

Allergic contact dermatitis caused by copper in a malachite necklace

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Despite frequent exposure to copper, immune reactions are rarely reported. Most cases of copper allergy in the literature refer to patients who have been systemically exposed to copper through the use of dental prostheses or intrauterine devices (1). Here, we describe a case of contact dermatitis caused by a copper-based mineral, malachite, worn as a gemstone in a necklace.

Case Report

A 63-year-old white female was assessed for a new spinal cord stimulator to treat chronic back pain. She was referred for patch testing to exclude metal allergy after having described the development of a rash after wearing a malachite necklace (Fig. 1). The eczematous rash developed where the stones sat in the necklace within 3 h of the necklace being worn. This reaction faded after 24 h. The patient had also previously experienced a similar rash after wearing a medic alert bracelet.

The patient was tested with a baseline and a metal series by use of the IQ Ultra™ (Chemotechnique, Vellinge, Sweden) patch test chamber system. Allergens were occluded for 48 h, and readings were performed on day (D) 2 and D4 in accordance with ESCD guidelines (2). Positive reactions were seen to copper sulfate 2% pet. (–/+), copper oxide 5% pet. (+/++) (Chemotechnique), fragrance mix I 8% pet. (–/+), sodium metabisulfite 1% pet. (?+/+++), and amalgam alloying metals 20% pet. (+/++) (Trolab®, Biodiagnostics, Upton-upon-Severn, UK). Amalgam alloying metals 20% pet. contains: 13.9% silver, 3.5% tin, 2.4% copper, and 0.2% zinc.

Prick tests gave negative results with copper sulfate 2% pet., copper oxide 5% pet. (supplied as above), and nickel sulfate 5% pet. (Trolab®). Readings were performed



Fig. 1. Malachite necklace.

after 20 min. Histamine and saline controls gave positive (7 mm) and negative (0 mm) results, respectively. Rechallenge with the necklace applied to the wrist produced a well-demarcated linear inflammatory rash after 48 h (Fig. 2).

Discussion

The history and patch test findings in our patient are in keeping with contact allergy to copper. Malachite is a green mineral of copper carbonate hydroxide [$\text{Cu}_2\text{CO}_3(\text{OH})_2$] that results from the weathering of copper ores. In addition, some alloys used in the medic

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Fig. 2. Linear inflammatory rash after application of the malachite necklace.

alert bracelet also contain copper. There was no patch test reaction to any other metal.

The applications of copper are vast. It is used across all industries, including transport, electronics, and coin manufacture, and in personal adornments (3). In a world-wide study to evaluate the main metal constituents in 956 pieces of inexpensive jewellery, copper was by far the most common metal (4). In addition, copper production is steadily increasing, and its antimicrobial properties are now being harnessed by the healthcare industry in the form of antimicrobial copper alloy appliances to reduce microbial bioburden (5).

However, despite our frequent exposure to copper, copper is rarely incriminated in allergic contact dermatitis. It has a low sensitizing potential according to the predictive guinea-pig test and the local lymph

node assay (6). One of the first reports of a copper allergy was recorded in 1980; it concerned a female patient whose hobby was copper beating (7). More recently, the few reports of copper allergy in the literature have concerned patients who have had systemic exposure. D'Ambrosio et al. described a case of endometritis and a widespread urticated rash in a 32-year-old patient with a copper intrauterine device. Copper sulfate positivity was shown by a 72-h patch test, and her symptoms resolved completely on removal of the device (8). In another case report, a 56-year-old female presented with oral lichen planus secondary to the use of a copper-containing buccal dental prosthesis. Patch testing with a baseline series and other relevant potential allergens gave positive results only with 2% copper sulfate. The lichen planus disappeared after the prosthesis was changed (9).

The banded form of malachite is considered to be a precious ornamental stone, and can be fashioned into necklace beads (10). To the best of our knowledge, this is one of only two reports of copper hypersensitivity occurring through contact with the skin, and the first to describe it being caused by malachite. The case illustrates that, although copper is a weak sensitizer as compared with other metals, we should bear in mind that it does have the potential to induce allergic contact dermatitis. This is especially relevant because of its manifest applications in industry, including healthcare.

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