

Overview**Useful For**

Diagnosis of bacteremia and septicemia in adults and children (including neonates)

Diagnosis of renal involvement in urinary tract infection in children

Diagnosis of bacterial infection in neutropenic patients

Diagnosis, risk stratification, and monitoring of septic shock

Diagnosis of systemic secondary infection post-surgery, and in severe trauma, burns, and multiorgan failure

Differential diagnosis of bacterial versus viral meningitis

Differential diagnosis of community-acquired bacterial versus viral pneumonia

Monitoring of therapeutic response to antibacterial therapy

Method Name

Homogeneous Time-Resolved Fluorescence

NY State Available

Yes

Specimen**Specimen Type**

Serum Red

Specimen Required

Collection Container/Tube: Red top

Submission Container/Tube: Plastic screw-top vial

Specimen Volume: 0.5 mL

Specimen Minimum Volume

0.25 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK
Gross icterus	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum Red	Refrigerated (preferred)	7 days	
	Frozen	90 days	

Clinical and Interpretive

Clinical Information

Procalcitonin (ProCT) is a 116-amino acid precursor of calcitonin (CT). ProCT is processed to an N-terminal 57 amino acid peptide (CT [32-amino acids]) and a 21-amino acid C-terminal peptide, catacalcin [CCP-1]. Expression of this group of peptides is normally limited to thyroid C cells and, to a small extent, other neuroendocrine cells. CT is the only hormonally active of these peptides. CT is secreted by C cells in response to hypercalcemia and inhibits bone resorption by osteoclasts, minimizing oscillations in serum calcium and calcium loss.

During severe systemic inflammation, in particular related to bacterial infection, the tissue-specific control of CT-related peptides expression breaks down and ProCT and CCP-1 (referred collectively to as ProCT) are secreted in large quantities by many tissues. CT levels do not change.

Noninfectious inflammatory stimuli need to be extremely severe to result in ProCT elevations, making it a more specific marker for severe infections than most other inflammatory markers (cytokines, interleukins, and acute-phase reactants). ProCT elevations are also more sustained than those of most other markers and occur in neutropenic patients. This reduces the risk of false-negative results.

ProCT becomes detectable within 2 to 4 hours after a triggering event and peaks by 12 to 24 hours. ProCT secretion parallels closely the severity of the inflammatory insult, with higher levels associated with more severe disease and declining levels with resolution of illness. In the absence of an ongoing stimulus, ProCT is eliminated with a half-life of 24 to 35 hours, making it suitable for serial monitoring. Finally, the dependence of sustained ProCT elevations on ongoing inflammatory stimuli allows identification of secondary septic events in conditions that can result in noninfectious ProCT elevations, such as cardiac surgery, severe trauma, severe burns, and multiorgan failure. ProCT levels should fall at a predictable pace in the absence of secondary infection.

Reference Values

Adults and children > or =72 hours: < or =0.15 ng/mL

Children < 72 hours: <2.0 ng/mL at birth, rises to < or =20 ng/mL at 18-30 hours of age, then falls to < or =0.15 ng/mL by 72 hours of age

Interpretation

General considerations:

-In children older than 72 hours and in adults, levels below 0.15 ng/mL make a diagnosis of significant bacterial infection unlikely.

-Procalcitonin (ProCT) between 0.15 and 2.0 ng/mL do not exclude an infection, because localized infections (without systemic signs) may be associated with such low levels.

-Levels above 2.0 ng/mL are highly suggestive of systemic bacterial infection/sepsis or severe localized bacterial infection, such as severe pneumonia, meningitis, or peritonitis. They can also occur after severe noninfectious inflammatory stimuli such as major burns, severe trauma, acute multiorgan failure, or major abdominal or

cardiothoracic surgery. In cases of noninfectious elevations, ProCT levels should begin to fall after 24 to 48 hours.

-Autoimmune diseases, chronic inflammatory processes, viral infections, and mild localized bacterial infections rarely lead to elevations of ProCT of more than 0.5 ng/mL.

Specific diagnostic applications, based on the current consensus in the literature:

-Diagnosis of bacteremia in neonates: After birth ProCT values increase from birth to reach peak values at about 24 hours of life and the decrease gradually by 48 hours of life. Therefore, during the first 72 hours of life different reference ranges will apply to newborn infants at different hours of age. ProCT levels on newborns suffering from early sepsis are significantly higher than those of noninfected newborns when reference ranges by hours of age are used.(1,2) Adult levels should apply at 72 hours or more after birth.

-Diagnosis of renal involvement in pediatric urinary tract infections: In children with urinary tract infections, a ProCT level above 0.5 ng/mL has 70% to 90% sensitivity and 80% to 90% specificity for renal involvement.

-ProCT responses in neutropenic patients are similar to patients with normal neutrophil counts and function, and the cutoffs discussed under general considerations above should be used.

In the appropriate clinical setting, ProCT levels above 2.0 ng/mL on the first day of admission to the intensive care unit (ICU) represent a high risk for progression to severe sepsis and/or septic shock. ProCT levels below 0.5 ng/mL on the first day of ICU admission represent a low risk for progression to severe sepsis and/or septic shock. Reported sensitivity and specificity for the diagnosis of sepsis range from 60% to 100%, depending on underlying and coexisting diseases and the patient populations studied. The higher the ProCT level the worse the prognosis.

A ProCT level below 0.5 ng/mL makes bacterial meningitis very unlikely. Most patients with bacterial meningitis will have ProCT levels of more than 10 times this level.

With successful antibiotic therapy, ProCT levels should fall with a half-life to 24 to 35 hours.

Cautions

Severe trauma, major burns, multiorgan failure, or major surgery can cause procalcitonin (ProCT) elevations in the absence of sepsis. After removal of the noxious stimulus, ProCT should start to decrease.

Patients with untreated end-stage renal failure may have ProCT levels greater than 0.15 ng/mL in the absence of infection or severe inflammation. Within 3 hemodialysis treatments this should fall to the normal reference range. End-stage renal failure patients on stable hemodialysis or peritoneal dialysis treatments have ProCT levels similar to healthy adults with normal renal function.

Patients with medullary thyroid carcinoma or, very rarely, islet cell tumors may have significant elevations in ProCT in the absence of sepsis. In certain cases, these levels may exceed 10,000 ng/mL.

Some infants and children may have ProCT levels from 0.15 ng/mL to 0.50 ng/mL for unknown reasons.

As with all immunometric assays, there is a low, but definite possibility of false-positive results in patients with heterophile antibodies. Test results that do not fit the clinical picture should therefore be discussed with the laboratory.

A hook effect can occur at ProCT concentrations above 2500 ng/mL (extremely rare), resulting in a lower measured ProCT concentration than is actually contained in the specimen. This may complicate the interpretation of serial ProCT measurements in rare patients with extremely high ProCT levels. If there is clinical suspicion of this occurring, then retesting after specimen dilution should be requested.

Note: A "high-dose hook" effect was observed at Mayo Clinic in a patient specimen with a ProCT concentration of 10,270 ng/mL (calcitonin 313,600 pg/mL). This specimen appeared to have a ProCT value of only 2.8 ng/mL when measured without dilution.

Clinical Reference

1. Chiesa C, Panero A, Rossi N, et al: Reliability of procalcitonin concentrations for the diagnosis of sepsis in critically ill neonates. *Clin Infect Dis* 1998;(3):664-672
2. Chiesa C, Natale F, Pascone R, et al: C reactive protein and procalcitonin: reference intervals for preterm and term newborns during the early neonatal period. *Clin Chim Acta* 2011;412(11-12):1053-1059
3. Sitter T, Schmidt M, Schneider S, Schiffl H: Differential diagnosis of bacterial infection and inflammatory response in kidney disease using procalcitonin. *J Nephrol* 2002;15:297-301
4. Becker KL, Nysten ES, White JC, et al: Procalcitonin and the calcitonin family of peptides in inflammation, infection and sepsis: a journey from calcitonin back to its precursors. *J Clin Endocrinol Metab* 2004;89:1512-1525
5. Van Rossum AM, Wulkan RW, Oudesluys-Murphy AM: Procalcitonin as an early marker of infection in neonates and children. *Lancet Infect Dis* 2004;4:620-623
6. Uzzan B, Cohen R, Nicolas P, et al: Procalcitonin as a diagnostic test for sepsis in critically ill adults and after surgery or trauma: a systematic review and meta-analysis. *Crit Care Med* 2006;34(7):1996-2003

Performance

Method Description

Procalcitonin (ProCT) is measured in this homogeneous automated immunofluorescent assay on the BRAHMS Kryptor. The Kryptor uses TRACE (time resolved amplified cryptate emission) technology based on a nonradioactive transfer of energy. This transfer occurs between 2 fluorescent tracers: the donor (europium cryptate) and the acceptor (XL665). In the ProCT assay, a sheep polyclonal antibody against calcitonin is labeled with europium cryptate and a mouse monoclonal antibody against calcitonin is labeled with XL665. ProCT is sandwiched between the 2 antibodies, bringing them into close proximity. When the antigen-antibody complex is excited with a nitrogen laser at 337 nm, some fluorescent energy is emitted at 620 nm and the rest is transferred to XL665. This energy is then emitted as fluorescence at 665 nm. A ratio of the energy emitted at 665 nm to that emitted at 620 nm (internal reference) is calculated for each sample. Signal intensity is proportional to the number of antigen-antibody complexes formed, and therefore to antigen concentration. (Package insert: BRAHMS PCT Sensitive Kryptor. Thermo Fisher Scientific BRAHMS LLC, Version 18.0us, 2017)

PDF Report

No

Day(s) and Time(s) Test Performed

Monday through Friday; 8 a.m.-4 p.m.

Saturday; 8 a.m.-5 p.m.

Analytic Time

Same day/1 day

Maximum Laboratory Time

3 days

Specimen Retention Time

3 months

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 cleared, approved or is exempt 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

84145

LOINC® Information

Test ID	Test Order Name	Order LOINC Value
PCT	Procalcitonin, S	33959-8

Result ID	Test Result Name	Result LOINC Value
PCT	Procalcitonin, S	33959-8