Ascension Health Antimicrobial Stewardship Committee

Procalcitonin Use Recommendations
## Workgroup Members

<table>
<thead>
<tr>
<th>Member</th>
<th>Ministry Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calvin Tucker, PharmD</td>
<td>Ministry Market: Jacksonville</td>
</tr>
<tr>
<td>Chris Trabue, MD</td>
<td>Ministry Market: Tennessee</td>
</tr>
<tr>
<td>Issa Ephtimios, MD</td>
<td>Ministry Market: Gulf Coast (Pensacola/Mobile)</td>
</tr>
<tr>
<td>Kari McCracken, PharmD</td>
<td>Ministry Market: Tulsa</td>
</tr>
<tr>
<td>Laura Leigh Stoudenmire, PharmD</td>
<td>Ministry Market: Tennessee</td>
</tr>
<tr>
<td>Mohamad Fakih, MD</td>
<td>Ascension Health System Office</td>
</tr>
<tr>
<td>Leonard Johnson, MD</td>
<td>Ministry Market: Michigan</td>
</tr>
<tr>
<td>Maha Assi, MD</td>
<td>Ministry Market: Kansas</td>
</tr>
<tr>
<td>Rebecca Maynard, PharmD</td>
<td>Ministry Market: Michigan</td>
</tr>
<tr>
<td>Ben Cottongim, PharmD</td>
<td>Ministry Market: Indianapolis</td>
</tr>
<tr>
<td>Maha Assi, MD</td>
<td>Ministry Market: Kansas</td>
</tr>
<tr>
<td>Todd Schroeder, PharmD</td>
<td>Ministry Market: Kansas</td>
</tr>
</tbody>
</table>
Situation

- Due to the wavering practices and understanding of the utility of PCT in antimicrobial stewardship, there is opportunity to standardize the use of this test across Ascension
Background

• PCT is a precursor of calcitonin that increases during most bacterial infections and can be used as a biomarker to assess the presence of infection.

• The levels in viral infections and other non-infectious conditions are typically low, although some exceptions have been identified.

• PCT becomes detectable in 2-6 hours after a triggering event and typically peaks at 12-24 hours.

• More specific marker for bacterial infections compared with more traditional markers such as C-reactive protein and WBC.
Background

• The utility of PCT has been extensively evaluated as a serum marker with the majority of the data found in respiratory infections and sepsis

• PCT has shown utility in various settings such as the emergency department, intensive care unit and general medical/surgical units

• The interpretive threshold has varied within the literature with values less than 0.25mcg/L typically indicating the absence of a bacterial infection
Literature Review

• Respiratory Infections
  • Muller et al. demonstrated PCT was increased significantly in bacteremic patients compared with patients without an identified bacterial pathogen
  • Schuetz et al. exhibited a mean duration of antibiotics exposure in the PCT vs control groups was lower in all patients, 5.7 vs 8.7 days
  • Schuetz et al. found that a PCT strategy was found to significantly reduce the overall patient exposure to antibiotics with the PCT group receiving 4 days vs 8 days median in the control group

• PCT guidance compared with standard guidelines resulted in similar rates of adverse outcomes, as well as lower rates of antibiotic exposure and antibiotic-associated adverse effects
Literature Review

COPD

• Verduri et al. demonstrated the rate of exacerbations at 6 months was not significantly different in the PCT-guided group when compared to standard of care

• Stolz et al. demonstrated that the use of PCT-guided therapy reduced antibiotic utilization and exposure by 30% compared to standard of care

• Van der Mass et al. exhibited incremental cost savings per day on antibiotic therapy avoided were (in Euros) €90 in the Netherlands, €125 in Germany, and €52 in the United Kingdom

• Falsely et al. described a sensitivity of 96%, however only exhibited a specificity of 31%. PCT was not able to distinguish bacterial from viral and noninfectious causes of AECOPD
Literature Review

Sepsis

• Schroeder et al. found that PCT guidance led to a significant reduction of antibiotic treatment from $6.6 \pm 1.1$ days compared with $8.3 \pm 0.7$ days in control patients

• Shehabi et al. demonstrated that in critically ill adults with undifferentiated infections, a PCT algorithm including $0.1$ ng/ml cut-off did not achieve 25% reduction in duration of antibiotic treatment
Limitations of Procalcitonin-Guided Therapy

- Elderly may have elevated baseline PCT levels, particularly those with underlying chronic kidney disease
- PCT levels may also be elevated by other noninfectious causes
- PCT levels may be falsely low in patients with a localized infection or antimicrobial pretreatment
- Success of PCT, particularly in sepsis is based on the understanding and adoption of processes that promote the appropriate use and interpretation
Assessment

• The evidence suggests that using PCT for patients with respiratory infections can lead to more parsimonious antibiotic use and de-escalation.

• If used serially, PCT can has been shown to be has shown effectiveness in sepsis compared to LRTI finding prognostic value solely in an initial level.

• The appropriate utility of PCT is largely dependent on the comprehensive understanding of how to use and interpret PCT values.

• The literature in septic patients is growing however its clinical application in sepsis must be furthered delineated.
Recommendations

PCT levels may be used as part of the antimicrobial stewardship efforts to assist with de-escalation/discontinuation of respiratory antimicrobials as outlined below:

• PCT should only be used at your facility if it is being run in-house or within the same health system. PCT should NOT be used if it has to be a send-out test

• PCT should be ordered as a one-time order by the provider or pharmacist within 24 hours of initiation of antibiotic therapy in patients with active order for a systemic antibiotic for the indication of community-acquired pneumonia

• Upon review of results and assessment of patients clinical status, it is recommended that the antimicrobial stewardship team discuss the option of discontinuation of antibiotics with the ordering provider if the procalcitonin level is less than 0.25 ug/L

• Serial (multiple) PCT levels should NOT be ordered for any infection source, including sepsis
Recommendations

• PCT should NOT be ordered in patients with lower respiratory tract infections in the following scenarios:
  • Patients with HAP
  • Active IV drug use
  • Severe immunosuppression (other than corticosteroid use)
  • Life-threatening medical comorbidities leading to possible imminent death
  • Recent antibiotic use or patients with a suspected or confirmed concomitant non-pulmonary infection in which antibiotics are indicated

• Provide the above recommendations and education to ED physicians and pharmacists at sites that have PCT testing

• The antimicrobial stewardship team shall evaluate on a consistent basis whether the test is having an impact in improving antimicrobial use across the organization
  • Steps shall be taken to reinforce education with providers if the test is not having an impact in improving appropriate antimicrobial use.

• Software Updates:
  • Update verbiage on procalcitonin results in EHR to include clinical applicability for lower respiratory tract infections that is consistent with the FDA-approved labeling
  • Create Sentri7 rule to identify patients receiving antibiotics with a PCT level less than or equal to 0.25 ug/mL
Ascension Lower Respiratory Tract Infection PCT Algorithm for Community Acquired Pneumonia

- **≤ 0.25 µg/L**: Antibiotic Cessation Encouraged
- **> 0.25 µg/L**: Antibiotic Cessation Discouraged

**Decisions on antibiotic use should not be based solely on procalcitonin levels.** The information is not meant to be applied rigidly and followed in all cases. Clinical judgment must remain central to application of this information and treatment decisions need to be re-assessed based on clinical condition and results of further testing.
References

13. Chu DC, Mehta AB, Walkey AJ. Practice Patterns and Outcomes Associated with Procalcitonin Use in Critically Ill Patients with Sepsis.CID 2017;00(00):1–7.