



Mercury and thermometers

Many colleagues who have worked in casualty departments or emergency rooms will have encountered anxious parents bearing fragments of glass thermometers that do not include the mercury-containing bulb, and whose children are presumably suffering from indigestion or worse. Many of those colleagues will have found the parental anxiety infectious. Mercury is after all known to be a very toxic substance. An X-ray of the abdomen reveals the offending object. What is to be done? Purge? Operate? Chelate? Or is masterly inactivity indicated?

The condition associated with acute and chronic mercury poisoning is named mercurialism. It is a combination of neurological symptoms and signs that include an erratic paranoid behavioural disturbance named erethism. Perhaps the proverbial mercurial personality is not a metaphor for mercury rising and falling in a thermometer tube, but rather refers to erethism. Renal and haematological effects are also described.

The main forms of mercury are inorganic and organic.¹ Inorganic mercury includes the metallic form found in thermometers. Metallic mercury is fairly harmless under non-occupational conditions. Vaporisation from mercury spills in areas with limited ventilation may result in rapid absorption from the lungs. However, negligible amounts are absorbed from the gastrointestinal tract (GIT) when swallowed, and I would be more worried about the glass than the mercury that we see on the X-ray. There are many mercury salts which occur naturally in ores or are manufactured in the chemical industry for a multitude of uses. These are more hazardous and are absorbed by the lungs and GIT as well as the skin.

As with so many toxic materials, occupational exposure has resulted in the identification, treatment and prevention of adverse health effects. Historically,² inorganic mercury in the form of mercury nitrate salts was used as a fungicide for felt preservation in the hat industry from the 1600s. There are interesting cultural and literary connections in that French Huguenots (well known to us in South Africa) held the monopoly on the process of *secretage* of felt, and their departure from Catholic France in the mid-1600s led to the decline of the French hat industry. (While their relocation to England gave the hat industry there a boost, little is known about their millinery contributions to South Africa.) The trade secret was mercury. Lewis Carroll's mad hatter in *Alice in Wonderland*, written in the 1860s, has been described by some as suffering from erethism, but this is disputed by other historical investigators.² Even murkier past connections have been proposed, which have syphilitic French felt-making workers on mercury therapy beneficiating their produce by urinating on the camel hair being transformed into felt. Industrial practices at the time involved mixing urine with the hair, and urine

containing mercury was presumably found empirically to be superior to non-syphilitic workers' urine in producing a better final product.

Inorganic mercury has many other uses, among others the extraction of gold and silver from ore, and dental amalgam. Some of these uses have been discontinued because of the toxic effects of mercury exposure on workers. Mercury nitrate used in felt making was banned in the USA in 1941.

Organic mercury compounds involve molecules in which mercury is bound to carbon atoms, and these are extremely toxic as they are readily absorbed by the lung, GIT and skin and easily cross the blood-brain barrier. The most infamous example is methylmercury, responsible for the Minimata Bay disaster in Japan, where between 1930 and 1960 a petrochemical company dumped large quantities of mercury compounds in the bay, resulting in high concentrations of methylmercury in the food chain and poisoning fish eaters on shore. Birth defects, brain damage and neurological disease affected and killed some 3 000 official victims, but subsequent studies have shown tens of thousands more. This is one of the relatively rare environmental disasters linked to industrial production – similar to the Bhopal disaster in India where in 1984 a Union Carbide plant leaked 40 tons of toxic methyl isocyanate gas, which killed more than 3 000 and injured up to half a million people in the world's worst environmental disaster.

Organic mercury compounds are used as antiseptics, diuretics, pesticides (mainly fungicides) and preservatives in paints and in the chemical industry.

In the occupational health setting there are well-established occupational exposure limits and biological exposure indices based on measuring mercury in blood. At levels below these limits no serious effects have been found in recent times. This includes studies of dentists, dental technicians and patients with dental restorations. Findings of subtle adverse effects at low exposure levels are somewhat controversial, and the number of dental restorations has recently been shown to increase the body burden of mercury.³

More recently, environmental concerns about mercury have focused on pollution caused by the use of mercury in gold refining near goldmining activities. This applies particularly to informal sector goldmining and associated refining, which is very widespread in southern African countries and also in the Amazon basin in Brazil, where there is currently a gold rush. Mercury is used to extract gold from the river sediments and is then burned off in its elemental form from amalgams or as mercury salts. Approximately 130 tonnes of mercury waste are released into the surrounding environment from goldmining in Brazil each year. Researchers found that mercury was present



EDITORIAL

in river sediments, in fish and in people associated with the river. The main component of the mercury in the river sediments was however found to originate not from industrial waste but rather from mercury that has naturally accumulated in soil over thousands of years being washed into waterways, through soil erosion caused by massive deforestation. Inorganic mercury is converted by micro-organisms in the soil and water to its organic form as methylmercury. Fish higher up the food chain ingest the organic mercury, which is particularly concentrated in carnivorous fish that prey on other fish. Researchers have found that low-level exposure to mercury measured in hair is associated with adverse neurobehavioural effects (motor and visual function).⁴

So what does one do when confronted with that X-ray showing a thermometer bulb? Let nature take its course –

which is probably what we should not be doing in order to control environmental mercury pollution. The latter scenario deserves more attention and preventive intervention.

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