An Automated, Pharmacist-Driven Initiative Improves Quality of Care for Staphylococcus aureus Bacteremia

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Journal Club Format

• Issue being studied
• Rationale
• Study design and methodology
• Main outcomes
• Primary conclusions
• Study limitations
• Study implications
• Questions/discussion
“The objective of this study was to evaluate the impact of an automated, pharmacist-driven targeted initiative for patients with *S. aureus* bacteremia (SAB).”
Rationale

• All patients with SAB were not being optimally managed. We could do better. We should do better. The challenge was how? Mandate ID consults? Pharmacists manage 24/7?
• As ASPs develop, we need to explore ways to maximize program efficiency.
• Technological advances such as the electronic medical record (EMR) and clinical decision support systems (CDSS) allow ASPs to deliver more efficient patient care.
• Incorporating health informatics allows ASPs to more seamlessly integrate data from various sources to optimize patient outcomes.
Study Design and Methodology

- **Design**: Retrospective, quasi-experimental study.
- **Subjects**: All hospitalized adult inpatients with a blood culture positive for *S. aureus*. (Only first episode of SAB per patient analyzed.)
- **Time frame**:
  - Pre-intervention period: January to March 2015
  - Intervention period: January to March 2016
- **Exclusions**: included patients who:
  - Were incarcerated.
  - Received an ID consult prior to positive blood culture.
  - Were transferred from an outside hospital with ongoing SAB on admission.
  - Were discharged prematurely against medical advice.
Study Design and Methodology

PRE-INTERVENTION

• Blood cultures: Standard analysis using RDT Verigene Gram positive blood culture (BC-GP) assay.

• Initial reporting: Laboratory personnel notified treating physician within 10 minutes (during both pre-intervention and intervention periods).

• Evidence-based practice guideline: Provided to clinicians for diagnosis and management of SAB.

• ASP evaluation: Case-by-case basis; no formal system-wide process to actively promote SAB quality-of-care measures.
Diagnosis and Management of *Staphylococcus aureus*
Bacteremia in Adults

- Suspected bloodstream infection*
- Two sets of blood cultures obtained
- Empiric antibiotics initiated

Blood culture(s) positive

- Nanosphere’s Verigene Gram-positive nucleic acid array performed directly on positive blood culture.
- Genus, species and resistance determinant identified in 2.5 hours.

Staphylococcus aureus DNA detected

Confirmed *Staphylococcus aureus* bacteremia:
- S. aureus isolated from blood culture should NEVER be considered a contaminant.

MSSA bacteremia

- Immediately begin nafcillin (refer to dosing chart on page 2).
- Cefazolin should be considered as an alternative therapy to nafcillin in patients with history of non-anaphylactic reaction to penicillins and those with severe hepatic dysfunction.
- Obtain Infectious Diseases consult.
- Repeat blood cultures daily until negative x 72 hours.
- Remove indwelling IV catheters.
- Obtain echocardiogram:
  - Obtain TEE in patients with a prosthetic valve or congenital heart disease.
  - If TTE is negative, obtain a TEE in patients whose fever and bacteremia do not resolve within 72 hours, presence of intracardiac device, hemodialysis dependency, or spinal infection or nonvertebral osteomyelitis.
  - If TTE is inadequate or of poor quality, discuss need for TEE with Echo (TEE) lab physicians.
- Rule out disseminated infection (i.e. endocarditis, septic arthritis, discitis, osteomyelitis, thrombophlebitis).

Methicillin resistance (meA) detected? YES

MRSA bacteremia

- Immediately begin vancomycin (refer to dosing chart on page 2).
- Obtain Infectious Diseases consult.
- Repeat blood cultures daily until negative x 72 hours.
- Remove indwelling IV catheters.
- Obtain echocardiogram:
  - Obtain TEE in patients with a prosthetic valve or congenital heart disease.
  - If TTE is negative, obtain a TEE in patients whose fever and bacteremia do not resolve within 72 hours, presence of intracardiac device, hemodialysis dependency, or spinal infection or nonvertebral osteomyelitis.
  - If TTE is inadequate or of poor quality, discuss need for TEE with Echo (TEE) lab physicians.
- Rule out disseminated infection (i.e. endocarditis, septic arthritis, discitis, osteomyelitis, thrombophlebitis).
- Daptomycin, ceftriaxone, or telavancin should be considered as an alternative to vancomycin in patients who have received > 6 weeks of prior vancomycin or with a history of MRSA bacteremia treated with vancomycin.

Recommended duration of therapy for bacteremia without disseminated infection (i.e. endocarditis, septic arthritis, discitis, osteomyelitis, thrombophlebitis) is at least 4 weeks from first documented negative blood culture with resolution of symptoms. Two weeks of therapy may be considered if ALL of the following criteria are met:
- Exclusion of endocarditis.
  - TTE: if negative or poor quality, consider TEE.
- No implanted prostheses or cardiac devices (PPM, ICD).
- Follow-up cultures are negative x 72 hours.
- Afebrile (<100.4°F) within 72 h of therapy.
- No evidence of metastatic sites of infection.
- Patient is not diabetic.
- All potential sources have been removed.
- Patient is not immunocompromised:
  - Neutropenia with ANC ≤ 500 cells/μL.
  - HIV with CD4 count < 200 cells/mm^2.
  - Receipt of chemotherapy within previous 2 weeks: for active malignancy.
  - Administration of immunosuppressive agents (azathioprine, cyclosporine, tacrolimus, sirolimus, and mycophenolate).
  - Administration of corticosteroid dose equivalent to 20 mg prednisone for at least 1 month.
Study Design and Methodology

POST-INTERVENTION

• **Pharmacist notification 24/7**: Service-based pharmacists notified of BC-GP results every 15 minutes through use of patient scoring tool.

• **Scoring tool**: Developed by project team consisting of 3 informatics pharmacists and 2 ID pharmacists.

• **Pharmacist action**: Pharmacists required to review patient scoring tool list at least once per shift (during 3 8-hr shifts). All patients with SAB evaluated; verbal and written recommendations provided to treating physician via EMR, as needed.
DATA AND OUTCOMES

• **Data obtained:** Age, sex, hospital service, wide range of comorbidities (including SAB in previous 90 days, source of SAB, SA methicillin susceptibility, and hospital or community SAB acquisition).

• **Primary outcomes:** Overall compliance and adherence to individual quality-of-care components:
  - ID consult
  - Repeat blood cultures
  - Echocardiogram
  - Initiation of SAB-targeted antimicrobial treatment (including time to initiation of targeted therapy)
Study Design and Methodology

DATA AND OUTCOMES (cont.)

• **Secondary Outcomes:**
  – Time to pharmacist intervention (difference between time BC-GP signaled positive for *S. aureus* and pharmacist documentation in EMR)
  – Duration of bacteremia
  – Length of hospital stay (LOS)
  – Infection-related LOS
  – 30-day readmission
  – 30-day all-cause mortality
123 Patients Screened

38 patients excluded:
- Received ID consult prior to SAB (36)
- Duplicate encounters (2)
- Age >89 years (1)

Pre-Intervention: 45 patients

Intervention: 39 patients
Subject Assessment

• Demographics and baseline characteristics: Well matched between the 2 groups.

• SAB source and data:
  – Catheter-related source most common.
  – MRSA accounted for over half of SAB episodes.
  – 2/3 and 3/4 of SAB occurrences were community-acquired in pre-intervention and intervention groups, respectively.
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Initiation of targeted antibiotics for SAB
- 40 hours sooner in intervention group

ID consults
- 84% → 100%
- \( P = 0.01 \)

Repeat blood cultures
- 95% → 100%
- \( P = 0.49 \)


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**Echocardiogram**

- 93% → 92%

**Mortality**

- 6 fold higher in pre-intervention

- 15% → 2%

  P<0.06

**Overall compliance**

- 68% → 92%

  P<0.008

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## Clinical Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pre-intervention (n = 45)</th>
<th>Intervention (n = 39)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of inpatient antibiotics, d</td>
<td>9.7 [0.98–71.4]</td>
<td>11.5 [1.5–56.6]</td>
<td>.433</td>
</tr>
<tr>
<td>Duration of bacteremia, d</td>
<td>3.1 [0.04–16.4]</td>
<td>2.9 [0.8–13.8]</td>
<td>.981</td>
</tr>
<tr>
<td>Infection-related LOS, d</td>
<td>8.5 [0.4–71.5]</td>
<td>11 [0.8–52.5]</td>
<td>.155</td>
</tr>
<tr>
<td>30-d all-cause mortality</td>
<td>7 (15.6)</td>
<td>1 (2.6)</td>
<td>.063</td>
</tr>
<tr>
<td>30-d readmission</td>
<td>24 (53.3)</td>
<td>16 (41)</td>
<td>.260</td>
</tr>
</tbody>
</table>

Data presented as n (%) or median [min-max].

Abbreviation: LOS, length-of-stay.
Conclusion

• An automated, pharmacist-driven initiative significantly improved adherence to quality-of-care components for patients with S. aureus bacteremia.

• Implementation of a pharmacist-driven intervention in patients with SAB resulted in a significant increase in
  1. number of patients receiving (not mandating) an ID consult
  2. number of patients receiving targeted antibiotic therapy

• We accomplished this by leveraging frontline pharmacists without additional stewardship efforts
Study Limitations

• Use of retrospective design: led to inability to definitively assign causality for process measure compliance.

• Small sample size, single-center, non-randomized.

• Pharmacists only required to review patient scoring tool once per shift.

• Pharmacists did not record amount of time required to make recommendations and interventions, but workload seemed manageable.

• Large disparities noted in some clinical endpoints (eg, mortality) but not statistically significant, possibly owing to small sample size.
Study Implications

• First study to demonstrate impact of an automated, pharmacist-driven intervention for management of patients with SAB.
• Findings show that pharmacist engagement via the EMR can serve as a framework for providing more efficient, impactful, disease state-based patient care for SAB.
Questions and Discussion