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Role of Urinary Metals in Cardiovascular Disease and Mortality

According to a new study, higher levels of urinary metals such as cadmium, tungsten, uranium, cobalt, copper, and zinc are associated with increased cardiovascular disease (CVD) and mortality. While previous research has documented the link between certain metals and CVD, this study expands the evidence to include a broader range of metals beyond arsenic, cadmium, and lead, particularly in a diverse population. The findings are published in Circulation.

This study is the largest to date, examining the relationship between urinary metals and cardiovascular disease. It highlights the role of these metals as novel risk factors for both CVD and all-cause mortality. These findings can inform risk prediction and preventive strategies to improve cardiovascular health by reducing metal exposures.

Metal exposure is widespread, with sources including air, soil, water, and food potentially exacerbated by climate change. The study notes that non-Hispanic Black, Hispanic/Latino, Chinese, and American Indian communities, as well as those with lower socioeconomic status, often face a higher burden of metal exposure due to sociopolitical, historical, and structural factors. Reducing metal exposure can particularly benefit these groups, who also experience a higher burden of CVD mortality.

The American Heart Association has recognised toxic metals like arsenic, cadmium, and lead as linked to some CVD incidence. However, this study is one of the first to investigate less-studied metals, including biometals like copper and zinc, and metal mixtures that more accurately reflect real-world exposures.

Using data from the Multi-Ethnic Study of Atherosclerosis (MESA), researchers assessed the association of six urinary metals with CVD events and mortality. Urine samples were analysed at Columbia University's Trace Metals Core Laboratory. To evaluate the combined effect of these metals, the researchers used a machine learning approach developed at Columbia University's Department of Biostatistics.

Among the study participants, 39% were non-Hispanic White, 27% non-Hispanic Black, 22% Hispanic/Latino, and 12% Chinese descent. Over the follow-up period, 1,162 participants developed CVD, and 1,844 participants died.

After adjusting for established CVD risk factors like smoking, hypertension, and diabetes, the study found that higher levels of the metal mixture in urine were associated with a 29% increased risk of CVD and a 66% increased risk of mortality. Each metal individually showed similar associations, with higher cadmium levels linked to up to a 25% increased risk of CVD and a 68% increased risk of mortality. Similar associations were observed for the other metals.

Exposure to lesser-known metals like tungsten and uranium can occur through drinking water, food, air pollution, and indoor dust. While biometals like copper and zinc are essential in small amounts, high levels in urine may indicate excessive exposure or a loss of body reserves, potentially signalling early stages of cardiovascular disease.

Implementing policies and regulations to address air pollution, drinking water and food contamination, consumer products, and community and household vulnerabilities can reduce metal exposure. While regulations have successfully reduced exposure to toxic metals like arsenic, cadmium, and lead, further study is needed to understand the impacts of less-regulated metals such as tungsten and cobalt.

These findings highlight the importance of reducing environmental exposure to these metals, which disproportionately affect minority and low-

income communities. This could lead to efforts to reduce metal exposure in our communities and help address health disparities in heart disease.

Source: Columbia University's Mailman School of Health

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Published on : Tue, 6 Aug 2024