

# Surgical mask dermatitis caused by formaldehyde (releasers) during the COVID-19 pandemic

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We present a case of occupational allergic contact dermatitis from formaldehyde and 2-bromo-2-nitropropane-1,3-diol (bronopol) contained in a polypropylene surgical mask.

## CASE REPORT

A 38-year-old woman with a history of erythematous and telangiectatic rosacea consulted us in December 2019 because of itchy, burning facial and periocular erythema lasting 1 year. Notwithstanding a primary diagnosis of rosacea, clinical examination also revealed subtle eczematous lesions. Moreover, the patient experienced minor

respiratory complaints, also related to her profession as a laboratory technician. She worked for a company producing coatings for the paper and cardboard industry, and her duties involved the quality control of water-based polymer mixtures containing formaldehyde, bromo-2-nitropropane-1,3-diol (bronopol), methylchloroisothiazolinone/methylisothiazolinone (MCI/MI), MI, and benzisothiazolinone (BIT). She wore protective gloves and (not fully occlusive) goggles, but no mask, thus still allowing airborne exposure to these chemicals; no hand dermatitis was present.

Given the peculiar clinical presentation, and the exposure to well-known sensitizers, patch tests were performed, as reported previously,<sup>1</sup> with the Belgian baseline series<sup>2</sup> and a cosmetic series.

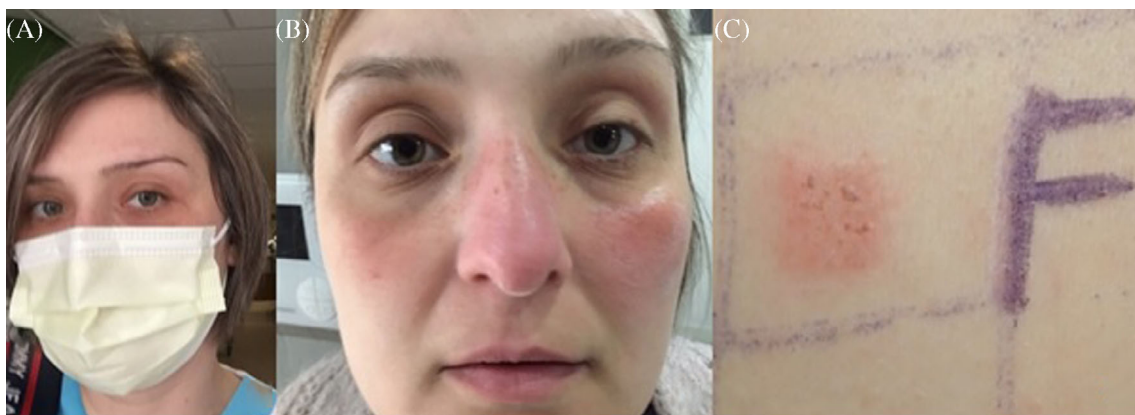


**FIGURE 1** (A) An auxiliary nurse, wearing a polypropylene surgical mask, (B) who developed rosacea-like allergic contact dermatitis from formaldehyde and bronopol contained in the mask; (C) positive patch test to formaldehyde 2% aq. on day 4

A flare-up of her facial condition occurred during the patch test week and readings showed, on day (D) 4, positive reactions to formaldehyde 2% aq. (++), bronopol 0.5% pet. (+), MCI/MI 0.02% aq. (++), BIT 0.1% pet. (+), and thiuram mix 1% pet. (+). She was thus diagnosed with occupational airborne allergic contact dermatitis from formaldehyde (releasers) and isothiazolinones; no relevance was found for thiuram mix. Both types of (volatile) preservatives were likely also involved in provoking the respiratory complaints, and the former possibly contributed to the clinical picture of rosacea.<sup>1,3</sup>

The patient subsequently changed profession and started working as an auxiliary nurse at a general hospital. The dermatitis completely resolved, except for occasional minor relapses of rosacea related to exposure to wind and cold weather. However, 5 months later (April 2020), while working on a COVID-19 ward, she developed a relapse of dermatitis a few hours following the prolonged use of a particular polypropylene ("plastic") surgical mask (Figure 1A–C). A flare-up of rosacea, as frequently reported in patients wearing facial masks,<sup>4</sup> was again considered, although the wearing of other types of surgical masks apparently caused no skin problems. Given the results of the previous patch tests, she contacted our department for advice. A literature search, as well as a quick response from the manufacturer of the mask, revealed that the nonwoven polypropylene mask might contain trace impurities of formaldehyde and bronopol,<sup>5,6</sup> whereas no isothiazolinones or thiurams (or carbamates) had been used during the production process.

## DISCUSSION

The prolonged use of facial masks may result in several skin problems, mostly irritant contact dermatitis (ICD), but also flare-ups of pre-existing dermatoses (eg, rosacea), contact urticaria, and allergic contact dermatitis (ACD).<sup>4,7</sup> For example, during the previous severe acute respiratory syndrome (SARS) epidemic, several facial skin problems were reported, and even respiratory complaints without skin lesions, due to the wearing of polypropylene N95 (FFP2) respirators. Of interest, patch tests revealed contact allergy to formaldehyde (releasers) in some of these cases and chemical analyses could confirm that trace amounts of free formaldehyde were present in these masks as a by-product of the degradation of polypropylene.<sup>5,6</sup> In the present case, both formaldehyde and bronopol in a polypropylene surgical mask caused facial ACD, mimicking a flare-up of rosacea. Polyester- or cellulose-based masks might constitute formaldehyde-free alternatives in these cases.<sup>5</sup>

In conclusion, because formaldehyde is a frequent contact sensitizer,<sup>8,9</sup> and given that health care workers, patients, and consumers now often have to wear (polypropylene) surgical masks at work and in the public environment, similar cases might be expected in the future. To propose safer alternatives, the contact sensitizers potentially present in facial masks, and related medical devices, should be labeled, or at least be easily retrievable as in the present case.

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## AUTHOR CONTRIBUTIONS

**Olivier Aerts:** Conceptualization; investigation; methodology; validation; writing-original draft; writing-review and editing. **Kenn Foubert:** Investigation; validation; writing-review and editing. **sofie stappers:** Investigation; writing-review and editing. **Michal Ulicki:** Investigation; writing-review and editing. **Ella Dendooven:** Investigation; methodology; writing-review and editing. **Julien Lambert:** Validation; writing-review and editing.

## CONFLICTS OF INTEREST

None.

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