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AMPATHCHAT

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CRP vs PCT: which one to choose and when?

Introduction

Clinicians are faced with a growing population of immuno-compromised patients who are at risk of systemic infections. The diagnosis of bacterial septicaemia is unfortunately not straightforward. Positive blood cultures remain the gold standard, but there is a substantial delay in obtaining a result, with associated false positives and false negatives. What then is a clinician to do? Every hour delay in initiating appropriate therapy is associated with a 7% increase in mortality. The medical fraternity is increasingly looking towards biomarkers as a possible early answer to these conundrums.

What is CRP and PCT?

CRP and PCT are the two most commonly used sepsis biomarkers currently in use. What exactly are they? And what is a biomarker?

C-reactive protein (CRP) and procalcitonin (PCT) are inflammatory biomarkers commonly used in the diagnosis of sepsis. Biomarkers are defined by the National Institute of Health as a broad subcategory of medical signs, which are objective indications of a medical state as observed from outside the patient, which can be measured accurately and can be reproduced.

CRP and PCT are two very different biomarkers with different properties. CRP is an acute phase protein that is synthesised in the liver under the stimulation of IL-6 during infections or other inflammatory conditions. PCT is the precursor protein of calcitonin, which is normally synthesised by the C-cells of the thyroid gland, but in response to bacterial infections, multiple cell types throughout the body produce PCT.

CRP vs PCT

CRP vs PCT So which one to choose and when? And does it really matter? PCT has been found to be superior to CRP both in terms of sensitivity (77% vs 75%)and specificity (79% vs 67%) in the differentiation of bacterial septicaemia from noninfectious systemic inflammatory response syndrome. PCT levels are raised much earlier during an infectious process in comparison with CRP (4–12 hours vs 24–38 hours), which facilitates earlier diagnosis.

PCT can be used as a prognostic marker as its levels correlate with bacterial load and severity of infection, which is not the case for CRP. PCT has a plasma elimination half-life of 24–35 hours (vs 48 hours for CRP), which makes daily measurement of the levels clinically significant. A 30–50% daily drop in circulating PCT levels indicates that the infection is well controlled.

Multiple randomised controlled trials performed in ICU patients with bacterial septicaemia have demonstrated that PCT measurements can guide the duration of antibiotic therapy. In the PCT arm, antibiotics were discontinued in patients who showed clinical resolution plus either an 80% drop in PCT from peak level or a drop in PCT to below 0.5 ng/mL. The patients in the PCT arm demonstrated improved mortality, decreased length of hospital stay, and decreased antibiotic use.

Another factor to consider is cost. PCT is substantially more expensive than CRP.

Indications

CRP

- Patients with Type II and Type III exacerbations of chronic obstructive airway disease (COPD) to differentiate likely bacterial from non-bacterial aetiology
- In the emergency department for a patient with acute respiratory illness when the diagnosis of community-acquired pneumonia (CAP) is in doubt

PCT

- To differentiate systemic bacterial infection from non-infectious systemic inflammatory response syndrome (SIRS) (diagnostic marker)
- To ascertain the severity of illness of bacterial sepsis (prognostic marker)
- To monitor response to therapy of systemic bacterial infections
- To guide discontinuation of antibiotics during systemic bacterial infections
- For cases of CAP and acute exacerbations of COPD to exclude a bacterial aetiology (if PCT < 0.25 ng/mL). The South African community acquired pneumonia

guidelines state that CRP or PCT can be used for patients in the emergency department with an acute respiratory illness where the diagnosis is in doubt.

Pros and cons of CRP and PCT

	CRP	PCT
Strengths	• Cheaper • Levels not influenced by: - renal disease or renal replacement therapy - neutropenia • More likely to be raised by invasive fungal infections (in a patient with raised CRP and normal to low PCT: consider invasive fungal infection)	• Expensive • Improved sensitivity and specificity • Shorter induction time and elimination half-life • Diagnostic and prognostic marker • Can be used to monitor response to therapy and shorten antibiotic therapy • Levels not raised by: - viral infections - most autoimmune diseases - Transplant rejection - Allergic reactions
Limitations	• Diagnostic marker only • Non-bacterial causes of elevated levels: - trauma - surgery - most autoimmune conditions	• Levels not raised by local bacterial infections • Non-bacterial causes of elevated levels: - severe trauma - surgery, especially abdominal surgery - severe burns - prolonged cardiogenic shock - severe pancreatitis - severe renal insufficiency - severe liver cirrhosis - acute or chronic viral hepatitis - newborns (can still be used in this population as long as value is interpreted according to reference ranges) - following administration of anti-lymphocyte globulin, anti-CD3 or OKT-3 antibodies - heat stroke - some autoimmune diseases: Kawasaki syndrome, Goodpasture's syndrome, Wegener's granulomatosis, anti-neutrophil antibody positive vasculitis - paraneoplastic syndromes - severe rhabdomyolysis

Conclusion

CRP and PCT are both clinically useful biomarkers that each have their place if appropriately ordered and interpreted within the clinical context.

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