

Short Communicaton

Toxic hygroscopic contact reaction to N-methyl-2-pyrrolidone

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Case Reports

3 employees of a manufacturers of toddler car-seats, age 21–29 years, were referred to the Accident & Emergency Department because of acute painful swelling and excessive wrinkling of the skin of their hands, after exposure to N-methyl-2-pyrrolidone (NMP) (Fig. 1). 2 had no dermatological history; the eldest had a history of mild hand eczema, without signs of atopy, for which no medical treatment was used.

They had all been newly exposed to N-methyl-2-pyrrolidone (NMP) as a solvent to clean parts of a device with which a newly introduced glue was applied to textile fabrics, to attach them to layers of protective foam. The 3 patients had used NMP as a cleaner for the previous 3 days. The parts that had to be cleaned were washed in a basin with NMP (99% concentration) with unprotected hands. This procedure was repeated several times, for a few minutes only, during their work shifts. The workers had decided to use their unprotected hands, because the polyvinyl chloride (PVC) gloves that were used initially rapidly became ill-fitting due to shrinkage caused by NMP exposure.



Fig. 1. Acute painful swelling and excessive wrinkling of the skin of the hand, after exposure to N-methyl-2-pyrrolidone (NMP).

After being exposed during 2 work shifts the skin had a slightly swollen appearance and started to give rise to a burning, stinging sensation. The 3rd day of exposure caused an acute worsening of these complaints. Both hands of all 3 patients showed extreme swelling and wrinkling of the skin, still with burning and stinging. Minimal signs of erythema were seen at the margins of the affected skin area.

Histologic examination of the volar side of the hand revealed hyperkeratosis (normal for the localization) with, mainly in its lower part just above the stratum lucidum, a translucent stratum corneum. Otherwise, the epidermis showed no abnormalities. In the dermis, only sporadic perivascular lymphocytes were seen.

The patients were transferred to “dry work” with no exposure to glues or solvents. Application of a potent topical corticosteroid 2× daily was prescribed for 10 days, with frequent use of emollients. All patients recovered completely.

Comment

NMP is used as a solvent and as an accelerator (Fig. 2). It is used as a solvent: for various extractions in cracking oils and other petrochemical reactions; as a medium for polymerization; for finish polymers; and in stripping potting resins and epoxides (1–3).

Exposure to organic solvents such as NMP may result in neurological toxicity, inhalation in high concentrations causing headache, giddiness, mental confusion and nausea, and ingestion abdominal pain, nausea and vomiting. To the skin, it is a mild irritant, but prolonged contact can result in severe dermatitis (2, 5). Avoidance

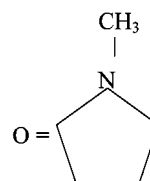


Fig. 2. Chemical structure NMP.

of contact with the skin and eyes and avoidance of breathing in the vapours, as well as wearing of goggles and gloves, is recommended. As first aid after skin contact, washing with soap and water of the contaminated skin is recommended.

Butyl rubber gloves will best prevent penetration of NMP, though polyvinyl acetate (PVA) can also be used. Latex, neoprene, nitrile and PVC are not recommended (2), but latex gloves, with cotton gloves inside to absorb moisture, can be used as long as they are changed every hour (2).

Because of environmental restrictions, the production process in this plant had been changed to the use of undiluted glue without volatile hydrocarbons. This new glue required a different type of solvent to clean the machinery: N-methyl-2-pyrrolidone (NMP). The factory's material safety data sheets on NMP were not specific in their advice on hand protection (4), leading to repeated exposure of the employees' hands. No clear changes, especially no clear signs of toxic inflammation, could be found on histological examination of the affected skin. Thus, with hindsight, the application of potent corticosteroids to suppress a possible inflammatory reaction was unnecessary.

The acute painful swelling and wrinkling, without signs of inflammation, after this repeated exposure can probably be attributed to the powerful hygroscopic effect of NMP on the stratum corneum. The clinical picture (Fig. 1) is characteristic of such NMP toxicity.

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