Overview

Useful For
Diagnosis of antithrombin deficiency, acquired or congenital

Monitoring treatment of antithrombin deficiency disorders, including infusion of antithrombin therapeutic concentrate

Special Instructions
- Coagulation Guidelines for Specimen Handling and Processing

Method Name
Chromogenic Assay

NY State Available
Yes

Specimen

Specimen Type
Plasma Na Cit

Advisory Information
Coagulation testing is highly complex, often requiring the performance of multiple assays and correlation with clinical information. For that reason, we suggest ordering AATHR / Thrombophilia Profile, Plasma.

Specimen Required
See Coagulation Guidelines for Specimen Handling and Processing in Special Instructions.

Specimen Type: Platelet-poor plasma

Collection Container/Tube: Light-blue top (citrate)

Submission Container/Tube: Polypropylene vial

Specimen Volume: 1 mL

Collection Instructions:
1. Centrifuge, remove plasma, and centrifuge plasma again.

2. Freeze plasma immediately (no longer than 4 hours after collection) at-20 degrees C, or, ideally < or = -40 degrees C.

Additional Information:
1. Double-centrifuged specimen is critical for accurate results as platelet contamination may cause spurious results.

2. Each coagulation assay requested should have its own vial.
3. Heparin treatment may lower plasma antithrombin.

**Forms**

If not ordering electronically, complete, print, and send a Coagulation Test Request (T753) with the specimen.

**Specimen Minimum Volume**

0.5 mL

**Reject Due To**

<table>
<thead>
<tr>
<th>Specimen Type</th>
<th>Reject Reason</th>
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<tbody>
<tr>
<td>Gross hemolysis</td>
<td>Reject</td>
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<tr>
<td>Gross lipemia</td>
<td>Reject</td>
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<tr>
<td>Gross icterus</td>
<td>Reject</td>
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**Specimen Stability Information**

<table>
<thead>
<tr>
<th>Specimen Type</th>
<th>Temperature</th>
<th>Time</th>
<th>Special Container</th>
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<tbody>
<tr>
<td>Plasma Na Cit</td>
<td>Frozen</td>
<td>14 days</td>
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**Clinical and Interpretive**

**Clinical Information**

Antithrombin is a member of the serine protease inhibitor (serpin) superfamily. It is the principal plasma anticoagulant serpin mediating inactivation of serine protease procoagulant enzymes, chiefly thrombin and coagulation factors Xa and IXa.(1) Heparin and certain other naturally occurring glycosaminoglycans markedly enhance the anticoagulant activity of antithrombins (approximately 1,000-fold) by providing a template to catalyze formation of covalently bonded, inactive complexes of serine protease and antithrombin that are subsequently cleared from circulation. Antithrombin is the mediator of anticoagulant activity of heparin.

The antithrombin gene on chromosome 1 encodes a glycoprotein of approximately 58,000 molecular weight that is synthesized in the liver and is present in a relatively high plasma concentration (approximately 2.3 mc mol/L). The biological half-life of antithrombin is 2 to 3 days.

Hereditary antithrombin deficiency, a relatively rare autosomal dominant disorder, produces a thrombotic diathesis (thrombophilia). Individuals with hereditary antithrombin deficiency are usually heterozygous with plasma antithrombin activity results of approximately 40% to 70%. These patients primarily manifest with venous thromboembolism (deep vein thrombosis: DVT, and pulmonary embolism: PE) with the potential of development as early as adolescence or younger adulthood. More than 100 different mutations have been identified throughout the gene producing either the more common type I defects (low antithrombin activity and antigen) or the rarer type II defects (dysfunctional protein with low activity and normal antigen).(2) Homozygous antithrombin deficiency appears to be incompatible with life.

The incidence of hereditary antithrombin deficiency is approximately 1:2,000 to 1:3,000 in general populations, although minor deficiency (antithrombin activity = 70%-75%) may be more frequent (approximately 1:350-650). In populations with venous thrombophilia, approximately 1% to 2% have antithrombin deficiency. Among the recognized hereditary thrombophilic disorders (including deficiencies of proteins C and S, as well as activated protein C: APC-resistance [factor V Leiden mutation]), antithrombin deficiency may have the highest phenotypic penetrance (greater risk of venous thromboembolism). Arterial thrombosis (eg, stroke, myocardial infarction) has occasionally
been reported in association with hereditary antithrombin deficiency.

Hereditary deficiency of antithrombin activity can also occur because of defective glycosylation of this protein in individuals with carbohydrate-deficient glycoprotein syndromes (CDGS). (3) Antithrombin activity assessment may be useful as an adjunct in the diagnosis and management of CDGS.

Acquired deficiency of antithrombin is much more common than hereditary deficiency. Acquired deficiency can occur due to:

- Heparin therapy (catalysis of antithrombin consumption)
- Intravascular coagulation and fibrinolysis (ICF) or disseminated intravascular coagulation (DIC), and other consumptive coagulopathies
- Liver disease (decreased synthesis and/or increased consumption) or with nephritic syndrome (urinary protein loss)
- L-asparaginase chemotherapy (decreased synthesis)
- Other conditions (1)

In general, the clinical implications (thrombotic risk) of antithrombin deficiency in these disorders are not well defined, although antithrombin replacement in severe disseminated intravascular coagulation/ intravascular coagulation and fibrinolysis (DIC/ICF) is being evaluated. (4) Assay of antithrombin activity may be of diagnostic or prognostic value in some acquired deficiency states.

**Interpretation**

Antithrombin deficiencies due to inherited causes are much less common than those due to acquired causes (see Clinical Information). Diagnosis or hereditary deficiency requires clinical correlation, with the prospect of repeat testing (including antithrombin antigen assay) and family studies (with appropriate counseling). DNA-based diagnostic testing may be helpful, but is not readily available.

The clinical significance (thrombotic risk) of acquired antithrombin deficiency is not well established, but accumulating information suggests possible benefit of antithrombin replacement therapy in carefully selected situations. (4)

Antithrombin deficiency, acquired or congenital, may contribute to the phenomenon of "heparin therapy resistance" (requirement of larger heparin doses than expected for achievement of therapeutic anticoagulation responses). However, it may more often have other pathophysiology, such as "acute-phase" elevation of coagulation factor VIII or plasma heparin-binding proteins.

Increased antithrombin activity is of unknown hemostatic significance. Direct factor Xa inhibitors, rivaroxaban (Xarelto), apixaban (Eliquis), and edoxaban (Savaysa) may falsely elevate the antithrombin activity and mask a diagnosis of antithrombin deficiency.

**Cautions**

Antithrombin functional result is affected by:

- Heparin (unfractionated or low-molecular-weight) >4 U/mL
- Alpha(1)-antitrypsin >4 mg/mL
- Alpha(2)-macroglobulin >10 mg/mL
Test Definition: ATTF
Antithrombin Activity, P

- Heparin cofactor II >4 U/mL
- Hemoglobin >500 mg/dL
- Bilirubin >40 mg/dL
- Triglycerides >2,300 mg/dL

Heparin therapy may temporarily decrease plasma antithrombin activity into the abnormal range.

Antithrombin activity in serum specimens may be significantly lower than in plasma.

Clinical Reference


Performance

Method Description
This assay is performed using the HemosIL Liquid Antithrombin Kit on the Instrumentation Laboratory ACL TOP instrument. Patient plasma, containing antithrombin, is mixed and incubated with reagent containing factor Xa and excess heparin. Factor Xa activity in the reagent is rapidly inhibited by antithrombin. Residual factor Xa activity is then measured using an amidolytic activity assay. This occurs when residual factor Xa lyses chromogenic substrate S-2765 (N-alpha-Z-D-Arg-Gly-Arg-pNA 2HCl) and subsequently releases pNA (detected at 405 nm) in a level that is inversely proportional to the amount of antithrombin in the sample. This method is based on inhibition of factor Xa and, therefore, only higher amounts of heparin cofactor II, alpha-2-macroglobulin, or alpha-1-antitrypsin will influence the assay. (Package insert: HemosIL Liquid Antithrombin. Instrumentation Laboratory Company, Bedford, MA, Rev 6 08/2014)

PDF Report
No

Day(s) and Time(s) Test Performed
Monday through Friday

Analytic Time
1 day

Maximum Laboratory Time
3 days

Specimen Retention Time
Test Definition: ATTF
Antithrombin Activity, P

7 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 has been modified from the manufacturer’s instructions. Its performance characteristics were 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
85300

LOINC® Information

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