Test Definition: COS

Cobalt, S

Overview

Useful For

Detecting cobalt toxicity

Monitoring metallic prosthetic implant wear

Special Instructions

- Trace Metals Analysis Specimen Collection and Transport

Method Name

Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)

NY State Available

Yes

Specimen

Specimen Type

Serum

Advisory Information

COWB / Cobalt, Blood is the FDA recommended test for monitoring cobalt in metal-on-metal implant patients.

Specimen Required

Patient Preparation: 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:

-Metal Free B-D Tube (No Additive), 6 mL (T184)

-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

Collection Instructions:

1. Allow the specimen to clot for 30 minutes; then centrifuge the specimen to separate serum from the cellular fraction.

2. Remove the stopper. Carefully pour specimen into a Mayo metal-free, polypropylene vial, avoiding transfer of the cellular components of blood**. Do not** inserta pipet into the serum to accomplish transfer, and **do not** ream the specimen with a wooden stick to assist with serum transfer.

3. See Trace Metals Analysis Specimen Collection and Transport in Special Instructions for complete instructions.

Additional Information: If ordering the trace element blood collection tube from BD, order catalog #368380.

Specimen Minimum Volume

0.4 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 and 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 renal 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

0.0-0.9 ng/mL

<10 ng/mL (MoM implant)

Reference values apply to all ages.

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

Interpretation

Concentrations greater than or equal to 1.0 ng/mL 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 (OSHA) 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 FDA recommends testing cobalt in EDTA anticoagulated whole blood in symptomatic patients with metal-on-metal implants.

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 all of 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;92:1-5

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;38:645-674

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;90:202-208

4. Lison D, De Boeck M, Verougstraete V, Kirsch-Volders M: Update on the genotoxicity and carcinogenicity of cobalt compounds. Occup Environ Med 2001;58:619-625

Performance

Method Description

Cobalt in serum is analyzed by inductively coupled plasma-mass spectrometry (ICP-MS) in kinetic energy discrimination (KED) mode using rhodium (Rh) as an internal standard and a salt matrix calibration.(Unpublished Mayo method)

PDF Report

No

Day(s) and Time(s) Test Performed

Wednesday; Continuously

Analytic Time

1 day

Maximum Laboratory Time

5 days

Specimen Retention Time

14 days

Performing Laboratory Location

Rochester

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

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