Overview

Useful For
Preferred screening test for detection of arsenic, cadmium, mercury, and lead using random urine specimens

Profile Information

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Reporting Name</th>
<th>Available Separately</th>
<th>Always Performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARSC</td>
<td>Arsenic/Creatinine Ratio, U</td>
<td>Yes, (order ARSCR)</td>
<td>Yes</td>
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<tr>
<td>CDRC</td>
<td>Cadmium/Creatinine Ratio, U</td>
<td>Yes, (order CDRCR)</td>
<td>Yes</td>
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<tr>
<td>HGRC</td>
<td>Mercury/Creatinine Ratio, U</td>
<td>Yes, (order HGRCR)</td>
<td>Yes</td>
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<tr>
<td>PBRC</td>
<td>Lead/Creatinine Ratio, U</td>
<td>Yes, (order PBRCR)</td>
<td>Yes</td>
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<tr>
<td>CDCR</td>
<td>Creatinine Conc</td>
<td>No</td>
<td>Yes</td>
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Reflex Tests

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<tbody>
<tr>
<td>ASFRU</td>
<td>Arsenic Fractionation, Random, U</td>
<td>Yes</td>
<td>No</td>
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</table>

Testing Algorithm
If arsenic concentration is greater than or equal to 35 mcg/L, then fractionation will be performed at an additional charge.

See Porphyria (Acute) Testing Algorithm in Special Instructions.

Special Instructions
- Trace Metals Analysis Specimen Collection and Transport
- Porphyria (Acute) Testing Algorithm

Method Name
ARSC, CDRC, HGRC, and PBRC: Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)

CDCR: Enzymatic Colorimetric Assay

NY State Available
Yes

Specimen

Specimen Type
Urine
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: 6 mL

Collection Instructions:

1. Collect a random urine specimen.

2. See Trace Metals Analysis Specimen Collection and Transport in Special Instructions 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

<table>
<thead>
<tr>
<th>Specimen Type</th>
<th>Temperature</th>
<th>Time</th>
<th>Special Container</th>
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</thead>
<tbody>
<tr>
<td>Urine</td>
<td>Refrigerated (preferred)</td>
<td>7 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frozen</td>
<td>7 days</td>
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Clinical and Interpretive

Clinical Information

Arsenic (As), lead (Pb), cadmium (Cd), and mercury (Hg) are well-known toxins and toxic exposures are characterized by increased urinary excretion of these metals.

Arsenic is a naturally occurring element that is widely distributed in the Earth's crust. 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 arsenuocholine) 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 less toxic methylated metabolites monomethylarsinic acid (MMA) and subsequently dimethylarsinic acid (DMA).

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 (e.g., 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. Arsenic toxicity affects a number of organ systems.

Lead toxicity primarily affects the gastrointestinal, neurologic, and hematopoietic systems.

Chronic exposure to cadmium causes accumulated renal damage.

The correlation between the levels of mercury (Hg) excretion in the urine and the clinical symptoms is considered poor. However, urinary Hg is the most reliable way to assess exposure to inorganic Hg.

**Reference Values**

**ARSENIC/CREATININE:**

0-17 years: not established

> or = 18 years: <24 mcg/g creatinine

**CADMIUM/CREATININE:**

0-17 years: not established

> or = 18 years: <0.6 mcg/g creatinine

**MERCURY/CREATININE:**

0-17 years: not established

> or = 18 years: <2 mcg/g creatinine

**LEAD/CREATININE:**

0-17 years: not established

> or = 18 years: <2 mcg/g creatinine
**Interpretation**

**Arsenic:**

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 (e.g., 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 (e.g., inorganic and methylated forms) or the relatively non-toxic organic forms (e.g., arsenobetaine and arslenocholine).

The inorganic toxic forms of arsenic (e.g., As[III] and As[V]) are found in the urine shortly after ingestion, whereas the less toxic methylated forms (MMA and 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 you have been exposed to above-average levels of arsenic. It cannot predict whether the arsenic levels in your body will affect your health.

**Cadmium:**

Cadmium excretion above 3.0 mcg/g creatinine indicates significant exposure to cadmium.

Results above 15 mcg/g creatinine are considered indicative of severe exposure.

**Mercury:**

Urinary mercury (Hg) is the most reliable way to assess exposure to inorganic Hg, but the correlation between the levels of excretion in the urine and clinical symptoms is poor.

**Lead:**

Urinary excretion of less than 4 mcg/g creatinine is not associated with any significant lead exposure.

Urinary excretion above 4 mcg/g creatinine is usually associated with pallor, anemia, and other evidence of lead toxicity.

**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.

Nitric acid cannot be added to either the collection or aliquot container. Nitrate interferes with the extraction procedure that would need to take place in the event of a positive arsenic result.

**Clinical Reference**


**Performance**

**Method Description**

Arsenic (As), cadmium (Cd), mercury (Hg), and lead (Pb) in urine are 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

**Day(s) and Time(s) Test Performed**

Monday through Saturday; 7 p.m.

**Analytic Time**

1 day

**Maximum Laboratory Time**

4 days

**Specimen Retention Time**

14 days

**Performing Laboratory Location**

Rochester

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Fees and 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 Regional Manager. 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. This test has not been cleared or approved by the U.S. Food and Drug Administration.

CPT Code Information
82175
82300
83825
83655
82570

LOINC® Information

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<tr>
<td>HMCRU</td>
<td>Heavy Metal/Creat Ratio, w/Reflex,U</td>
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<td>48542</td>
<td>Arsenic Concentration w/Reflex</td>
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