Poison Facts:

Low Chemicals: Dimethyl Sulfate

Properties of the Chemical

Dimethyl sulfate (also known as dimethyl ester) is a clear, colorless, oily liquid with a faint onion-like odor.

Uses of the Chemical

The major use of dimethyl sulfate is as an alkylating agent. It is used in the manufacture of dyes, pharmaceuticals and perfumes and in the extraction of aromatic hydrocarbons as a solvent. It is also used as a sulfating and sulfonating agent. In World War I, it was used as a war gas.

Absorption, Distribution, Metabolism and Excretion (ADME)

Dimethyl sulfate is rapidly absorbed by ingestion, inhalation and through intact skin. It is slowly metabolized to methanol and sulfuric acid. In studies with the chemical, the lungs and brain exhibited a much higher degree of nucleic acid alkylation than the liver and kidneys. Since the lungs and brain receive a relatively larger proportion of the cardiac output, it has been proposed that dimethyl sulfate does not equilibrate throughout the body but breaks down in the organs that it penetrates first, owing to its alkylating abilities. The associated kidney damage would suggest renal elimination of the chemical.

Clinical Effects of Acute Exposure

- **Ocular exposures:** Dimethyl sulfate in both the liquid and vapor forms can be corrosive. Severe ocular burns have been reported, as well as color vision defects. Immediate effects of vapor exposure are irritation and erythema of the eyes that progresses to lacrimation, blepharospasms and chemosis.
- **Dermal exposures:** Dimethyl sulfate has strong corrosive and vesicant properties. The agent also has a numbing effect, so that initial pain is not severe, and treatment may not be sought immediately. Symptoms may be delayed for up to five hours (even after decontamination), during which time absorption through the skin continues. Minimal exposures can result in severe symptomatology.
- **Inhalation exposures:** Severe irritation of the respiratory tract is expected. Ulcerations of the nasal mucosa and throat have also been reported. Cough, hoarseness and edema of the tongue, lips, larynx and lungs occur later, and pulmonary edema may result.
- **Ingestion exposures:** Irritation to the oral mucosa and throat with subsequent ulcerations is possible. These corrosions are equivalent to those caused by sulfuric acid. Dysphagia and glottic, as well as laryngeal edema, should be anticipated. Dimethyl sulfate is classified as a hepatotoxin. Symptoms of hepatic disease include malaise, lethargy, nausea, vomiting, pruritus, right upper

quadrant pain and anorexia. Signs of hepatic disease include scleral icterus, hepatic enlargement and tenderness, dark urine and light-colored, loose stools. Complications of hepatic failure are portal hypertension (esophageal varices, prominent superficial abdominal veins and internal hemorrhoids), edema, spider angiomata, upper gastrointestinal bleeding, encephalopathy, electrolyte imbalance, and, occasionally, concomitant renal failure.

In-Field Treatment Prior to Arrival at a Health Care Facility

All exposures should be transported to a health care facility, even if symptoms are not present at the time.

- **Ocular exposures:** Use copious amounts of water, and irrigate the eyes for 15 minutes prior to or during transport of the patient to a health care facility.
- **Dermal exposures:** Remove all contaminated clothing carefully to avoid exposure to the chemical. Flood the patient's skin and hair with water, and follow up with soap and water prior to transport.
- **Inhalation exposures:** Move the patient to fresh air. For patients experiencing respiratory distress, administer oxygen if available. Airway management may be necessary if laryngeal edema is present.
- **Ingestion exposures:** Immediately give the patient 4 to 8 ounces of milk or water – no more than 8 ounces or 240 ml for adults and 4 ounces or 120 ml for children. Do not induce vomiting.

Special note to first responders:

- Wear a positive-pressure Self-Contained Breathing Apparatus (SCBA).
- Wear chemical protective clothing that is specifically recommended by the manufacturer.
- Decontaminate all equipment, including personal protective gear.

Treatment of Exposures in a Health Care Facility

- **Ocular exposures:** Irrigate the eyes with sterile 0.9 percent saline solution for at least 1 hour or until the cul-de-sacs are free from particulate matter and the pH is neutral when tested with pH paper. The full extent of injury to the eyes and vision may not be apparent for up to 72 hours post-exposure. Patients will need close follow-up care.
- **Dermal exposures:** Remove contaminated clothing carefully. Irrigate the patient in a shower with copious amounts of water, followed by soap and water washings for 20 to 30 minutes. Dermal effects may be delayed for hours. Dermal exposure may lead to systemic effects.
- **Inhalation exposures:** Maintain ventilation and oxygenation. Draw frequent blood gases. Early use of mechanical ventilation with PEEP may be warranted. Glottic and laryngeal edema may be present, and airway management may be necessary.

- **Ingestion exposures:** Immediately administer water – no more than 8 ounces or 240 ml for adults and 4 ounces or 120 ml for children. Ipecac is contraindicated. If a large ingestion has occurred, suctioning gastric contents may be of benefit; however, this poses a high risk of mucosal injury. Since most ingestions will warrant an endoscopy, activated charcoal is not recommended. Due to the corrosive nature of this chemical, activated charcoal should only be used under the advice of the Poison Control Center.

Though symptoms may be delayed, they can progress quickly to critical, as this chemical is known for late-onset effects.

For more poison prevention and first aid information, call the

Poison Control Center

Serving the Residents of Kansas

Toll-free Hotline

1-800-222-1222

THE UNIVERSITY OF KANSAS HOSPITAL

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