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Harmful effect of arsenic poisoning

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Abstract

Arsenic is a heavy metal which is highly poisonous and carcinogenic, produce very harmful effect to human body. Arsenic is a semi-metal element, its symbol is as and atomic no33. arsenic and its compound especially the trioxide are used in the production of pesticides, treated wood product herbicides and insecticides these application are decline due to the toxicity of arsenic and its compound. Organic arsenic is less harmful than inorganic arsenic. Seafood is a common source of the less toxic organic in the form of arsenobetain. Man-made sources of arsenic are generally by-products of the smelting of nonferrous metal ores, primarily copper and to a lesser degree lead, zinc, and Gold. Organic arsenic compounds tend to be eliminated in the urine in unchanged form, while inorganic forms are largely converted to organic arsenic compounds in the body prior to urine excretion. In Long term exposure Arsenic poisoning may develop the symptoms as change in the fingernail pigmentation, a metallic taste in the mouth and garlicky breath, blood in urine, hair loss and cramping muscles, convulsions, excessive sweating and problem in swallowing. More recent finding show that consumption of water with levels as low as 0.00017mg/L (0.17 parts per billion) over long periods of time can lead to Arsenicosis.

Keywords: Carcinogenic, arsenobetain, pigmentation, cramping, convulsions

Introduction

Arsenic poisoning, or arsenicosis, happens when a person takes in dangerous levels of arsenic. Arsenic is a heavy metal which is highly poisonous and carcinogenic, produce very harmful effect to human body. Arsenic is a natural semi-metallic chemical that is found all over the world in groundwater. Intake can result from swallowing, absorbing, or inhaling. Arsenic poisoning can cause major health complications and death if it is not treated, so precautions exist to protect those who are at risk. Arsenic trioxide is used in the production of pesticides, treated wood product herbicides and insecticides these application are decline due to the toxicity of arsenic and its compound. Arsenious oxide is most toxic which is known as Sankhaya/Somak, it occurs in two forms white crystalline powder or opaque mass. no taste or smell and sparingly soluble in water. it is widely used in calico painting, taxidermy, artificial flowers, wall paperation, preservation of timber against ant. And for treatment of rheumatic arthritis, impotence syphilis. other inorganic compounds are Arsenic tri sulphide, Arsenic di sulphide, copper compounds of arsenic Scheel green/copper arsenite and Paris green/copper acetoarsenite. Arsenic organic compounds are Cacodylates, Aotxyl, Salvarson and Arsenobentine. Organic arsenic is less harmful than inorganic arsenic. Seafood is a common source of the less toxic organic in the form of arsenobetain. Man-made source of arsenic are generally by-products of the smelting of nonferrous metal ores, primarily copper and to a lesser degree lead, zinc, and Gold. The symptoms of arsenic poisoning can be acute, or severe and immediate, or chronic, where damage to health is experienced over a longer period. Organic arsenic compounds tend to be eliminated in the urine in unchanged form, while inorganic forms are largely converted to organic arsenic compounds in the body prior to urine excretion. This will often depend on the method of exposure. The symptoms may include drowsiness, headaches, confusion and severe diarrhoea. In Long term exposure Arsenic poisoning may develop the symptoms as change in the fingernail pigmentation, a metallic taste in the mouth and garlicky breath, blood in urine, hair loss and cramping muscles, convulsions, excessive sweating and problem in swallowing. Arsenic poisoning typically affects the skin, liver, lungs and kidney. The most common reason for long term exposure is contaminated drinking water. Ground water most often becomes naturally.

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Often becomes contaminated naturally. Food grown in arsenic affected areas, arsenic is not found inside the food like cereals, pulses or fruits but may be found in external layer of food or fruits due to spread of arsenated water. A few stray reports of arsenic in cow's milk are most likely due to adulteration of milk by arsenicated water. This element has long been associated with criminal activity and still is an emotionally highly charged topic, as larger homicidal doses can cause cholera like symptoms (acute poisoning) and death. Ingestion of low dose via food or water is the main pathway of this metalloid into organism, where absorption takes place in the stomach and intestines, followed by release into blood stream. Chronic poisoning, arsenic is then converted by the liver to a less toxic form, from where it is eventually largely excreted in the urine. Only very high exposure can, in fact, lead to appreciable accumulation in the body. Minor alternative pathways of entry are known through inhalation and dermal exposure. Arsenic is a protoplasmic poison due to its effect on sulphhydryl group of cells interfering with cell enzymes, cell respiration and mitosis.

However contamination may also occur from mining or agriculture. The countries having high level of Arsenic containing ground water are United States, India, China and Mexico. The most affected areas are Bangladesh and West Bengal. Tests are available to diagnose poisoning by measuring arsenic in blood, urine, hair, and finger nails. More recent findings show that consumption of water with levels as low as 0.00017 mg/L (0.17 parts per billion) over long periods of time can lead to arsenicosis.

Causes: Drinking Water, Arsenic is naturally found in groundwater and presents serious health threats when high amounts exist. Chronic arsenic poisoning results from drinking contaminated well water over a long period of time. Many aquifers contain high concentration of arsenic salts. The World Health Organization (WHO) Guidelines for drinking water quality established in 1993 a provisional guideline value of 0.01 mg/L (10 parts per billion) for maximum contaminant levels of arsenic in drinking water. This recommendation was established based on the limit of detection for most laboratories' testing equipment at the time of publication of the WHO water quality guidelines. More recent findings show that consumption of water with levels as low as 0.00017 (0.17 parts per billion) over long periods of time can lead to arsenicosis. The greatest threat to public health from arsenic originates from contaminated ground water. Inorganic arsenic is naturally present at high level in the ground water of a number of countries including Argentina, Bangladesh, Chile, China, India, Mexico and United States of America, crops irrigated with contaminated water and food prepared with contaminated water are the source of exposure.

From a 1988 study in China, US protection agency quantified the life time exposure of arsenic in drinking water at concentration of 0.0017 mg/L (1.7 ppb), 0.00017 mg/L and 0.000017/L. The life time skin cancer risk of 1 in 10,000, 1 in 100,000 and 1 in 1,000,000 respectively. WHO asserts that a water level of 0.01 mg/L (10 ppb) poses a risk of 6 in 10,000 chance of lifetime skin cancer and contends that this level of risk is acceptable. One of the worst incidents of arsenic poisoning via well water occurred in Bangladesh, which the World Health Organization called the "largest mass poisoning of a population in history" recognized as a major

public health concern. The contamination in the Ganga-Brahmaputra fluvial plains in India and Padma-Meghna fluvial plains in Bangladesh demonstrated adverse impacts on human health.

Mining techniques such as hydraulic fracturing may mobilize arsenic in ground water and aquifers due to enhance methane transport and resulting changes in redox conditions, and inject fluid containing additional arsenic. Exposure to arsenic via drinking water, air, food, and beverage has been reported occurring at many places in the world. Exposure through drinking water is increasing due to contamination from industrial operation and over withdrawal of ground for irrigation.

Ground Water: Arsenic contamination of ground water, in the US, the U.S. Geological Survey estimates that the median ground water concentration is 1 µg/L or less, although some groundwater aquifers, particularly in the western United States, can contain much higher levels. For example, median levels in Nevada were about 8 µg/L but levels of naturally occurring arsenic as high as 1000 µg/L have been measured in the United States in drinking water.

Air: Arsenic in air has three major sources: smelting of metals, burning of coal, and use of arsenical pesticides. Two known acute incidents of arsenic pollution from smelters have occurred in the United States. The most serious air-pollution problem, however, is associated with manufacturing processes and occupational hazards. The European Commission (2000) reports that levels of arsenic in air range 0-1 ng/m³ in remote areas, 0.2-1.5 ng/m³ in urban areas, and up to about 50 ng/m³ in the vicinity of industrial sites. Based on these data, The European Commission (2000) estimated that in relation to food, cigarette smoking, water and soil, air contributes less than 1% of total arsenic exposure. Occupational and environmental health problems can result from the frequent commercial presence of arsenicals. Exposure to arsine gas is also an environmental health hazard of concern in numerous occupational circumstances. Arsine is a colourless, odourless, tasteless, nonirritating gas that causes a rapid and unique destruction of red blood cells and may result in kidney failure, which is uniformly fatal without proper therapy. Most cases of arsine poisoning have occurred with the use of acids and crude metals of which one or both contained arsenic as an impurity.

Soil: Exposure to arsenic in soil can occur through multiple pathways. Compared with the intake of naturally occurring arsenic from water and the diet, soil arsenic constitutes only a small fraction of intake. The major arsenic residues resulting from use of agricultural pesticide and fertilizers are found in soils and to lesser degree in plants and animals living on contaminated soils. The highest pesticide residues occur in orchard soils that received large application of lead arsenate. Some soils that received massive application of arsenate are currently incapable of supporting plant growth. **Pesticides:** The largest use of arsenic is in the production of agricultural pesticide in the categories of herbicides, insecticides, desiccants, wood preservatives and food additives. Arsenic trioxide was the raw material for the older inorganic pesticide, including lead arsenate, calcium arsenate and sodium arsenite. The new major organic arsenical pesticides include three herbicides, monosodium and disodium methanearsonate and cacodylic acid and

four feed additives that are substituted phenylarsonic acids. Chromate copper arsenate (CCA) has been registered for use in US since the 1940 as wood preservative, protecting wood from insects and microbial agents.

Copper Smelting: Exposure studies in the copper melting industry are much more extensive and have established definitive links between arsenic, a by product of copper smelting, and lung cancer via inhalation. The arsenic exposure measured from these studies ranged from about 0.05 to 0.3 mg/m³ and are significantly higher than airborne environmental exposures to arsenic.

Diagnosis

Arsenic may be measured in blood or urine. Some analytical techniques are capable of distinguish organic from inorganic forms of the element. Organic arsenic compounds tends to be eliminated in the urine in unchanged form, while inorganic forms are largely converted to organic arsenic compounds in body prior to urinary excretion. The current biological exposure index for U.S. workers of 35 µg/L total urinary arsenic may easily be exceeded by healthy persons eating a seafood meal.

Tests are available to diagnose poisoning by measuring arsenic in blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Urine testing needs to be done within 24-48 hours for an accurate analysis of an acute exposure. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if one has been exposed to above-average levels of arsenic. They cannot predict, however, whether the arsenic levels in the body will affect health. Chronic arsenic exposure can remain in the body systems for a longer period of time than a shorter term or more isolated exposure and can be detected in a longer frame after the introduction of the arsenic, important in trying to determine the source of the exposure. Hair is a potential bio indicator for arsenic exposure due to its ability to store trace elements from blood. Incorporated elements maintain their position during growth of hair.

Treatment

- Removing clothes that could be contaminated with arsenic.
- Thoroughly washing and rinsing affected skin.
- Blood transfusion
- Taking heart medication in case where the heart starts failing.
- Using mineral supplements that lower the risk of potentially fatal heart rhythm problems
- Observing kidney function
- Bowel irrigation is another option. A special solution is passed through the gastrointestinal tract, flushing out the contents. The irrigation removes traces of arsenic and prevents it from being absorbed into gut.
- Chelation therapy may also be used. This treatment uses certain chemicals, including dimercaptosuccinic acid and dimercaprol, to isolate the arsenic from the blood proteins.

Conclusion

The symptoms of arsenic poisoning can be acute, or severe and immediate, or chronic, where damage to health is experienced over a longer period. Organic arsenic

compounds tend to be eliminated in the urine in unchanged form, while inorganic forms are largely converted to organic arsenic compounds in the body prior to urine excretion. The symptoms may include drowsiness, headaches, confusion and severe diarrhoea.

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