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Editorial

Environmental Heavy Metal Pollution and its Toxicological Effects on People Toxicology and Arsenic Exposure from a Historical Perspective

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Abstract

Humans frequently come into contact with the natural environmental pollutant metalloid arsenic through food, water, air, and soil. In addition to its long history as a murderous substance, arsenic has been utilised as a pesticide, a chemotherapeutic, and a component of consumer goods over the past century. High amounts of naturally occurring arsenic in drinking water are a toxicological issue in several parts of the world. Due to its ability to combine with other elements to form alloys and establish covalent connections with hydrogen, oxygen, carbon, and other elements, arsenic exists in a variety of structural shapes and oxidation states. Inorganic and organic forms of arsenic that are trivalent or pentavalent in nature are relevant to the environment. Arsenic's (+3 oxidation state) role in the catalysis of arsenic metabolism Methyltransferase is an enzyme that sequentially reduces molecules from pentavalency to trivalency and then oxidatively methylates them to return to pentavalency. In general, pentavalent arsenic is less toxicologically powerful than trivalent arsenic. Acute consequences of arsenic might be as severe as death or gastrointestinal upset. Chronic arsenic exposure may have an impact on multiple main organ systems depending on the dose. The main cancers caused by swallowed arsenic are those of the skin, bladder, and lungs. Arsenic's mode of action for its illness endpoints is actively being researched. The interaction of trivalent arsenicals with sulphur in proteins and arsenic's capacity to cause oxidative stress are two important areas. Understanding of the toxicity of arsenic will continue to increase thanks to technological developments and the recent creation of animal models for arsenic carcinogenicity (Kawasaki M et al ., 2013).

Keywords: Arsenic, Cancer, Exposure

INTRODUCTION

(Arora M et al., 2017) The majority of people experience terror when they hear the term "arsenic." This is due to the lengthy history of arsenic's usage as a poison against people, both knowingly and unknowingly. However, because arsenic occurs naturally in the environment, is utilised in industrial products, and has medical uses, the majority of laypeople are unaware of or unconcerned about the fact that we are regularly exposed to it. Several regions of the world have arsenic from natural or manmade sources at levels that constitute a toxicological concern, despite the fact that the majority of ordinary environmental exposures to arsenic do not pose a health risk. Numerous of these areas have been identified, and actions are being taken to prevent access to them or rehabilitate them (Scales WE et al., 1988).

Arsenic is the number one substance in the most recent (ATSDR, 2007a) Comprehensive, Environmental, Response, Compensation and Liability Act (CERCLA) Priority List of Hazardous Substances published by the Agency for Toxic Substances and Disease Registry (ATSDR). This list is comprised of substances found at hazardous waste sites on the National Priorities List. The substances are ranked on

frequency or occurrence, toxicity, and potential for human exposure (Trewavas A et al., 2006).

To comprehend the toxicity of this metalloid, which has both metal and nonmetal features, one must understand the chemistry of arsenic. (A metal is malleable and ductile, transmits heat and electricity, and has shine. Arsenic in its elemental form is usually nonductile (Midgley G et al , 2015). Arsenic can be found in the environment in both inorganic and organic forms, as well as in a variety of valence or oxidation states (Balachandran K et al., 2012). The trivalent and pentavalent states of arsenic are those that are of importance to environmentalists. Arsenic is an element with a valence state of. The valence of arsine and arsenides is. We shall concentrate on the trivalent and pentavalent forms of arsenicals that are present in the environment and to which people are exposed in this review. Relevant environmental arsenicals listed (Brown R et al., 1991).

Arsenic as a homicide and suicide poison intentional

An individual normally comes into contact with arsenic on a daily basis via their food, water, soil, and air. Arsenic is a naturally occurring element. While there is now much research being done to understand how environmental exposures, particularly at low levels, may affect human health, arsenic's toxicity has long been understood by humans on some level (Livina VN et al., 2010).

Due to its frequent usage and involvement in numerous high-profile killings, arsenic rose to prominence in the Middle Ages as a potent homicidal and suicide substance. In fact, due to its potency and the stealth with which it might be delivered, especially with the aim to kill, arsenic is frequently referred to as the "king of poisons" and during the Middle Ages and the Renaissance, of getting rid of members of the governing class. For instance, it is generally known that the Medici and Borgia families employed arsenic as one of their poisons to eliminate rivals. The most famous murder case involving arsenic was the one involving Napoleon Bonaparte in 1851, which some conspiracy theorists believe to have been a political assassination. Arsenic continued to maintain its reputation as a high-profile poison and was connected to several other notable homicide cases (Hirota M et al., 2011).

Arsenic remained a common toxin up until the middle of the 1850s for a number of reasons. Arsenic was easily accessible, and as it had no taste or odour, it could not be detected in food or drink (Marwan N et al., 2007). The most obvious signs of acute arsenic poisoning—vomiting, diarrhoea, and stomach pain—could be easily mistaken for other prevalent illnesses of the time, such as cholera and pneumonia. Although early tests for arsenic were introduced in the mid-1700s, it is also significant to note that for a very long time, there was no reliable analytical method for detecting, much less measuring, arsenic in tissue or other media. It's interesting to note that the first trial ever recorded to use forensic evidence resulted in the execution of a lady because a white powder found by a servant was "proved" to be arsenic.on look, texture, water behaviour, and a burning odour resembling garlic (Caudill, 2009; Cullen, 2008). In 1832, James Marsh made the decision to research analytical techniques in order to give jurors more trustworthy proof of "visible arsenic," which led to a significant advancement in the detection of arsenic (Cullen, 2008). The trial of Marie LaFarge in France in 1840, where Mme. LaFarge was accused of poisoning her husband with arsenic-laced cakes, saw the first application of his test method (Cullen, 2008). In most cases, the tests entailed combining the target sample with zinc and acid, heating the vessel with flame, and watching for the accumulation of a silvery substance on the glass vessel, which was regarded as diagnostic for arsenic in concentrations as low as 0.02 mg (Marsh, 1837; Newton, 2007). The Marsh test was a turning point in arsenic analytics and the beginning of the end of unreported arsenic poisonings, even though by today's standards this procedure would be regarded as crude.

Pharmacokinetic processes

Through the digestive system, nickel is absorbed as a lipophilic molecule with a small molecular weight. The gut's ion and ligand composition will have an impact on how well nickel is absorbed there. Animal studies have demonstrated that nickel in low concentrations will be absorbed by active transport and enhanced diffusion. On the other hand, if there is a high concentration of nickel, the carriers become saturated and nickel is absorbed through passive diffusion. When nickel was absorbed by the jejunum and passively diffused through the ileum, in vitro tests produced results that are comparable. Nickel is transported in the blood by binding to albumin with ultra-filterable ligands such amino acids and short polypeptides. At the albumin site, nickel and copper are competitors.

Toxicology methods

It was shown that nickel activates the transcription factor NF-B during the inflammatory and apoptotic processes. ATF-1, a member of the ATF/CREB family of transcription factors, is another transcription factor that nickel can activate. When calcium levels rise, a protein kinase cascade is initiated, which in turn leads to the phosphorylation of ATF/CREB. It has been observed that nickel-induced activation of ATF-1 results in a reduction in the regulator of TSP I, which consequently increases angiogenesis and accelerates the growth of tumours.

DISCUSSION

Human activity is to blame for the contamination of heavy metals in our soils, rivers, and atmosphere. Though in little amounts, each is necessary for our daily nutrition. Heavy metals can cause symptoms that are potentially fatal and irreversible in higher amounts. Worker exposure to heavy metals through inhalation, digestion, or touch should be minimised by wearing protective equipment and using

extreme caution. Given that many of the symptoms are similar to those of other neurological illnesses, proper diagnoses should be established.

CONCLUSION

The world is being polluted in so many ways with heavy metals, mostly due to human contamination, that it is affecting the health of so many people. All these diagnoses should go on to make us aware of the adverse effects that are being caused by these metals, the symptoms that are seen, and ways to remove some of the contamination we have from all the heavy metals.

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