What are the benefits of this initiative?
Procalcitonin (PCT) is a biomarker that can be used to help with the initiation and de-escalation of antibiotics. There are various practices regarding the use of PCT within Ascension Ministries. Due to the differences in the use of procalcitonin and understanding of the utility of PCT, there is opportunity to provide guidance on the clinical scenarios that PCT can offer a major impact.

What is procalcitonin (PCT)?
PCT is a 116 amino acid prohormone of the hormone calcitonin. Calcitonin is exclusively produced by C-cells of the thyroid gland in response to hormonal stimuli, whereas PCT can be produced by several other cell types from a wide range of organs in response to inflammation or infection. Recent experimental studies suggest that PCT may play a pathogenic role in sepsis.

What affects PCT levels?
Bacterial endotoxins and proinflammatory cytokines (IL-1, IL-2, IL-6, and TNFα) are powerful stimuli for PCT production.

How do PCT levels change in sepsis?
PCT levels increase within approximately 3 to 6 hours of the stimulus. Higher PCT levels are associated with poorer prognosis and are found in patients with sepsis, severe sepsis, and septic shock.

What is the reference range for PCT?
In healthy individuals, PCT concentrations are typically < 0.05 ng/mL, but PCT concentrations can increase up to 1000 ng/mL in patients with sepsis, severe sepsis or septic shock. PCT concentrations > 0.5 ng/mL are generally considered abnormal and values in the range of 0.5 and 2 ng/mL suggests that the patient is at risk for sepsis and generally represent a gray zone in terms of the assessment of sepsis and related conditions. Viral infections do not typically result in elevated PCT levels. The Ascension Lower respiratory tract infection (LRTI) PCT Algorithm for suspected Community-Acquired Pneumonia encourages antibiotic cessation with PCT levels < 0.25 ng/mL (0.25 μg /L) and discourages antibiotic cessation with PCT levels > 0.25 ng/mL (0.25 μg /L).

How should PCT values be interpreted?
PCT is a marker of the inflammatory response. Elevated values are highly suggestive of an infection, often bacterial, with a systemic response. When plasma PCT values are < 0.5 ng/mL, bacterial sepsis is unlikely. PCT levels > 2 ng/mL are associated with bacterial infection and an increased likelihood of sepsis and progression to severe sepsis. PCT levels should be used in conjunction with other clinical information and not in isolation. The Ascension Lower respiratory tract infection (LRTI) PCT Algorithm for suspected Community-Acquired Pneumonia gives a PCT 0.25 ng/mL (0.25 μg /L) threshold for discouraging the use of antimicrobials.

What is the half-life and stability of PCT?
Plasma PCT has a half-life of 25 to 30 hours. PCT is stable in both plasma and serum samples. Samples stored at room temperature for 24 hours retain 80% of their initial concentration, whereas those stored at 4°C retain >90% of their initial concentration.
When should PCT measurements be initiated?
PCT measurements should be obtained as soon as CAP is suspected and prior to antibiotics are initiated. If obtained within 24hrs of antibiotic initiation, the PCT level can be useful for discontinuation.

Should PCT measurements be repeated?
Repeat/serial PCT levels have demonstrated benefit in antibiotic de-escalation and discontinuation in community acquired pneumonia and sepsis. Repeat levels should be done every 24 hours after baseline to evaluate response to antimicrobial therapy.4 To determine efficacy, the subsequent level must demonstrated a reduction from the baseline level. The decline of the PCT values of the subsequent level varies across the literature, ranging from 30-90%, with no consensus. In order for serial levels to be effective careful and consistent interpretation is need to ensure appropriate utilization and to combat overuse. Repeat levels should not be obtained routinely but may be helpful to assess complex patient’s response to the therapy and if antibiotics can be discontinued

What are some limitations of using PCT?
PCT does not typically respond (PCT levels are much less pronounced) in viral infections, fungal infections, chronic inflammatory disorders, autoimmune processes, and local infections with no systemic response.6 PCT may be elevated due to non-bacterial causes such as with newborns (<48-72 hours; after 72 interpret levels as usual), massive stress (severe trauma, surgery, cardiac shock, burns), severe cardiogenic shock, and organ perfusion abnormalities.7 Baseline PCT levels can be elevated in patients that are elderly and with renal impairment (CKD and ESRD) which must be considered when interpreting levels.

References