

**HEAVY METAL TOXICITY AND ITS PREVENTIVE MEASURES AND TREATMENT:
A REVIEW**

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ABSTRACT

Heavy metal toxicity has proven to be a major threat and there are several health risks associated with it. The toxic effects of these metals, even though they do not have any biological role, remain present in some or the other form harmful for the human body and its proper functioning. Few metals, such as aluminium, can be removed through elimination activities, while some metals get accumulated in the body and food chain, exhibiting a chronic nature. Various public health measures have been undertaken to control, prevent and treat metal toxicity occurring at various levels, such as occupational exposure, accidents and environmental factors. Metal toxicity depends upon the absorbed dose, the route of exposure, i.e acute and chronic. These can lead to various disorders and can also result in excessive damage due to oxidative stress induced by free radical formation.

KEYWORDS: Heavy metals, metal toxicity.

INTRODUCTION

The most commonly found heavy metals in waste water include arsenic, cadmium, chromium, copper, lead, nickel and zinc. Heavy metals enter the surroundings by natural means and through human activities. These heavy metals are commonly found in the environment and diet. In small amounts they are required for maintaining good health but in larger amounts they can become toxic or dangerous. Heavy metal toxicity can lower energy levels and damage the functioning of the brain, lungs, kidney, liver, blood composition and other important organs. Long-term exposure can lead to gradually progressing

physical, muscular, and neurological degenerative processes that imitate diseases such as multiple sclerosis, Parkinson’s disease, Alzheimer disease and muscular dystrophy. Repeated long term exposure of some metals and their compounds may even cause cancer.

OBJECTIVES

- 1) To provide insight into the sources of heavy metals and their harmful effects on the environment and living organisms.
- 2) To aware common people about adverse effects of heavy metal poisoning and prevention about that.

Sr. No	Metals	Sources	Adverse effects
1	Arsenic	Paints, dyes, soaps, drugs, pesticides, beer, table salt, tap water, pigments, cosmetics, glass and mirror manufacture, fungicides, insecticides, treated wood, contaminated food, fertilizers, animal feeding operations, drinking water	<ul style="list-style-type: none"> - Cancer of lungs, liver, bladder, skin pigmentation and keratosis - In chronic arsenic toxicity nausea, vomiting, abnormal heart beat, priking sensation in hands and legs - Long term exposure lead to formation of skin lesions, internal cancers, neurological problems, pulmonary disease, hypertension, ccardiovascular disease, diabetes mellitus
2	Lead	Industrial processes, food and smoking, drinking water, domestic source, gasoline, house paint, plumbing pipes, storage batteries, toys, faucets, cosmetics, pewter pitchers, contaminated soils	<ul style="list-style-type: none"> - Acute exposure cause loss of appetite, headache, hypertension, abdominal pain, renal dysfunction, fatigue, sleeplessness, arthritis, hallucination, vertigo. - Chonic exposure result in mental retardation, birth defects, psychosis, autism, allergies, weight loss, hyperactivity, paralysis, brain and kuidoey

			damage, muscular weakness, even death.
3	Mercury	Anthropogenic activities such as agriculture, Municipal waste water discharges, mining, incineration and discharges of industrial waste water. Used in pulp and paper industries, as a component of batteries, dental preparation such as amalgams, air pollution, all shell fish, sea vegetables	<ul style="list-style-type: none"> - Mercury vapours can cause bronchitis, asthma and temporary respiratory problems - Exposure to metallic mercury vapours lead to lung damage, vomiting, diarrhea, nausea, skin rashes, increased heart rate or blood pressure - Organic mercury poisoning include depression, memory problems, tremors, fatigue, headache, hairloss
4	Cadmium	Natural activities like volcanic eruptions, weathering, river transport, Human activities such as mining, smelting, tobacco smoking, incineration of municipal waste, manufacture of fertilizers.	<ul style="list-style-type: none"> - Formation of renal stones, hypercalciuria, bone mineralization either through bone damage or by renal dysfunction, osteoporosis, damage to lungs, stomach irritation, vomiting, diarrhea, kidney disease, fragile bones, lung damage.
5	Chromium	Metal alloys, magnetic tapes, paint paints, rubber, cement, papper, wood preservatives, leather tanning and metal plating	<ul style="list-style-type: none"> - Ulcers on nasal septum common in chromate workers.
6	Alluminium	Cookware, beverages in aluminium cans, tap water, table salt, backing powders, antacids, processed cheese, antiperspirants, bleached flour, vaccines and perhaps other medications, occupational exposure. Drinking water, food, alluminium containing drugs, long term intravenous nutrition.	<ul style="list-style-type: none"> - Anaemia, dental caries, dementia dialactica, hypoparathyroidism, Parkinson's disease, Alzheimer disease, contact dermatitis, irritant dermatitis. - Adverse effects on nervous system resulted in loss of memory, loss of coordination, brain damage. - Alluminium induced adyanamic bone disease, aluminium induced osteomalacia, lung problems anaemia, nervous system problem,
7	Iron		<ul style="list-style-type: none"> - 1st stage after 6 hrs of iron overdose- gastrointestinal effect such as gastro intestinal bleeding, vomiting, and diarrhea. - 2nd stage progresses within 6-24 hrs of overdose - 3rd stage occurs between 12 to 96 hrs- shocks, hypotension, lethargy, tachycardia, hepatic necrosis, metabolic acidosis, sometimes death - 4th stage- within 2-6 weeks of iron overdose.- gastrointestinal ulcerations and development of strictures.
8	Antimony	- Flovent, an inhaler used for asthma. - Bullets, motor bearings, pewter, some paints and glass and some microelectronic circuits. -It was formerly used in some anti-parasitic drugs. - used in most fire retardants that arwe required on most furniture, mattresses, cribs and products.	<ul style="list-style-type: none"> - Symptoms are usually chronic. Skin exposure can cause dermatitis. Lung exposure causes irritation and inflammation. Chronic use of flovent (a drug) appears to keep the hair phosphorous level low.
9	Beryllium	Air pollution (burning fossil fuels), manufacture of plastics, electronics, steel alloys and volcanic ash.	<ul style="list-style-type: none"> - Adrenal insufficiency, arthritis, bone spurs, bursitis, depression, fatigue, osteoporosis and symptoms of slow metabolism.
10	Nickel	Hydogenated oils, shell fish, air pollution, cigarette smoke, plating and occupational exposure	<ul style="list-style-type: none"> - Cancer (oral, intestinal), depression, heart attacks, hemorrhages, kidney dysfunction, low blood pressure, malaise, muscle tremors and paralysis, nausea, skin problems, tetany and vomiting.
11	Copper	Copper water pipes, copper added to tap water, pesticides, swimming pools, intra-uterine devices, vegetarian diets, dental amalgams, nutritional supplements- especially prenatal vitamins, birth control pills, weak adrenal glands and occupational exposure.	<ul style="list-style-type: none"> - Acne, allergies, anaemia, arthritis, cancer, diabetes, heart attacks, hypothyroidism, insomnia, kidney and liver dysfunctions, osteoporosis, premenstrual syndrome, adrenal hyperactivity and/or insufficiency, hair loss, elevated cholesterol, depression, hypertension

DIAGNOSIS

Heavy metal poisoning may be detected using blood and urine tests, hair and tissue analysis, or x-ray. The doctor should take a thorough patient history with particular emphasis on patient's occupation.

In childhood, blood lead levels above 80ug/dl generally indicate lead poisoning.

In adults, symptoms of lead poisoning are usually seen when blood lead levels exceed 80ug/dl for a number of weeks.

Symptoms of mercury poisoning may be seen when mercury levels exceed 20ug/dl in blood and 60ug/dl in urine.

Since arsenic is rapidly cleared from the blood, blood arsenic levels may not be very useful in diagnosis. Arsenic in the urine may exceed 50 ug/dl in people with arsenic poisoning. Arsenic may also be detected in the hair and nails for months following exposure.

Cadmium toxicity is generally indicated when urine levels exceed 10 ug/dl of creatinine and blood levels exceed 5 ug/dl.

Thallium poisoning often causes hair loss (alopecia), numbness, and a burning sensation in the skin as well as nausea, vomiting, and dizziness. As little as 15-20 mg of Thallium per kilogram of body weight is fatal in humans.

Prevention

Because arsenic and thallium were commonly used in rat and insect poisons at one time, many countries have tried to lower the rate of accidental poisonings by banning the use of heavy metals in pest control products. Because exposure to heavy metals is often an occupational hazard, protective clothing and respirators should be provided and worn on the job. Protective clothing should then be left at work site and not worn home, where it could carry toxic dust to family members. Industries are urged to reduce or replace the heavy metals in their processes wherever possible. Exposure to environmental sources of lead, including lead-based paints, plumbing fixtures, vehicle exhaust, and contaminated soil, should be reduced or eliminated.

TREATMENT

Chelation therapy

The treatment for most heavy metal poisoning is chelation therapy. A chelating agent specific to the metal involved is given either orally, intramuscularly, or intravenously. The three most common chelating agents are calcium disodium edetate, dimercaprol (BAL) and penicillamine. The chelating agent encircles and binds to the metal in the body's tissues, forming a complex, that complex is then released from the tissue to travel in the blood stream. The complex is filtered out of the blood by the kidneys and excreted in the urine. Chelation therapy

is effective in treating lead, mercury, and arsenic poisoning, but is not useful in treating cadmium poisoning.

In cases of acute mercury, arsenic, or thallium ingestion, vomiting may be induced. Activated charcoal may be given in cases of thallium poisoning. Washing out the stomach may be useful. The patient may also require treatment such as intravenous fluids for such complications of poisoning as shock, anemia, and kidney failure.

Intravenous chelation therapy

It involves intravenous injections of a chelating agent, EDTA (ethylene diamine tetra-acetic acid), a synthetic amino acid. Chelation therapy is treatment used in conventional medicine for removing heavy metals (including mercury) from blood.

Iron chelation therapy

Iron chelation is a drug therapy for iron overload. This therapy uses drugs called iron chelators to remove extra iron from your body. There are two iron chelators that are approved by the U.S. Food and Drug Administration (FDA) for use in the United States. They are 1) Deferoxamine (Desferal) 2) Deferasirox (Exjade).

Copper Therapy

Copper therapy is aimed at removing excess accumulated copper and preventing its reaccumulation. Copper overload results in Wilson disease. Chelation therapy drugs approved for treating Wilson disease include penicillamine (cuprimine and Depen) and trientine (syprine and Trientine Dihydrochloride) both of these drugs act by chelation or binding of copper, causing its increased urinary excretion.

Lead chelation

The most important step in treatment is to prevent further exposure to lead. Various lead chelating agents include Succimer, D-penicillamine, Edetate (EDTA) calcium disodium (CaNa₂EDTA) Dimercaprol.

DISCUSSION

In present era as there is increasing demand of cosmetics, air pollution due to overuse of vehicles, then pesticides for agriculture, industrial waste water. All these things contain heavy metals such as arsenic, mercury, cadmium, beryllium, copper. Exposure to these toxic elements causes hazardous effects on health such as developmental retardation, several types of cancer, kidney damage, endocrine disruption, immunological, neurological effects and other disorders. General people are not aware of these adverse effects. Preventive measures should be taken, the people who work where there is exposure of these toxic elements should be provided respirators and protective clothing to wear. These protective clothes should not be worn in home. It should be worn only in work site. Likewise other

preventive measures should be carried out. Chelation therapy is useful in treating heavy metal toxicity.

CONCLUSION

In this review we reviewed the sources and effects of some heavy metals ie Arsenic, lead, Mercury, Cadmium, Chromium, Aluminium, Iron on the human beings. Effective legislation, guidelines and detection of the areas where there are higher levels of heavy metals are necessary. failure to control the exposure will result in severe complications in the future because of the adverse effects imposed by heavy metals. Occupational exposure to heavy metals can be decreased by engineering solutions. Monitoring the exposure to heavy metals in the environment and in humans can become a momentum step towards prevention.

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