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Treating Exposure to Chemical Warfare Agents: Implications for Health Care Providers and Community Emergency Planning

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Current treatment protocols for exposure to nerve and vesicant agents found in the U.S. stockpile of unitary chemical weapons are summarized, and the toxicities of available antidotes are evaluated. The status of the most promising of the new nerve agent antidotes is reviewed. In the U.S., atropine and pralidoxime compose the only approved antidote regimen for organophosphate nerve agent poisoning. Diazepam may also be used if necessary to control convulsions. To avoid death, administration must occur within minutes of substantial exposure together with immediate decontamination. Continuous observation and repeated administration of antidotes are necessary as symptoms warrant. Available antidotes do not necessarily prevent respiratory failure or incapacitation. The toxicity of the antidotes themselves and the individualized nature of medical care preclude recommending that autoinjectors be distributed to the general public. In addition, precautionary administration of protective drugs to the general population would not be feasible or desirable.

No antidote exists for poisoning by the vesicant sulfur mustard (H, HD, HT); effective intervention can only be accomplished by rapid decontamination followed by palliative treatment of symptoms. British anti-Lewisite (BAL) (2,3-dimercapto-1-propanol) is the antidote of choice for treatment of exposure to Lewisite, another potent vesicant. Experimental water-soluble BAL analogues have been developed that are less toxic than BAL. Treatment protocols for each antidote are summarized in tabular form for use by health care providers.

Introduction

The U.S. stockpile of aging lethal unitary chemical weapons and agents is currently scheduled for destruction by April 30, 1997, under the Department of Defense Authorization Acts (PL 99-145 and PL 100-456). Unitary weapons contain lethal agents at the time of assembly, in contrast to binary weapons containing agent precursors that mix upon firing and react to form lethal agents. Thus, the deteriorating unitary weapons stockpile poses a threat in storage as well as in handling during disposal. The stockpiled chemical agents include the organophosphate nerve agents GA (tabun; *N,N*-dimethyl phosphoroamidocyanidate, ethyl ester), GB (sarin; methylphosphonofluoridate isopropyl ester), and VX [*S*-(diisopropylaminoethyl) methylphosphonothiolate *o*-ethyl ester] and the vesicant (blister) agents H/HD [sulfur mustard; *bis*(2-chloroethyl) sulfide], HT: 60% HD and 40% T or *bis*[2(2-chloroethylthio)ethyl] ether, and Lewisite [dichloro (2-chlorovinyl)arsine]. These agents were specifically designed to cause incapacitation or death in military use and are quite effective due to their high toxicities at low doses.

The unitary stockpile is housed at eight locations in the continental U.S. in the form of various weapons (bombs, cartridges, mines, projectiles, rockets), spray tanks, and ton containers (Fig. 1). Two locations, Aberdeen Proving Ground (near Edgewood, Maryland) and Pueblo Depot Activity (near Pueblo, Colorado) store only mustard agent, while the rest stockpile both nerve and blister agents. Agents GB and VX compose most of the nerve agent inventory; a small amount of GA is housed only at Tooele Army Depot near Salt Lake City, Utah.

An analysis of the available antidotes for each nerve and blister agent in the stockpile was performed as a part of evaluating the options of on-site destruction versus transport to a regional disposal facility (*1*). Current decontamination and treatment protocols, antidote toxicities, and the status of recently developed antidotes were evaluated. The study objectives were to compile what is known about antidotes and treatment protocols and to make this information available for evaluation of the risks entailed in various stockpile destruction options and for use by health professionals in community emergency planning.

The essential nature of emergency planning was highlighted in the Final Programmatic Environmental Impact Statement (*1*) for the Chemical Stockpile Disposal Program (CSDP); the probabilities of individual accidents with off-site consequences during the disposal program range from 1×10^{-4} to 1×10^{-10} for the entire stockpile (*1,2*). Thus, the probability of accidents occurring is low but considered credible (i.e., requiring emergency preparedness at prob

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