Activated Partial Thromboplastin Time

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
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<td>Synonyms</td>
<td>aPTT, APTT.</td>
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<td>Test Description</td>
<td>The aPTT is functional determination of the intrinsic pathway of coagulation (factors XII, XI, IX, VIII, V, II, I, prekallikrein, high molecular weight kininogen). This pathway is initiated by the interaction of Factor XII with a negatively charged surface. A cascade mechanism results in fibrin production and clot formation. The aPTT is utilized to detect congenital and acquired abnormalities of the intrinsic coagulation pathway and to monitor patients receiving heparin.</td>
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<td>Patient Preparation</td>
<td>No specific patient preparation is required. However, since lipemia may interfere with photo-electric measurements of clot formation, specimens should not be obtained after a meal. In patients receiving intermittent heparin injections, peripheral blood for aPTT analysis should be obtained one hour before the next dose of heparin is scheduled. The specimen should not be drawn from an arm with a heparinized catheter or heparin lock.</td>
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<td>Specimen</td>
<td>Citrated, platelet-poor plasma is used for the aPTT.</td>
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<td>Specimen Collection and Preparation</td>
<td>Specimen requirements for coagulation assays are described in NCCLS H21-A3 (Collection, Transport, and Processing of Blood Specimens for Coagulation Assays; Approved Guideline - Third Edition, December, 1998). These requirements are summarized below. Citrated, platelet-poor plasma is prepared from peripheral venous blood collected by clean, nontraumatic venipuncture directly into a plastic or siliconized glass tube containing 109 nM (3.2%) trisodium citrate at a ratio of 9:1. With a blood collection set, the tube for coagulation analysis automatically fills to the correct volume. The tube should be immediately inverted at least four time after filling. A needle with a gauge of 22 to 19 should be utilized in adult patients, while a 21 to 23 gauge needle is suitable in pediatric patients. A traumatic venipuncture can activate coagulation factors, leading to a shortened aPTT. In patients receiving heparin, extreme care must be taken to avoid release of platelet factor 4 (PF4), which is a potent heparin inhibitor. Syringe draws - Blood obtained from a syringe draw is not preferred for aPTT analysis due to safety issues and the increased chance of specimen hemolysis or clotting. If a syringe must be used for aPTT specimen collection, a small volume syringe (&lt; 20 mL) is recommended. The double syringe technique is recommended, with the second tube used for coagulation analysis. The blood must be transferred from the syringe to a plastic or siliconized glass tube tube containing the proper amount of anticoagulant within one minute after collection. Indwelling catheters - Blood dilution and contamination with heparin are risks when blood specimens collected from an indwelling catheter are utilized for the aPTT. If such a specimen must be used, the line should first be flushed with saline, and the first 5 mL or six dead space volumes of the catheter drawn and discarded. Care must also be taken free the catheter and blood collection system from air leaks.</td>
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### Specimen Collection and Preparation (Cont’D)

**Multiple specimens** - If multiple blood specimens are obtained, the aPTT should be performed on the second or third tube. If the blood is being obtained only for coagulation testing, the first tube should be drawn and discarded, and the second tube submitted to the laboratory.

**Specimen preparation** - Platelet-poor plasma (platelet count < 10 x 10⁹/L) is prepared from the whole blood specimen by centrifuging the capped specimen tube at an appropriate speed for an appropriate time. Centrifugation at 1500 g for 15 minutes at room temperature is recommended for this purpose. A centrifuge with a swing-out bucket rotor should be used to avoid remixing of platelets and plasma during plasma removal.

**Specimen storage** -

- **Unheparinized specimens** - Specimens for aPTT analysis from unheparinized patients should be maintained centrifuged or uncentrifuged with plasma remaining on top of the cells in an unopened tube maintained at 2-4°C or 18-24°C and tested within four hours of specimen collection.

- **Heparinized specimens** - Specimens suspected of containing heparin should be centrifuged within one hour of collection and the plasma analyzed within four hours of collection. Plasma should be separated and removed within one hour if the specimen is being transported to a remote location for analysis or otherwise agitated.

- **Frozen plasma** - Plasma should be separated from specimens which cannot be analyzed within four hours and frozen at -20°C for up to two weeks or at -70°C for up to six months in a frost-free freezer. Frozen plasma specimens should be rapidly thawed at 37°C, gently mixed, and analyzed immediately or stored at 4°C for a maximum of two hours prior to analysis.

**Causes for Specimen Rejection** - The aPTT cannot be performed on specimens that are clotted, visibly hemolyzed, collected into the wrong anticoagulant, collected into an improper quantity of anticoagulant, not labeled, or improperly labeled.

### Test Methodology

The aPTT is usually performed by automated testing in the batch or stat mode. In the aPTT an aliquot of undiluted, platelet-poor plasma is incubated at 37°C with a particulate factor XII activator (i.e., silica, celite, kaolin, micronized silica, ellagic acid, etc.). A reagent containing phospholipid (partial thromboplastin) is added, followed by CaCl₂. The time required for clot formation is measured by one of a variety of techniques (photo-optical, electromechanical, etc.). The aPTT result is reported as the time required for clot formation after the addition of CaCl₂.

Many different phospholipid reagents animal and plant origin, such as cephalin, have been used as partial thromboplastins, and a variety of activating substances are in use. The sensitivity of the assay to factor deficiencies, inhibitors, and heparin varies with the reagents used in the assay.

### Normal Values and Critical Limits

24 - 37 sec (Jordan, C.D. et al., Normal reference laboratory values. N. Engl. J. Med. 327:718-724, 1992). Statistically, the aPTT is slightly lengthened in young individuals and slightly shortened in older populations. Premature infants have prolonged aPTT values which return to normal by 6 months of age. However, age-specific normal ranges are not utilized in patient care at this time.

### Interferences

Lipemia and hyperbilirubinemia interfere with the detection of clot formation by photo-optical methods. The results of the aPTT may be affected by a wide variety of factors, including the manner of blood coagulation, the type of container, the type of anticoagulant, specimen transport and storage conditions, incubation time and temperature, assay reagents, and the method of end point detection.
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The PT and aPTT are the fundamental assays of the coagulation system. The principal clinical uses of the aPTT include: (1) the detection of hereditary or acquired deficiencies or defects of the intrinsic and common pathway coagulation factors (factors XII, XI, IX, VIII, prekallikrein, high molecular weight kininogen), (2) monitoring heparin anticoagulant therapy, (3) the detection of coagulation inhibitors (i.e., lupus anticoagulant), and (4) to monitor coagulation factor replacement therapy in patients with hemophilia.

The aPTT is increased above the upper limit of normal with hereditary or acquired intrinsic factor deficiencies < 40% (factor VIII:C, Factor IX, Factor XI, Factor XII, vWF), lupus anticoagulants, or specific inhibitors of the intrinsic coagulation factors. Other causes of an elevated aPTT include liver disease, disseminated intravascular coagulation (DIC), heparin or anticoagulant therapy, or improper specimen collection (i.e., traumatic phlebotomy or hemolyzed specimen).

References


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