alergija. Uzrokuju ga brojni agensi, od kojih su gotovo svi uobičajeni za radni okoliš u proizvodnji kozmetike. Alergije su relativno česte a lezije su gotovo uvijek simetrično raspoređene po licu, vratu i rukama, odnosno pod pazuhom i na preponama. Dosada, međutim, nije zabilježen niti jedan slučaj aerogenog kontaktnog dermatitisa uzrokovanog 2-amino-2-metil-1-propanolom (AMP 100) koji je uveden kao zamjena za amonijak u proizvodnji lakova i boja za kosu.

Ovaj rad opisuje dva zabilježena slučaja aerogenog kontaktnog dermatitisa uzrokovanog AMP-om 100 u pacijenata s periorbitalnim eritemom i svrbežom. Reakcije na epikutano alergijsko testiranje pokazale su se pozitivnima samo s otopinama od 10% i 20%, i to ne samo u dvoje opisanih pacijenata nego i u šest ispitanika koji nisu iskazivali simptome a radili su na istome radnom mjestu. Autori su pritom dijagnosticirali iritativni oblik aerogenoga kontaktnog dermatitisa uzrokovanog AMP-om 100.

Stoga autori vjeruju da bi AMP 100 trebalo dodati zamjetnoj listi proizvoda koji uzrokuju aerogeni kontaktni dermatitis u kozmetičkoj industriji. Štoviše, zbog stalne uporabe AMP-a 100 u frizerskim salonima trebalo bi obratiti pozornost na zaštitu od njegovih učinaka na frizere.

Ključne riječi

alergija, AMP 100, iritacija, kozmetička industrija, periorbitalni eritem, svrbež

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