Utilizing Procalcitonin Levels to Augment a Pharmacist Driven Antimicrobial Stewardship Program

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Abstract

Background: Antibiotic overutilization remains a challenge for healthcare systems, with up to 50% of antibiotic use in the acute care setting being inappropriate. Procalcitonin (PCT) is a biomarker which has been used to evaluate the presence of bacterial infections. Using PCT levels has been shown to reduce the number of antibiotic prescriptions and reduce the duration of therapy for patients with suspected sepsis or lower respiratory tract infections (LRTIs). The objective of this study is to decrease antibiotic exposure in patients admitted with suspected sepsis and/or LRTIs through the addition of PCT levels to augment a pharmacist driven antimicrobial stewardship program.
Methods: PCT algorithm recommendation forms were incorporated into the current antibiotic stewardship program at a 500-bed tertiary care community hospital. Provider education was delivered prior to the implementation of the chart notes and on an individual basis as needed. A daily report of PCT test results was used to identify patients in addition to the daily report of all patients on antibiotics. Patients identified by the antimicrobial stewardship team had a PCT algorithm form left in the chart with written recommendations for PCT levels and antibiotic regimen changes. Patients admitted to the medical floor from November 2012 – February 2013 with suspected sepsis and/or LRTI were eligible for inclusion. Antimicrobial utilization was calculated for each patient using days of therapy (DOT). The antimicrobial therapy cost was based on acquisition price and the cost for PCT was also included for the study group.
Results: A total of 66 patients were included in the study and placed into either the PCT group (n=35) or the no PCT group (n=31). The utilization of PCT showed a four day reduction in the mean antibiotic days of therapy per patient (PCT 10.1 days vs. no PCT 14.4 days, p=0.002). There was no significant difference in the mean cost of treatment per patient in the PCT group compared to the no PCT group (PCT $178.74 vs. no PCT $209.11, p=0.54).
Conclusion: The use of a PCT algorithm may help improve an antibiotic stewardship program through a reduction in antibiotic days of therapy without an increase in the average cost of treatment per patient.

Introduction

- Procalcitonin (PCT) is the precursor of calcitonin
  - Low or undetectable in healthy individuals
  - PCT increases within 3-6 hours after onset of bacterial infections
  - Increases in proportion to severity in bacterial infections
  - Falls quickly in response to appropriate antibiotic therapy
  - PCT remains low in viral illness
- Studies have shown PCT to be a useful biomarker for guiding antibiotic therapy and reduce antibiotic use

Purpose and Methods

- Our primary objective was to decrease antibiotic exposure in patients ≥ 18 yrs. of age admitted with lower respiratory tract infection and/or suspected sepsis.
- A single-center, prospective study from November 2012 – February 2013 at Mercy Medical Center (Des Moines, IA).
- PCT education to the hospitalists, emergency room physicians, and pulmonology/critical care physicians.
- Pharmacist reviewed daily list of PCT results, and patients admitted with LRTIs or sepsis syndrome.
  - Pharmacist recommended PCT levels on appropriate candidates
- Patients were excluded from the study with the following conditions:
  - Pregnancy
  - Immunosuppression
  - Recent trauma
  - Burn patients
  - Recent Surgery
  - Cardiogenic Shock
  - Cytokine stimulator use
  - Positive PCT level
- This study was approved by the Mercy Medical Center Institutional Review Board

Figure 1: PCT algorithm for LRTI

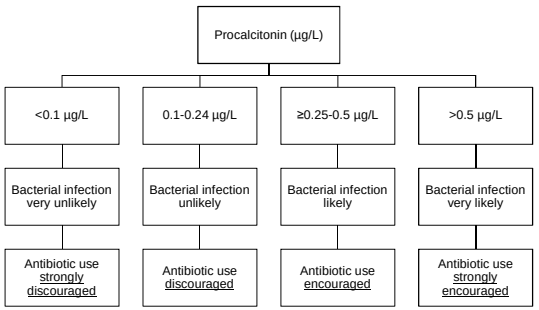
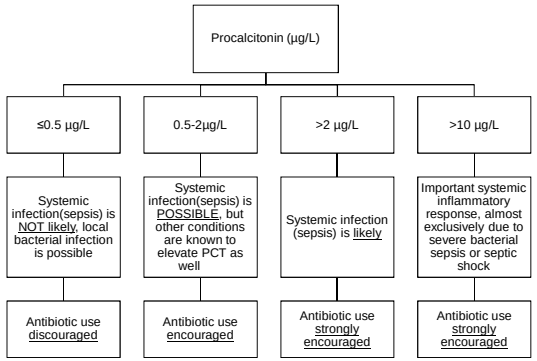


Figure 2: PCT algorithm for Sepsis



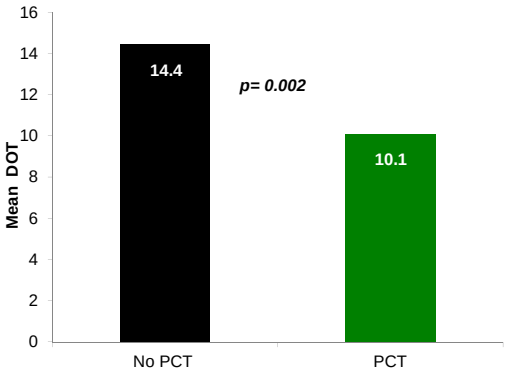
Results

Table 1: Patient Characteristics

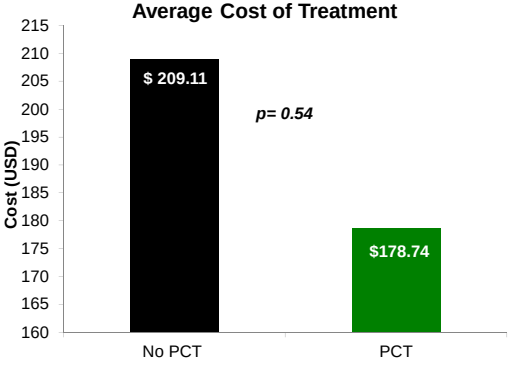
	No PCT N=31(%)	PCT N=35 (%)
Mean Age (yrs)	75	73
Mean LOS (days)	7.3	6.2
Female	22 (71)	19(54.3)
Diagnosis		
CAP	12 (38.7)	14 (40)
HCAP	14 (45.2)	16 (45.7)
AECOPD*	2 (6.5)	10 (28.6)
Bronchitis	4 (12.9)	5 (14.3)
Asthma Exacerbation	1 (3.2)	2 (5.7)
Sepsis	1 (3.2)	0 (0)
Comorbidities		
CHF	11 (35.5)	15(42.9)
COPD	11 (35.5)	13 (37.1)
Clinical Findings		
Mean initial WBC (k/mm³)	10.9	10.2
Mean Tmax (Fahrenheit)	99.1	99.3
Chills	10 (32.3)	5 (14.3)
Dyspnea*	21 (67.7)	32 (91.4)
Cough	22 (71)	24 (68.6)
Increased sputum production	12 (38.7)	9 (25.7)
Influenza positive	5(16.1)	9 (25.7)
Positive chest radiograph	9 (29)	11 (31.4)
Mean Days of Antibiotic therapy*	14.4	10.1
30- day readmission	2 (6.5)	1 (2.9)

*** p-value < 0.05**

Antibiotic Days of Therapy (DOT)



Average Cost of Treatment



Conclusions

- Use of a PCT algorithm helped reduce antibiotic days of therapy in patients primarily with lower respiratory tract infections
- Cost of the PCT assay was offset by the reduction in antimicrobial utilization in our population
- Addition of PCT testing to standing orders may improve utilization of PCT and decrease antibiotic utilization
- Continued education is needed to assure proper use of PCT

References

Schuetz, P, Christ-Crain M Thomann R, et al. Effect of Procalcitonin-based guidelines vs standard guidelines on antiboitic use in lower respiratory tract infections, the ProHOSP randomized controlled trial. JAMA 2009;302(10):1059-66. Kopterides P, Siempos II, Tsangaris I, et al. Procalcitonin-guided algorithms of antibiotic therapy in the intensive care unit: a systematic review and meta-analysis of randomized controlled trials. Crit Care Med 2010;38:229-41. Wenzel RP, Fowler AA. Acute bronchitis. N Engl J Med 2008;355(20):2125-30. Agarwal R, Schwartz DN. Procalcitonin to guide duration of antimicrobial therapy in intensive care units: a systematic review. Clin Infec Dis 2011;53:379-97.