Implementation of a pharmacist-guided procalcitonin protocol in a community hospital

Jasmine Coatie PharmD

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Implementation of a Pharmacist-Guided Procalcitonin Protocol in a Community Hospital

Jasmine Coatie, PharmD
PGY1 Resident
Parkview Health

The speaker has no actual or potential conflict of interest in relation to this presentation
Procalcitonin Pathophysiology - Normal

Procalcitonin Pathophysiology - Infection

Pre-Procalcitonin

Procalcitonin

Procalcitonin Pathophysiology - Infection

Pre-Procalcitonin

Release from multiple tissues

Systemic Inflammation

Procalcitonin

Procalcitonin Pathophysiology - Infection

Potential Causes of Procalcitonin Elevation

- Infection
- Surgery
- Cardiac Shock
- Burns
- Trauma
- ESRD/HD

The use of procalcitonin as a predictive biomarker has most extensively been studied in which disease states?

A. Bacteremia and upper respiratory tract infection
B. Sepsis and lower respiratory tract infection
C. Cellulitis and sepsis
D. Meningitis and UTI
Role in Therapy

• Bacterial infections
  • Sepsis
  • Septic shock
  • Lower respiratory tract infections (LRTI)
    • Community-acquired pneumonia (CAP)
    • Healthcare-associated pneumonia (HCAP)
    • Ventilator-associated pneumonia (VAP)
De Jong, et al.

- Prospective, multi-center, randomized, controlled trial
- Utilized non-binding advice
  - Discontinue antibiotics if procalcitonin decreased by 80% or more of its peak value or to 0.5 mcg/L or lower.
- Results
  - Median duration of treatment: 5 days vs. 7 days
  - Mortality at day 28: 20% vs. 25%

Lam, et al.

- Systematic review, meta-analysis
- Included 15 randomized controlled trials

Results

- Mortality: RR 0.93
- Difference in antibiotic duration:
  - Cessation trials: - 1.26 days
  - Mixed strategy trials: - 3.10 days
- No difference in hospital or ICU length of stay

Use of Pharmacist-Guided Protocols at Other Institutions

• Multiple institutions have instituted protocols for LRTI and sepsis
  • Nebraska Medicine and Washington Providence Medical Center
  • Align with other trials that have been done in this area
Procalcitonin Journey at Parkview

June 2016
Availability of procalcitonin assay

2016 - 2017
Analysis of pre-PCT assay vs. post-PCT assay

PCT: Procalcitonin
Procalcitonin Journey at Parkview

- Pre-PCT assay vs. Post-PCT assay analysis showed:
  - Decreased length of antibiotic therapy
  - Decreased hospital length of stay
  - Decreased ICU length of stay
Procalcitonin Journey at Parkview

- **June 2016**
  - Availability of procalcitonin assay

- **November 2017**
  - Implementation of procalcitonin protocol

- **February 2018**
  - Data Collection following PCT protocol implementation

- **2016 - 2017**
  - Analysis of pre-PCT assay vs. post-PCT assay
Assessment Question

Which of the following could result from using procalcitonin levels to assist in guiding therapy?

A. Increased cost
B. Decreased need for physician monitoring of microbiology cultures
C. Increased ICU length of stay
D. Decreased length of antibiotic therapy
Purpose

• To evaluate patient outcomes following implementation of a pharmacist-guided procalcitonin protocol
  • Antibiotic length of therapy
  • Hospital length of stay
  • ICU length of stay
Parkview Regional Medical Center

- Parkview Health
- Community hospital
- Level II trauma center
- 6 intensive care units
- Included units
  - Medical ICU (MICU)
  - Surgical Trauma ICU (STICU)
  - Cardiovascular ICU (CVICU)
  - Cardiac ICU (CICU)
  - Progressive Care Unit
Study Design

- Retrospective chart review following protocol implementation
- Patients were matched on the following criteria:
  - Simplified Acute Physiology Score (SAPS II)
  - Age
  - Diagnosis

Procalcitonin assay availability

After procalcitonin protocol implementation

PARKVIEW
Consider continuing therapy if clinically unstable or positive cultures with known source of infection.

- **PCT < 0.25**
  - Discontinuation strongly encouraged

- **PCT 0.25 – 0.49**
  - Or Peak decrease by ≥ 80%
  - Discontinuation encouraged

- **PCT ≥ 0.5**
  - And Peak decrease by < 80%
  - Continuation encouraged

- **PCT ≥ 0.5**
  - And Rising/not decreasing
  - Continuation strongly encouraged
Consider continuing therapy if clinically unstable or positive cultures with known source of infection.
Inclusion Criteria

- Age $\geq$ 18 years old
- Diagnosis of sepsis, septic shock, CAP, HCAP or VAP
- Admitted to a critical care unit for $\geq$ 48 hours
- Pharmacy-to-dose consult for management of antibiotics
Exclusion Criteria

• Death during admission
• Infectious Disease consult for antibiotic therapy management
• Known concomitant infection other than those listed in inclusion criteria
• Receiving antibiotics for > 24 hours prior to first drawn PCT level
• Positive culture or known source of infection
Objectives

• Primary Objective
  • Length of antibiotic therapy

• Secondary Objectives
  • Length of hospital stay
  • Length of ICU stay
Study Population

PCT Assay Availability
Included subjects from assay availability group (n = 137)
Matched subjects enrolled into control arm (n = 12)

Post-PCT Protocol Implementation
Subjects screened from protocol documentation (n = 23)
11 Excluded subjects
5 Died
2 Concomitant infection
2 ID consult
1 Antibiotics > 24h before first PCT
1 Unmatched
Matched subjects enrolled into treatment arm (n = 12)
## Baseline Characteristics

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>PCT assay availability (n = 12)</th>
<th>Post-PCT protocol implementation (n = 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24:</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25-34:</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35-60:</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>61-75:</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>≥76:</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Mean age (age ± SD)</td>
<td>62.8 ± 13.5</td>
<td>64.7 ± 15.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAPS II</th>
<th>PCT assay availability (n = 12)</th>
<th>Post-PCT protocol implementation (n = 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤29:</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>30-40:</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>41-52:</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>53-64:</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>≥65:</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mean SAPS II (score ± SD)</td>
<td>38 ± 13</td>
<td>38.2 ± 12.8</td>
</tr>
</tbody>
</table>
Baseline Characteristics

Diagnosis

- Sepsis: 7
- HCAP: 4
- CAP: 1

Note: No patients matched were diagnosed with septic shock or VAP
# Results – Primary Outcome

<table>
<thead>
<tr>
<th></th>
<th>PCT assay availability</th>
<th>Post-PCT protocol implementation</th>
<th>Significance P-value (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotic length of</td>
<td>10.2 ± 5.7</td>
<td>5.2 ± 3.7</td>
<td>0.020 (0.89, 9.16)</td>
</tr>
<tr>
<td>therapy (days ± SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Results – Secondary Outcomes

<table>
<thead>
<tr>
<th></th>
<th>PCT assay availability</th>
<th>Post-PCT protocol implementation</th>
<th>Significance P-value (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital length of stay (days)</td>
<td>13.5 ± 5.8</td>
<td>12.1 ± 8.3</td>
<td>0.612 (-4.59, 7.59)</td>
</tr>
<tr>
<td>ICU length of stay (days)</td>
<td>6.2 ± 3.6</td>
<td>5.5 ± 3.8</td>
<td>0.659 (-2.46, 3.81)</td>
</tr>
</tbody>
</table>
Intervention Acceptance Rate

- Most interventions resulted in de-escalation with eventual discontinuation
- 2 resulted in immediate discontinuation
- 2 were denied without further attempts
Conclusions

• Pharmacy monitoring of PCT resulted in:
  • Decreased antibiotic therapy by 5 days
  • Decreased hospital length of stay by 1.4 days
  • Decreased ICU length of stay 0.8 days

• Pharmacists role
  • Monitoring and assessing PCT level trends
  • Making recommendations for discontinuation when necessary
Limitations

- Retrospective chart review
- Small sample size
- High exclusion rate
- Lack of consistent staffing schedule
Further Direction

- Continue data collection to obtain similar sample size to previous group
- Expand protocol use to other hospital areas
- Integrate PCT monitoring into daily workflow for clinical pharmacists
  - Potentially develop a monitoring flag on the electronic medical record
- Publication
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- Sarah Pfaehler, PharmD, MBA, BCPS


• Procalcitonin algorithm for guidance in antibiotic therapy decisions in respiratory tract infections and sepsis. Washington Providence Medical Center.

• Procalcitonin guidance. Nebraska Medicine.
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Jasmine Coatie, PharmD
PGY1 Resident
Parkview Health
jasmine.coatie@parkview.com