

Allergic Contact Dermatitis from N,N-Methylenebismorpholine in a Cutting Oil

To the Editor:

We present a case of allergic contact dermatitis (ACD) from the biocide N,N-methylenebismorpholine in a cutting oil. A 48-year-old male fitter working in an engineering company presented with a 6-month history of dermatitis on his forearms and on the dorsal aspect of his hands with some interdigital involvement. At work, he was exposed daily to cutting oils, including Cooledge BI oil (Castrol (Ireland) Ltd., Dublin, Ireland) and Shell Tonna oil (Shell U.K. Limited, London, United Kingdom). He had no significant medical history but gave a family history of atopic dermatitis (daughter).

He was patch-tested with the British Contact Dermatitis Society standard series, bases and preservatives, cosmetics series, oil and coolant series, Cooledge BI oil 1%, 10%, and 50% aqueous (aq), Shell Tonna oil 1% and 10% aq, and Drumex handwash (Dreumex B.V., Oss, Netherlands) 1% and 10% aq. He was patch test positive to formaldehyde and had positive (++) patch-test reactions to Cooledge BI oil 10% and 50%. He was also patch test positive to the formaldehyde releasers diazolidinylurea, imidazolidinylurea, dimethylol dimethyl hydantoin, hexamethylenetetramine, 1,3,5-tris(hydroxyethyl)hexahydro-triazine, and Bioban CS-1135. He had an irritant reaction to 10% Drumex handwash. The manufacturers kindly provided the constituents of Cooledge BI oil, and he was patch-tested with a compound composed of amides, tall-oil amide, and N,N-bis(hydroxyethyl) 1% in petrolatum (pet); N,N-methylenebismorpholine 1% pet; distilled tall oil 10% pet; and severely treated base oil in 1% and 10% methyl ethyl ketone. He had a positive patch-test reaction to N,N-methylenebismorpholine 1%.

In the United Kingdom, between 1994 and 1999, 491 cases of ACD in metalworkers were reported; 12.8% of the cases were attributable to metalworking fluids (MWFs).¹ MWFs have a complex composition and contain a broad variety of additives (including emulsifiers,

biocides, etc), many of which are skin sensitizers.² N,N-Methylenebismorpholine is a low-toxicity water-based liquid biocide. It is a constituent of some MWFs because it has broad-spectrum antimicrobial activity. It is a formaldehyde releaser. Geier and colleagues tested 144 metalworkers with two panels of MWFs: their standard MWF series and a second panel containing MWF components that are not available as commercial patch-test preparations.² Their study pointed to N,N-methylenebismorpholine as an important MWF allergen (7 of 144 [4.9%]). Six of their seven patients also had positive reactions to formaldehyde or to other formaldehyde releasers, similar to our patient. The positive reactions to N,N-methylenebismorpholine Geier and colleagues observed were considered clinically relevant and independent of that compound's formaldehyde-liberating capacity. The formaldehyde concentration in their test preparation was very low (0.16%).²

Biocides such as N,N-methylenebismorpholine are compounds that usually contain an amine and a formaldehyde molecule. Their release of formaldehyde is pH dependent. The pH of MWF is usually 9, and the amine-formaldehyde bond is relatively strong in these conditions. If there is bacterial growth, the pH drops and results in the release of formaldehyde and a reduction in bacterial growth. The pH rises again, and the biocide bonds stabilize. Therefore, good MWF maintenance (pH, bacterial growth, contamination control, etc) is important.

Our case supports Geier and colleagues' findings of N,N-methylenebismorpholine as an important contact allergen in occupational exposure to cutting oils. Most cutting oils contain agents that are potential formaldehyde releasers, making strict allergen avoidance very difficult for metalworkers.

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