MAYO CLINIC LABORATORIES

Test Definition: ASU24

Arsenic w/Reflex, 24 Hr, U

Overview

Useful For

Preferred screening test for detection of arsenic exposure using 24-hour urine specimens

Testing Algorithm

If total arsenic concentration is 10 mcg/L or greater, then speciation will be performed at an additional charge.

Special Instructions

- Urine Preservatives-Collection and Transportation for 24-Hour Urine Specimens
- Trace Metals Analysis Specimen Collection and Transport

Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
SPASU	Arsenic Speciation, 24 Hr, U	Yes	No

Method Name

Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)

NY State Available

Yes

Specimen

Specimen Type

Urine

Necessary Information

24 Hour volume is required.

Specimen Required

Patient Preparation:

-Patient should not eat seafood for a 48-hour period prior to start of collection.

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

Supplies: Urine Tubes, 10 mL (T068)

Collection Container/Tube: Clean, plastic urine container with no metal cap or glued insert.

Submission Container/Tube: Plastic, 10-mL urine tube or clean, plastic aliquot container with no metal cap or glued insert.

Specimen Volume: 10 mL

Collection Instructions:

1. Collect urine for 24 hours.
2. Refrigerate specimen within 4 hours of completion of 24-hour collection.
3. See Trace Metals Analysis Specimen Collection and Transport in Special Instructions for complete instructions.

Additional Information: See Urine Preservatives-Collection and Transportation for 24-Hour Urine Specimens.

Urine Preservative Collection Options

Ambient	OK
Refrigerate	Preferred
Frozen	OK
50% Acetic Acid	OK
Boric Acid	No
Diazolidinyl Urea	No
6M Hydrochloric Acid	OK
6M Nitric Acid	OK
Sodium Carbonate	No
Thymol	No
Toluene	No

Reject Due To

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

Specimen Minimum Volume

3 mL

Specimen Stability Information

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

Clinical & Interpretive

Clinical Information

Arsenic is a naturally occurring element that is widely distributed in the Earth's crust. Arsenic is classified chemically as a metalloid, having both properties of a metal and a nonmetal. Elemental arsenic is a steel grey solid material. However, arsenic is usually found in the environment combined with other elements such as oxygen, chlorine, and sulfur. Arsenic combined with these elements is called inorganic arsenic. Arsenic combined with carbon and hydrogen is referred to as organic arsenic. The organic forms (eg, arsenobetaine and arsenocholine) are relatively nontoxic, while the inorganic forms are toxic. The toxic inorganic forms are arsenite (As[3+]/As[III]) and arsenate (As[5+]/As[V]). Inorganic As(V) is readily reduced to inorganic As(III), which is then primarily broken down to the less toxic methylated metabolites monomethylarsinic acid (MMA) and subsequently dimethylarsinic acid (DMA).

In the past, inorganic arsenic compounds were predominantly used as pesticides, primarily on cotton fields and in orchards. Inorganic arsenic compounds can no longer be used in agriculture. However, organic arsenic compounds, namely cacodylic acid, disodium methylarsenate (DSMA), and monosodium methylarsenate (MSMA), are still used as

pesticides, principally on cotton. Some organic arsenic compounds are used as additives in animal feed. Small quantities of elemental arsenic are also added to other metals to form metal mixtures or alloys with improved properties. The greatest use of arsenic in alloys is in lead-acid batteries for automobiles. Another important use of arsenic compounds is in semiconductors and light-emitting diodes.

People are exposed to arsenic by eating food, drinking water, or breathing air. Of these, food is usually the largest source of arsenic. The predominant dietary source of arsenic is seafood, followed by rice/rice cereal, mushrooms, and poultry. While seafood contains the greatest amounts of arsenic, for fish and shellfish, this is mostly in an organic form of arsenic called arsenobetaine, which is much less harmful. Some seaweed may contain arsenic in the inorganic form, which is more toxic. In the United States, some areas also contain high natural levels of arsenic in rock, which can lead to elevated levels in the soil and drinking water. Occupational (eg, copper or lead smelting, wood treating, or pesticide application) expose is another source where people may be introduced to elevated levels of arsenic. Lastly, hazardous waste sites may contain large quantities of arsenic and, if not disposed of properly, may get into the surrounding water, air, or soil.

A wide range of signs and symptoms may be seen in acute arsenic poisoning including headache, nausea, vomiting, diarrhea, abdominal pain, hypotension, fever, hemolysis, seizures, and mental status changes. Symptoms of chronic poisoning, also called arseniasis, are mostly insidious and nonspecific. The gastrointestinal tract, skin, and central nervous system are usually involved. Nausea, epigastric pain, colic abdominal pain, diarrhea, and paresthesias of the hands and feet can also occur.

Since arsenic is excreted predominantly by glomerular filtration, measurement of arsenic in urine is the most reliable means of detecting arsenic exposures within the last several days.

Reference Values

0-17 years: not established

> or =18 years: <35 mcg/24 hour

Interpretation

Physiologically, arsenic exists in a number of toxic and nontoxic forms. The total arsenic concentration reflects all the arsenic present in the sample regardless of species (eg, inorganic vs. methylated vs. organic arsenic). The measurement of urinary total arsenic levels is generally accepted as the most reliable indicator of recent arsenic exposure. However, if the total urine arsenic concentration is elevated, arsenic speciation must be performed to identify if it is the toxic forms (eg, inorganic and methylated forms) or the relatively non-toxic organic forms (eg, arsenobetaine and arsenocholine). The inorganic toxic forms of arsenic (eg, As[III] and As[V]) are found in the urine shortly after ingestion, whereas the less toxic methylated forms (monomethylarsinic acid: MMA dimethylarsinic acid: DMA) are the species that predominate longer than 24 hours after ingestion. In general, urinary As(III) and As(V) concentrations peak in the urine at approximately 10 hours and return to normal 20 to 30 hours after ingestion. Urinary MMA and DMA concentrations normally peak at approximately 40 to 60 hours and return to baseline 6 to 20 days after ingestion.

After a seafood meal (seafood generally contains the nontoxic, organic form of arsenic (eg, arsenobetaine), the urine output of arsenic may increase to over 300 mcg/24 hour specimen, after which it will decline.

This test can determine if you have been exposed to above-average levels of arsenic. It cannot predict whether the arsenic levels in your body will affect your health.

Cautions

Consumption of seafood before collection of a urine specimen for arsenic testing is likely to result in a report of an elevated concentration of arsenic found in the urine, which can be clinically misleading.

Clinical Reference

1. Fillol CC, Dor F, Labat L, et al: Urinary arsenic concentrations and speciation in residents living in an area with naturally

contaminated soils. Sci Total Environ. 2010 Feb 1;408(5):1190-1194
2. Caldwell K, Jones R, Verdon C, et al: Levels of urinary total and speciated arsenic in the US population: National Health and Nutrition Examination Survey 2003-2004. J Expo Sci Environ Epidemiol. 2009 Jan;19(1):59-68
3. Agency for Toxic Substances and Disease Registry: Toxicological profile for arsenic. US Department of Health and Human Services. August 2007. https://www.atsdr.cdc.gov/ToxProfiles/tp2.pdf
4. Strathmann FG, Blum LM: Toxic elements. In: Rafai N, Horwath AR., Wittwer CT, eds. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. 6th ed. Elsevier; 2018:chap 42
5. Keil DE, Berger-Ritchie J, McMillin GA: Testing for toxic elements: A focus on arsenic, cadmium, lead, and mercury. Lab Med. 2011 Dec;42(12):735-742. https://academic.oup.com/labmed/article/42/12/735/2504927
6. Navas-Acien A, Francesconi KA, Silbergeld EK, Guallar E: Seafood intake and urine concentrations of total arsenic, dimethylarsinate and arsenobetaine in the US population. Environ Res. 2011 Jan;111(1):110-8. doi: 10.1016/j.envres.2010.10.009
7. Tchounwou PB, Yedjou CG, Udensi UK, et al: State of the science review of the health effects of inorganic arsenic: Perspectives for future research. Environ Toxicol. 2019 Feb;34(2):188-202. doi: 10.1002/tox.22673

Performance

Method Description
Arsenic (As) in urine is analyzed by inductively coupled plasma-mass spectrometry (ICP-MS) in kinetic energy discrimination (KED) mode using gallium (Ga), rhodium (Rh), and iridium (Ir) as internal standards and a 5% nitric acid salt matrix calibration.(Unpublished Mayo method)

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
82175