MAYO CLINIC LABORATORIES

Test Definition: HG

Mercury, B

Overview

Useful For

Detecting mercury toxicity

Special Instructions

- Trace Metals Analysis Specimen Collection and Transport

Method Name

InductivelyCoupledPlasma-MassSpectrometry(ICP-MS)

NY State Available

Yes

Specimen

Specimen Type

Whole blood

Specimen Required

Patient Preparation: High concentrations of gadolinium and iodine are known to interfere with most metal tests. If either gadolinium- or iodine-containing contrast media has been administered, a specimen should not be collected for 96 hours.

Supplies: Metal Free B-D Tube (EDTA), 6 mL (T183)

Container/Tube: Royal blue top (EDTA) plastic trace element blood collection tube

Specimen Volume: Full tube

Collection Instructions:

1. See Trace Metals Analysis Specimen Collection and Transport in Special Instructions for complete instructions.
2. Send specimen in original tube. **Do not** aliquot.

Additional Information: If ordering the trace element blood collection tube from BD, order catalog #368381.

Reject Due To

Gross hemolysis	OK
Gross lipemia	OK
Gross icterus	OK

Specimen Minimum Volume

0.3 mL

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Whole blood	Refrigerated (preferred)	28 days	
	Ambient	28 days	
	Frozen	28 days	

Clinical & Interpretive

Clinical Information

Mercury (Hg) is relatively non-toxic in its elemental form. If Hg(0) is chemically modified to the ionized, inorganic species, Hg(2+), it becomes toxic. Further bioconversion to an alkyl Hg, such as methyl Hg (CH3Hg[+]), yields a species of mercury that is highly selective for lipid-rich tissue such as neurons and is very toxic. The relative order of toxicity is:
Least Toxic - Hg(0) < Hg(2+) << CH3Hg(+) -- Very Toxic

Mercury can be chemically converted from the elemental state to the ionized state. In industry, this is frequently done by exposing Hg(0) to strong oxidizing agents such as chlorine.
Hg(0) can be bioconverted to both Hg(2+) and alkyl Hg by microorganisms that exist both in the normal human gut and in the bottom sediment of lakes, rivers, and oceans. When Hg(0) enters bottom sediment, it is absorbed by bacteria, fungi, and small microorganisms; they metabolically convert it to Hg(2+), CH3Hg(+), and C2H6Hg. Should these microorganisms be consumed by larger marine animals and fish, the mercury passes up the food chain in rather toxic form.
Mercury expresses its toxicity in 3 ways:
-Hg(2+) is readily absorbed and reacts with sulfhydryl groups of protein, causing a change in the tertiary structure of the protein-a stereoisomeric change-with subsequent loss of the unique activity associated with that protein. Because Hg(2+) becomes concentrated in the kidney during the regular clearance processes, this target organ experiences the greatest toxicity.
-With the tertiary change noted previously, some proteins become immunogenic, eliciting a proliferation of T lymphocytes that generate immunoglobulins to bind the new antigen; collagen tissues are particularly sensitive to this.
-Alkyl Hg species, such as CH3Hg(+), are lipophilic and avidly bind to lipid-rich tissues such as neurons. Myelin is particularly susceptible to disruption by this mechanism.
Members of the public will occasionally become concerned about exposure to mercury from dental amalgams. Restorative dentistry has used a mercury-silver amalgam for approximately 90 years as a filling material. A small amount of mercury (2-20 mcg/day) is released from a dental amalgam when it was mechanically manipulated, such as by chewing. The habit of gum chewing can cause release of mercury from dental amalgams greatly above normal. The normal bacterial flora present in the mouth converts a fraction of this to Hg(2+) and CH3Hg(+), which was shown to be incorporated into body tissues. The World Health Organization safety standard for daily exposure to mercury is 45 mcg/day. Thus, if one had no other source of exposure, the amount of mercury released from dental amalgams is not significant.(1) Many foods contain mercury. For example, commercial fish considered safe for consumption contain less than 0.3 mcg/g of mercury, but some game fish contain more than 2.0 mcg/g and, if consumed on a regular basis, contribute to significant body burdens.
Therapy is usually monitored by following urine output; therapy may be terminated after urine excretion is below 50 mcg/day.

Reference Values

<10 ng/mL
Reference values apply to all ages.

Interpretation

The quantity of mercury (Hg) found in blood and urine correlates with degree of toxicity. Hair analysis can be used to document the time of peak exposure if the event was in the past.

Normal whole blood mercury is usually below 10 ng/mL.
Individuals who have mild exposure during work, such as dentists, may routinely have whole blood mercury levels up to 15 ng/mL.
Significant exposure is indicated when the whole blood mercury is above 50 ng/mL if exposure is due to alkyl Hg, or above 200 ng/mL if exposure is due to Hg(2+).

Cautions
No significant cautionary statements

Clinical Reference
1. Lee R, Middleton D, Calwell K, et al: A review of events that expose children to elemental mercury in the United States. Environ Health Perspect. 2009;117:871-878
2. Bjorkman L, Lundekvam B, Laegreid T, et al: Mercury in human brain, blood, muscle and toenails in relation to exposure: an autopsy study. Environmental Health. 2007;6:30-44
3. deBurbure C, Buchet J-P, Leroyer A, et al: Renal and neurologic effects of cadmium, lead, mercury, and arsenic in children: evidence of early effects and multiple interactions at environmental exposure levels. Environ Health Perspect. 2006;114:584-590
4. Strathmann FG, Blum LM: Toxic elements. In: Rifai N, Horwath AR., Wittwer CT, eds. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics 6th ed. Elsevier; 2018:chap 42

Performance

Method Description
Mercury (Hg) is analyzed by inductively coupled plasma-mass spectrometry (ICP-MS) in kinetic energy discrimination (KED) mode using helium as a nonreactive gas to collide with polyatomic interferences such as argon chloride (ArCl). Internal standard used is lutetium (Lu) and iridium (Ir) summed. A salt matrix calibration is used.(Nixon DE, Burritt MF, Moyer TP: The determination of mercury in whole blood and urine by inductively coupled plasma mass spectrometry. Spectrochimica Acta Part B-Atomic Spectroscopy. 1999;54:1141-1153; Hanley MM, Eckdahl SJ, Kiedrowski B, et al: A comparison of methods for attenuation of oxide interferences in cadmium and mercury analysis by ICP-MS [Paper 38169]. 38th Federation of Analytical Chemistry and Spectroscopy Societies, Reno, NV, October 2-6, 2011)

PDF Report
No

Specimen Retention Time
14 days

Performing Laboratory Location
Rochester

Fees & Codes

Test Classification

This test was developed, and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. This test has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information

83825