

Evaluating Mercury Exposure: Information for Health Care Providers

This fact sheet is designed to increase the primary care provider's knowledge of environmental elemental (metallic) mercury exposure, and to aid in the clinical evaluation and treatment of patients who have been exposed to elemental mercury.

Elemental Mercury

The elemental (metallic) form of mercury is a heavy, silvergray liquid that volatilizes slowly at room temperature. Elemental mercury, also known as quicksilver, poses a negligible risk of severe toxicity after a single ingestion dose. However, mercury vapors are readily absorbed when inhaled and mercury is rapidly distributed through the body, including the central nervous system and the placenta. Exposures can result in central nervous system and renal toxicity which may be insidious in onset and non-specific.



Possible Exposure Sources

- Improper clean-up (vacuuming) of broken mercury-containing household items (thermometers, thermostats, electrical switches, compact fluorescent light bulbs)
- Recent application of mercury-containing paint or caulk
- Occupation and hobbies of home occupants
- Recent move to a residence contaminated with mercury by previous tenant
- Use of folk remedies
- Use of elemental mercury in a school laboratory
- Misuse of mercury by collecting large quantities and using it for recreational activities
- Mercury containing sphygmomanometers and thermometers in your office

Signs, Symptoms and Health Effects

Signs, symptoms and health effects from elemental mercury exposure will vary based on concentration of exposure, route of exposure, duration of exposure as well as individual susceptibility.

Acute Inhalation (High Dose)

Inhalation of high concentrations of elemental mercury vapor may rapidly produce cough, dyspnea, chest pain, nausea, vomiting, stomatitis, diarrhea, fever, and a metallic taste in the mouth. Later, interstitial pneumonitis, necrotizing bronchiolitis, and pulmonary edema may develop. Children less than 30 months of age appear to be at increased risk for pulmonary toxicity, usually following an incident of mercury vaporization in the home. Renal manifestations include proteinuria, acute tubular necrosis, and oliguric renal failure. Conjunctivitis and an erythematous, pruritic rash have been reported with relatively mild exposure to mercury vapor.

Acute Ingestion

Ingested liquid elemental mercury is poorly absorbed and therefore poses only limited risk of toxicity. Individuals with gastrointestinal abnormalities (fistula, perforation) may sequester mercury and have subsequent absorption.

Acute Direct Contact

Contact with liquid mercury has been associated with a dermatitis characterized by a papular erythema.

Chronic Inhalation

Chronic exposure primarily affects the central nervous system. Chronic exposure produces a classic triad of tremor, gingivitis and erethism (insomnia, excessive shyness, and emotional lability). Other psychological findings include headache, short-term memory loss, and anorexia. Fine tremors in the fingers, eyelids, and lips are early signs of mercury toxicity. Other peripheral nervous system findings include distal paresthesias, motor and sensory nerve conduction delay, and limb weakness. Gingivitis, stomatitis and excessive salivation may occur. Acrodynia, a non-allergic hypersensitivity reaction, may develop in children exposed to mercury vapors. In children, developmental milestones should be evaluated.

Laboratory Tests

Urine levels of mercury provide the most appropriate assessment of elemental mercury exposure and are useful for the assessment of acute and chronic exposures. A 24-hour urine specimen collected in an acid-washed plastic container is the preferred specimen. A first morning void can provide a close approximation of the urine (using specific gravity or amount of creatinine present). A urinary mercury concentration of less than 2 micrograms per liter ($\mu\text{g/L}$)¹ (the 95th percentile for adults) would be considered within the background range.

Mercury has a short half-life in blood (3 days), so blood analysis may be performed during the first 3 days after an acute high level exposure. Interpretation of blood Hg levels may be complicated by dietary sources of mercury. Blood samples should be collected in vacutainers containing heparin and then refrigerated. The blood Hg level for the 95th percentile of the U.S. population is below 5 micrograms per liter ($\mu\text{g/L}$)¹; a blood concentration of 50 $\mu\text{g/L}$ or greater is considered the threshold for symptoms of toxicity. Some individuals with high blood mercury levels may not exhibit clinical symptoms. Hair analysis primarily measures organic (methyl) mercury exposure only and is not useful for assessing recent exposures.

Relationship of Urinary Mercury Concentration with Effects

URINARY MERCURY CONCENTRATION ($\mu\text{g/L}$)	SIGNS AND SYMPTOMS
<20	None
20 - 100	<ul style="list-style-type: none">• Decreased response on tests for nerve conduction, brain-wave activity, and verbal skills• Early indication of tremor on testing
100 - 500	<ul style="list-style-type: none">• Irritability, depression, memory loss, minor tremor, other nervous system disturbances• Early signs of disturbed kidney function
500 - 1000	<ul style="list-style-type: none">• Kidney inflammation• Swollen gums• Significant tremor and nervous system disturbances

Elemental Mercury Treatment and Management

Symptomatic patients who have experienced acute high-dose elemental mercury inhalation exposure should receive supportive care and be monitored for development of acute pneumonitis and pulmonary edema in a hospital setting. For severe symptoms and highly elevated circulating levels of elemental mercury, chelation may be required. Agents, such as dimercaptosuccinic acid (DMSA) contain sulfhydryl groups, which bind mercury ions and facilitate their excretion through urine and feces. These drugs may be expensive and are not always covered by health insurance.

For More Information

- ATSDR Case Studies in Environmental Medicine—Taking an Exposure History www.atsdr.cdc.gov/csem/
- ATSDR Medical Management Guidelines for Mercury www.atsdr.cdc.gov/MMG/MMG.asp?id=106&tid=24

References

¹CDC National Health and Nutrition Examination Survey (NHANES) (2013-2014); summarized in Fourth National Report on Human Exposure to Environmental Chemicals (<https://www.cdc.gov/exposurereport/index.html>).



Consult your regional Poison Control Center, 1-800-222-1222, or a medical toxicologist experienced in chelation therapy for decisions regarding administration of chelation therapy.

- If more than two tablespoons of mercury are spilled, it is mandatory to call the National Response Center (NRC), available 24 hours a day, 1-800-424-8802.
- If you have health-related questions about mercury, call the Agency for Toxic Substances and Disease Registry (ATSDR) at 800-232-4636 or TTY: 888-232-6348, or by email to cdcinfo@cdc.gov.