MAYO CLINIC LABORATORIES

Test Definition: CDUOE

Cadmium Occupational Exposure, Random, Urine

Overview

Useful For

Detecting occupational exposure to cadmium, a toxic heavy metal, using random urine specimens

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
CDOU	Cadmium Occupational Exposure	No	Yes
CRETR	Creatinine, Random, U	No	Yes

Special Instructions

- Metals Analysis Specimen Collection and Transport

Method Name

CDOU: 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: 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: 3 mL
Collection Instructions:
1. Collect urine a random urine specimen.
2. See Metals Analysis Specimen Collection and Transport for complete instructions.

Specimen Minimum Volume
1.5 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	14 days	
	Frozen	28 days	

Clinical & Interpretive

Clinical Information
The toxicity of cadmium resembles the other heavy metals (arsenic, mercury, and lead) in that it attacks the kidney; kidney dysfunction with proteinuria with slow onset (over a period of years) is the typical presentation. Measurable changes in proximal tubule function, such as decreased clearance of para-aminohippuric acid, also occur over a period of years and precede overt kidney failure.

Breathing the fumes of cadmium vapors leads to nasal epithelial deterioration and pulmonary congestion resembling chronic emphysema.

For nonsmokers, the primary source of cadmium exposure is from the food supply. In general, leafy vegetables such as lettuce and spinach, potatoes and grains, peanuts, soybeans, and sunflower seeds contain high levels of cadmium. For smokers, the most common source of cadmium exposure is tobacco smoke, which has been implicated as the primary source of the metal, leading to reproductive toxicity in both male and female patients.

Chronic exposure to cadmium causes accumulated renal damage. The excretion of cadmium is proportional to creatinine except when kidney damage has occurred. Kidney damage due to cadmium exposure can be detected by increased cadmium excretion relative to creatinine.

OSHA mandated (Fed Reg 57:42,102-142,463, September 1992) that all monitoring of employees exposed to cadmium in the workplace should be done using the measurement of urine cadmium and creatinine, expressing the results of mcg of cadmium per gram of creatinine.

Reference Values
CADMIUM/CREATININE:
Biological Exposure Indices (BEI): <5.0 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

Urine cadmium levels primarily reflect total body burden of cadmium. Cadmium excretion above 3.0 mcg/g creatinine indicates significant exposure to cadmium.

For occupational testing, the OSHA cadmium standard is below 3.0 mcg/g creatinine, and the biological exposure index is 5 mcg/g creatinine.

Cautions

Collection of urine specimens through a catheter frequently results in elevated values because rubber contains trace amounts of cadmium that are extracted as urine passes through the catheter.

Clinical Reference

1. 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 Apr;114(4):584-590
2. Schulz C, Angerer J, Ewers U, et al: Revised and new reference values for environmental pollutants in urine or blood of children in Germany derived from the German Environmental Survey on Children 2003-2006(GerESIV) Int J Hyg Environ Health. 2009 Nov;212(6):637-647
3. Occupational Safety and Health Administration: Cadmium exposure and control. US Department of Labor; Updated 9/2/2008. Accessed July 17, 2020. Available at osha.gov/SLTC/cadmium/evaluation.html
4. Agency for Toxic Substances and Disease Registry: Toxicological profile for cadmium. US Department of Health and Human Services; September 2012. Available at www.atsdr.cdc.gov/ToxProfiles/tp5.pdf
5. 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
6. Wang M, Chen Z, Song W, Hong D, Huang L, Li Y: A review on cadmium exposure in the population and intervention strategies against cadmium toxicity. Bull Environ Contam Toxicol. 2021 Jan;106(1):65-74. doi: 10.1007/s00128-020-03088-1
7. Zhang H, Reynolds M: Cadmium exposure in living organisms: A short review. Sci Total Environ. 2019 Aug 15;678:761-767. doi: 10.1016/j.scitotenv.2019.04.395

Performance

Method Description

Cadmium:
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

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
82300
82570

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
CDUOE	Cadmium Occupat Exp, Random, U	13471-8

Result ID	Test Result Name	Result LOINC® Value
CRETR	Creatinine, Random, U	2161-8
608892	Cadmium Occupational Exposure	13471-8