MAYO CLINIC LABORATORIES

Test Definition: COU

Cobalt, 24 Hour, Urine

Overview

Useful For

Detecting cobalt exposure

Monitoring metallic prosthetic implant wear

This test is **not useful** to assess vitamin B12 activity.

Special Instructions

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

Method Name

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

NY State Available

Yes

Specimen

Specimen Type

Urine

Necessary Information

24-Hour volume (in milliliters) is required.

Specimen Required

Patient Preparation: High concentrations of gadolinium and iodine are known to potentially interfere with most inductively coupled plasma mass spectrometry-based 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: 0.5 mL

Collection Instructions:

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

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

collections.

Urine Preservative Collection Options

Note: The addition of preservative or application of temperature controls **must occur within 4 hours of completion** of the collection.

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

Specimen Minimum Volume

0.3 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	28 days	
	Frozen	28 days	

Clinical & Interpretive

Clinical Information

Cobalt is rare but widely distributed in the environment. It is an essential cofactor in vitamin B12. While cobalt is an essential element, cobalt deficiency has not been reported in humans.

Cobalt is used in the manufacture of hard alloys with high melting points and resistance to oxidation. Cobalt salts are also used in the glass and pigment industry. Previously, cobalt salts were sometimes used as foam stabilizers in the brewing industry; this practice was banned due to the cardiovascular diseases it induced. The radioactive isotope of cobalt, (60)Co, is used as a gamma emitter in experimental biology, cancer therapy, and industrial radiography.

Cobalt is not highly toxic, but large doses will produce adverse clinical manifestations. Acute symptoms are pulmonary edema, allergy, nausea, vomiting, hemorrhage, and kidney failure. Chronic symptoms include pulmonary syndrome, skin

disorders, and thyroid abnormalities. The inhalation of dust during machining of cobalt alloyed metals can lead to interstitial lung disease. Improperly handled (60)Co can cause radiation poisoning from exposure to gamma radiation.

Urine cobalt concentrations are likely to be increased above the reference value in patients with metallic joint prosthesis. Prosthetic devices produced by Zimmer Company and Johnson and Johnson typically are made of aluminum, vanadium, and titanium. Prosthetic devices produced by DePuy Company, Dow Corning, Howmedica, LCS, PCA, Osteonics, Richards Company, Tricon, and Whiteside typically are made of chromium, cobalt, and molybdenum. This list of products is incomplete, and these products change occasionally; see prosthesis product information for each device for composition details.

Reference Values

0-17 years: Not established
> or =18 years: 0.2-3.5 mcg/24 hours

Interpretation

Concentrations of 2.0 mcg/specimen or more indicate excess exposure. There are no Occupational Safety and Health Administration blood or urine criteria for occupational exposure to cobalt.

Prosthesis wear is known to result in increased circulating concentration of metal ions. In a patient with a cobalt-based implant, modest increase (2-4 mcg/specimen) in urine cobalt concentration is likely to be associated with a prosthetic device in good condition. Excessive exposure is indicated when urine cobalt concentration is above 5 mcg/specimen, consistent with prosthesis wear. Urine concentrations above 20 mcg/specimen in a patient with a cobalt-based implant suggest significant prosthesis wear. Increased urine trace element concentrations in the absence of corroborating clinical information do not independently predict prosthesis wear or failure.

Cautions

Specimen collection procedures for cobalt require special specimen collection tubes, rigorous attention to ultraclean specimen collection and handling procedures, and analysis in an ultraclean facility. Unless these precautions are taken, elevated urine cobalt results may be an incidental and misleading finding.

Metal-free urine collection procedures must be followed (see Metals Analysis Specimen Collection and Transport).

Clinical Reference

1. Keegan GM, Learmonth ID, Case CP. A systematic comparison of the actual, potential, and theoretical health effects of cobalt and chromium exposures from industry and surgical implants. Crit Rev Toxicol. 2008;38(8):645-674
2. Lhotka C, Szekeres T, Steffan I, Zhuber K, Zweymuller K. Four-year study of cobalt and chromium blood levels in patients managed with two different metal-on-metal total hip replacements. J Orthop Res. 2003;21(2):189-195
3. Lison D, De Boeck M, Verougstraete V, Kirsch-Volders M. Update on the genotoxicity and carcinogenicity of cobalt compounds. Occup Environ Med. 2001;58(10):619-625
4. Crutsen JRW, Koper MC, Jelsma J, et al. Prosthetic hip-associated cobalt toxicity: a systematic review of case series and case reports. EFORT Open Rev. 2022;7(3):188-199
5. Leyssens L, Vinck B, Van Der Straeten C, Wuyts F, Maes L. Cobalt toxicity in humans-A review of the potential sources and systemic health effects. Toxicology. 2017;387:43-56. doi:10.1016/j.tox.2017.05.015
6. Sodi R. Vitamins and trace elements. Rifai N, Chiu RWK, Young I, eds: Tietz Textbook of Laboratory Medicine. 7th ed. Elsevier; 2023:chap 39

Performance

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

PDF Report
No

Day(s) Performed
Monday

Report Available
2 to 8 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
83018

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
COU	Cobalt, 24 Hr, U	29916-4

Result ID	Test Result Name	Result LOINC® Value
80083	Cobalt, 24 Hr, U	29916-4

TM75	Collection Duration (h)	13362-9
VL64	Volume (mL)	3167-4