■ ELISA/ACT Biotechnologies LLC ■

LRA by ELISA/ACT® CLINICAL UPDATE #5

Mercury Toxicity

Mercury Toxicity and Hypersensitivity

Mercury is, in myth, the fleet-footed messenger of the gods. Mercury salts, however, when introduced into a living organism, are the antithesis. In a living organism, mercury disrupts communication systems by uncoupling the energetic and information processing machinery. Neurologic, immunologic, hormone, and enzyme-dependent essential cell functions are affected.

Mercury effects are by different mechanisms and include:
1. The ability to cause competitive and noncompetitive inhibition of enzyme activity by reversibly or irreversibly binding to an active sulfur at the activity center.
2. By binding where other divalent cations, like magnesium, manganese, zinc, and copper would be preferable, mercury disrupts critical electron transfer reactions.
3. By binding to complex molecules and inducing in them a change in structure or conformation, which makes them be seen as foreign by the body's immune defense and repair system. This hypersensitivity can potentiate or exacerbate autoimmune reactions.1,2

Mercury has a special affinity for enzymes with a sulfhydryl protein component. These enzymes are involved in intracellular respiration, free radical scavenging, and detoxification. Mercury binds to these enzymes and blocks their ability to function, resulting in a kind of "cellular suffocation". As a by-product of these effects, mercury promotes intracellular free radical production and cellular dysregulation. This can ultimately result in cell-to-cell (and, therefore, organ-to-organ) communication breakdown. Dose-dependent, this can have profound systemic consequences.

Mercury accumulates mainly within organs and tissues that contain the greatest concentrations of sulfhydryl enzymes.1,2 Those tissues/organs include brain, nerve tissue, and spinal ganglia; anterior pituitary; adrenal medulla; liver; kidney; spleen; lungs; and intestinal lymph glands.1-3 Its greatest preference, however, is for the brain, nerve tissue, and liver. Methylmercury has a half-life of approximately 70 days in most tissues, and up to 240 days in the brain. Half-life or turnover rate is dependent upon the levels of sulfur-containing amino acids like cysteine and methionine as well as minerals like zinc and copper, magnesium, and manganese. Supplementation with these minerals and particularly when combined with ascorbate can displace and reduce the body's burden of mercury.1,4,5

Uptake and Exposures

Areas of mercury uptake in the body include the lungs, intestinal tract, jaw tissue, and skin.1,5 The lungs are primarily exposed to mercury vapor from: 1) amalgams via chewing, bruxism, acidic foods, and/or brushing; 2) latex paint; 3) some fungicides and adhesives; and 4) air around industrial areas and sewage/waste disposal plants.1-6 The intestinal tract and jaw tissue is primarily exposed to mercury from amalgams and the consumption of contaminated foods such as many fresh and saltwater fish (primarily sword fish, tuna, blue fish, white bass, and shark) and shellfish, grains and seeds treated with mercurial fungicides, and produce grown in soil fertilized with sewage sludge.1-6 Principle contact with the skin comes from:
1) industrial/occupational exposures;
2) broken thermometers;
3) paints;
4) fungicides;
5) cinnabar (used in jewelry);
6) mercurial ointments and antiseptics; and
7) some fabric softeners, cosmetics, adhesives, floor waxes and polishes, and wood preservatives.1-7

By far, it appears that the most common chronic exposure to mercury is through silver-amalgam dental fillings.4 Mercury accounts for about 50% of this alloy by weight. In a well-filled mouth, mercury amalgams can release 10 µg to 100 µg per day.4 A positive correlation

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between the number of occlusal surfaces of dental amalgams and mercury levels in the brain have been demonstrated.8 Single composition type amalgams release more mercury than conventional or disbursed ones.7

Probably, the most common acute exposure to mercury is through occupational contact and inhalation of mercury vapor from the indoor use of mercury-containing latex paints.2,9,10 Mercury is still used in many latex, water-based paints to prolong shelf life, due to its fungicidal and bactericidal properties. These paints are commonly used indoors. "Potentially hazardous exposures to mercury have occurred among persons whose homes were painted with a brand of paint containing mercury at concentrations approximately 2-1/2 times the Environmental Protection Agency's recommended limit."10

Toxic Manifestations

Chronic, low-level mercury exposure has been associated with immune dysfunction (primary effect on T lymphocytes and thymic cortex), chronic fatigue, various neurologic disorders including multiple sclerosis, and organic mental disorders.1,2 Symptoms of mercury exposure/toxicity include fatigue, leg cramps, rash, excessive perspiration and/or salivation, tachycardia, intermittent low-grade fevers, irritability, depression, apprehension, poor cognition and memory, insomnia, personality changes, headaches, tremors (especially of the extremities, tongue, and lips), chorea, muscle weakness, peripheral nervous system dysfunction, ataxia, diarrhea, stomatitis, swollen tongue, slurred speech, anorexia, weight loss, nephritis, and renal failure.1,2

Besides the symptoms/disorders caused by mercury toxicity, exposure to mercury compounds can also result in delayed type hypersensitivity (DTH) reactions. It has been estimated that about 5.4% of the population of North America has a contact hypersensitivity to mercury.5 In those people with such a hypersensitivity, mercury exposures (chronic or acute), at very minimal levels (not commonly considered to be problematic), can result in symptoms/ disorders associated with DTH. These people may not necessarily have elevated levels of mercury upon testing but may still complain of problems associated with mercury exposure. They are also more likely to have problems with silver-amalgam fillings.

Testing for mercury toxicity and hypersensitivity can be done in a few different ways.

For mercury toxicity, we recommend 24 hour provocative urine testing (provoked with d-penicillamine or some other chelator) for urinary levels of mercury over analysis for blood levels. Blood levels of mercury are poorly reflective of tissue levels.4

For mercury hypersensitivity testing, we recommend the Lymphocyte Response Assay (LRA) by ELISA/ACT® -- a unique way to measure immune hypersensitivity to mercury.

For further information on the LRA by ELISA/ACT tests and treatment plans, please contact EAB at (800) 553-5472. We will be happy to provide you with information about mercury hypersensitivity and provocation testing you need to better serve your patients.

References

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10. Agocs MM, et al: Mercury exposure from interior latex paint. *NEJM* 1990; 323:1096-101.

Contact

If you have any questions or would like more information about LRA by ELISA/ACT testing, please contact EAB's Client Services Department at (800) 553-5472.