Comparison of Procalcitonin Testing to a Targeted Audit-and-Feedback Strategy on Prescribed Durations of Therapy for Community-Acquired Pneumonia

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Background

- Community-acquired pneumonia (CAP) is one of the most common causes of hospitalization
- One-third of cases are viral, however, antibiotics are almost always given empirically
- The Centers for Disease Control and Prevention (CDC) reported that most patients receive ten days of antibiotics for CAP when only five days are recommended for the majority of patients
- Procalcitonin (PCT) is a unique biomarker that is FDA-approved to help guide antibiotic therapy for CAP and reduce unnecessary antibiotic use
- The 2019 CAP guidelines recommend against using PCT to withhold antibiotics due to a wide range of sensitivities and mixed clinical outcomes reported in recent literature

Objectives

Primary: To compare antibiotic duration at two sites; one using audit and feedback with PCT testing and one using targeted audit and feedback alone

Secondary: To compare length of stay, 30-day readmission, and mortality

Methods

Study Setting
- Two Trinity Health community teaching hospitals in West Michigan
  - Hospital with targeted audit-and-feedback **(TAF)**
  - Hospital with onsite procalcitonin testing **(PCT)**

Study Design
- Retrospective cohort with double control arms
  - Pre: May 1 to September 30, 2016
  - Post: May 1 to September 30, 2018

Inclusion Criteria
- Adult patients ages 18 years or older that were admitted with an antibiotic ordered with an indication of CAP or pneumonia

Exclusion Criteria
- Concurrent infection, death, discharge, or hospice within 48 hours, fungal, Gram-negative, or aspiration pneumonia, critically ill or immunocompromised patients

Data Collected

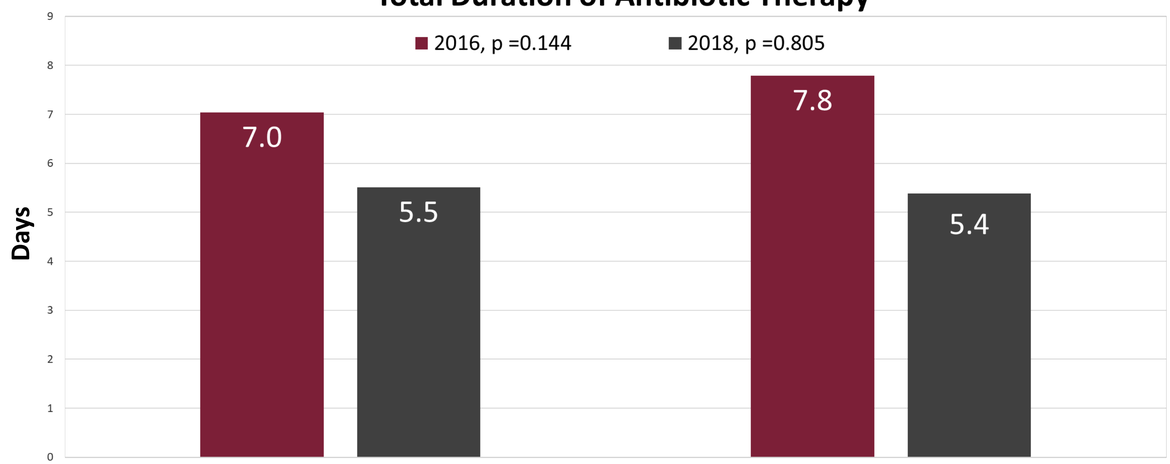
Patient Characteristics
- Demographics
- Cultures/serologies
- Charlson Co-morbidity Index

Antibiotic Therapy
- Empiric antibiotics
- Length of therapy

Procalcitonin Use
- 1st and 2nd PCT levels
- Treatment concordant with algorithm

Outcomes
- *Clostridioides difficile* within 30 day of discharge
- 30 day infection-related readmission
- 30 day all-cause mortality

Procalcitonin was as impactful as targeted audit-and-feedback alone in reducing total days of therapy for CAP



TAF Hospital mean (±SD)	Pre-TAF n = 80	Post-TAF n = 71	p-value
Total duration of therapy	7.0 (±3.1)	5.5 (±3.1)	**0.002**
Total PO	3.8 (±2.6)	2.4 (±2.5)	**0.001**
Total IV	2.9 (±1.5)	3.0 (±1.9)	0.732
Total inpatient	4.3 (±2.0)	4.1 (±2.1)	0.41
Total outpatient	4.0 (±2.3)	2.8 (±1.8)	**0.013**
Length of hospital stay	4.3 (±2.2)	5.2 (±3.4)	0.125

PCT Hospital mean (±SD)	Pre-PCT n = 80	Post-PCT n = 80	p-value
Total duration of therapy	7.8 (±3.3)	5.4 (±3.5)	**<0.001**
Total PO	4.8 (±3.1)	3.1 (±2.7)	**<0.001**
Total IV	3.0 (±1.5)	2.3 (±1.1)	**0.001**
Total inpatient	4.2 (±1.8)	3.3 (±1.5)	**0.002**
Total outpatient	4.9 (±2.1)	3.8 (±1.8)	**0.009**
Length of hospital stay	3.8 (±1.8)	3.7 (±1.6)	0.58

Procalcitonin Use

1st Level, n (%)	n = 71
<0.1 (Strongly Discourage Antibiotics)	49 (59)
0.1- 0.25 (Discourage Antibiotics)	10 (14)
0.26-0.50 (Encourage Antibiotics)	5 (7)
>0.50 (Strongly Encourage Antibiotics)	14 (20)

Procalcitonin Data	n = 71
1st Level, median (IQR)	0.06 (0.0 - 0.34)
After 1st PCT, antibiotics continued? n (%)	56 (79)
After 1st PCT, antibiotics de-escalated? n (%)	9 (13)

Followed protocol, n (%)	PCT ≤0.25	PCT >0.25	Overall
Yes	14 (27)	15 (79)	29 (41)
No	34 (65)	3 (16)	37 (52)
Other	4 (8)	1 (5)	5 (7)

Baseline Characteristics

	Pre-TAF n = 80	Pre-PCT n = 80	Post-TAF n = 80	Post-PCT n = 71
Male, n (%)	41 (51)	36 (45)	45 (56)	30 (42)
Chest imaging, n (%)	74 (93)	78 (98)	79 (99)	55 (93)
ID consulted, n (%)	4 (5)	6 (8)	3 (4)	3 (4)
Charlson Comorbidity Index, median (IQR)	4.5 (2 - 6)	5 (3 - 6)	4 (3 - 7)	5 (3 - 7)
Age, mean (SD)	68 (±17)	68 (±16)	70(±16)	72 (±15)

Antibiotic Therapy, n (%)	Pre-TAF n = 80	Pre-PCT n = 80	Post-TAF n = 80	Post-PCT n = 71
Antibiotics started in the ED	75 (94)	75 (94)	73 (92)	69 (97)
Empiric Antibiotics				
Fluoroquinolone	6 (8)	8 (10)	1 (1)	3 (4)
β-lactam + azithromycin	72 (90)	12 (15)	74 (93)	64 (90)
β-lactam + doxycycline	0 (0)	44 (55)	2 (3)	5 (6)
Other	2 (2.5)	16 (20)	3 (4)	0 (0)
Discharged on antibiotics	55 (70)	61 (76)	37 (47)	36 (51)

Clinical Outcomes

Outcome, n (%)	Post-TAF n = 80	Post-PCT n = 71	p-value
Readmission within 30 days	10 (13)	9 (13)	0.97
Infection-related	4 (5)	3 (4)	0.76
Pneumonia-related	2 (3)	3 (4)	0.15
All-cause mortality	0 (0)	0 (0)	1.0
***Clostridioides difficile* within 30 days**	0 (0)	0 (0)	1.0

Discussion & Conclusions

- **Study Limitations**
  - Source of patients depended on prescribers choosing an indication of pneumonia or CAP for antibiotic
  - Unable to determine sensitivity/specificity of PCT testing
  - Potential differences in practice between sites
  - Low adherence to PCT protocol
- **Conclusions**
  - PCT testing was as impactful as targeted audit-and-feedback alone in reducing total days of antibiotic therapy for CAP
  - Targeted audit-and-feedback may be a more cost-effective way to reduce antimicrobial duration for CAP than PCT testing

References

1. Self WH, et al. Clin Infect Dis. 2017 Feb 26:65(2):183-90.
2. Center for Disease Control and Prevention. Antibiotic Use in the United States, 2018 Update: Progress and Opportunities. Atlanta, GA: US Department of Health and Human Services, CDC; 2019. Accessed April 25, 2020.
3. Food and Drug Administration. FDA clears test to help manage antibiotic treatment for lower respiratory tract infections and sepsis. Accessed April 25, 2020.
4. Metlay et al. Am J Respir Crit Care Med. 2019 Oct 1:200(7):e45-e67.