Metal Exposure – What do I order and how do I interpret lab reports?

With increasing concerns about occupational or environmental metal exposure, patients are asking to be tested to see if they are at risk of adverse health effects. You order a blood test and the result comes back "high". Now what do you do? Do you recommend chelation therapy? Benefit of chelation will not outweigh harm if the metal level is in a safe range.

The first challenge that you have is the reference range. Hospitals-In-Common Laboratory give a "normal/therapeutic" range for nickel of 1.70-25.50 nmol/L urine. This is not a safety range. From a toxicity perspective, a standard safe level for soluble forms of nickel is anything below 1300 nmol/L urine. A value of 50 nmol/L is high relative to no exposure, but does not indicate that the patient is at risk of developing adverse health effects.

Hospitals-In-Common Laboratory in Toronto does the metal testing for provincial hospital labs in Atlantic Canada. Unless specifically marked for environmental or occupational exposure, the sample is processed through the "medical stream" which uses a non-exposed convenience sample of patients as the reference group. The occupational / environmental exposure stream provides results relative to standards on safe exposure ranges. Hospitals-In-Common Laboratory is looking into how to best provide physicians with the additional information on whether a "high" value is within safe limits or in the toxic range.

The nickel example raises a second challenge: are we doing the right test? Urine test for nickel looks for soluble forms. If the concern is nickel exposure from welding, we want insoluble nickel not soluble nickel. With a short half-life, testing the urine for nickel is not productive. Hence, there are no toxicity standards for insoluble nickel. Testing for manganese and copper is similarly not helpful. Trivalent chromium is essential for glucose metabolism. A low blood value is useful in showing a deficiency of chromium. Hexavalent chromium is the toxic form. Toxicity standards are based on urine testing. *Testing blood, hair and nails provides you with results that you cannot meaningfully interpret.* When assessing arsenic exposure, you want to look for inorganic arsenic. While there are special tests to distinguish inorganic from organic, unless specifically requested you get one that tests for both. As with chromium, you want to test urine not blood, hair or nails.

The third challenge is that of confounders. Organic arsenic is common in seafood. One needs to abstain from eating seafood prior to testing. Arsenic is also common is soil, ash (lots of it from days when we used coal to heat our houses) and cigarette smoke. Chromium can be common in deer and moose meat. It can be found in groundwater contamination, contaminated air from incinerators, and cigarette smoke. Collection containers and testing equipment can contain lead and mercury – giving spurious results for these metals. Testing for organic mercury (e.g., methylmercury) should generally be limited to the research context because of the requirement for special collection equipment.

A good reference is the "Occupational Medicine Forum" by Joseph Schwerha in JOEM Vol. 49 (11), November 2007. Physicians who would like a copy can send me an email and I will forward a PDF of the article. Dr. Christopher Martin was one of the responders. He hails from Newfoundland,, is an occupational medicine specialist and professor at the University of West Virginia. He does a lot of international consulting in toxicology. The Commission uses him for guidance on testing and interpretation for chemicals and metals. Physicians needing assistance in evaluating a possible exposure can give me a call.

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