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Heavy Metal Toxicity

Treatment Regimes for Selected Heavy MetALS

- Arsenic
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Arsenic

Chelation therapy shortens the distribution of arsenic in the blood and reduces the body burden. It can reduce the risks of serious delayed effects, but chelation does not reverse damage from the delayed effects of acute arsenic poisoning (see the ATSDR Medical Management Guidelines). BAL, DMSA, and D-penicillamine are the primary drugs used to remove arsenic. Chelation therapy with BAL by injection is the primary form of treatment for acute arsenic toxicity. The oral chelating agent DMSA is also an effective treatment choice.

Supportive care with abundant fluids to increase elimination of arsenic may be required. Exchange transfusion and hemodialysis may also be necessary in the event of kidney failure. However, these treatments are supportive and do not remove arsenic (Roberts 1999). Decontamination of the gastrointestinal system with gastric lavage aids in reducing continued absorption of arsenic. Whole bowel irrigation may also be necessary. Use supportive measures, such as correcting heart rhythm irregularities and hypotension (Ferner 2001).

Mercury

Chelation therapy is the usual treatment method for mercury poisoning, using BAL, DMSA, or D-penicillamine (Ferner 2001). BAL is widely used for inorganic mercury poisoning (Roberts 1999), with D-penicillamine used as an alternative. Other treatments are activated charcoal for gastrointestinal decontamination unless there is evidence of corrosive damage in the gastrointestinal tract (Ferner 2001), gastric and whole bowel lavage, and supportive measures. However, charcoal is not usually given when elemental mercury is ingested because elemental mercury is poorly absorbed in the gastrointestinal tract (see the ATSDR Medical Management Guidelines; see Life Extension Magazine, May 2001, page 48, for a detoxification protocol to be used in conjunction with the removal of mercury amalgams).

Iron

Chelation with deferoxamine is commonly used with blood serum levels greater than 500 mg/dL. (This level is only a guide. Much lower levels are known to produce cardiovascular difficulties, and some persons with higher levels exhibit no symptoms.) Deferoxamine is a drug that binds to absorbed iron very well and is eliminated in urine. Deferoxamine may be administered by injection or by intravenous administration; however, IV administration is less painful and more efficient. Supportive care with special attention to fluid balance and cardiovascular stabilization are essential in iron poisoning (Roberts 1999).

Blood levels are used as a guide to therapy, but the estimated ingested amount is often used to determine the initial course of action. If the person is symptomatic, however, or if the amount ingested exceeds 20 mg/kg (or as few as 5-9 30-mg tablets for a 30-pound child), gastrointestinal decontamination is recommended. Inducing emesis is an option within the first hour after ingestion. Gastric lavage may also remove fragments of tablets (Roberts 1999). Note: BAL chelation is contraindicated for iron toxicity, because BAL can combine with medicinal iron to become very toxic (see the ATSDR Medical Management Guidelines).

Lead

Chelation therapy with DMSA for children with blood lead levels of greater than 45 mcg/dL was approved in 1991 by the FDA (Wentz 2000). A major advantage of DMSA is that it can be given orally, which leads to better compliance by the patient. DMSA is relatively safe and significantly reduces blood levels of iron (Fournier et al. 1988). BAL, D-penicillamine, and EDTA are also used (Wentz 2000). Whole bowel irrigation is used if x-rays indicate the presence of lead (Ferner 2001). Follow-up blood testing is required because stored lead in bones may continue to release from the bones when the lead exposure has been long-term (Wentz 2000).

Aluminum

Although deferoxamine has not been approved by the FDA for aluminum chelation, deferoxamine has been used since 1980 as a first-line of treatment in cases of aluminum toxicity. (Important: Remember that deferoxamine is used to chelate iron. Therefore, during chelation treatment for aluminum, iron would also be chelated.) EDTA may also be used (Wentz 2000).

Cadmium

There is no known medical chelating method that is effective for the treatment of cadmium toxicity; however, DMSA may be used in cases of acute oral cadmium poisoning to help prevent additional absorption of cadmium in the gastrointestinal tract (Wentz 2000). Prevention or elimination of exposure is all that is available at this time for cadmium toxicity (ATSDR ToxFAQs for Cadmium).

Preventing Heavy Metal PoisoniNG

Occupational exposure can be reduced by engineering solutions that address the manufacturing process, collecting and removing fumes, reducing dusts, and substituting other materials when possible. For example, in recent years, the pottery industry has replaced certain lead compounds in their products that are used as dishes or food containers. In most countries, laws have been passed to protect workers, setting limits of exposure, requiring monitoring in the workplace and medical surveillance of workers, and making recommendations (International Occupational Safety and Health Information Centre 1999):

- No smoking, eating, or drinking in work areas.
- Provide appropriate protective clothing that will remain at the facility.
- Provide showering facilities as needed.
- Work clothes and street clothes will not be kept in the same area.

Three agencies in the United States that provide information and guidance are the Occupational Safety and Health Administration (OSHA), the National Institute for Occupational Safety and Health (NIOSH), and the Agency for Toxic Substances and Disease Registry (ATSDR). Local health departments, regional poison control centers, and clinics that specialize in occupational and environmental health conditions can also provide valuable resources and guidance.

In the home, practical measures include raising your awareness of possible sources of exposure and reducing the threat of exposure. Think carefully about the necessity of having products containing toxic metals around the house or in the garage (e.g., fertilizers, fungicides, insect or rodent poisons, lead-based paint, refinishing chemicals, household cleaning agents, hobby supplies, photographic chemicals, batteries, etc.). Use alternatives when possible. When these products are necessary, store them carefully and dispose of them properly. Medicines and personal health care products should be stored so that they are in a location well out of the creative and imaginative reach of children. Emphasize safety rules with children. If appropriate, before leaving the workplace, follow decontamination procedures to avoid bringing toxic materials into your house on your clothing and shoes or on your skin and hair. Consider cumulative exposures, such as from cookware, storage containers, medicines, water, foodstuffs, and the environment (National Medical Library 2001).

1. Use the least harmful product possible.
2. Buy only as much as you need.
3. Read labels. Know the potential hazards of what you are buying.
4. Store products in their original container. Read the label every time you use a product. Refer to the label in case of an accidental spill or ingestion. Never store household chemicals in a food container, even if the container has been relabeled.
5. Support and use established disposal programs and facilities in your area.
6. Become familiar with the symptoms of and first aid procedures for ingestion of substances containing toxic metals.

Natural Therapies to Promote Chelation, Detoxification, and ProtectiON

- Antioxidants
- Detoxifying Agents
- Dietary Fiber
- Protective Agents

There is no substitute for prompt professional medical attention in cases of heavy metal toxicity. However, there are a number of things of a dietary nature that you can do that are beneficial, protective, and supportive of good health and the body's own natural chelation mechanisms. Many herbs and supplements have natural chelating characteristics and properties that help to detoxify the body. Important supplements to consider are antioxidants, herbs, minerals, essential amino acids, phytoextracts, detoxifying agents, protective agents, and fiber (see also the Immune Enhancement protocol).

Antioxidants

- Vitamin C
- Vitamin E
- Vitamin A
- Alpha-Lipoic Acid
- Glutathione
- Lactoferrin
- Selenium and Zinc
- Herbs
- Cilantro
- Garlic
- Green Tea
- Minerals
- Essential Amino Acids
- Cysteine and N-Acetyl Cysteine
- Glycine

Vitamins C, E, and A; alpha-lipoic acid; glutathione; lactoferrin; and selenium and zinc are important antioxidants that aid our overall health by increasing our protection from oxidative stress.

Vitamin C

Vitamin C has long been recognized as having positive effects for the prevention of heart disease and some forms of cancer, improving immune function, maintaining healthy skin and blood vessels, accelerating healing, and reducing allergic reactions. A steady supply of vitamin C is vital to overall good health. Because the human body cannot manufacture or store vitamin C, our requirements must be met from dietary sources, such as citrus fruit, vegetables, and supplements. Vitamin C is particularly beneficial for antioxidant protection for the lungs. It has been shown to protect the airways from

inhaled (environmental) oxidants (Ghio et al. 1998). Additionally, researchers have shown that vitamin C can help reduce the harmful effects of lead, aluminum, copper, silica, and radiation (Dhir et. al. 1990, 1993; West et al. 1994; Ghio et al. 1998; Vij et al. 1998; Cai et al. 2001).

Vitamin E

Some of the benefits of vitamin E include synergy with vitamin A; reducing cellular aging; reducing the risk of Alzheimer's disease; protecting the nervous system; preventing abnormal blood clotting; lowering the risk of heart disease (Pryor 2000); protecting immune function; lowering the risk of certain cancers; and protecting the lungs from toxins and pollutants (West et al. 1994).

As early as 1981, studies using three different feeding experiments revealed that when animals received silver, copper, cobalt, tellurium, cadmium, and zinc, the animals frequently developed lesions that were characteristic of selenium and vitamin E deficiency, such as necrosis (local destruction of tissue because of disease or injury) of cardiac and skeletal muscle and the smooth muscle of the intestine and gizzard. In studies by Van Vleet et al. (1981), vitamin E (and selenium) gave complete protection from muscle lesions produced by copper, cobalt, tellurium, cadmium, and zinc. Vitamin E also produced protection against lesions caused by silver. (There was partial protection using selenium.) Ten years later, in another study in animals, Tandon et al. (1992) found that cadmium caused kidney, liver, and blood biochemical markers to be changed negatively. When these researchers coadministered vitamin E, the cadmium-induced biochemical alterations were reduced and accumulation of cadmium in the kidneys, liver, and blood was also reduced. Tandon et al. (1992) concluded that the antioxidant properties of vitamin E seemed to be responsible for protection from cadmium toxicity.

A recent study reported by Milchak et al. (2002) examined lipid peroxidation (oxidative damage) and cell death on liver cells caused by iron (ferrous sulfate) in animals. Milchak et al. (2002) found that vitamin E reduced lipid peroxidation by 39% and increased cell viability by 12%. However, the greatest protective effect against iron-induced lipid peroxidation occurred when vitamin E, glutathione (GSH), and N-acetyl-cysteine (NAC) were combined. The combination reduced lipid peroxidation by 94% in iron-treated cells.

Vitamin A

Vitamin A (retinol) is essential for normal cell growth and protection from various diseases. Vitamin A has also been shown to help inhibit cancer cell proliferation (particularly against leukemia) and to aid in a return to normal cell growth patterns. Recent research into vitamin A has shown that it has protective effects against tumor growth as well (Villamor et al. 2000). Beta-carotene is a potent source of vitamin A (via the liver) and is another important antioxidant. However, continuous, high doses of vitamin A or beta-carotene are not recommended. Pregnant women should not take vitamin A.

Alpha-Lipoic Acid

Alpha-lipoic acid is a potent free radical scavenger that has an ability to detoxify metals and regenerate other antioxidants, such as vitamins C and E, coenzyme Q10, and glutathione. Alpha-lipoic acid has also been used in the treatment of diabetes, heart disease, and other oxidant-related diseases. In a study by Gurer et al. (1999), lipoic acid improved the thiol capacity of cells by increasing glutathione levels and reducing malondialdehyde levels in lead-exposed cells.

- ***Note:*** *Thiols participate in detoxification activity in the body. Malondialdehyde occurs in the bloodstream as a product of lipid peroxidation. It also occurs naturally in a variety of foods, depending on source and method of preparation.*

Another study used two different lipoic acid protocols on exposure to mercury and neurotoxicity, and the results showed ameliorating effects. Anuradha et al. (1999) concluded that "the ameliorating effect of lipoic acid and its therapeutic efficacy during various modes of therapy on the antioxidant status were established in the nervous tissues." Other toxic substances such as cyanide, glutamate, or iron ions have been shown to be neurotoxic. Prolonged pretreatment with lipoic acid provided protection for the cells (Muller et al. 1995). Alpha-lipoic acid also appears to have positive effects for cadmium toxicity, providing a protective effect for cadmium-induced cell dysfunction and membrane damage in hepatocytes (the most basic liver cells that perform all functions of the liver) (Muller et al. 1989; 1990).

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