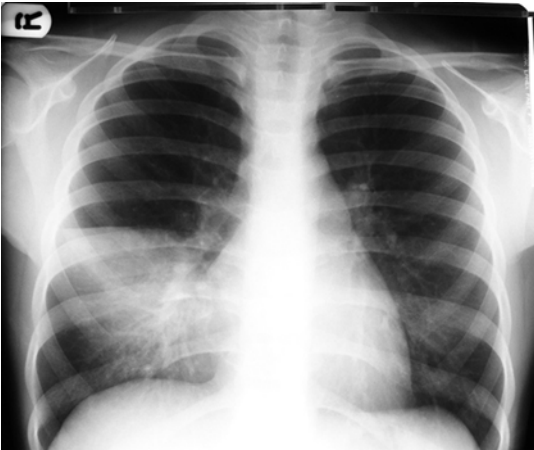


Optimizing Antibiotic Stewardship in the ED



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SCHOOL OF MEDICINE AND PUBLIC HEALTH

Learning Objectives

1. Synthesize the emerging literature to improve antibiotic prescribing for skin and soft tissue infections.
2. Identify clinical scenarios during which PCT can safely guide antibiotic prescribing for respiratory tract infections.
3. Reduce the risk of UTI misdiagnosis via improved UA interpretation practices.

Defining Antibiotic Stewardship

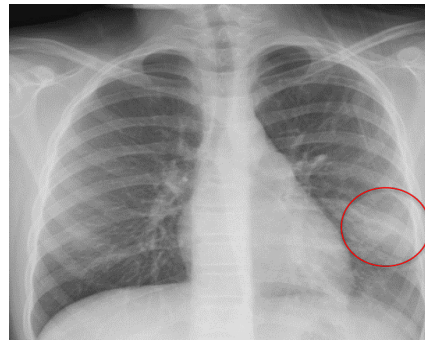
The 4 D's

-Diagnosis

-Drug

-Dose

-Duration



Current State of Affairs

- Skin and Soft Tissue Infections
 - 30% misdiagnosis of cellulitis, dual therapy use
Pallin et al, West JEM 2014; Weng et al, JAMA Derm 2017
- Respiratory Tract Infections
 - 30% overuse for inappropriate diagnoses
 - No widespread implementation of PCT
Palms et al JAMA IM 2018
- Urinary Tract Infections
 - Excess prescribing for asymptomatic bacteriuria
Gordon et al JAGS 2013, Elshimy et al OFID 2017

Why?

Specific Barriers to ED Stewardship

- Clinical Factors
 - Diagnostic uncertainty
 - Pseudocellulitis, abscess pathogen
 - Pneumonia diagnosis and etiology
 - 'Asymptomatic' bacteriuria
 - Sepsis vs non-infectious mimics
- Organizational Factors
 - Overcrowding, EHR usability, malpractice concern
- Patient Factors
 - Access to care, expectations/satisfaction, health literacy

Abscesses – Choosing Wisely

 **Choosing Wisely**[®]

An initiative of the ABIM Foundation

 American College of
Emergency Physicians[®]
ADVANCING EMERGENCY CARE 

4

Avoid antibiotics and wound cultures in emergency department patients with uncomplicated skin and soft tissue abscesses after successful incision and drainage and with adequate medical follow-up.

Skin and soft tissue infections are a frequent reason for visiting an emergency department. Some infections, called abscesses, become walled off and form pus under the skin. Opening and draining an abscess is the appropriate treatment; antibiotics offer no benefit. Even in abscesses caused by Methicillin-resistant *Staphylococcus aureus* (MRSA), appropriately selected antibiotics offer no benefit if the abscess has been adequately drained and the patient has a well-functioning immune system. Additionally, culture of the drainage is not needed as the result will not routinely change treatment.

Emerg Med J. 2014 Jul;31(7):576-578. doi: 10.1136/emered-2013-202571. Epub 2013 May 18.

Systemic antibiotics after incision and drainage of simple abscesses: a meta-analysis.

Singer AJ¹, Thode HC Jr¹.



- Talan et al 2016 NEJM
 - 1,247 subjects
 - 86% cure placebo
 - 93% cure TMP/SMX
 - NNT = 14
 - Daum et al 2017 NEJM
 - 786 subjects
 - 69% ‘cure’ placebo
 - 82% ‘cure’ TMP/SMX
 - 83% ‘cure’ clindamycin
 - NNT = 7
- Average abscess ~4 cm with 27 cm of erythema

Clinical Controversy

Antibiotics Should Not Be Routinely Prescribed After Incision and Drainage of Uncomplicated Abscesses

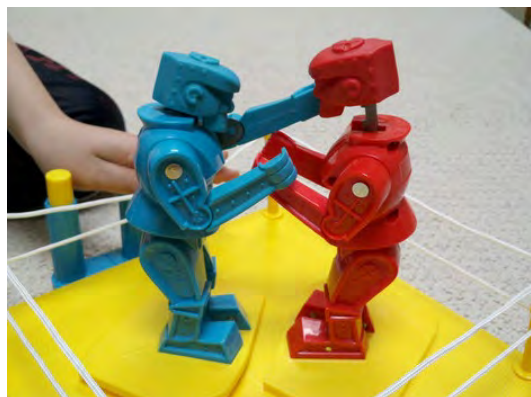
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April 2019 Volume 73, Issue 4, Pages 377–378



Stewardship of Patient Outcomes Based on Evidence not Expert Opinion

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April 2019 Volume 73, Issue 4, Pages 375–376



- Pros

- Antibiotics reduce treatment failure
- Antibiotics reduce recurrent abscesses

- Cons

- Antibiotics do not benefit the vast majority of patients
 - High NNTs
- Failure = needs antibiotic
 - No infection related deaths (>2,600 trial pts)

Proposed Solutions

- Small lesions (<5 cm²) with erythema (<5 cm²)
 - Glorified pimples – No antibiotics
 - 89% placebo cure rate, NNT 12 Talan et al 2018
- Watch and wait prescriptions
 - Safe based on trial data
- Shared decision making
 - Include NNT and side effects in discussion
- Avoid double covering
 - Rapid MRSA PCR improves antibiotic selection May et al 2015
 - 3x risk of adverse events with clindamycin and TMP/SMX Shehab et al 2008
 - Uncomplicated cellulitis as well = no MRSA coverage Moran et al 2017

MRSA PCR

- 21% ↑ in MRSA active agents for MRSA +
- 14% ↑ in beta-lactam use for MSSA+

- Tailored therapy vs dual coverage
 - More important now following Talan/Daum trials
 - Individuals advocating universal prescribing

A Randomized Clinical Trial Comparing Use of Rapid Molecular Testing for *Staphylococcus aureus* for Patients With Cutaneous Abscesses in the Emergency Department With Standard of Care

Larissa S. May ^(a1), Richard E. Rothman ^(a2), Loren G. Miller ^(a3), Gillian Brooks ^(a4), Mark Zocchi ^(a5), Catherine Zatorski ^(a4), Andrea F. Dugas ^(a3), Chelsea E. Ware ^(a4) and Jeanne A. Jordan ^(a6) 

Cellulitis = A Tricky Diagnosis?

JAMA Dermatology | Original Investigation

Costs and Consequences Associated With Misdiagnosed Lower Extremity Cellulitis

Qing Yu Weng, MD; Adam B. Raff, MD, PhD; Jeffrey M. Cohen, MD; Nicole Gunasekera, BS; Jean-Phillip Okhovat, MD, MPH; Priyanka Vedak, MD; Cara Joyce, PhD; Daniela Kroshinsky, MD, MPH; Arash Mostaghimi, MD, MPA, MPH

- 30.5% of ED cellulitis cases were misdiagnosed
 - Per retrospective dermatologist chart review
- National projections = 50-100k unnecessary admissions/year
 - ~\$200-500 million in healthcare costs
 - 9,000 nosocomial infections, 1000-5000 Cdiff cases
- “I think that typically the diagnostic certainty is in the diagnosis of a skin and soft tissue infection. I don’t find that I come across that too often when I’m not sure if it’s an infection or not.” ~ Attending, < 3 yrs. experience, community ED

Skin Surface Temperatures Measured by Thermal Imaging Aid in the Diagnosis of Cellulitis

Lauren N. Ko^{1,3}, Adam B. Raff^{1,2,3}, Anna C. Garza-Mayers¹, Allison S. Dobry¹, Antonio Ortega-Martinez², R. Rox Anderson^{1,2} and Daniela Kroshinsky¹

Journal of Investigative Dermatology (2018), Volume 138

- 40 participants in initial model
 - 32 in validation cohort
- Dermatology consult for ED pts with suspected cellulitis
 - Determined cellulitis vs pseudocellulitis
- Thermal imaging of affected limb and unaffected limb compared
- Group comparisons for cellulitis vs pseudocellulitis
- Diagnostic accuracy = primary outcome
 - Also generated a threshold for distinguishing cellulitis

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Journal of Investigative Dermatology (2018), Volume 138

LN Ko et al.

Thermal Imaging of Skin Aids in Cellulitis Diagnosis

Table 2. Skin surface temperatures in cellulitis and pseudocellulitis patients randomized to dermatology consultation (n = 40)

	Affected Skin Temperature (°C)	Unaffected Skin Temperature (°C)	Difference, Mean (95% CI), P-Value
Cellulitis, mean (95% CI)	34.1 (33.3–34.9)	30.4 (29.2–31.6)	3.7 (2.68–4.76), <0.00001
Pseudocellulitis, mean (95% CI)	31.5 (29.3–33.6)	31.3 (29.2–33.3)	0.2 (–1.07 to 1.49), 0.44425
Difference, mean (95% CI), P-value	2.6 (0.7–4.6), 0.008	–0.9 (–3.3 to 1.6), 0.48	3.5 (1.9–5.2), 0.002

Abbreviation: CI, confidence interval.

- Predictive model threshold
 - 0.47°C or greater between affected/unaffected skin 87.5% accuracy



Etiology of Pneumonia in the Community (EPIC) Study

- 2,259 pts admitted with CAP-radiographic confirmation
- Pathogen detected in only 38% of cases – extensive search
- Viral = 23%, bacterial = 11%, combo = 3%, fungal = 1%
- *Strep pneumo* most common bacteria at 5% of cases

PCT - Basics

- High sensitivity assay
 - Cutoff values (ng/mL)
 - Turn-around-time ~ 20 min.
 - Cost = \$37 per 2017 guide
 - FDA approved for LRTI in 2017



PCT – A Useful Tool

- CXR Limitations

- Infiltrate pattern cannot predict etiology
- Low diagnostic yield in suspected pneumonia
- Poor interrater reliability, EPs/radiology

Courtoy et al 1989, Wilkins 2005, Campbell et al 2005

- 2017 Cochrane Review: PCT for LRTI

- 26 RCTs, 6,708 subjects
- No increase in treatment failure (moderate LOE)
- Reduced mortality, antibiotic utilization, and adverse reactions (high LOE)

Schuetz et al 2017

- ProACT trial – Design limitations?

What about ProACT?

- 14 center RCT, 1656 participants
- LRTI – Physician “Willing to consider PCT?”
- Included asthma, bronchitis, COPD and pneumonia
- Only 39% adherence in pneumonia pts
- Reduced abx for bronchitis (82% adherence)

Procalcitonin-Guided Use of Antibiotics for Lower Respiratory Tract Infection.

Huang DT¹, Yealy DM¹, Filbin MR¹, Brown AM¹, Chang CH¹, Doi Y¹, Donnino MW¹, Fine J¹, Fine MJ¹, Fischer MA¹, Holst JM¹, Hou PC¹, Kellum JA¹, Khan F¹, Kurz MC¹, Loffipour S¹, LoVecchio F¹, Peck-Palmer OM¹, Pike F¹, Prunty H¹, Sherwin RL¹, Southerland L¹, Terndrup T¹, Weissfeld LA¹, Yabes J¹, Angus DC¹; ProACT Investigators.

Procalcitonin-Guided Antibiotic Use

The null result for the use of procalcitonin level to guide the prescription of antibiotics, reported by Huang et al. (July 19 issue),¹ is incongruent with our experience as an early emergency department (ED) adopter. Rapid procalcitonin assays have been ordered for more than 4000 patients since 2014. The ability of procalcitonin to differentiate viral from bacterial infections is most helpful when there is uncertainty as to whether a diagnosis of bronchitis or pneumonia should be made.²⁻⁴ Since both conditions often have viral causes, the results of a procalcitonin assay, if used as a guide, have the potential to substantially reduce ED antibiotic prescribing.⁵ Unfortunately, less than half of the trial participants had these diagnoses. For bronchitis, procalcitonin guidance was followed in most cases, yielding a 14.8% reduction in ED antibiotic prescribing.¹ Conversely, in patients with pneumonia, the procalcitonin result was almost universally disregarded (77.7% of patients had a negative result on the procalcitonin assay, yet 71.9% received antibiotics).¹ Simply put, clinicians did not trust procalcitonin even among a cohort of patients in which the majority had a Pneumonia Severity Index (PSI) score indicating low risk (with 60% having PSI Class I or II pneumonia), a factor that attenuated the observed 4.4% reduction in ED antibiotic prescribing for pneumonia.¹ Future work should focus on the usefulness and implementation of the procalcitonin assay for patients in whom pneumonia is suspected.

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Table S12. Clinician adherence to procalcitonin-guided antibiotic prescription, by center.

Center	PCT group patients (n)	PCT guideline adherence (%)
1	54	83.3
2	26	80.8
3	85	78.8
4	97	72.2
5	26	69.2
6	61	68.9
7	111	67.6
8	33	66.7
9	26	65.4
10	42	64.3
11	64	59.4
12	73	43.8
13	56	42.9
14	38	39.5

PCT – procalcitonin. PCT guideline adherence defined as clinicians followed the guideline at all timepoints.

The ProACT trial does not inform the evidence base regarding safety and clinical effectiveness of procalcitonin (PCT) as a biomarker to guide antibiotic administration for LRTIs, but reveals potential challenges in the introduction of PCT in real life.

Cite as: Mathioudakis AG, Vestbo J. Was the implementation strategy of the ProACT trial adequately proactive? *Breathe* 2019; 15: 77–80.

2019 IDSA Guideline: Asymptomatic Bacteriuria

- Older patients with functional and/or cognitive impairment with bacteriuria and delirium (acute mental status change, confusion) or fall and without local genitourinary symptoms or other systemic signs of infection (eg, fever or hemodynamic instability), we recommend assessment for other causes and careful observation rather than antimicrobial treatment (strong recommendation, very low-quality evidence).

Asymptomatic Bacteriuria

Published CID, 3/21/2019

Clinical Infectious Diseases, ciy1121, <https://doi.org/10.1093/cid/ciy1121>

Published: 21 March 2019

UTI MythBusters

- Cloudy/smelly urine
 - Leuk. esterase/nitrates
 - Pyuria
 - Bacteriuria
 - 10% of healthy adult women
 - 15% of pregnant women
 - 50% of community dwelling older women
 - 75% of women in long term care settings
 - 100% of chronically catheterized patients
- ≠ UTI

MITIGATE ANTIMICROBIAL STEWARDSHIP TOOLKIT

A guide for practical implementation in adult and pediatric emergency department and urgent care settings



Larissa May, Kabir Yadav, Samuel D. Gaona, Rakesh Mistry, Aubyn Stahmer, Daniella Meeker, Jason Doctor, and Ross Fleischman.

Version 4/13/18

- Google MITIGATE Toolkit
- https://qioprogram.org/sites/default/files/editors/141/MITIGATE_TOOLKIT_final_approved%281%29_508.pdf
- ACEP Resolution 38(18) Support of AMS in the ED
 - <https://www.acep.org/globalassets/new-pdfs/council/2018-resolutions-compendium.pdf>

AAEM Antimicrobial Stewardship Task Force

- Established in 2015 as part of White House Forum
 - ‘Safe harbors’ for guideline compliant care
 - Need accurate, rapid (1 hour) diagnostics
- <https://www.aaem.org/get-involved/committees/task-forces/antibiotic-stewardship>
- AMS Pledge: <https://form.jotform.us/83176352658162>



AAEM Works for Antibiotic Stewardship on the National Stage

Michael S. Pulla, MD FAAEM
Chair, AAEM Antimicrobial Stewardship Task Force

ANY
QUESTIONS?

