

## Overview

### Useful For

Differentiating congenital type I protein C deficiency from type II deficiency

Evaluating the significance of decreased functional protein C, especially when decreased protein C activity might be congenital rather than acquired (eg, due to oral anticoagulant effect, vitamin K deficiency, liver disease, or intravascular coagulation and fibrinolysis/disseminated intravascular coagulation)

This test is **not useful** for predicting a thrombotic event.

### Special Instructions

- [Coagulation Guidelines for Specimen Handling and Processing](#)

### Method Name

Enzyme-Linked Immunosorbent Assay (ELISA)

### NY State Available

Yes

## Specimen

### Specimen Type

Plasma Na Cit

### Ordering Guidance

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

Testing of protein C functional activity (CFX / Protein C Activity, Plasma) is recommended for initial laboratory evaluation of patients suspected of having congenital protein C deficiency (personal or family history of thrombotic diathesis).

### Necessary Information

If the patient is being treated with warfarin, this should be noted as warfarin will lower protein C.

### Specimen Required

**Specimen Type:** Platelet-poor plasma

**Patient Preparation:**

Fasting: 8 hours, preferred but not required

**Collection Container/Tube:** Light-blue top (3.2% sodium citrate)

**Submission Container/Tube:** Polypropylene plastic vial

**Specimen Volume:** 1 mL Plasma

**Specimen Stability Information:** Frozen 2 years

**Collection Instructions:**

1. For complete instructions, see [Coagulation Guidelines for Specimen Handling and Processing](#).
2. Centrifuge, transfer all plasma into a plastic vial, and centrifuge plasma again.
3. Aliquot plasma into a plastic vial leaving 0.25 mL in the bottom of centrifuged vial.
4. Immediately freeze plasma (no longer than 4 hours after collection) at -20 degrees C or ideally, at -40 degrees C or below.

**Additional Information:**

1. A 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.

**Forms**

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

**Specimen Minimum Volume**

Plasma: 0.5 mL

**Reject Due To**

Gross hemolysis	Reject
Gross lipemia	Reject

**Specimen Stability Information**

Specimen Type	Temperature	Time	Special Container
Plasma Na Cit	Frozen		

**Clinical & Interpretive**

**Clinical Information**

Protein C is a vitamin K-dependent anticoagulant proenzyme. It is synthesized in the liver and circulates in the plasma. The biological half-life of plasma protein C is approximately 6 to 10 hours, similar to the relatively short half-life of coagulation factor VII.

Protein C is activated by thrombin, in the presence of an endothelial cell cofactor (thrombomodulin), to form the active enzyme, activated protein C (APC). APC functions as an anticoagulant by proteolytically inactivating the activated forms of coagulation factors V and VIII (factors Va and VIIIa). APC also enhances fibrinolysis by inactivating plasminogen activator inhibitor type 1 (PAI-1).

Expression of the anticoagulant activity of APC is enhanced by a cofactor, protein S, another vitamin K-dependent plasma protein.

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Congenital homozygous protein C deficiency results in severe thrombotic diathesis, evident in the neonatal period and resembling purpura fulminans.

Congenital heterozygous protein C deficiency may predispose the patient to thrombotic events, primarily venous thromboembolism. Arterial thrombosis (stroke, myocardial infarction, etc) may occur. Some individuals with hereditary heterozygous protein C deficiency may have no personal or family history of thrombosis and may or may not be at increased risk.

The 2 types of hereditary heterozygous protein C deficiencies that are recognized are:

- Type I (concordantly decreased protein C function and antigen)
- Type II (decreased protein C function with normal antigen)

Acquired deficiency of protein C may occur in association with:

- Vitamin K deficiency
- Oral anticoagulation with warfarin compounds
- Liver disease
- Intravascular coagulation and fibrinolysis/disseminated intravascular coagulation

### Reference Values

Adults: 72%-160%

Normal, full-term newborn infants or healthy premature infants may have decreased levels of protein C antigen (15%-50%), which may not reach adult levels until later in childhood or early adolescence.\*

\*See Pediatric Hemostasis References section in [Coagulation Guidelines for Specimen Handling and Processing](#).

### Interpretation

Values less than 70% to 75% may represent a congenital deficiency state, if acquired deficiencies can be excluded.

Protein C antigen and activities generally are undetectable in individuals with severe, homozygous protein C deficiency.

Acquired protein C deficiency is of uncertain clinical hemostatic significance.

The clinical significance of increased protein C is unknown.

### Cautions

No significant cautionary statements

### Clinical Reference

1. Mannucci PM, Owen WG. Basic and clinical aspects of proteins C and S. In: Bloom AL, Thomas DP, eds. Haemostasis and Thrombosis. 2nd ed. Edinburgh, Churchill Livingstone; 1987:452-464
2. Marlar RA, Mastovich S. Hereditary protein C deficiency: a review of the genetics, clinical presentation, diagnosis and treatment. Blood Coagul Fibrinolysis. 1990;1(3):319-330
3. Marlar RA, Montgomery RR, Broekmans AW. Diagnosis and treatment of homozygous protein C deficiency. Report of the Working Party on Homozygous Protein C Deficiency of the Subcommittee on Protein C and Protein S, International Committee on Thrombosis and Haemostasis. J Pediatr. 1989;114(4 Pt 1):528-534
4. Miletrich J, Sherman L, Broze G Jr. Absence of thrombosis in subjects with heterozygous protein C deficiency. N Engl J Med. 1987;317(16):991-996

5. Cooper PC, Pavlova A, Moore GW, Hickey KP, Marlar RA. Recommendations for clinical laboratory testing for protein C deficiency, for the subcommittee on plasma coagulation inhibitors of the ISTH. J Thromb Haemost. 2020;18(2):271-277

## Performance

### Method Description

Protein C antigen is quantitated by enzyme-linked immunoassay using monospecific antibody. The assay is performed using the REAADS PCAg kit on a Janus G3 integrated system, which includes a BioTek microplate reader.(Package insert: REAADS Protein C Antigen Test Kit. Corgenix, Inc; 09/2023)

### PDF Report

No

### Day(s) Performed

Monday through Friday

### Report Available

3 to 7 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 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 US Food and Drug Administration.

### CPT Code Information

85302

### LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
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PCAG	Protein C Ag, P	27820-0
<b>Result ID</b>	<b>Test Result Name</b>	<b>Result LOINC® Value</b>
9127	Protein C Ag, P	27820-0