Overview

Useful For
Investigation of macrocytic anemia
Workup of deficiencies seen in megaloblastic anemias

Testing Algorithm
See Vitamin B12 Deficiency Evaluation in Special Instructions.

Special Instructions
- Vitamin B12 Deficiency Evaluation

Method Name
Immunoenzymatic Assay

NY State Available
Yes

Specimen

Specimen Type
Serum

Advisory Information
This test provides a measurement of serum vitamin B12 level only. For a more comprehensive workup, order ACASM / Pernicious Anemia Cascade, Serum, which initiates testing with measurement of vitamin B12. Depending of the vitamin B12 concentration, testing for intrinsic factor blocking antibody, gastrin, and methylmalonic acid may be added.

Necessary Information
Ask patients if they have received a vitamin B12 injection within the last 2 weeks. Patient results will not reflect deficiency or malabsorption after recent B12 injection. If patient has received an injection within the past 2 weeks, this test should not be ordered.

Specimen Required

Container/Tube:

Preferred: Serum gel

Acceptable: Red top

Specimen Volume: 0.6 mL

Collection Instructions:
1. Serum gel tubes should be centrifuged within 2 hours of collection.
2. Red-top tubes should be centrifuged and aliquoted within 2 hours of collection.
**Forms**

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

**Specimen Minimum Volume**

0.5 mL

**Reject Due To**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemolysis</td>
<td>Mild OK; Gross reject</td>
</tr>
<tr>
<td>Lipemia</td>
<td>Mild OK; Gross OK</td>
</tr>
<tr>
<td>Icterus</td>
<td>NA</td>
</tr>
<tr>
<td>Other</td>
<td>Plasma</td>
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</table>

**Specimen Stability Information**

<table>
<thead>
<tr>
<th>Specimen Type</th>
<th>Temperature</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum</td>
<td>Refrigerated (preferred)</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>Frozen</td>
<td>90 days</td>
</tr>
</tbody>
</table>

**Clinical and Interpretive**

**Clinical Information**

Vitamin B12 (cobalamin) is necessary for hematopoiesis and normal neuronal function. In humans, it is obtained only from animal proteins and requires intrinsic factor (IF) for absorption. The body uses its vitamin B12 stores very economically, reabsorbing vitamin B12 from the ileum and returning it to the liver; very little is excreted.

Vitamin B12 deficiency may be due to lack of IF secretion by gastric mucosa (e.g., gastrectomy, gastric atrophy) or intestinal malabsorption (e.g., ileal resection, small intestinal diseases).

Vitamin B12 deficiency frequently causes macrocytic anemia, glossitis, peripheral neuropathy, weakness, hyperreflexia, ataxia, loss of proprioception, poor coordination, and affective behavioral changes. These manifestations may occur in any combination; many patients have the neurologic defects without macrocytic anemia.

Pernicious anemia is a macrocytic anemia caused by vitamin B12 deficiency that is due to a lack of IF secretion by gastric mucosa.

Serum methylmalonic acid and homocysteine levels are also elevated in vitamin B12 deficiency states.

**Reference Values**

180-914 ng/L

**Interpretation**

A serum vitamin B12 level less than 180 ng/L may cause megaloblastic anemia and peripheral neuropathies.

Vitamin B12 levels less than 150 ng/L is considered evidence of vitamin B12 deficiency. Follow-up with a test for
antibodies to intrinsic factor (IFBA / Intrinsic Factor Blocking Antibody, Serum) is recommended to identify this potential cause of vitamin B12 malabsorption. For specimens without antibodies and the patient is symptomatic, follow-up testing for vitamin B12 tissue deficiency may be indicated. Consider analysis of methylmalonic acid (MMAS / Methylmalonic Acid [MMA], Quantitative, Serum) and/or homocysteine (HCYSP / Homocysteine, Total, Plasma). Patients with serum vitamin B12 levels between 150 and 400 ng/L are considered borderline and should be evaluated further by functional tests for vitamin B12 deficiency. Plasma homocysteine measurement (HCYSP / Homocysteine, Total, Plasma) is a good screening test where a normal level effectively excludes vitamin B12 and folate deficiency in an asymptomatic patient. However, the test is not specific and many situations can cause an increased level. In contrast, an increased serum MMA level is more specific for cellular-level B12 deficiency and is not increased by folate deficiency.

In patients being evaluated for vitamin B12 deficiency who have intrinsic factor blocking antibodies (IFBA), false elevations of vitamin B12 may occur due to IFBA interference, potentially obscuring a physiological deficiency of vitamin B12. If observed vitamin B12 concentrations are discordant with clinical presentation, measurement of methylmalonic acid (MMA) should be considered.

See Vitamin B12 Deficiency Evaluation in Special Instructions.

Cautions

Patients taking vitamin B12 supplementation may have misleading results.

Many other conditions are known to cause an increase or decrease in the serum vitamin B12 concentration and should be considered in the interpretation of the assay results, including:

<table>
<thead>
<tr>
<th>Increased serum vitamin B12</th>
<th>Decreased serum vitamin B12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingestion of vitamin C</td>
<td>Pregnancy</td>
</tr>
<tr>
<td>Ingestion of estrogens</td>
<td>Aspirin</td>
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<tr>
<td>Ingestion of vitamin A</td>
<td>Anticonvulsants</td>
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<tr>
<td>Hepatocellular injury</td>
<td>Colchicine</td>
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<tr>
<td>Myeloproliferative disorder</td>
<td>Ethanol ingestion</td>
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<tr>
<td>Uremia</td>
<td>Contraceptive hormones</td>
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<tr>
<td></td>
<td>Smoking</td>
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<tr>
<td></td>
<td>Hemodialysis</td>
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<td></td>
<td>Multiple myeloma</td>
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</table>

The evaluation of macrocytic anemia requires measurement of both vitamin B12 and folate levels; ideally, they should be measured simultaneously.

Some patients exposed to animal antigens, either in the environment or as part of treatment or imaging procedure, may have circulating antianimal antibodies present. These antibodies may interfere with the assay reagents to produce unreliable results.

Clinical Reference
Test Definition: B12
Vitamin B12 Assay, S


Performance

Method Description

The instrument used is a Beckman Coulter DXI 800. The Access Vitamin B12 assay is a competitive-binding immunoenzymatic assay. A sample is added to a reaction vessel along with alkaline potassium cyanide and dithiothreitol. This treatment denatures B12 binding proteins and converts all forms of vitamin B12 to the cyanocobalamin form. After neutralization, intrinsic factor-alkaline phosphatase conjugate and paramagnetic particles coated with goat-antimouse IgG:mouse monoclonal anti-intrinsic factor are added to the sample. Vitamin B12 in the sample binds to the intrinsic factor conjugate, preventing the conjugate from binding to the solid phase anti-intrinsic factor. After incubation in a reaction vessel, materials bound to the solid phase are held in a magnetic field, while unbound materials are washed away. The chemiluminescent substrate Lumi-Phos 530 is added to the vessel and light generated by the reaction is measured with a luminometer. The light production is inversely proportional to the concentration of vitamin B12 in the sample. The amount of analyte in the sample is determined by means of a stored, multipoint calibration curve.(Instruction manual: Beckman Coulter Assay Manual 2015, Beckman Coulter Inc, Brea, CA)

PDF Report

No

Day(s) and Time(s) Test Performed

Monday through Friday; 5 a.m.-12 a.m.
Saturday; 6 a.m.-6 p.m.

Analytic Time

Same day/1 day

Maximum Laboratory Time

3 days

Specimen Retention Time

2 weeks

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.
Test Definition: B12
Vitamin B12 Assay, S

- Prospective clients should contact their Regional Manager. For assistance, contact Customer Service.

Test Classification
This test has been cleared or approved by the U.S. Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

CPT Code Information
82607

LOINC® Information

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<td>2132-9</td>
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