Procalcitonin Monitoring Related to the Diagnosis and Treatment of Respiratory Tract Infections and Emerging Sepsis – Adult – Inpatient Clinical Practice Guideline

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Executive Summary

Guideline Overview

1. Adult patients with a clinical suspicion of bacterial respiratory infection or sepsis warranting antimicrobial initiation or adult patients who have been maintained on antimicrobial therapy and may be candidates for de-escalation of therapy.
2. Immunocompromised hosts and other special populations were excluded from procalcitonin studies and, therefore, PCT monitoring cannot be extrapolated to patients with the following conditions: pregnancy, neutropenia, transplant patients with moderate to intense immune suppression, chronic infections, and infections for which prolonged antibiotic therapy is the standard of care (osteomyelitis, infective endocarditis).
3. PCT monitoring has not been evaluated in the diagnosis and management of most infectious disease conditions, and those populations in #2.
4. PCT monitoring is NOT currently appropriate for use in the following conditions: pulmonary aspiration syndromes, myocardial infarction patients with pulmonary infiltrates and/or decompensated heart failure.

Key Revisions 2016 Periodic Review

1. No revisions were made to the document with the 2016 periodic review. The guideline was simply reaffirmed as being safe to use as written.

Key Practice Recommendations

1. Procalcitonin monitoring is recommended for adult patients with a clinical suspicion for bacterial respiratory tract infection according to Algorithm 1. (*UWHealth Strong Recommendation, Moderate Quality of Evidence*).
2. Procalcitonin monitoring is reasonable during the evaluation of a patient with systemic inflammatory response syndrome (SIRS) according to Algorithm 2. (*UWHealth Strong Recommendation, Low Quality of Evidence*)
3. Procalcitonin monitoring should not replace standard diagnostic evaluation of the patient with chronic obstructive pulmonary disease (COPD) and potential need for antibiotics (*UWHealth Strong Recommendation, Moderate Quality of Evidence*); however, a value of < 0.25 µg/L and a rapidly improving clinical status supports a non-bacterial infection etiology and antibiotic cessation or modification is encouraged (*UWHealth Strong Recommendation, Low Quality of Evidence*). See Algorithm 3.
4. Procalcitonin use in most infectious disease conditions, but especially pulmonary aspiration syndromes, and myocardial infarction patients with pulmonary infiltrates and/or decompensated heart failure is NOT recommended (*UWHealth Strong Recommendation, Moderate Quality of Evidence*).

Companion Documents

- UWHC Lab Test Directory - Procalcitonin

Scope

Disease/Condition: Patients with suspected bacterial respiratory tract infection or emerging sepsis.

Clinical Specialty: Physicians and pharmacists

Objective: To provide guidance on the use of procalcitonin in managing patients with possible bacterial infections

Target population:
Adult patients with a clinical suspicion of bacterial respiratory infection warranting antimicrobial initiation or who have been maintained on antimicrobial therapy and may be candidates for de-escalation or discontinuation of therapy. Adult patients with emerging bacterial sepsis. Other patients (COPD, myocardial infarction, aspiration pneumonia) are addressed; however, the use of procalcitonin is not recommended

Major Outcomes Considered

- Proportion of positive and negative procalcitonin tests
- Deescalation/discontinuation of antibiotics with negative procalcitonin test

Methodology

Methods Used to Collect/Select the Evidence:
Electronic database searches (PUBMED) were conducted by the guideline authors and workgroup members to collect evidence for review. Expert opinion and clinical experience were also considered during discussions of the evidence.

Methods Used to Formulate the Recommendations:
The workgroup members agreed to adopt recommendations developed by external organizations and/or arrived at a consensus through discussion of the literature and expert experience. All recommendations endorsed or developed by the guideline workgroup were reviewed and approved by other stakeholders or committees.

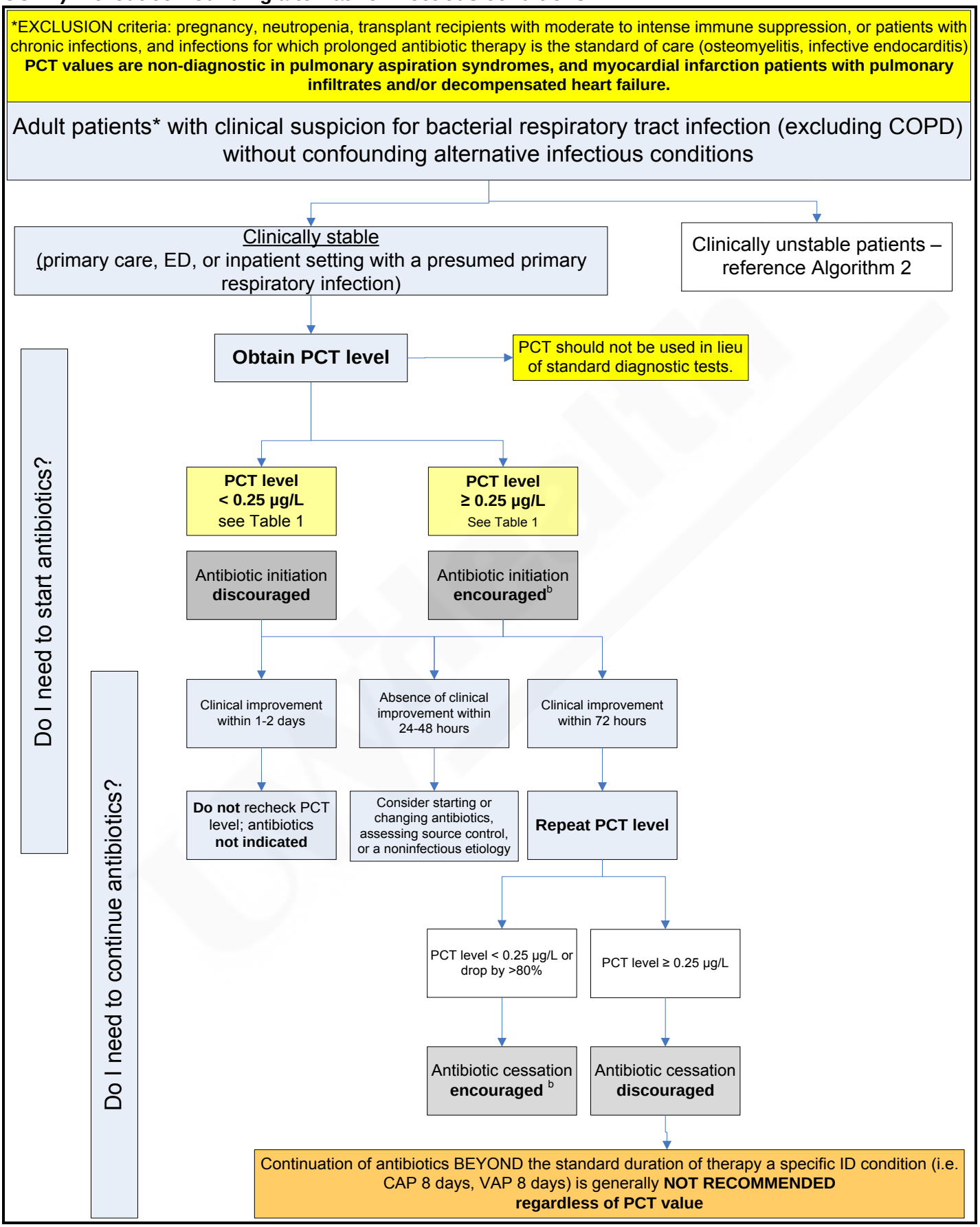
Methods Used to Assess the Quality of the Evidence/Strength of the Recommendations:
Recommendations developed by external organizations maintained the evidence grade assigned within the original source document and were adopted for use at UW Health.

Internally developed recommendations, or those adopted from external sources without an assigned evidence grade, were evaluated by the guideline workgroup using an algorithm adapted from the Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology (see Figure 1 in Appendix A).[1]

Rating Scheme for the Strength of the Evidence/Recommendations:
See Appendix A for the rating scheme used within this document.

Recognition of Potential Health Care Disparities:
None identified.

Algorithm 1. Adult patients with clinical suspicion for bacterial respiratory tract infection (excluding COPD) without confounding alternative infectious conditions



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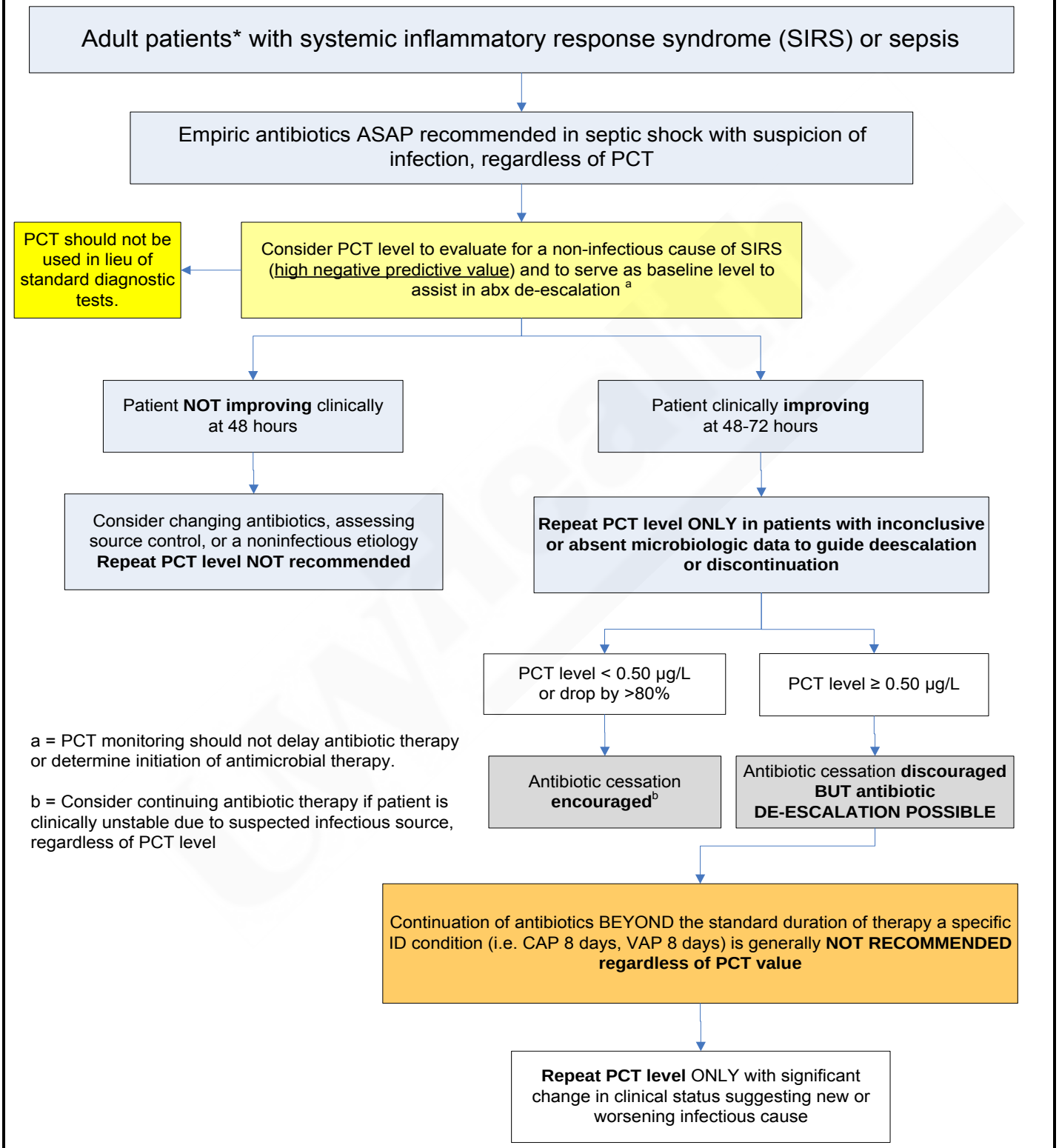
Algorithm 2. Adult patients with systemic inflammatory response syndrome (SIRS) or sepsis

*EXCLUSION criteria: pregnancy, neutropenia, transplant recipients with moderate to intense immune suppression, or patients with chronic infections, and infections for which prolonged antibiotic therapy is the standard of care (osteomyelitis, infective endocarditis)
PCT values are non-diagnostic in pulmonary aspiration syndromes, and myocardial infarction patients with pulmonary infiltrates and/or decompensated heart failure.



a = PCT monitoring should not delay antibiotic therapy or determine initiation of antimicrobial therapy.

b = Consider continuing antibiotic therapy if patient is clinically unstable due to suspected infectious source, regardless of PCT level

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Algorithm 3. Adult patients with clinical suspicion for bacterial respiratory tract infection with a history of COPD

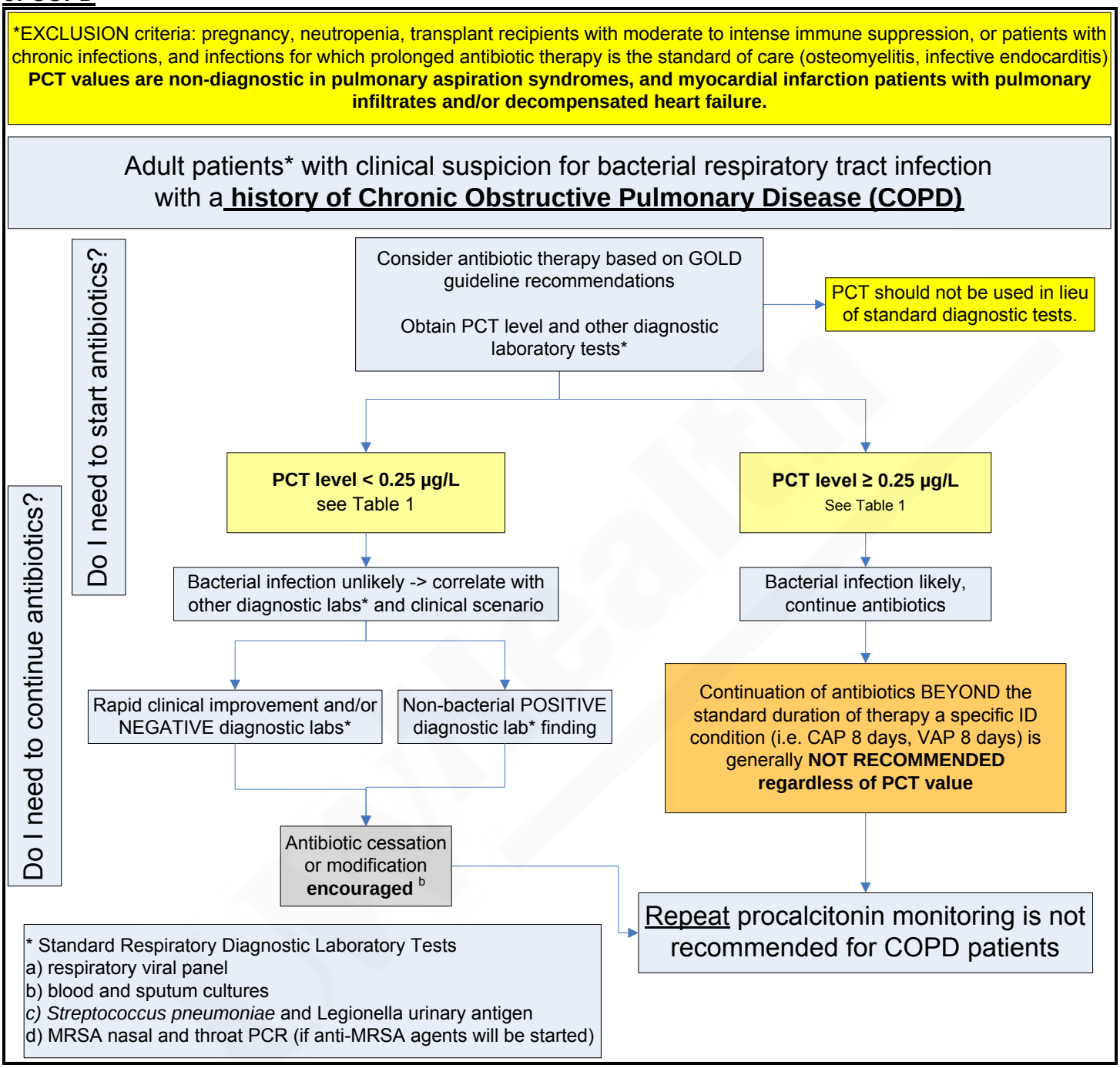


Table 1. Procalcitonin (PCT) level evaluation for antibiotic *initiation* in clinically stable patients with suspected respiratory tract infections without COPD in primary care, ED, or inpatient settings[2-13] *(UWHealth Weak/Conditional Recommendation, Moderate Quality of Evidence)*

Evaluation for antibiotic initiation in clinically stable patients with suspected LRTI without COPD in primary care, emergency department, or inpatient settings		
PCT level (µg/L)	**Antibiotic initiation**	**When to consider overruling algorithm**
<0.10	strongly discouraged	If patient becomes clinically unstable or has strong evidence of bacterial pathogen
0.10-0.24	discouraged	
0.25-0.49	encouraged	
≥0.5	strongly encouraged	

Table 2. Procalcitonin (PCT) level evaluation for antibiotic *de-escalation* in clinically stable patients with suspected lower respiratory tract infections without COPD in primary care, ED, or inpatient settings[2-13] *(UWHealth Weak/Conditional Recommendation, Moderate Quality of Evidence)*

Evaluation for antibiotic de-escalation in clinically stable patients with suspected RTI without COPD in primary care, emergency department, or inpatient settings			
PCT level (µg/L)	**Antibiotic cessation**	**When to consider overruling algorithm**	**Serial PCT Monitoring**
<0.10 or drop by >90%	strongly encouraged	Consider continuing antibiotic therapy if patient clinically unstable, regardless of PCT level	Repeat PCT level only if new or worsening respiratory based infection Consider initiation or modification of antibiotic therapy if no improvement in PCT level
0.10-0.24 or drop by >80%	encouraged		
0.25-0.49	discouraged		
≥0.5	strongly discouraged		

Table 3. Procalcitonin (PCT) level evaluation for antibiotic *de-escalation* in ICU patients with suspected bacterial infections or sepsis[2-4,11,14-27] *(UWHealth Weak/Conditional Recommendation, Moderate Quality of Evidence)*

Evaluation for antibiotic de-escalation ICU patients with suspected bacterial infection or sepsis			
PCT level (µg/L)	**Antibiotic de-escalation or cessation**	**When to consider overruling algorithm**	**Follow-up**
<0.25 or drop by >90%	strongly encouraged	Consider continuing current antibiotic therapy if patient clinically unstable, regardless of PCT level	Repeat PCT level in 48-72 hours with significant change in clinical status suggesting new or worsening infectious cause Consider initiation or modification of antibiotic therapy if no improvement in PCT level
0.25-0.49 or drop by >80%	encouraged		
0.50-1.00	discouraged		
>1.00	strongly discouraged		

Definitions

1. Available PCT Assays[28]
    1.1. Brahms PCT-Q assay (rapid PCT)
        1.1.1. Semi-quantitative
        1.1.2. Results in ~30 minutes
    1.2. Brahms PCT LIA test (LUMItest PCT)
        1.2.1. Standard assay for determining PCT levels in the plasma
        1.2.2. Results in ~60 minutes
        1.2.3. Analytical sensitivity of 0.1 µg/L and function sensitivity of 0.3 µg/L
        1.2.4. Interassay variability between 9-82% when PCT values between 0.1-1 µg/L
            1.2.4.1. Better assay for severe, systemic infections
    1.3. Brahms PCT Kryptor
        1.3.1. Most sensitive and highly precise plasma PCT measurement
        1.3.2. Results in ~20 minutes
        1.3.3. Analytical sensitivity of 0.02 µg/L and function sensitivity of 0.06 µg/L

Introduction

Biomarkers can serve as a helpful tool to differentiate bacterial infections from viral infections or non-infectious inflammatory states. One such biomarker is procalcitonin (PCT), an amino acid precursor to calcitonin. PCT is released as a component of the inflammatory cascade in response to bacterial infections, and is a more sensitive and specific marker than other markers such as C-reactive protein.[8] PCT levels rise to detectable levels within 3-6 hours of the onset of the inflammatory condition, peak at 12-48 hours, and fall rapidly during clinical recovery; levels increase with increasing infection severity.[2,8,29,30] PCT levels are usually not elevated in viral infections, most inflammatory conditions, or following the use of corticosteroids or NSAIDs. However, ***PCT may be mildly elevated in some inflammatory states such as malaria, pancreatitis, burn, traumatic injury, renal failure, or in post-surgical patients***.[8]

PCT monitoring may be used to guide antibiotic initiation and de-escalation for respiratory tract infections (RTIs), reducing unnecessary antimicrobial exposure, length of stay, and total hospital cost.[2,11] The decision to initiate and deescalate antibiotics based on PCT values and clinical picture will be discussed in this guideline.

PCT monitoring was included with a grade 2C recommendation in the 2012 update of the Surviving Sepsis Guidelines as an option to assist the clinician in the discontinuation of empiric antibiotics in patients who initially appear septic, but have no subsequent evidence of infection.[31] Empiric antibiotic therapy should not be withheld in the setting of sepsis and SIRS, but the use of PCT values to deescalate antibiotic therapy in the clinically unstable or ICU patient will be discussed in this guideline.

PCT monitoring has been studied in patients with pulmonary aspiration syndromes[32,33] and myocardial infarction patients with pulmonary infiltrates[34] and/or decompensated heart failure.[35] The results of serum procalcitonin monitoring in these conditions are not helpful in distinguishing bacterial infection from alternative etiologies for decompensation.

Recommendations

1. General Recommendations
    1.1. Procalcitonin (PCT) is a tool to differentiate bacterial from viral infections or non-infectious inflammatory states and is useful when considering initiation of and de-escalation of antimicrobial therapy in certain patient populations.[2] *(UWHealth Strong Recommendation, High Quality of Evidence)*
    1.2. PCT levels ≤ 0.1 µg/L should exclude bacterial infection in most cases.[2,8] *(UWHealth Strong Recommendation, High Quality of Evidence)*
        1.2.1. Procalcitonin levels are usually not elevated in viral infections, most inflammatory conditions, or following the use of corticosteroids or NSAIDs.[2,8]
    1.3. Procalcitonin can be mildly elevated in some inflammatory states such as malaria, pancreatitis, burn, traumatic injury, renal failure, in post-surgical patients[8], In patients with these conditions, the use of procalcitonin to identify bacterial infection is not well established and is cautioned. *(UWHealth Weak/Conditional Recommendation, Moderate Quality of Evidence)*

1.4. Procalcitonin may be variable and monitoring is not recommended in the following: pregnancy; absolute neutropenia; immunocompromised states; chronic infections, and infections for which prolonged antibiotic therapy is standard of care (e.g., infective endocarditis).[36] *(UWHealth Strong Recommendation, High Quality of Evidence)*

1.5. Procalcitonin monitoring has been studied in patients with pulmonary aspiration syndromes[33], myocardial infarction (with or without pulmonary infiltrates) and decompensated heart failure.[34,35] The use of PCT in these clinical scenarios is NOT recommended. *(UWHealth Strong Recommendation, Moderate Quality of Evidence)*

1.6. Procalcitonin monitoring is not recommended for detection of invasive fungal infections.[37] *(UWHealth Strong Recommendation, Moderate Quality of Evidence)*

1.6.1. In a retrospective analysis of 55 episodes of invasive fungal infection, PCT was elevated in less than 50% of the episodes.[37] The sensitivity and specificity of PCT was low.

1.7. Monitoring of procalcitonin levels is useful as levels rise to detectable levels within 3-6 hours of the onset of the inflammatory condition, peak at 12-48 hours, and fall rapidly during clinical recovery.[2,8,29,30] *(UWHealth Strong Recommendation, High Quality of Evidence)*

1.7.1. Levels of PCT have been shown to increase within 6 to 12 hours of the initial bacterial infection, and circulating PCT levels are expected to decrease by half daily when the infection is controlled by the host immune system and antibiotics.[2,38]

1.8. If PCT levels fail to start decreasing within 48-72 hours of treatment initiation, it is reasonable to consider treatment failure and potential lack of source control. [23,30,39] *(UWHealth Strong Recommendation, Moderate Quality of Evidence)*

1.9. Procalcitonin levels have not been studied as a tool to determine the admission or discharge status of patient from the Emergency department. Procalcitonin level may have a lag of 6-12 hours. Therefore, procalcitonin values alone should not be used to determine the need for admission or discharge of a patient from the Emergency department. *(UWHealth Strong Recommendation, Low Quality of Evidence)*

2. ***Clinically stable*** patients with suspected ***respiratory tract infections*** without COPD in primary care, ED, or inpatient settings[2-10,12,13]

2.1. <u>When to order:</u>

2.1.1. PCT measurement upon hospital or ED admission to determine antibiotic initiation is reasonable to reduce unnecessary antibiotic exposure. [2-10,12,13] *(UWHealth Strong Recommendation, Moderate Quality of Evidence)*

2.1.1.1. Levels of PCT have been shown to increase within 6 to 12 hours of the initial bacterial infection.[2,38]

2.2. <u>How to interpret:</u>

2.2.1. Initiation of antibiotic therapy is not recommended if initial PCT level is less than 0.25 µg/L.[2-10] *(UWHealth Strong Recommendation, High Quality of Evidence), although in patients with COPD, acute bacterial exacerbations are possible with levels lower than 0.25 and should be individualized[40] (UWHealth Strong Recommendation, Moderate Quality of Evidence)*

2.2.1.1. Alternative diagnoses of viral infection and pulmonary embolism should be considered in patients with an initial PCT level of less than 0.25 µg/L.[2-10] *(UWHealth Strong Recommendation, High Quality of Evidence)*

2.2.2. Initiation of antibiotics is reasonable if PCT level increases to ≥0.25 µg/L.[2] *(UWHealth Strong Recommendation, Moderate Quality of Evidence)*

2.2.3. Recommendations for the use of PCT monitoring for the initiation of antibiotics in clinically stable patients with suspected respiratory tract infections are listed in Table 1.[2-10] *(UWHealth Weak/Conditional Recommendation, Moderate Quality of Evidence)*

UWHealth Strong Recommendation, Moderate Quality of Evidence **Table 1. Procalcitonin (PCT) level evaluation for antibiotic *initiation* in clinically stable patients with suspected respiratory tract infections without COPD in primary care, ED, or inpatient settings**[2-13] *(UWHealth Weak/Conditional Recommendation, Moderate Quality of Evidence)*

Evaluation for antibiotic initiation in clinically stable patients with suspected LRTI without COPD in primary care, emergency department, or inpatient settings		
PCT level (µg/L)	**Antibiotic initiation**	**When to consider overruling algorithm**
<0.10	strongly discouraged	If patient becomes clinically unstable or has strong evidence of bacterial pathogen
0.10-0.24	discouraged	
0.25-0.49	encouraged	
≥0.5	strongly encouraged	

2.3. How to follow-up:
- 2.3.1. If antibiotics are held on admission:
  - 2.3.1.1. Remeasurement of PCT is not recommended if patient demonstrates clinical or symptom improvement within 1-2 days.[2] *(UWHealth Strong Recommendation, High Quality of Evidence)*
  - 2.3.1.2. In cases with antibiotics are initially withheld, PCT levels should be rechecked in 12-48 hours when no clinical improvement is present and bacterial infection is still in the differential diagnosis[2-10] *(UWHealth Strong Recommendation, High Quality of Evidence)*
- 2.3.2. If antibiotics are ordered on admission:
  - 2.3.2.1. PCT levels can be effective every 48-72 hours to consider early cessation of antibiotics.[2-7] *(UWHealth Strong Recommendation, Moderate Quality of Evidence)*
    - 2.3.2.1.1. Repeat PCT monitoring at 48-72 hours is reasonable to reduce antimicrobial prescription rates and duration of antimicrobial therapy in patients with concern for respiratory tract infection.[2-7,36] *(UWHealth Strong Recommendation, Moderate Quality of Evidence)*
      - 2.3.2.1.1.1. A systematic review of 8 studies including 3431 randomized hospitalized patients with suspected RTIs showed a significant reduction in number of antibiotic prescriptions (RR 0.69, 95%CI 0.55 to 0.88, P=0.03) and duration of antibiotic use (SMD -1.27, 95%CI -1.26 to -0.68, P<0.001) in patients with PCT-guided antibiotic treatment compared to standard therapy.[6] There was no impact on mortality (RR 1.00, 95%CI 0.98 to 1.02, p=0.912), admission to ICU (RR 0.78, 95%CI 0.57 to 1.08, p=0.727), or length of hospital stay between groups (SMD -0.355, 95%CI -0.77 to 0.06, p=0.097).
      - 2.3.2.1.1.2. A multicenter, noninferiority, randomized controlled trial among 1359 patients in emergency departments of 6 tertiary care hospitals found a significant reduction in mean duration of antibiotic use in a serial PCT monitoring group (every 2 days) versus control group (5.7 days versus 8.7 days, RRR -34.8%, 95%CI -40.3% to 28.7%).[3] The rate of overall adverse outcomes was comparable in the PCT and control groups (15.4% versus 18.9%).
  - 2.3.2.2. The discontinuation of antibiotics is reasonable if the PCT level decreases to less than 0.25 µg/L or by at least 80% of the peak value and patient is improved clinically.[2-7,11] *(UWHealth Strong Recommendation, Moderate Quality of Evidence)*

2.3.2.3. Recommendations for the use of PCT monitoring to assist with determination of antibiotic de-escalation in clinically stable patients with suspected respiratory tract infections are listed in Table 2.[2-10] *(UWHealth Weak/Conditional Recommendation, Moderate Quality of Evidence)*

Table 2. Procalcitonin (PCT) level evaluation for antibiotic *de-escalation* in clinically stable patients with suspected lower respiratory tract infections without COPD in primary care, ED, or inpatient settings[2-13] *(UWHealth Weak/Conditional Recommendation, Moderate Quality of Evidence)*

Evaluation for antibiotic de-escalation in clinically stable patients with suspected RTI without COPD in primary care, emergency department, or inpatient settings			
PCT level (µg/L)	**Antibiotic cessation**	**When to consider overruling algorithm**	**Serial PCT Monitoring**
<0.10 or drop by >90%	strongly encouraged	Consider continuing antibiotic therapy if patient clinically unstable, regardless of PCT level	Repeat PCT level only if new or worsening respiratory based infection Consider initiation or modification of antibiotic therapy if no improvement in PCT level
0.10-0.24 or drop by >80%	encouraged		
0.25-0.49	discouraged		
≥0.5	strongly discouraged		

3. ***Clinically unstable*** or ICU patients with suspected ***bacterial infection or sepsis***[2,4,11,14-26]
   3.1. When to order:
      3.1.1. Procalcitonin monitoring should not delay antibiotic therapy or determine initiation of antimicrobial therapy.[2,4,14-26] *(UWHealth Strong Recommendation, High Quality of Evidence)*
      3.1.2. Procalcitonin monitoring is reasonable in the initial patient evaluation to differentiate sepsis from other non-infectious causes of a systemic inflammatory response to assist in de-escalation of antibiotics later in hospitalization, despite mixed data to date.[2,4,14-26] *(UWHealth Strong Recommendation, Moderate Quality of Evidence)*
         3.1.2.1. A large systemic review of 3943 patients among 33 studies supports the use of PCT as a diagnostic test for sepsis in critically ill adults post-surgery or trauma, noting its superiority to C-reactive protein in determining presence of infection supported by a greater global odds ratio for diagnosis of infection (15.7 versus 5.4, 95%CI 9.1 to 27.1).[15]
         3.1.2.2. A systemic review and meta-analysis of 2097 patients among 18 studies determined PCT levels cannot accurately differentiate sepsis for other non-infectious causes of a systemic inflammatory response in critically ill adult patients.[17,18]
      3.1.3. Procalcitonin monitoring may be reasonable as a marker to help guide de-escalation of antimicrobial therapy regardless of whether it was used to help guide the decision to initiate antibiotic therapy.[2,4,14-26] *(UWHealth Weak/Conditional Recommendation, Moderate Quality of Evidence)*
   3.2. How to interpret:
      3.2.1. Empiric antibiotic therapy may be considered in patients with clinical suspicion for infection who present with septic shock, regardless of PCT.[2,4,14-26] *(UWHealth Strong Recommendation, High Quality of Evidence)*
      3.2.2. De-escalation of antibiotics may be considered if PCT levels decrease to less than 0.50 µg/L or by at least 80%-90% of the peak value and patient is improved clinically.[2,4,14-26] *(UWHealth Weak/Conditional Recommendation, Moderate Quality of Evidence)*
   3.3. How to follow-up:
      3.3.1. Periodic monitoring of PCT levels may be considered in critically ill patients to assist with cessation or de-escalation of antimicrobial therapy for suspected bacterial infections.[2,4,14-26] *(UWHealth Weak/Conditional Recommendation, Moderate Quality of Evidence)*
         3.3.1.1. Three systematic reviews of 5, 6 and 7 trials, respectively, found PCT monitoring resulted in a decrease in antimicrobial duration or exposure with no change in mortality.[21-23]

3.3.1.2. In a large multicenter, randomized controlled open-label trial of 1200 patients, there was no significant difference in death from any cause at day 28 between the PCT and standard therapy group (31.5% versus 32.0%, RR 0.6%, 95%CI -4.7% to 5.9%), however the PCT group had a significantly longer length of ICU stay (6 days versus 5 days, p=0.004).[19]

3.3.2. It is reasonable to check PCT levels every 48-72 hours to consider de-escalation or early cessation of antibiotics.[2,4,14-26] *(UWHealth Strong Recommendation, Moderate Quality of Evidence)*

3.3.3. If patient PCT levels do not respond to antibiotics within 48 hours and/or if the patient is deteriorating clinically, it is reasonable to switch antibiotic therapy and/or consider source control and a noninfectious workup.[2,4,14-26] *(UWHealth Strong Recommendation, Moderate Quality of Evidence)*

3.3.4. Recommendations for the use of PCT monitoring to assist with determination of antibiotic de-escalation in ICU patients with suspected bacterial infections or sepsis are listed in Table 3.[2-4,11,14-27] *(UWHealth Weak/Conditional Recommendation, Moderate Quality of Evidence)*

Table 3. Procalcitonin (PCT) level evaluation for antibiotic *de-escalation* in ICU patients with suspected bacterial infections or sepsis[2-4,11,14-27] *(UWHealth Weak/Conditional Recommendation, Moderate Quality of Evidence)*

Evaluation for antibiotic de-escalation ICU patients with suspected bacterial infection or sepsis			
PCT level (µg/L)	**Antibiotic de-escalation or cessation**	**When to consider overruling algorithm**	**Follow-up**
<0.25 or drop by >90%	strongly encouraged	Consider continuing current antibiotic therapy if patient clinically unstable, regardless of PCT level	Repeat PCT level in 48-72 hours with significant change in clinical status suggesting new or worsening infectious cause Consider initiation or modification of antibiotic therapy if no improvement in PCT level
0.25-0.49 or drop by >80%	encouraged		
0.50-1.00	discouraged		
>1.00	strongly discouraged		

UW Health Implementation

Potential Benefits:

- Antimicrobial stewardship through diagnostics-guided deescalation and escalation of antibiotics.
- Rapid identification of patient who may benefit from antibiotics.
- Implementation of procalcitonin monitoring may reduce unnecessary antibiotic exposure, reduce ICU and hospital length of stay and reduce unnecessary admission to the hospital from the ED.

Potential Harms:

- Misinterpretation of the PCT value may result in inappropriate discontinuation of antibiotics.

Pertinent UW Health Policies & Procedures

None

Patient Resources

None

Guideline Metrics

None

Implementation Plan/Clinical Tools

1. Guideline will be posted on UConnect in a dedicated location for Clinical Practice Guidelines.
2. Content and hyperlinks within clinical tools, documents, or Health Link related to the guideline recommendations (such as the following) will be reviewed for consistency and modified as appropriate.

UW Health Guidelines

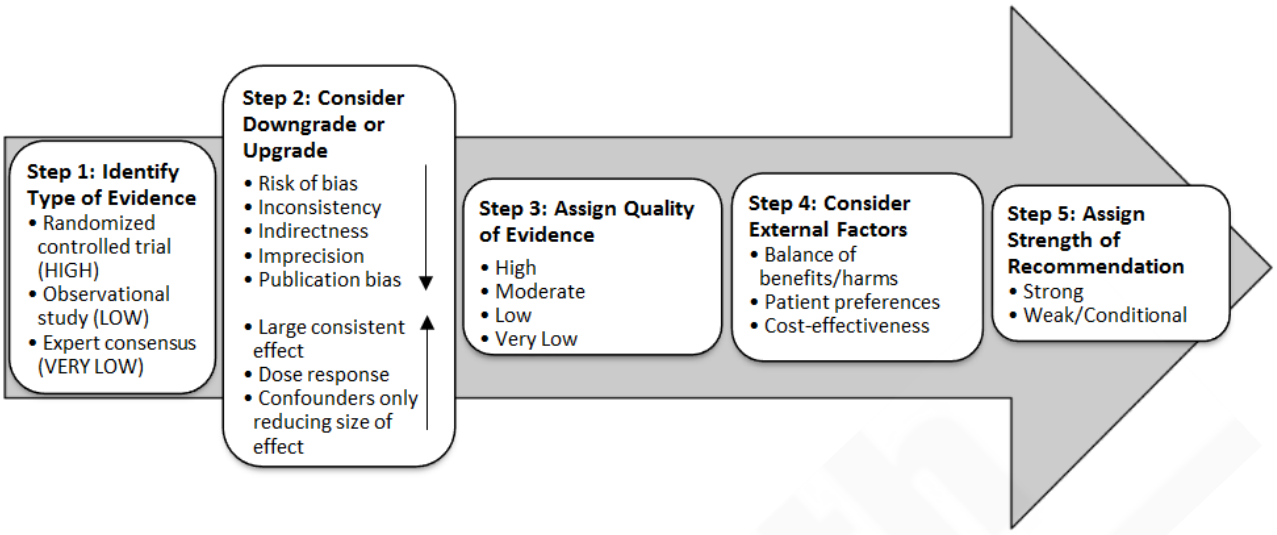
COPD – Adult – Inpatient/Ambulatory

Disclaimer

Clinical practice guidelines assist clinicians by providing a framework for the evaluation and treatment of patients. This guideline outlines the preferred approach for most patients. It is not intended to replace a clinician's judgment or to establish a protocol for all patients. It is understood that some patients will not fit the clinical condition contemplated by a guideline and that a guideline will rarely establish the only appropriate approach to a problem.

Appendix A. Evidence Grading Scheme

Figure 1. GRADE Methodology adapted by UW Health[1]



GRADE Ranking of Evidence

High	We are confident that the effect in the study reflects the actual effect.
Moderate	We are quite confident that the effect in the study is close to the true effect, but it is also possible it is substantially different.
Low	The true effect may differ significantly from the estimate.
Very Low	The true effect is likely to be substantially different from the estimated effect.

GRADE Ratings for Recommendations For or Against Practice

Strong	The net benefit of the treatment is clear, patient values and circumstances are unlikely to affect the decision.
Weak/conditional	Recommendation may be conditional upon patient values and preferences, the resources available, or the setting in which the intervention will be implemented.

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