Overview

Useful For
Diagnosing methemoglobinemia and sulfhemoglobinemia
Identifying cyanosis due to other causes, such as congenital heart disease

Profile Information

<table>
<thead>
<tr>
<th>Test Id</th>
<th>Reporting Name</th>
<th>Available Separately</th>
<th>Always Performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>METH</td>
<td>Methemoglobin, B</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>SULF</td>
<td>Sulfhemoglobin, B</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Method Name
Spectrophotometry (SP)

NY State Available
Yes

Specimen

Specimen Type
Whole Blood EDTA

Specimen Required
Specimen must arrive within 72 hours of draw.

Container/Tube: Lavender top (EDTA)
Specimen Volume: Full tube
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.

Reject Due To
Gross hemolysis

Specimen Minimum Volume
1 mL

Specimen Stability Information

<table>
<thead>
<tr>
<th>Specimen Type</th>
<th>Temperature</th>
<th>Time</th>
<th>Special Container</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Blood EDTA</td>
<td>Refrigerated (preferred)</td>
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</table>
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 commonly encountered as a result of administration of medications such as phenacetin, phenazopyridine, sulfonamides, local anesthetics, dapsone, or following ingestion of nitrites or nitrates. Congenital methemoglobinemias are rare. They are either due to:
- Deficiency of methemoglobin reductase (also called cytochrome B5 reductase or diaphorase) in erythrocytes, an autosomal recessive disorder.
- One of several intrinsic structural disorders of hemoglobin, called methemoglobin-M, all of which are inherited in the autosomal dominant mode.
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 by ingestion of therapeutic doses of flutamide.
In contrast to methemoglobinemia, sulfhemoglobinemia persists until the erythrocytes containing it are destroyed. Therefore, 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

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>METHEMOGLOBIN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-11 months:</td>
<td>not established</td>
<td></td>
</tr>
<tr>
<td>&gt; or =1 year:</td>
<td>0.0-1.5% of total hemoglobin</td>
<td></td>
</tr>
</tbody>
</table>

| 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 >40% of hemoglobin. Very high concentrations (>70%) may be fatal.

Cautions
Methemoglobin is unstable and is reduced to hemoglobin at a rate of about 40% per day at 0 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
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 (1978).(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;253:2386-2391; Fairbanks VF, Klee GG: Biochemical aspects of hematology. In Teitz Textbook of Clinical Chemistry. Edited by CA Burtis, ER Ashwood, WB Saunders Company, 1999, pp 1676-1678)

PDF Report
No

Specimen Retention Time
7 days

Performing Laboratory Location
Rochester

Fees & Codes

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 US Food and Drug Administration.

CPT Code Information
83050-Methemoglobin
83060-Sulfhemoglobin