MAYO CLINIC LABORATORIES

Test Definition: HMHA

Heavy Metals, Hair

Overview

Useful For

Detection of nonacute arsenic, mercury, and lead exposure using hair specimens

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
ASHA	Arsenic, Hair	Yes	Yes
PBHA	Lead, Hair	Yes	Yes
HGHAR	Mercury, Hair	Yes	Yes

Special Instructions

- Collecting Hair and Nails for Metals Testing

Method Name

Triple-Quadrupole Inductively Coupled Plasma Mass Spectrometry (ICP-MS/MS)

NY State Available

No

Specimen

Specimen Type

Hair

Necessary Information

Indicate source of hair (axillary, head, or pubic) if known

Specimen Required

Supplies: Hair and Nails Collection Kit (T565)

Source: Head (preferred), beard, mustache, chest, pubic

Specimen Volume: 0.2 g

Collection Instructions: Prepare and transport specimen per the instructions in kit or see Collecting Hair and Nails for Metals Testing.

Specimen Minimum Volume

0.05 g

Reject Due To

All specimens will be evaluated at Mayo Clinic Laboratories for test suitability.

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Hair	Ambient (preferred)		
	Refrigerated		
	Frozen		

Clinical & Interpretive

Clinical Information

Arsenic:
Arsenic circulating in the blood will bind to protein by formation of a covalent complex with sulfhydryl groups of the amino acid cysteine. Keratin, the major structural protein in hair and nails, contains many cysteine residues and, therefore, is one of the major sites for accumulation of arsenic. Since arsenic has a high affinity for keratin, the concentration of arsenic in hair is higher than in other tissues.

Arsenic binds to keratin at the time of exposure, "trapping" the arsenic in hair. Therefore, hair analysis for arsenic is not only used to document that an exposure occurred, but when it occurred. Hair collected from the nape of the neck can be used to document recent exposure. Axillary or pubic hairs are used to document long-term (6 months-1 year) exposure.

Mercury:
Once absorbed and circulating, mercury becomes bound to numerous proteins, including keratin. The concentration of mercury in hair correlates with the severity of clinical symptoms. If the hair can be segregated by length, such an exercise can be useful in identifying the time of exposure.

Lead:
Hair analysis for lead can be used to corroborate blood analysis or to document past lead exposure. If the hair is collected and segmented in a time sequence (based on length from root), the approximate time of exposure can be assessed.

Reference Values

ARSENIC
0-15 years: Not established
> or =16 years: <1.0 mcg/g of hair

LEAD
<4.0 mcg/g of hair
Reference values apply to all ages.

MERCURY
0-15 years: Not established
> or =16 years:<1.0 mcg/g of hair

Interpretation

Hair grows at a rate of approximately 0.5 inch/month. Hair keratin synthesized today will protrude through the skin in approximately 1 week. Thus, a hair specimen collected at the skin level represents exposure of 1 week ago, 1 inch distally from the skin represents exposure 2 months ago, etc.

Arsenic:
Hair arsenic levels above 1.00 mcg/g dry weight may indicate excessive exposure. It is normal for some arsenic to be present in hair, as everybody is exposed to trace amounts of arsenic from the normal diet.

The highest hair arsenic concentration observed at Mayo Clinic was 210 mcg/g dry weight in a case of chronic exposure, which was the cause of death.

Mercury:
Normally, hair contains less than 1 mcg/g of mercury; any amount more than this indicates that exposure to more than normal amounts of mercury may have occurred.

Lead:
Normal hair lead content is below 4.0 mcg/g. While hair lead content above 10.0 mcg/g may indicate significant lead exposure, hair is also subject to potential external contamination with environmental lead and contaminants in artificial hair treatments (eg, dyeing, bleaching, or permanents). Ultimately, the hair lead content needs to be interpreted in addition to the overall clinical scenario including symptoms, physical findings, and other diagnostic results when determining further actions.

Cautions

No significant cautionary statements

Clinical Reference

1. Sthiannopkao S, Kim K-W, Cho KH, et al. Arsenic levels in human hair, Kandal Province, Cambodia: The influences of groundwater arsenic, consumption period, age and gender. Applied Geochemistry. 2010;25(1):81-90
2. Pearce DC, Dowling K, Gerson, AR, et al. Arsenic microdistribution and speciation in toenail clippings of children living in a historic gold mining area. Sci Total Environ. 2010;408(12):2590-2599
3. Marques RC, Dorea JG, Bastos WR, Malm O. Changes in children hair-Hg concentrations during the first 5 years: maternal, environmental and iatrogenic modifying factors. Regul Toxicol Pharmacol. 2007;49(1):17-24
4. Canuel R, de Grosbois SB, Atikesse L, et al. New evidence on variations of human body burden of methylmercury from fish consumption. Environ Health Perspect. 2006;114(2):302-306
5. Barbosa F Jr, Tanus-Santos JE, Gerlach RF, Parsons PJ. A critical review of biomarkers used for monitoring human exposure to lead: advantages, limitations, and future needs. Environ Health Perspect. 2005;113(12):1669-1674
6. DiPietro ES, Phillips DL, Paschal DC, Neese JW. Determination of trace elements in human hair. Reference intervals for 28 elements in nonoccupationally exposed adults in the US and effects of hair treatments. Biol Trace Elem Res. 1989;22(1):83-100
7. Strathmann FG, Blum LM. Toxic elements. In: Rifai N, Chiu RWK, Young I, Burnham CAD, Wittwer CT, eds. Tietz Textbook of Laboratory Medicine. 7th ed. Elsevier; 2023:chap 44

Performance

Method Description
The metal analytes of interest are analyzed by triple-quadrupole inductively coupled plasma mass spectrometry.(Unpublished Mayo method)

PDF Report
No

Day(s) Performed
Wednesday

Report Available
2 to 14 days

Specimen Retention Time
14 days

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Superior Drive

Fees & Codes

Fees
- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

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

CPT Code Information
82175
83655
83825

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
HMHA	Heavy Metals, Hair	34667-6

Result ID	Test Result Name	Result LOINC® Value
31896	Arsenic, Hair	5584-8
ASHSC	Specimen Source	31208-2
31900	Mercury, Hair	5686-1
HGHSC	Specimen Source	31208-2

31898	Lead, Hair	5673-9
PBHSC	Specimen Source	31208-2