MAYO CLINIC LABORATORIES

Test Definition: COS

Cobalt, Serum

Overview

Useful For

Detecting cobalt toxicity

Monitoring metallic prosthetic implant wear

This test **is not useful for** assessment of vitamin B12 activity.

Special Instructions

- 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

Serum

Ordering Guidance

The US Food and Drug Administration recommended test for monitoring cobalt in patients with metal-on-metal implants is COWB / Cobalt, Blood.

This test should not be ordered to assess vitamin B12 activity. For that assessment see B12 / Vitamin B12 Assay, Serum or ACASM / Pernicious Anemia Cascade, Serum.

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: Metal Free Specimen Vial (T173)
Collection Container/Tube: Plain, royal blue-top Vacutainer plastic trace element blood collection tube
Submission Container/Tube: 7-mL Mayo metal-free, screw-capped, polypropylene vial
Specimen Volume: 1.6 mL Serum
Collection Instructions: See Metals Analysis Specimen Collection and Transport for complete instructions.

Specimen Minimum Volume

Serum: 0.3 mL

Reject Due To

Gross hemolysis	OK
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	28 days	METAL FREE
	Ambient	28 days	METAL FREE
	Frozen	28 days	METAL FREE

Clinical & Interpretive

Clinical Information

Cobalt is rare but widely distributed in the environment, used in the manufacture of hard alloys with high melting points and resistance to oxidation; cobalt alloys are used in manufacture of some artificial joint prosthesis devices. Cobalt salts are 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 an essential cofactor in vitamin B12 metabolism. Cobalt deficiency has not been reported in humans.

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.

Serum cobalt concentrations are likely to be increased above the reference range in patients with joint prosthesis containing cobalt. Prosthetic devices produced by DePuy Company, Dow Corning, Howmedica, LCS, PCA, Osteonics, Richards Company, Tricon, and Whiteside are typically 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

<1.0 ng/mL
<10.0 ng/mL (Metal-on-metal implant)
Reference values apply to all ages.

The reported unit of measurement for cobalt of ng/mL is equivalent to mcg/L.

Interpretation

Concentrations of 1.0 ng/mL and above indicate possible environmental or occupational exposure.

Cobalt concentrations associated with toxicity must be interpreted in the context of the source of exposure. If cobalt is ingested, concentrations greater than 5 ng/mL suggest major exposure and likely toxicity. If cobalt exposure is due to orthopedic implant wear, there are no large case number reports associating high circulating serum cobalt with toxicity.

There are no Occupational Health and Safety Administration blood or urine criteria for occupational exposure to cobalt.

Prosthesis wear is known to result in increased circulating concentration of metal ions. Modest increase (4-10 ng/mL) in serum cobalt concentration is likely to be associated with a prosthetic device in good condition. Serum concentrations above 10 ng/mL in a patient with cobalt-based implant suggest significant prosthesis wear. Increased serum trace element concentrations in the absence of corroborating clinical information do not independently predict prosthesis wear or failure. However, the US Food and Drug Administration recommends testing cobalt in EDTA anticoagulated whole blood in symptomatic patients with metal-on-metal implants.

Cautions

Because this test uses mass spectrometry detection, the radioactive form of cobalt, (60)Co, is not quantified.

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 serum cobalt results may be an incidental and misleading finding.

Clinical Reference

1. Tower SS. Arthroprosthetic cobaltism: neurological and cardiac manifestations in two patients with metal-on-metal arthroplasty: a case report. J Bone Joint Surg Am. 2010;92(17):2847-2851
2. 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
3. De Smet K, De Haan R, Calistri A, et al. Metal ion measurement as a diagnostic tool to identify problems with metal-on-metal hip resurfacing. J Bone Joint Surg Am. 2008;90 Suppl 4:202-208
4. 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
5. 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
6. 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
7. 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 through Friday

Report Available
1 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
83018

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
COS	Cobalt, S	5627-5

Result ID	Test Result Name	Result LOINC® Value
80084	Cobalt, S	5627-5