MAYO CLINIC LABORATORIES

Test Definition: COWB

Cobalt, Blood

Overview

Useful For

Monitoring exposure to cobalt using whole blood specimens

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

Whole blood

Ordering Guidance

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

*****This specimen container cannot be opened or used for any other testing before shipping.*****

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 EDTA 3 mL Tube (T989)
Container/Tube: Royal blue-top BD vacutainer with EDTA blood collection tube (3 mL) (T989) (BD catalog no. 367777)
Specimen Volume: 1 mL
Collection Instructions:
1. See Metals Analysis Specimen Collection and Transport for complete instructions
2. Send whole blood specimen in original tube. **Do not aliquot.**

Specimen Minimum Volume

0.4 mL

Reject Due To

Gross hemolysis	OK
Gross lipemia	OK
Gross icterus	OK
Microtainer	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Whole blood	Refrigerated (preferred)	28 days	
	Ambient	28 days	
	Frozen	28 days	

Clinical & Interpretive

Clinical Information

Cobalt (Co) is a naturally occurring, hard, grey element widely distributed in the environment. It is used to produce alloys in the manufacturing of aircraft engines, cutting tools, and some artificial hip and knee joint prosthesis devices. 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. One of the radioactive isotopes of cobalt, (60)Co, is used to sterilize medical equipment, in radiation therapy for cancer patients, and to irradiate food.

Cobalt is an essential cofactor in vitamin B12, which is necessary for neurological function, brain function, and the formation of blood. For most people, food is the largest source of cobalt intake. However, more than a million workers are potentially exposed to cobalt and its compounds, with the greatest exposure in mining processes, cemented tungsten-carbide industry, cobalt powder industry, and alloy production industry.

Cobalt is not highly toxic, but large doses will produce adverse clinical manifestations. Acute symptoms include pulmonary edema, allergy, nausea, vomiting, hemorrhage, and kidney failure. Chronic exposure to cobalt-containing hard metal (dust or fume) can result in a serious lung disease called hard metal lung disease, which is a type of pneumoconiosis (lung fibrosis). Furthermore, inhalation of cobalt particles can cause respiratory sensitization, asthma, shortness of breath, and decreased pulmonary function. Even though the primary route of occupational exposure to cobalt is the respiratory tract, skin contact is also important because dermal exposures to hard metal and cobalt salts can result in significant systemic uptake. Sustained exposures can cause skin sensitization, which may result in eruptions of contact dermatitis.

Per US Food and Drug Administration recommendations, orthopedic surgeons should consider measuring and following serial cobalt concentrations in EDTA anticoagulated whole blood in symptomatic patients with metal-on-metal hip implants as part of their overall clinical evaluation. Blood 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

0-17 years: Not established
> or =18 years: <1.0 ng/mL

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. In the context of failed metal-on-metal prosthetics, elevated cobalt in serum or blood is rarely the initial finding and is often preceded by physical symptoms including reduced range of motion, swelling, inflammation around the joints, and general discomfort or pain.

The American Conference of Governmental Industrial Hygienists (ACGIH) Biological Exposure Index (BEI) for cobalt in blood is 1 mcg/L (1 ng/mL), which should be collected at the end of shift at the end of the work week.

Cautions

This test should not be ordered to assess vitamin B12 activity.

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 blood 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 from industry and surgical implants. Crit Rev Toxicol. 2008;38(8):645-674
3. De Smet K, De Hann 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 Sppl 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. US Food and Drug Administration: Information about Soft Tissue Imaging and Metal Ion Testing. FDA; Updated March 15, 2019. Accessed October 17, 2023. Available at: www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/ImplantsandProsthetics/MetalonMetalHipImplants/ucm331971.htm
6. US Department of Health and Human Services. Toxicological Profile for Aluminum. HHS: Agency for Toxic Substances and Disease Registry. 2006. Accessed June 4, 2025. Available at www.atsdr.cdc.gov/toxprofiles/tp22.pdf
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

8. 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
9. 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

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
Tuesday through Friday

Report Available
1 to 5 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

COWB	Cobalt, B	5625-9

Result ID	Test Result Name	Result LOINC® Value
60355	Cobalt, B	5625-9