Example 6.4 Procalcitonin Algorithm and Guidelines, Dominican Hospital, Dignity Health (1 of 5)

Dignity Health.
Dominican Hospital

Dignity Health Antimicrobial Stewardship Guidelines

Procalcitonin (PCT) Algorithm and Guidelines for Antibiotic Therapy Decisions

I. PURPOSE:

Procalcitonin is a pro-hormone of calcitonin. The production of procalcitonin is stimulated by inflammatory cytokines. Unlike other acute phase reactants (e.g. ESR and CRP), production of procalcitonin is usually only stimulated by bacterial infection, making it a useful biomarker to differentiate bacterial infection from non-infection or viral infection.

The purpose of these guidelines is to provide information for the ordering and diagnostic use of procalcitonin levels in the decision process of ordering or continuing antibiotic therapy for the:

1. Treatment of lower respiratory tract infections (LRTIs)
2. Pneumonia (CAP)
3. Chronic bronchitis
4. Ventilator-associated pneumonia (VAP)
5. Differentiation between bacterial verses viral respiratory infection
6. Sepsis

PCT levels are NOT recommended for as a diagnostic tool in the empiric treatment of:

1. Catheter-related infections
2. Post-surgical infections
3. Febrile neutropenia and other immunocompromised patients
4. Endocarditis
5. Burns
6. Trauma
7. Osteomyelitis
8. Complicated skin and soft tissue infections.* (see section V)
9. CNS infections* (see section 5)

II. GUIDELINES

Initial Testing and Monitoring:

For patients with a low pretest probability of contracting a bacterial infection (e.g., patients with nonpneumonic upper and lower respiratory tract infection treated in the primary care setting), a single measurement of PCT level and a cutoff ranging from less than 0.10 to less than 0.25 µg/L appears to be an appropriate and safe approach in this setting to determine the need for antibiotics. Clinical follow-up with re-measurement of PCT should be performed in all patients in whom antibiotics were withheld and who show no clinical improvement

Interpretation of procalcitonin results should always be performed in conjunction with evaluation of signs and symptoms that may suggest the presence of bacterial infection as well as diseases and conditions that may account for a patient's apparent systemic inflammatory response. Conditions associated with a falsely elevated procalcitonin include recent

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trauma/burns, recent major surgery, pancreatitis, cardiogenic shock, certain malignancies, or treatment with drugs that stimulate release of pro-inflammatory cytokines. An Infectious Disease consultation should be considered in cases when such confounders cloud the interpretation of procalcitonin results.

A number of randomized trials have been performed evaluating the utility of PCT levels in guiding antibiotic therapy. Most studies in sepsis have evaluated using PCT to discontinue antibiotics although one large trial did use PCT levels to assist in the decision to initiate treatment. Because of limited data, the decision to initiate therapy in the ICU should be driven by the severity of illness and clinical assessment of the likelihood of infection with the PCT used as an adjunct to assist in the decision to initiate antibiotics. Much more rigorous evidence exists to support the use of PCT to discontinue antibiotics.

PCT levels that are not declining or are increasing are strong negative prognostic indicators of lack of control of the infection by the host immune system and/or antibiotics. It has generally been recommended that further diagnostic procedures/imaging or broader spectrum antibiotics be initiated based upon a rising value.

Again, careful reassessment of the patient for other sites/sources or infection or evidence of resistant pathogens and decisions regarding further interventions be made based upon this evaluation.

How procalcitonin will be ordered and reported:
Procalcitonin will be available 24-hours a day and will be run as needed. STAT order results will be available within 90 minutes while results of routine testing will be available during the same shift (usually 2-4 hours). A value of ≥ 0.1 µg/L will be flagged as elevated. The specific comment included on the laboratory report is included below:

Normal: <0.1 ng/mL (infants >72 hours and adults)

Suspected Lower Respiratory Tract Infection:
- 0.1-0.25 ng/mL - Low likelihood for bacterial infection; Antibiotics discouraged.
- >0. 25 ng/mL -Increased likelihood bacterial infection; Antibiotics encouraged.

Suspected Sepsis: Strongly consider initiating antibiotics in all unstable patients.
- 0.1–0.5ng/mL– Low- likelihood for sepsis; Antibiotics discouraged.
- >0. 5 ng/mL – Increased likelihood sepsis; Antibiotics encouraged.
- >2.0 ng/mL – High risk of sepsis/septic shock; Antibiotics strongly encouraged.

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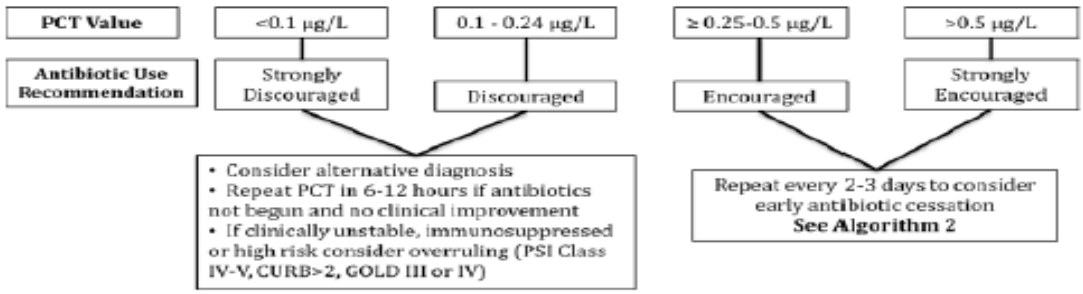
III. Lower Respiratory Tract Infections: Algorithms 1 and 2:

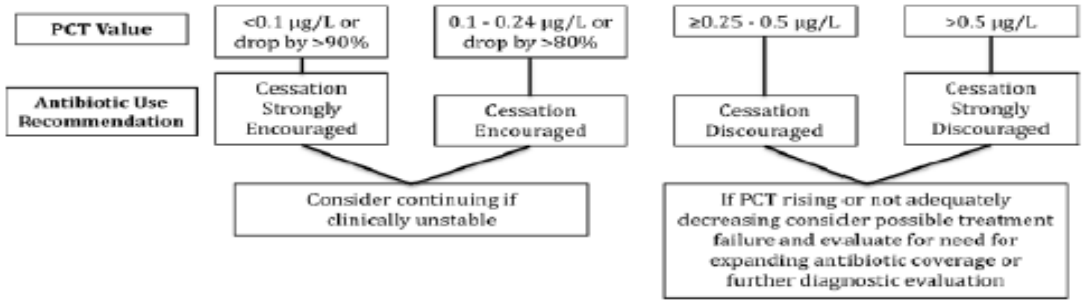
For patients who are clinically stable and are treated at the ED or are hospitalized with pneumonia, the initiation of antibiotic therapy should be based on clinical grounds and a PCT threshold value of at least 0.25 µg/L. In patients with an initial PCT level of no higher than 0.25µg/L, alternative diagnoses (e.g., viral infection and pulmonary embolism) should be considered.

Thereafter, repeated measurement of PCT levels every other day should occur, with directions to discontinue antibiotic therapy when PCT levels drop to less than 0.25 µg/L or by at least 80% to 90% of the peak value and when the patient has improved clinically. If Abx are withheld initially, algorithms suggest retesting PCT levels 6 to 12 hours after the initial measurement.

Algorithm 1: **LRTI Initial PCT Value**



Algorithm 2: **LRTI PCT Value Follow Up**



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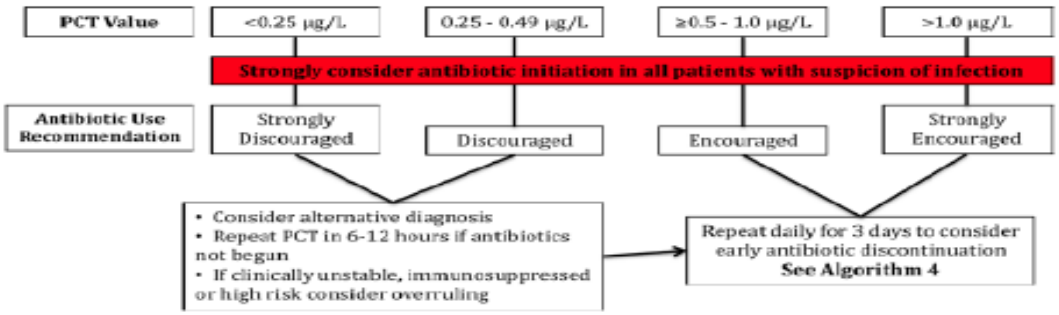
IV. Sepsis (SIRS, sepsis, severe sepsis, septic shock): Algorithms 3 and 4

In high-risk or ICU patients with suspected sepsis, algorithms dictate that empirical antibiotic therapy is not delayed for PCT measurement. Periodic monitoring of PCT levels after initiation of antibiotic therapy may be the preferred strategy, and a drop of PCT levels to less than 0.50 µg/L or by at least 80% to 90% from baseline in patients who show a clinical improvement after therapy are reasonable thresholds for cessation of antibiotic therapy.

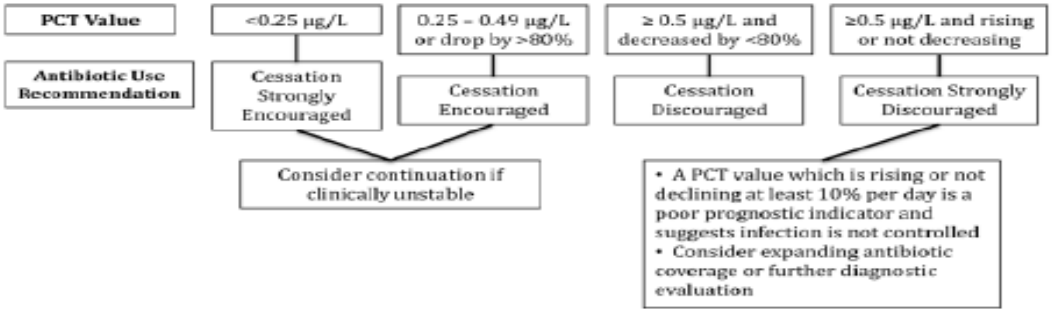
For postoperative patients in the ICU, a decrease in PCT level to less than 1.0 µg/L may be sufficient to discontinue antibiotics. As with moderate risk/moderate acuity algorithms, if antibiotic(s) are withheld initially based on a low PCT level, a second measurement should be obtained within 6 to 12 hours.

Based upon the above information it is recommended that patients admitted to the ICU with presumed sepsis/septic shock/etc have PCT drawn on admission and that PCT be repeated on Days, 1, 2 and 3. Decisions regarding antibiotic therapy can then be made based upon PCT dynamics, culture data, and patient specific clinical data. Further PCT values may be drawn at the discretion of the physician.

Algorithm 3: **Sepsis Initial PCT Value**



Algorithm 4: **Sepsis PCT Follow Up**



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V. Meningitis and Cellulitis: Currently, there is limited data and no formal recommendations on the efficacy of using PCT values in the decision to use or discontinue antibiotics for the treatment of CNS infections and soft tissue and skin infections.

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