MAYO CLINIC LABORATORIES

Test Definition: ASUCR

Arsenic/Creatinine, Ratio, with Reflex, Random, Urine

Overview

Useful For

Preferred screening test for detection of arsenic exposure using random urine specimens

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
ASCU	Arsenic/Creatinine Ratio, U	No	Yes
CRETR	Creatinine, Random, U	No	Yes

Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
SPAS	Arsenic Speciation, Random, U	Yes	No

Testing Algorithm

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

Special Instructions

- Metals Analysis Specimen Collection and Transport

Method Name

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

CRETR: Enzymatic Colorimetric Assay

NY State Available

Yes

Specimen

Specimen Type

Urine

Specimen Required

Patient Preparation:

1. For the 48-hour period prior to start of collection, patient **should not** eat seafood.
2. 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: 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: 6 mL
Collection Instructions:
1. Collect urine a random urine specimen.
2. See Metals Analysis Specimen Collection and Transport for complete instructions.

Specimen Minimum Volume
3 mL

Reject Due To

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

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Urine	Refrigerated (preferred)	28 days	
	Ambient	72 hours	
	Frozen	28 days	

Clinical & Interpretive

Clinical Information
Arsenic (As) is a naturally occurring element that is widely distributed in the Earth's crust. Arsenic is classified chemically as a metalloid, having both metal and nonmetal properties. Elemental arsenic is a steel gray 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, monomethylarsonic acid and, subsequently, dimethylarsinic acid.

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, and monosodium methylarsenate 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 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, from 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) exposure 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

ARSENIC/CREATININE:
0-17 years: Not established
> or =18 years: <24 mcg/g creatinine

CREATININE:
> or =18 years: 16-326 mg/dL
Reference values have not been established for patients who are younger than 18 years of age.

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 a toxic form (eg, inorganic and methylated forms) or a relatively nontoxic organic form (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, monomethylarsonic acid (MMA) and 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.

This test can determine if a patient has been exposed to above-average levels of arsenic. It cannot predict whether the arsenic levels in their body will affect their 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. 20101;408(5):1190-1194
2. Caldwell KL, Jones RL, Verdon CP, Jarrett JM, Caudill SP, Osterloh JD. 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;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. Available at www.atsdr.cdc.gov/ToxProfiles/tp2.pdf
4. Strathmann FG, Blum LM. Toxic elements. In: Rifai N, Chiu RWK, Young I, Burnham CD, Wittwer CT, eds. Tietz Textbook of Laboratory Medicine. 7th ed. Elsevier; 2023:chap 44
5. Keil DE, Berger-Ritchie J, McMillin GA. Testing for toxic elements: A focus on arsenic, cadmium, lead, and mercury. Lab Med. 2011;42(12):735-742. doi:10.1309/LMYKGU05BEPE7IAW
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;111(1):110-118 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;34(2):188-202 doi:10.1002/tox.22673

Performance

Method Description

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

Creatinine:
The enzymatic method is based on the determination of sarcosine from creatinine with the aid of creatininase, creatinase, and sarcosine oxidase. The liberated hydrogen peroxide is measured via a modified Trinder reaction using a colorimetric indicator. Optimization of the buffer system and the colorimetric indicator enables the creatinine concentration to be quantified both precisely and specifically. (Package insert: Creatinine plus ver 2. Roche Diagnostics; V15.0, 03/2019)

PDF Report

No

Day(s) Performed

Monday through Friday

Report Available

2 to 4 days

Test Definition: ASUCR

Arsenic/Creatinine, Ratio, with Reflex, Random, Urine

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
82570

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
ASUCR	Arsenic/Creat w/Reflex, Random,U	13463-5

Result ID	Test Result Name	Result LOINC® Value
CRETR	Creatinine, Random, U	2161-8
608900	Arsenic/Creatinine Ratio, U	13463-5
608901	Total Arsenic Concentration	5586-3