

## Pharmacist-Driven Procalcitonin Protocol for Adult Patients

Procalcitonin (PCT) is a precursor of calcitonin which under normal circumstances is produced by the thyroid C-cells. Serum concentrations of PCT are normally <0.05 ng/mL but in circumstances of systemic inflammation, particularly bacterial infection, PCT is produced in large quantities by many body tissues. PCT has some advantages over other biomarkers in common clinical use such as C-reactive protein (CRP) and white blood cell count, including: specificity for bacterial infection (vs inflammation in general), the rapidity of its rise after an insult (6 hours), the rapid decline with immune control on infection (half-life of 24 hours), excellent correlation with severity of illness (higher levels in more severely ill), and the lack of impact of anti-inflammatory and immunosuppressive states on production. This combination of characteristics makes PCT potentially a very useful, specific biomarker for the diagnosis and monitoring of acute bacterial infections.

### Clinical situations where PCT may be useful:

- Differentiation of bacterial vs. viral lower respiratory tract infections (LRTI)
- Determination of antibiotic treatment duration in LRTI

### Limitations of PCT:

*False positive and false negative results can occur with any test and clinical context should guide interpretation of PCT results.*

- Massive stress (severe trauma, surgery, cardiac shock, burns)
  - In absence of infection, PCT levels trend down after inciting event
- Treatment with agents which stimulate cytokines (OKT3, anti-lymphocyte globulins, alemtuzumab, IL-2, granulocyte transfusion)
- Malaria and some fungal infections
- Prolonged, severe cardiogenic shock or organ perfusion abnormalities
- Some forms of vasculitis and acute graft vs. host disease
- Paraneoplastic syndromes due to medullary thyroid and small cell lung cancer
- Significantly compromised renal function, especially ESRD/hemodialysis
- Newborns (<48-72 hours; after 72 interpret levels as usual)
- Localized infections
  - May be falsely low in osteomyelitis, abscess, subacute endocarditis, etc.
- PCT level checked too early

### Protocol:

Pharmacists may order follow-up PCT levels for patients meeting the below inclusion/exclusion criteria. The algorithm below will be used as a guide and interpretation of results should be discussed with the provider(s) to optimize antibiotic regimens.

- **Inclusion criteria:** Lower respiratory tract infections (pneumonia, COPD exacerbations, bronchitis)
- **Exclusion criteria:** ESRD/HD, trauma, cardiac shock, neoplasm of the thyroid, small cell lung cancer, neonates (<72hrs)

**Lower respiratory tract infection (pneumonia, COPD exacerbation, bronchitis)**

Excellent evidence supports the use of PCT for assisting clinicians in antibiotic management in lower respiratory tract infection (LRTI) including pneumonia, exacerbations of COPD, and other LRTI's (bronchitis, asthma exacerbation, etc.). Based upon available evidence it is suggested that patients evaluated for bacterial LRTI or started on antibiotics have a PCT value measured on admission and levels repeated for trending. Interpretation of values are listed below in Algorithm 1 on the next page.

- Procalcitonin should be evaluated in context with all findings and the total clinical status; clinical judgment always necessary. PCT should not be used in isolation to decide whether to initiate antibiotics in patients with suspected bacterial pneumonia.
- If initial PCT is low and no antibiotics are started, a repeat PCT measurement may be considered if clinical suspicion for infection persists 6-24 hours after the first measurement.
- Procalcitonin should NOT be routinely used to extend treatment duration, and continuation of antibiotics beyond standard durations, in the setting of clinical stability, is NOT recommended, regardless of PCT level.

## Lower Respiratory Tract Infection Initial PCT

Draw initial PCT STAT *before or after initial antibiotic dose(s)*

Repeat PCT in 24 - 48 hours

## Lower Respiratory Tract Infection Follow-Up PCT

PCT result ( $\mu\text{g/L}$ ) based *subsequent* level

$< 0.1$   
*Or drop by >90%*

$0.1 - 0.24$   
*Or drop by >80%*

$\geq 0.25 - 0.5$

$> 0.5$

Interpretation

Bacterial infection unlikely

Bacterial infection unlikely

Bacterial infection possible

Bacterial infection highly likely

Antibiotic management

Stop antibiotics

Encourage stopping antibiotics

Do not stop antibiotics

Definitely do not stop antibiotics

Other recommendations

- Encourage continuing abx if clinically unstable
- Repeat PCT every 48-72 hours to consider antibiotic cessation

- If PCT rising or stable, consider possible treatment failure and evaluate need for expanding abx coverage or further diagnostic evaluation
- Repeat PCT every 48-72 hours to consider early antibiotic cessation

## References

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