

Mustard Gas Recognition and Treatment

Chemical Warfare Agent Identification Fact Sheet Series

The vesicant or “blister agent” known as mustard gas (sulfur mustard) is a chemical warfare agent (CWA) that can cause serious damage to the respiratory tract and eyes and produces life-threatening blisters on the skin. These blisters can look like severe burns. If a victim of mustard gas exposure receives medical treatment shortly after contact with the agent, survival is likely. Mustard gas is deployed as a brownish-yellow vapor with an odor similar to that of garlic, horseradish, or mustard.

- Mustard gas is a chemical warfare agent (CWA) that causes severe chemical burns, painful blisters, and difficulty breathing.
- Exposure is rarely deadly to healthy persons but can cause long-term effects. If person is already sick, mustard gas exposure can result in death.
- Exposure is usually to the gas form, which is yellow/brown; the liquid form is yellow.
- Mustard gas is usually odorless, but may smell like mustard, onions or garlic.
- The best protection against mustard gas is to avoid exposure.
- Leave the affected area if possible. If not, attempt to seal off a room by closing ventilation to the outside and sealing spaces under doors and around windows with wet towels to prevent gas from entering.
- Mustard gas is denser than air and settles in low areas near the ground.
- Gas masks only protect eyes and lungs. Normal clothing provides little to no protection, as mustard gas will penetrate clothing and be absorbed across any body surface.
- Do NOT eat food or drink water exposed to mustard gas.
- Signs and symptoms appear within 2-24 hours following exposure:
 - Severe skin irritation, itching, and blisters
 - Severe irritation of eyes, nose, mouth, and throat
 - Difficulty breathing
- Patients exhibiting these symptoms MAY have mustard gas exposure. Other chemicals called vesicants can cause similar symptoms. A urine or blood test can determine definitively if someone has been exposed. Hair can sometimes be used, if it has absorbed the agent.

continued

Table of Contents

- 2 Properties of Mustard Gas
- 3 Collect Samples to Test for Exposure (applies to all CWAs)
- 3 Protection Against Mustard Gas
- 4 Recognizing Mustard Gas Exposure
- 4 Differential Diagnosis
- 5 Initial Treatment
- 6 Follow-Up Treatment
- 7 Population-Wide Precautionary Measures

This CWA Fact Sheet is part of a Physicians for Human Rights (PHR) series designed to fill a gap in knowledge among medical first responders to possible CWA attacks. PHR hopes that, by referencing these fact sheets, medical professionals may be able to correctly diagnose, treat, and document evidence of exposure to CWAs.

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Mustard Gas Overview

continued

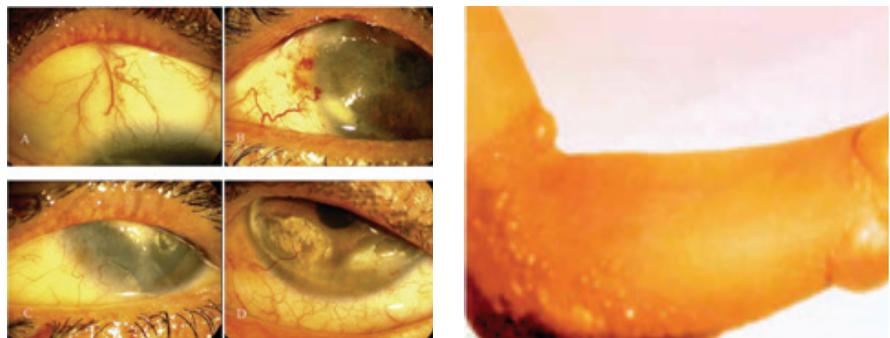
- Decontamination is critically important – for both affected patients and rescuers.
 - Wear protective clothing, including a respirator, and use heavy rubber gloves for protection. If possible, decontaminate in an area away from where treatment will be given.
 - Decontaminate all protective clothing, respirator, and gloves after exposure to contaminated clothing.
 - Equipment may have to be disposed of in sealed, impermeable plastic bags.
 - Cut off clothes rather than pull them over the head to avoid further exposure to eyes, nose, and throat.
 - Gently wash skin immediately with soapy water. May use 10cc bleach per liter of water (saline), but take care not to damage skin.
 - If available, use neutralizing preparations such as chloramine solutions, fuller's earth, or Reactive Skin Decontamination Lotion (RSDL).
- Use cool mist or steam to ease respiratory complaints.
- Routine wound care: Apply sterile petroleum jelly to eyelids and ruptured blisters to prevent them from sticking to dressings.

Properties of Mustard Gas:

- Name refers to both nitrogen mustard and the three forms of sulfur mustard (H, HD, and HT)
- Can be weaponized in liquid, mist, or gas form
- Can be absorbed through inhalation or through the skin
- May be odorless or smell like garlic, onions, horseradish, or mustard
- Pale yellow or amber color when in liquid form
- Heavier than air, tends to remain in low areas
- Can remain in the environment for up to two days in warm weather / over a week in cold weather (but much longer if buried beneath the soil surface)
- Can be transported easily by the wind

Eye irritation caused by mustard gas (left)

Blisters caused by mustard gas (right)



Mustard gas causes severe chemical burns, painful blisters, and difficulty breathing.

Collect Samples to Test for Exposure (CWAs)

- Collect urine samples, and blood and hair samples if possible, immediately after exposure.
- Collect follow-up samples at 24 hours and 48 hours and again 7 days after exposure.
- Blood and urine can be collected as long as 30 days after exposure and laboratory tests may reveal the presence of mustard gas or breakdown products.
- Use containers made of unbreakable plastic.
- Affix a means of identifying samples, record date taken, time taken; seal securely.
- Document all symptoms on paper and include with sample; note amount of time it took patients to begin experiencing symptoms after initial exposure.

Urine-specific

- Collect at least 10-30 ml of urine.
- Collect a control urine sample from a person who was not exposed.
- Collect urine in sterile urine cups.
- Ship urine sample with dry ice if possible so that sample is frozen, or at least kept cold.

Blood-specific

- Collect at least 10-15 ml of blood.
- Keep blood samples cold by placing on ice for as long as possible.
- Where possible, spin blood to collect plasma. If not possible, allow blood to coagulate and collect serum.
- Conduct a complete blood count (CBC) test.
 - A CBC is a regularly used test to examine the health of an individual by measuring the concentration of substances in the blood.
 - Red and white blood cell count may indicate presence of mustard gas.
 - Blood test is usually combined with a urine test to gather definitive proof of exposure.

Hair-specific

- Collect a sample preferably before it has been washed.
- The hair does not need to be collected at the scalp.

Protection Against Mustard Gas

- Remain upwind of the affected area if possible.
- Use gas masks to protect eyes and lungs.
- Use full body gear to protect skin (normal clothing offers little protection).
- Attempt to seal off room from contaminated air if unable to exit a contaminated building.
 - Stay in rooms without vents or windows.
 - Turn off ventilation systems if possible.
 - Set ventilation systems to only cycle air inside the building if gas is released outside.
 - Place wet towels, rags, or other airtight materials along openings under doors or around windows to prevent gas from seeping in.
- Do not consume food and water that has come into contact with mustard gas.

Exposure to mustard gas is rarely deadly to healthy persons but can cause long-term effects.

Recognizing Mustard Gas Exposure

- Physical reactions to mustard gas usually manifest within 2-24 hours after exposure – but some people may react sooner.
- Symptoms of exposure to mustard gas include:
 - Severe skin irritation, including redness and blisters
 - Severe eye irritation, including tearing, conjunctivitis, and corneal damage
 - Mild to extreme respiratory distress, ranging from sore throat and hoarse voice to pneumonia
 - 2nd and 3rd degree chemical burns
 - Intense itching and a brown-yellow pigmentation at the burn site
- Death can occur but is unlikely if adequate medical care is provided.

Differential Diagnosis:

- A patient exhibiting the above symptoms has NOT necessarily been exposed to mustard gas.
- A urine or blood sample can definitively determine whether a person was exposed to mustard gas.
- Other vesicants in addition to mustard gas will cause similar damage to individuals.

Blisters

- Blisters similar to those seen in cases of mustard gas exposure can be caused by allergic reactions to certain insects or plants (see photo below).
- Itching, rashes, and swelling are also common in many allergic reactions.
- Blisters can also be caused by diseases:
 - Bullous pemphigoid – common in people over 60
 - Dermatitis herpetiformis – a condition in which large blisters are intensely itchy and develop bilaterally
 - Chronic bullous dermatosis of childhood – where blisters form around the face, mouth, and genitals

Eyes

- Conjunctivitis can be caused by allergic, viral, or bacterial infections as well as mustard gas.

Respiratory Distress

- Other respiratory conditions such as bronchitis can cause a hoarse voice and pneumonia.
- Bacterial infections from a variety of sources can also cause pneumonia.
- Hot air or steam inhaled from fires, incendiary weapons, or caustic chemical fumes can also cause similar tissue damage to the respiratory system.

Poison Oak reaction (left)

Mustard gas reaction (right)



Mustard gas exposure can cause 2nd and 3rd degree chemical burns.

Initial Treatment

Triage

- Should happen immediately
- Separate contaminated patients into three categories:
 - Contaminated patients who are medically stable
 - Contaminated patients who require immediate stabilization prior to decontamination (patients with life-threatening bleeding, in cardiogenic shock, etc.)
 - Contaminated patients who have life-sustaining medical gear (tourniquet, airway adjunct) that will need to be replaced after decontamination

Decontamination / Treatment

- No antidote exists for mustard gas exposure.
- Focus on decontamination.
- Start decontamination within the first two minutes of exposure, or blisters will form.
- Decontaminate in an area away from where treatment will be given.
- Wear protective clothing, a respirator, and use heavy butyl rubber gloves for protection over nitrile gloves if possible.
 - If unable to obtain butyl gloves, two layers of nitrile gloves will suffice.
- Start decontamination procedures at the head and end at the toes.
 - Cut off any clothing that would have to go over the head to prevent further contamination.
 - Remove contaminated clothing while taking proper precautions to keep the rescuer safe.
- Gently wash skin immediately with soapy water for decontamination. May use 10cc bleach per liter of water (saline), but take care not to damage skin.
 - If available, use neutralizing preparations such as chloramine solutions, fuller's earth, or Reactive Skin Decontamination Lotion (RSDL).
- Wash the patient's skin and eyes thoroughly with water or saline solution.
 - Wash the eyes starting from the nose and moving toward the temples.
- Cut off or wash hair after a sample has been collected and stored in a plastic tube.
- After decontaminating patients, rescuers must be decontaminated.
 - Protective clothing, respirator, and gloves will require decontamination after working with contaminated clothing.
 - Equipment may have to be disposed of in sealed, impermeable plastic bags.
- Perform triage on decontaminated patients similarly to a typical mass casualty event.

No antidote exists for mustard gas exposure.

Follow-Up Treatment

Blisters

- Blisters caused by mustard gas are initially fragile, but will harden over time.
- Fluid in blisters is not dangerous to the rescuer.
- Fluid will reabsorb in 1-3 weeks depending on severity/location/sensitivity.
 - Highly vascular areas (face) reabsorb faster.
 - Low vascular areas (hands/feet) take longer.
- Infection is the primary concern if the blister ruptures.
 - Clean area with tap water or saline solution.
 - Cut away the ragged edge of a ruptured blister to prevent secondary infection.
 - Apply topical antibiotics regularly.
 - Cover small, open blisters with petrolatum gauze.
 - Leave large, open blisters uncovered.
 - Inspect wounds and change dressings every 3 to 4 days .
 - Carefully remove dressings so that the tops of blisters are not pulled off.

Eyes

- Treat mild eye irritation with antibiotics to prevent infection.
- Apply sterile petroleum jelly in between the eyelids to prevent the lids from sticking together.
- Serious eye irritation will result in swelling and photophobia, blocking patient's vision.
 - Gently force the patient's eyes open to reassure them they are not blind.
- Do not bandage eyes; eyelids can stick together and cause corneal damage.

Burns

- Mustard gas burns often look like a sunburn or rash in area surrounding blisters.
- Burns may appear without any blisters in cases of mild exposure.
- Treat burns with topical ointments to reduce swelling and itching.

Respiratory Distress

- Treatment is seldom required for mild respiratory irritation such as hoarse voice and sore throat.
- Treat irritation by having the patient inhale steam or cool mist.
- Lesions occasionally develop in the upper and lower respiratory system.
- Symptoms can lead to pulmonary complications, including infection and pneumonia.
- Use targeted antibiotics where appropriate.
- Respiratory complication is the most common reason for death from mustard gas.

Mustard gas burns often look like a sunburn or rash in area surrounding blisters.

Population-Wide Precautionary Measures

- Locate safe, easily sealable rooms in homes and offices.
 - Review with family members and colleagues how to access and exit these rooms in an emergency. Store supplies listed below in these rooms.
- Supplies
 - Clothes
 - Store extra clothing in airtight containers to have safe clothes to wear after decontamination.
 - Decontamination materials
 - Store bleach and water in safe, airtight containers.
- Food and water
 - Store food and water in airtight containers.
 - Decontaminate exterior of tin cans or aluminum cans before eating food.
- Cover open water sources such as wells with tarps to prevent contamination.
- Assume that water from aquifers is contaminated until tested.

* Information in this fact sheet has been compiled from publicly available sources, including: The Centers for Disease Control and Prevention, Emedicine, Federation of American Scientists, Global Security, International Committee of the Red Cross, National Health Service, New York State Department of Health, QANDIL, US Army, US Occupational Safety and Health Administration, and Washington State Department of Labor and Industries.



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