Because [elemental] mercury produces subtle effects at chronic low-level exposures, mercury toxicity can be a difficult diagnosis to establish.

Exposure Pathways

Mercury exists in three forms: elemental mercury ..., inorganic mercury salts ..., and organic mercury [eg methylmercury]. Elemental mercury is a silver-gray liquid at room temperature that vaporizes readily when heated [as well as at room temperature]. Commonly referred to as quicksilver or metallic mercury [azogue or mercurio in Spanish; mercure or vie d’argent in French; merki in Haitian Creole], it is used in thermometers, thermostats, switches, barometers, batteries, and other products. Elemental mercury vapor accounts for most occupational exposures.

[This excerpt deals primarily with elemental mercury exposure.]

Elemental mercury vapor accounts for most occupational and many accidental exposures. Metallic mercury has been used by Mexican-American and Asian populations in folk remedies for chronic stomach disorders and by Latin-American and Caribbean natives in occult practices.

Who’s at Risk

Fetuses, infants, and children are at greatest risk of ... mercury’s adverse effects. Children are at increased risk of exposure to elemental mercury in the home because mercury vapor tends to settle to the floor.

Children are attracted to the appearance and unique properties of liquid elemental mercury and are at risk of ingesting elemental mercury, as well as mercury-containing dust and soil, because of natural mouthing behaviors. Infants and children are at increased risk of inhaling elemental mercury vapor because mercury vapor is heavier than air and tends to settle to the floor.
Biologic Fate

Inhaled as a vapor, elemental mercury is almost completely absorbed (about 80%) and diffuses rapidly across the placental and blood-brain barriers. Ethanol, even at non-intoxicating levels, inhibits mercury oxidation in the blood and prolongs elemental mercury’s half-life in the body.

When ingested, elemental mercury is poorly absorbed from the gastrointestinal tract (about 0.01%). ... elemental mercury as a liquid or vapor can be absorbed percutaneously.

The urine and fecal elimination pathways account for most of the excretion of elemental mercury. Exhalation of mercury vapor and secretion of mercuric ions in saliva and sweat contribute to the elimination process. The biologic half-life of inhaled elemental mercury in humans is approximately 60 days.

Physiologic Effects

The primary organ system affected by chronic exposure to elemental mercury ... is the nervous system.

Exposure to mercury vapor ... produces an apparently dose-dependent proteinuria or nephrotic syndrome.

In experimental animals, exposure to elemental mercury vapor ... has produced developmental anomalies, but the relevance of these findings to humans is unknown.

Clinical Evaluation

A complete history and careful evaluation of the nervous system and kidneys are essential in diagnosing mercury toxicity.

A complete history of a patient with possible mercury toxicity should contain the following information: ...

- recent move. Previous tenants may have spilled mercury, ...

- uses of folk medicines. Mercury compounds have been detected in folk and nontraditional healing medications. ...

The nervous system and kidneys should be carefully examined. Recent behavioral changes, such as an increase in irritability or shyness and changes in short-term memory, should be documented. In children, developmental milestones should be evaluated. Blood pressure and liver function also should be assessed. ... If elemental mercury vapor has been inhaled, a chest x-ray should be obtained.
Signs and Symptoms
Chronic Exposure
Elemental Mercury

The most important effects of chronic exposure to elemental vapor involve the nervous system. At chronic low doses, the body oxidizes most of the elemental mercury to mercuric ions ..., which do not readily cross the blood-brain barrier. At high doses, the body is not able to metabolize the mercury rapidly enough, and more mercury reaches the brain. CNS signs and symptoms include psychological changes, insomnia, loss of appetite with weight loss, excessive shyness, and emotional instability), irritability, headache, and short-term memory loss.

Tremor, though seldom the first sign to appear, is characteristic of exposure; it usually disappears if exposure is stopped. Other peripheral nervous system findings include distal paraesthesias, motor and sensory nerve conduction delay, and limb weakness.

Acrodynia, a rare syndrome characterized by severe leg cramps; irritability; paraesthesias; and painful pink fingers and peeling hands, feet and nose, may develop in children exposed to elemental mercury ... It is not known why children but not adults are affected by acrodynia. It is also an enigma why few children exposed to mercury develop acrodynia. If one case is diagnosed, it is likely that other persons have been exposed.

Laboratory Tests
Direct Biologic Indicators

Mercury can be measured in blood, urine, and hair. Since mercury has a short half life in blood (3 days), blood analysis is typically performed shortly after exposure; urine is the best biologic specimen when chronic mercury exposure is suspected. Hair analysis can provide evidence of methylmercury exposure. ...
A urinary mercury concentration of less than 20ug/L in adults is considered background. [In NY State, a urine Hg level =>20ug/L must be reported to the NYS DOH Heavy Metals Registry in Albany.] Urine mercury concentrations from 20 to 100ug/L are associated with subtle changes on some tests, even before overt symptoms occur. [These include] decreased response on tests for nerve conduction, brain-wave activity, and verbal skills, [and] early detection of tremor on testing. [Urine mercury levels of] 100 to 500 [ug/L are associated with] irritability, depression, memory loss, minor tremor, and other nervous system disturbances, [as well as] early signs of disturbed kidney function.

Background or toxic urinary mercury concentrations have not been determined for children.
Treatment and Management

Chelation therapy has been used successfully in treating patients who have ... inhaled elemental mercury.

Elemental mercury is usually nontoxic when ingested; the amount contained in a fever thermometer typically presents little risk.

To clean up a spill of metallic mercury, an ordinary household vacuum cleaner is of little use and may be harmful since it will vaporize the mercury and increase the airborne mercury concentration. Professional toxic clean-up with a self-contained vacuum system or a mercury clean-up kit should be used. Contaminated carpeting or porous tile should be discarded after clean-up.

The original 25 page monograph, and others in the "Case Studies in Environmental Medicine" series, are available gratis from the:

Continuing Education Coordinator
Agency for Toxic Substances and Disease Registry
Division of Health Education, E33
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Monograph 17, Mercury Toxicity, includes a test which can be submitted to the ATSDR for continuing medical education (CME) credit or continuing education units (CEU).

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