MAYO CLINIC LABORATORIES

Test Definition: MET

Methemoglobin and Sulfhemoglobin, Blood

Overview

Useful For

Diagnosing methemoglobinemia and sulfhemoglobinemia

Identifying cyanosis due to other causes, such as congenital heart disease

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
METH	Methemoglobin, B	No	Yes
SULF	Sulfhemoglobin, B	No	Yes

Method Name

Spectrophotometry (SP)

NY State Available

Yes

Specimen

Specimen Type

Whole Blood EDTA

Shipping Instructions

Specimen must arrive within 72 hours of collection.

Necessary Information

Patient's age is required.

Specimen Required

Container/Tube: Lavender top (EDTA)
Specimen Volume: Full tube
Collection Instructions: Send whole blood specimen in original tube. **Do not aliquot.**
Additional Information: Patient's age is required.

Forms

If not ordering electronically, complete, print, and send a Benign Hematology Test Request Form (T755) with the specimen.

Specimen Minimum Volume

1 mL

Reject Due To

Gross hemolysis	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Whole Blood EDTA	Refrigerated	72 hours	

Clinical & Interpretive

Clinical Information

Methemoglobin:
When iron in hemoglobin is oxidized from the normal divalent state to a trivalent state, the resulting brownish pigment is methemoglobin. Methemoglobin cannot combine reversibly with oxygen and is associated with cyanosis. Methemoglobinemia, with or without sulfhemoglobinemia, is most frequently encountered as a result of the administration of medications such as phenacetin, phenazopyridine, sulfonamides, local anesthetics, dapsone, or following ingestion of nitrites or nitrates. Congenital methemoglobinemias are rare. They are due to either: deficiency of methemoglobin reductase (also called cytochrome B5 reductase or diaphorase) in erythrocytes, an autosomal recessive disorder or one of several intrinsic structural disorders of hemoglobin, called methemoglobin-M; all autosomal dominant in inheritance. Methemoglobinemia responds to treatment with methylene blue or ascorbic acid.

Sulfhemoglobin:
Sulfhemoglobin cannot combine with oxygen. Sulfhemoglobinemia is associated with cyanosis and often accompanies drug-induced methemoglobinemia. Sulfhemoglobinemia can be due to exposure to trinitrotoluene or zinc ethylene bisdithiocarbamate (a fungicide) or ingestion of therapeutic doses of flutamide.

In contrast to methemoglobinemia, sulfhemoglobinemia persists until the erythrocytes containing it are destroyed. Therefore, the blood level of sulfhemoglobin declines gradually over a period of weeks.

Patients with sulfhemoglobinemia often also have methemoglobinemia. There is no specific treatment for sulfhemoglobinemia. Therapy is directed at reversing the methemoglobinemia if present.

Reference Values

METHEMOGLOBIN
0-11 months: Not established
> or =1 year: 0.0-1.5% of total hemoglobin

SULFHEMOGLOBIN
0-11 months: Not established
> or =1 year: 0.0-0.4% of total hemoglobin

Interpretation

In congenital methemoglobinemia, the methemoglobinemia concentration in blood is about 15% to 20% of total hemoglobin. Such patients are mildly cyanotic and asymptomatic.

In acquired (toxic) methemoglobinemia, the concentration may be much higher. Symptoms may be severe when methemoglobin is greater than 40% of hemoglobin. Very high concentrations (>70%) may be fatal.

Sulfhemoglobin is not a normal constituent of blood. Sulfhemoglobinemia can be seen alone or accompanying methemoglobinemia and is also associated with cyanosis. Sulfhemoglobinemia has been reported with prescription and over the counter medications, recreational drug use, and occupational exposure to sulfur compounds including sulfonamides, metoclopramide, sumatriptan, paint/varnish vapors, magnesium sulfate (Epsom salts), dextroamphetamine, amobarbital, Darvon, Alka-Seltzer, dimethylsulfoxide (DMSO), acetanilide, phenacetin, anilines, and in chronic constipation/intestinal bacterial overgrowth (*Morganella morganii*).

Cautions

Methemoglobin is unstable and is reduced to hemoglobin at a rate of about 40% per day at 0 degrees C to 4 degrees C.

A normal methemoglobin value obtained with stored or shipped specimens does not exclude prior mild methemoglobinemia. However, significant methemoglobinemia will still be demonstrable.

Sulfhemoglobin is stable and does not change in stored or shipped specimens.

Clinical Reference

Prchal JT. Methemoglobinemia and other dyshemoglobinemias. In: In: Kaushansky K, Prchal JT, Burns LJ, Lichtman MA, Levi M, Linch DC, eds. Williams Hematology, 10 ed. McGraw-Hill Education; 2021:chap 51

Performance

Method Description

Methemoglobin:
The normal absorption spectrum of oxyhemoglobin has very little optical density above 600 nm. The absorption spectrum of methemoglobin exhibits a small, characteristic peak at 630 nm. This peak is abolished as methemoglobin is converted to cyanmethemoglobin upon addition of potassium cyanide, and the drop in optical density is proportional to methemoglobin concentration.

Sulfhemoglobin:
The normal absorption spectrum of oxyhemoglobin has very little optical density above 600 nm. However, if certain poorly defined hemoglobin denaturation products are present in a hemolysate, there is a broad elevation of the absorption curve in the range of 600 nm to 620 nm. This sulfhemoglobin plateau is not affected by treatment with cyanide. Sulfhemoglobin is not available, nor can it be prepared, in a pure form for preparation of a sulfhemoglobin standard. In calculating sulfhemoglobin concentration, the factor for sulfhemoglobin quantitation is based on studies of Carrico, et al.(Evelyn KA, Malloy HT. Microdetermination of oxyhemoglobin, methemoglobin, and sulfhemoglobin in a single sample of blood. J Biol Chem. 1938;126:655-662; Carrico RJ, Peisach J, Alben JO. The preparation and some

physical properties of sulfhemoglobin. J Analyt Biochem. 1978;253[10]:2386-2391; So JCC, Ma ESK. Hemoglobin and hemoglobinopathies. In: Rifai N, Chiu RWK, Young I, Burnham CAD, Wittwer CT, eds. Tietz Textbook of Laboratory Medicine. Elsevier; 2023:chap 77)

PDF Report
No

Day(s) Performed
Monday through Saturday

Report Available
Same day/1 to 3 days

Specimen Retention Time
7 days

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Main Campus

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
83050-Methemoglobin
83060-Sulfhemoglobin

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
MET	Methemoglobin and Sulfhemoglobin, B	98902-0

Result ID	Test Result Name	Result LOINC® Value
8268	Methemoglobin, B	2614-6
8272	Sulfhemoglobin, B	4685-4