

VESICANTS (BLISTER AGENTS)

Sulfur Mustard; Nitrogen Mustard; Lewisite; Mustard-Lewisite mixtures.

Agent/Disease: Vesicants (blister agents) are manufactured chemicals used to incapacitate and cause pain and panic rather than to kill, although heavy exposure can result in death. Vesicants are comprised of the mustards – sulfur mustard (H, HD), nitrogen mustard (HN₁, HN₂, HN₃) – and the organic arsenicals: Lewisite (HI, HT, TL, L), methyldichloroarsine (MD), phenyldichloroarsine (PD), and ethyldichloroarsine (ED). Although phosgene oxime (CX) is often included with the vesicants, it is not a true blister agent because exposure does not cause the skin to blister.

Incubation period: Lewisite, combinations of Lewisite and mustard, and phosgene oxime cause immediate symptoms. Symptoms of mustards are typically delayed for several hours after exposure.

Signs/Symptoms: Initial effects of vesicants are on the eyes, skin, and airways. Eye symptoms can range from mild burning, itching, tearing, and conjunctivitis (e.g., low-dose exposure) to iritis and corneal blisters at higher exposure doses. Temporary blindness is common. Recurrent corneal ulcers leading to corneal opacities and permanent loss of vision can occur after high-dose exposure. Skin exposure causes mild to intense itching and burning and a scarlet fever-like rash. After heavy skin exposure, relatively painless blisters appear, usually in the axillae, groin, about the neck, and under the breasts. Blisters may be extensive, resulting in large areas of denuded skin. Respiratory exposure may cause rhinorrhea, pharyngitis, hoarseness, and aphonia from vocal cord damage. Hypoxia from damage to the airways and secondary respiratory infections are common. Death may occur from primary lung damage or from the sequelae of exposure. Severe respiratory exposure that does not cause death can result in permanent lung damage and chronic respiratory disease.

Diagnosis:

Differential Diagnosis: Solitary or isolated cases are difficult to recognize. Signs, symptoms, history and physical examination are the quickest way to diagnose exposure to vesicants, which burn the skin and cause blisters without charring the integument. The victim may have a distinct and disagreeable chemical odor about their person. Differential diagnoses include thermal burns, scarlet fever, sunburn, exposure to plant toxins (e.g., poison ivy), and adverse drug reactions.

Diagnostic Tests: Urinary arsenic excretion is elevated after exposure to Lewisites. Mustard or its metabolite, thiodiglycol, is detectable in urine for up to a week after exposure; however, the presence of thiodiglycol may not be diagnostic, as thiodiglycol has been found in the urine of both exposed and unexposed persons. No other specific biomarkers of exposure to vesicants are available. Reactive leukocytosis and other nonspecific markers of tissue destruction may appear, but are not diagnostic.

Supportive Tests: CBC with differential is useful in the differential diagnosis of vesicant exposures. If mustard exposure is suspected, white blood cell counts should be serially monitored (mustards depress bone marrow function). Gram stains and cultures of skin, eyes, and bronchial secretions can aid diagnosis of secondary infection after vesicant damage.

Chest x-rays will be useful if pneumonia, a common complication of pulmonary exposure to vesicants, is suspected. Monitor electrolyte status if large areas of skin are denuded.

Treatment: Remove vesicants by scraping or blotting the agent from the skin, removing clothing, or using adsorbents to soak up the material; flush the skin with large amounts of water or have the patient shower for several minutes. Soap added to the procedure may marginally improve decontamination, as soap increases ionic degradation and dissolves oily residues. If bleach is used, make a 0.5% solution of Clorox® (1 part Clorox® with 9 parts water). **Do not** use full-strength bleach. **Do not** use bleach solutions to decontaminate areas around the eyes, the mucous membranes, or on patients with thoracic, neural, or abdominal wounds.

Irrigate the eyes with water, normal saline or, for mustards, 1.26% sodium bicarbonate. Follow irrigation with topical ophthalmic antibiotics such as silver sulfadiazine. Topical ophthalmic steroids may be useful if applied within the first 48 hours of exposure. Apply petroleum jelly to the edges of the lids to prevent them from sticking together. Use systemic opioid analgesics to treat the painful eye. Use of local analgesics in the eyes is **NOT** recommended.

If the skin sustains large burns, establish an IV line, but **do not** push fluids as for thermal burns. Cover small blisters (less than 2 cm) and erythematous areas with antibiotic ointments or calamine lotion. Denude (unroof) large vesicles (> 2 cm); thoroughly irrigate the area with sterile normal saline and then apply topical antibiotics. Intense pain and itching may require systemic analgesics and antipruritics. Patients with large areas of blistered or desquamated skin require attention to fluid and electrolyte balance.

Treat hypoxic patients with supplemental humidified oxygen and use mechanical ventilation if necessary. Use cough suppressants to alleviate other upper respiratory symptoms. Sterile cool mist inhalations may be used for laryngitis and tracheitis. Reserve antibiotics for patients who develop fever or show other signs of infection. If purulent bronchitis or pneumonia occurs, identify the causative agent and initiate appropriate antimicrobial therapy.

Vaccines and Prophylaxis: No vaccines or prophylactic agents are available for protection from vesicants.

Infection Control: Emergency and other medical personnel must use appropriate personal protective equipment to protect themselves from secondary exposure to chemical weapons agents. After donning personal protective equipment, personnel should remove the patient's contaminated clothing and isolate the clothing in double plastic bags for later disposal. Decontamination is of the utmost importance and should be done before transporting the patient to prevent secondary contamination of medical personnel and facilities.

Report: Immediately report any suspect cases to the local health authority at 800-705-8868 or the Texas Department of Health at 800-252-8239; reports may also be faxed to (512) 458-7616.