CLIA

Procalcitonin (PCT)

Diagnosis, monitoring and treatment surveillance of sepsis

Human

Diagnostics Worldwide

Procalcitonin (PCT)

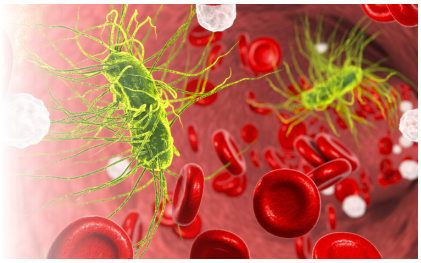
An important biomarker for bacterial infection – diagnosis, monitoring and treatment surveillance of sepsis

What is PCT?

Healthy people produce procalcitonin (PCT) in the cells of the thyroid gland. PCT is a precursor hormone of calcitonin and is not detectable in healthy individuals, because the synthesis of procalcitonin outside the thyroid gland is normally suppressed.

Why testing for PCT?

Bacterial versus viral Infections



Already in 1993, it was demonstrated that there is a positive correlation between high serum levels of PCT and patients with positive findings for bacterial infection and sepsis. Nevertheless, owing to its greater availability, C-reactive protein (CRP) has been widely used as a biomarker of infection and sepsis. However, PCT is often reported to be more superior to CRP, being more specific for sepsis and bacterial infection.

This is, because PCT starts to rise earlier and returns to normal concentration more rapidly than CRP, thereby allowing for an earlier diagnosis and better monitoring of disease progression (see figure 1).
In addition, PCT levels remain low in viral infections compared with bacterial infections. This makes PCT the most ideal biomarker for distinguishing bacterial infection from other non-infectious causes of inflammation.[1, 2, 3, 6]

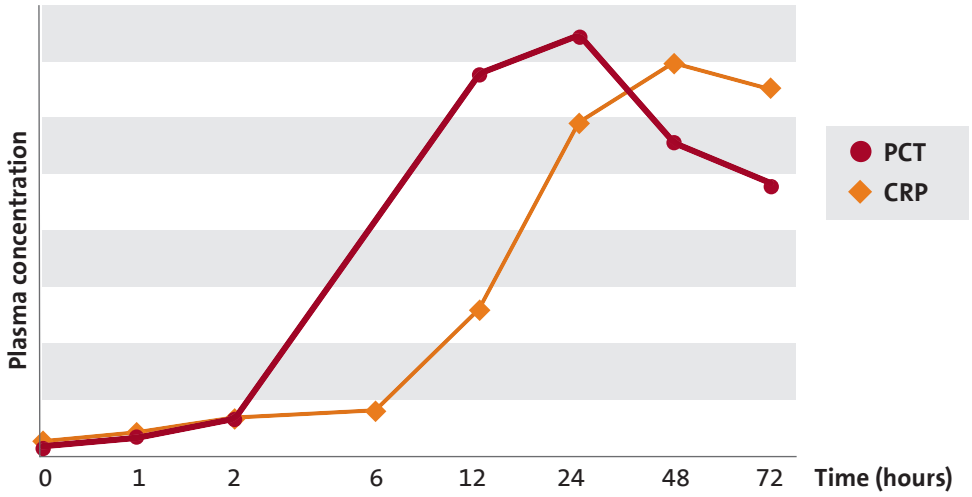


Fig. 1: PCT concentration increase faster after bacterial endotoxin exposure, compared to CRP levels (adapted from Meisner M.[5])

However, bacterial infections may cause an inflammatory event, after e.g. a cut injury, an insect bite, burn or pneumonia. In some cases, the body is no longer able to fight the pathogens on its own, as a result blood poisoning (sepsis) occurs. One of the stimuli for the release of procalcitonin are bacterial endotoxins, e.g. lipopolysaccharides. Almost all organs can produce procalcitonin, which leads to a rapid increase of the PCT concentration in the blood, of up to 1,000 ng/ml within six to twelve hours. Clinically, it may be difficult to differentiate viral from bacterial infections. But the differentiation of the cause of an infection is crucial, because untreated bacterial infections may cause serious complications. In addition, treating viral illnesses or noninfective causes of inflammation with antibiotics is not only ineffective, but also contributes to the development of antibiotic resistance, increases costs, and adds the risks of toxicity and allergic reactions.[6]

Furthermore, PCT values reflect the severity of systemic sepsis, ranging from slightly elevated levels in minor infections to very high levels in severe sepsis or septic shock. Once the infection is under control, the procalcitonin concentration decreases again very quickly.

« In short, the higher the concentration of PCT, the more likely it is that the patient is experiencing a systemic infection or sepsis.» (see figure 2)

≥ 10 ng/ml	**Septic shock**	**›** Extremely high levels are found almost exclusively as a result of severe bacterial sepsis or septic shock, with a high mortality risk as a result of multiple organ failure
2 - < 10 ng/ml	**Severe sepsis**	**›** Indication of a severe systemic inflammation, probably due to infection or sepsis
0.5 - < 2 ng/ml	**Sepsis likely**	**›** Indication of a moderate systemic inflammation other conditions may also induce significant PCT rise e.g. trauma, surgery
0.05 - 0.5 ng/ml	**Sepsis unlikely**	**›** But inflammatory response is not excluded; possible localized infection
< 0.05 ng/ml	**Healthy adult**	

Fig. 2: PCT levels in the blood rise with increasing severity of infection (adapted from Meisner M.[7]).

Supporting antibiotic stewardship

In addition, more recently, it was shown that PCT can be used as a persuasive, evidence-based approach to a more rational use of antibiotics. This is because PCT mirrors the likelihood of bacterial infection and the severity of infection. Thus, PCT can provide guidance to antibiotic therapy, because serum levels of PCT decrease following administration of appropriate antibiotic therapies. In addition, a PCT-guided reduced use of antibiotics results in lower side-effects and an improvement in clinical outcomes.[8, 9]

« PCT determination is also used to help with the decision to initiate antibiotic therapy or to assess therapy response, thereby reducing the use of antibiotics. »[10, 11]

Time matters – early PCT detection can help save lives

It is important to detect sepsis in a timely manner, because severe sepsis leads to a breakdown of the entire immune system. In a toxic septic shock, several organs fail simultaneously (multi-organ failure) and blood pressure drops massively. If sepsis has progressed to this stage the in-hospital mortality rates approaching 30–50%.[12] Timely drug and/or surgical treatment is therefore important for successful treatment.

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Summary of Indications

- Aid in the diagnosis of sepsis
- Aid in the diagnosis of severe bacterial infections
- Monitoring of the response of antibiotic treatment

Product and order information

HumaCLIA 150	REF 15910
Random-access chemiluminescence immunoassay system	

PCT HumaCLIA SR	REF 85020
Content	2 x 50 tests incl. calibrators
Measurement range	0.03-100 ng/ml
Reference interval	< 0.05 ng/ml
Sample volume	28 µl
PCT HumaCLIA SR Control	REF 85820
Content	2 levels each with 2 x 2 ml

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