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Toxicology

Consensus statement: Risk of nosocomial organophosphate poisoning in emergency departments

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There is great concern regarding the risk of nosocomial poisoning in staff caring for the organophosphate (OP) pesticide poisoned patient in prehospital, ED and intensive care settings. In many instances, elaborate nursing practices including the use of personal protective equipment (PPE) have been developed in order to reduce this risk. Elsewhere, HAZMAT responses have been instituted in response to OP poisoning and resulted in closures of highways and EDs with the result that the victim has been denied access to standard hospital and transport facilities. Such actions compromise not only the care of the poisoning victim but that of others reliant on those health care facilities and systems. We will briefly review the evidence in the literature regarding nosocomial OP poisoning, examine some of the reasons why symptoms occur amongst staff treating OP-poisoned patients and provide consensus guidelines on reasonable precautions that should be taken when managing these patients.

The clinical features of OP pesticide poisoning arise as a result of cholinesterase inhibition. Significant poisoning almost always occurs in the context of ingestion and can be confirmed by assays of either red cell or plasma cholinesterase activity. The poisoning associated with inhalational or dermal exposure to OPs is generally mild or nonexistent.

Most available OP preparations contain the active organophosphate chemical dissolved in a hydrocarbon solvent. OP compounds themselves have extremely low volatility. Vapour pressures for OP compounds are usually in the order of mPa at room temperature (e.g. fenthion 0.74 mPa at 20°C, chlorpyrifos 3 mPa at 25°C)[1] Indeed, they would be ineffective as pesticides if they were to vaporize rapidly following application to plants or soil. In contrast, the hydrocarbon solvents are highly volatile with vapour pressures quoted in kPa (e.g. toluene 2.93 kPa at 20°C, xylene 0.91 kPa at 20°C).[2]

On a global basis, OP poisoning is common and has a high case fatality rate. In China alone, there are an estimated 170 000 deaths annually from pesticide poisoning, mainly from OPs and virtually all as a result of deliberate self-poisoning by ingestion.[3] The incidence of self-poisoning with OP pesticides is much lower in developed nations however, the potential for lethality without treatment remains high.

There have been a number of reports of nosocomial poisoning occurring in staff caring for patients who have self-poisoned with OPs.[4–7] These reports are

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A consensus statement prepared by the medical consultants to the Poison Information Centres of New South Wales,* Western Australia, † Queensland,‡ New Zealand§ and the Australian Capital Territory.¶
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frequently cited to support the need for institution of extreme protocols to protect staff from secondary poisoning. In each of these reports the clinical features described (including eye irritation, nausea, lacrimation, headache, cough) could be attributed to exposure to solvent fumes and in not a single case is the diagnosis of OP poisoning supported by documented depression in cholinesterase activity. There are two reports of staff actually requiring treatment following nosocomial exposure to OPs. Documentation of exposure in both cases was extremely poor. Two people became unwell after performing mouth-to-mouth in a prehospital setting on a 19-year-old female who had ingested an OP.[4] Cholinesterase activity was not assayed but they were treated with atropine and pralidoxime. The only serious case of nosocomial poisoning is reported by Geller *et al.* from Georgia, USA.[5] Three staff involved in the care of a patient who had ingested a veterinarian insecticide (73% naphthalene, xylene, surfactant and 11.6% phosmet) were poisoned. One staff member required ventilation and was administered atropine and pralidoxime. Another received atropine and pralidoxime for 12 h. The patient was not decontaminated. The staff did not wear any skin protective clothing. Cholinesterase activity was not assayed. In the only report where cholinesterase activity was actually measured, the results were all well within normal range even for the 14 symptomatic health care workers.[6] This suggests that the reported symptoms were not due to significant OP poisoning. None of the 25 staff who managed a patient with OP ingestion in a United Kingdom ED developed any symptoms suggestive of OP poisoning.[7] Nosocomial OP poisoning has not been reported from those developing nations with a high incidence of self-poisoning with OPs. Health workers in those countries do not use PPE and do not perceive themselves to be a risk. The combined experience of all the authors includes the treatment of over 100 patients with OP poisoning and no similar cases have been observed and nor are we aware of any other cases manifesting either clear evidence of cholinergic toxicity or requiring intubation.

In summary, there is little evidence to support the assumption that staff caring for OP-poisoned patients are at any risk of developing secondary nosocomial OP poisoning under normal circumstances. Theoretical considerations and the absence of reports from those countries where OP poisoning is a common clinical problem would suggest strongly that it does not occur.

It is important that staff caring for OP-poisoning victims recognize that the distinctive odours that may be experienced relate to the hydrocarbon solvent and not the OP compound. Exposure to hydrocarbon vapours can cause mild self-limiting symptoms and the occurrence of these symptoms can be limited by caring for the patient in a well-ventilated area together with regular rotation (every 30 min) of staff.

Staff should adopt universal precautions to avoid dermal exposure to OP compounds. All OP-poisoned patients should have their clothes removed and bagged on arrival and their bodies washed with soap and water. The patient who has ingested an OP-containing pesticide may also have some of the product on their skin or clothes. Their body secretions may contain small concentrations of OP and direct contact should be avoided. Personal protective equipment does not need to be routinely worn for the management of OP-poisoned patients. Measures to avoid secondary exposure to OP-containing pesticides should never be instituted to the detriment of timely and effective transport, assessment and treatment of the poisoned patient.

Summary of recommended precautions when managing poisoning with organophosphate-containing pesticides

- Resuscitation and further treatment should ideally take place in a well-ventilated area with regular rotation of staff.
- All staff with direct patient contact should observe universal precautions — gloves, gowns, eye protection.
- Patients should undergo external decontamination as soon as practicable: clothes removed and bagged, and body washed with soap and water. This process should not take place to the detriment of timely resuscitation and medical assessment.
- Staff inadvertently coming into direct contact with patient's bodily secretions should immediately and thoroughly wash the affected area.

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