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CONTACT POISONS: A BRIEF TOUCH[1]

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'Murder by poisoning is a crime of devilish wickedness and inhumanity which no language can adequately describe. '

John Glaister (1954)[1]

Introduction

Gail Bell, in her book 'The Poison Principle', tries to establish why people use poison[2]. She looks back over the centuries, from Cleopatra and Socrates to more modem poisoners like Crippen, and speculates that, with advanced analytical technology, the heyday of poisons is over[2]. But is it?

Contact poisons are those chemicals and toxins which are absorbed in sufficient quantities by direct skin contact to produce toxic effects, including death, in an individual. The popular media, literature and film commonly portray the use of contact poisons to murder various individuals. This perception has been reinforced by some relatively recent criminal trials. In May 1991, members of the Minnesota Patriots Council procured a ricin kit from an anarchist source. The kit included instructions on how to mix the ricin with dimethyl sulfoxide (DMSO) to produce a poison, which would be absorbed across the skin when the victim contacted it[3].

In the subsequent trial, the FBI expressed doubts about the ability of DMSO to carry ricin across the skin into the bloodstream because of the toxin's high molecular weight[4]. In April 1997, Thomas Leahy was arrested in Wisconsin for possession of ricin. According to the Assistant U.S. Attorney, police also discovered three spray bottles containing a mixture of nicotine and DMSOS.

While the majority of these cases are of academic (or in some cases, literary) interest, military physicians should be aware that there are contact poisons which may produce morbidity if not mortality. These poisons are of far more concern from an industrial health viewpoint than they are as an intentional poison. The recent F-111 Seal-Reseal Board of Inquiry dealt with a number of chemicals, some of which could be absorbed through the skin. This paper will look at various chemical agents, of military, industrial or agricultural interest, which fall into the category of contact poisons.

Percutaneous Toxicity

The skin is an important portal of entry for many chemical substances. The two most important factors affecting absorption are the concentration of the applied chemical and the surface area of contact. Percutaneous toxicity is enhanced by delivering the largest concentration of agent over the greatest area. Percutaneous uptake will also usually increase if the skin has been damaged by the chemical. Other important factors are the solvent used to deliver a chemical, the site of application (e.g. scalp is 4 times more porous than the hand), the condition of the skin (e.g. DMSO dissolves lipids). The frequency of application[6], age, race and the general hydration of the skin[7]. Areas of greater hydration have greater absorption.

Discussion

Nerve agents, particularly VX, soman (GD) and GF, remain the quintessential contact poisons. Fortunately, they are generally difficult to either manufacture or procure. Other chemicals, whilst not having the extreme toxicity of the nerve agents, are more available industrially or agriculturally and are toxic enough to cause death, generally within a week. Both the organophosphate TEPP, Parathion) and organochlorine pesticides (Chlordane, Endrin) are sufficiently toxic to cause death and have been implicated in a number of industrial and accidental deaths.[s-14] Other agents which pose a danger as contact poisons include organic solvents (carbon tetrachorlide), explosive-related chemicals, (nitroglycerin, ethylene glycol dinitrate), industrial dyes and related chemicals (aniline, benzidine, toluidine) and assorted other chemicals (carbon disulfide, ethylene chlorohydrin, dimethyl sulfate, glycolonitrile, nicotine). B-14 Nicotine and aniline, particularly, have been responsible for a number of accidental contact poisonings[12]. Many of these agents have a noticeable odour which may, fortunately, discourage prolonged contact. Most are, however, commonly used in industry or commercially. Generally, the various toxins, plant poisons, toxic gases and poisonous metals are very poorly absorbed transdermally and pose a greater risk as ingestional or inhalational poisons.

DMSO

One interesting area of current research in the pharmaceutical industry is the development of drug delivery systems, which enhance the percutaneous absorption of various drugs[7]. These agents include Dimethyl Sulfoxide (DMSO). Azone (Laurocapram). Propylene glycol and N-methylpyrrolidone. Solvents such as DMSO can facilitate the penetration of toxicants through the skin by increasing the permeability of the barrier layer of the skin[15], principally by disrupting the lipid layers. A number of these solvents are commercially available. While this is maybe effective in improving the absorption of relatively simple organic molecules, like carbon tetrachloride, the percutaneous absorption of complex molecules like toxins utilising such solvents is expected to be very limited. Leahy's alleged mixture of DMSO and nicotine, however, could be a very effective contact poison.

Conclusion

Although contact poisons remain a favourite of crime fiction writers, they should not be dismissed as a mere literary device. Many military, industrial and agricultural chemicals pose a contact risk. Medical officers should be aware of the possible morbidity from such agents and should consider taking a detailed industrial/commercial exposure history, particularly where there are non-specific health complaints in an industrial setting. Rapid identification and management may prevent long term damage and possible death.

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