Staphylococcus aureus Bacteremia
Bundle Implementation

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Atlanta, Georgia
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Antimicrobial Stewardship

Optimize antibiotic selection, dose, frequency, duration

Optimize Treatment Management

▲ Outcomes

▼ Resistance

▼ ADRs

▼ Costs

ADR = adverse drug reactions

Bundle Implementation Timeline

- Identifying the problem
- Collect data
- Present data
- Bundle approval
- Go-live!
- Intervention analysis
Identifying the Problem

Overall
• Institutional goals
• Literature?
• Your biggest pet peeve
• Stewardship initiative

Grady Experience
*Staphylococcus aureus* bacteremia (SAB)
• Repeat blood cultures
• Source control
• ID consultation
Collecting SAB Data

Overall
• Guidelines

• Supporting literature
  – See data

Grady Experience
• Assigned priority antimicrobial stewardship project
• Assigned pharmacy student project
## Management Bundles on SAB

<table>
<thead>
<tr>
<th>S. aureus</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lopez-Cortes</td>
<td>14-day mortality (OR 0.49; p=0.016)</td>
</tr>
<tr>
<td>Clin Infect Dis 2013</td>
<td>30-day mortality (OR 0.59; p=0.04)</td>
</tr>
<tr>
<td>Nguyen et al.</td>
<td>readmission for recurrent SAB (11.0% vs 1.1%; p 0.008)</td>
</tr>
<tr>
<td>J Antimicrob Chem 2015</td>
<td></td>
</tr>
</tbody>
</table>

OR = odds ratio
# Outcomes for ID Consultation for SAB

<table>
<thead>
<tr>
<th>Study</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bai et al. CID 2015</td>
<td>↓ in-hospital mortality 28%</td>
</tr>
<tr>
<td></td>
<td>↓ by 3 days in LOS</td>
</tr>
<tr>
<td>Tissot et al J Infect 2015</td>
<td>↓ 30-day mortality 50%</td>
</tr>
<tr>
<td></td>
<td>↓ in-hospital mortality 55%</td>
</tr>
<tr>
<td></td>
<td>↓ by 5 days infection related LOS</td>
</tr>
<tr>
<td>Fries et al. CID 2013</td>
<td>↓ crude mortality 65%</td>
</tr>
<tr>
<td></td>
<td>↑ source removal/drained 68%</td>
</tr>
<tr>
<td>Honda et al. Am J Med 2010</td>
<td>↓ 28-d mortality 56%</td>
</tr>
</tbody>
</table>

LOS = length of stay
# SAB Data

<table>
<thead>
<tr>
<th>Data collection period: 9/1/2013 to 8/31/2014</th>
<th>N = 80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Mortality, n (%)</td>
<td>9 (11.3)</td>
</tr>
<tr>
<td>Received all SAB bundle components, n (%)</td>
<td>20 (25)</td>
</tr>
<tr>
<td>Average infection-related length of stay (iLOS), days</td>
<td>19.2</td>
</tr>
<tr>
<td>Patients who received an ID consult, n (%)</td>
<td>59 (74)</td>
</tr>
</tbody>
</table>

## Adherence to individual SAB bundle components

| Follow up cultures within 96 hours, n (%) | 68 (85) |
| Source control, n (%)                   | 48 (60) |
| Echocardiography (TEE), n (%)            | 32 (40) |
| Appropriate definitive treatment, n (%)  | 71 (89) |

| Adequate treatment duration, n (%)       | 57 (80) |

*patients who expired or were discharged prior to treatment duration being determined were excluded

*Mortality rate in previously published literature has been reported from 10 to 30%*
Present Data/Bundle Approval

- Antimicrobial Subcommittee
  - Create and agree upon bundle
- P&T Committee
- Infection Control Committee
- Critical Care Committee
- Medical Executive Committee
  - Best practice alert (BPA)
  - Order set
**Grady Health System Staphylococcus aureus Bacteremia Management Bundle**

1. **CONSULTATION**  
   Infectious Diseases  
   • Within first 5 days of first positive blood culture

2. **SOURCE CONTROL**  
   • Removal of intravascular catheters within 24 hours of diagnosis  
   • Do not insert any central vascular access, prosthesis or other foreign material until negative blood cultures are documented for at least 48 hours  
   • Drainage of abscesses or removal of prosthetic or cardiac devices if thought to be the source

3. **REPEAT BLOOD CULTURES**  
   • Within 48-72 hours of first positive blood cultures  
   • Follow-up blood cultures every day or every other day, to document clearance of bacteremia

4. **ECHOCARDIOGRAM**  
   • Transesophageal echocardiogram (TEE) in high risk patients (ie. Prosthetic valve, persistent bacteremia) or in patients is considered complicated and/or clinical suspicion is high to rule out infective endocarditis  
   • Transthoracic echocardiogram (TTE) should be performed in all patients with Staphylococcus aureus bacteremia; **TTE is insufficient to rule out infective endocarditis**

5. **ANTIBIOTIC MANAGEMENT**  
   **Empiric management with vancomycin or known MRSA**  
   • Vancomycin IV (pharmacy to dose) with goal trough of 15-20 mcg/ml obtained prior to 4th or 5th dose; adjusted if not at goal  
   **MSSA**  
   • Nafcillin 6 g IV q12h as continuous infusion or cefazolin 2 g IV q8h  
   • Do not use vancomycin unless contraindication to use nafcillin or cefazolin  
   • Consider desensitization in patient with severe penicillin allergy

6. **DURATION OF THERAPY**  
   • Patients **NOT** meeting ALL of the below criteria would qualify as complicated SAB and will require **minimum ≥ 28 days** of intravenous therapy from first documented clear blood culture  
   • Patients who meet **ALL** of the following criteria below qualify as an uncomplicated SAB and must be treated for a **minimum of 14 days** from first documented clear blood culture  
     • Exclusion of endocarditis  
     • No implanted prostheses/graft material  
     • Blood culture clearance within 72 hours of initial positive culture  
     • Full source control (ie removal of central line, drainage of abscess)  
     • Defervescence within 72 hours of initiating effective therapy  
     • Immunocompetent (no comorbid conditions such as diabetes, hemodialysis, HIV/AIDS, malignancy, chronic corticosteroid use, does not use immunomodulatory therapy)  
     • No evidence of metastasis to other sites (ie heart, spine, bone, joints)

*SAB = Staphylococcus aureus bacteremia; MRSA = methicillin-resistant S. aureus; MSSA = methicillin-susceptible S. aureus*
Go-Live!

Pre-Go Live

• Work with information technology department
  – Build:
    • BPA
    • Order set

• Set go-live date
  – August 3rd 2016

• EDUCATION!
Positive for *Staphylococcus Aureus*

Result for Blood Culture:

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Component</th>
<th>Value</th>
<th>Units</th>
<th>Date/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Culture [71038317] (Abnormal)</td>
<td>Specimen Information: BLOOD Culture</td>
<td></td>
<td></td>
<td>Collected: 03/03/16 1649</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Updated: 03/03/16 1649</td>
</tr>
</tbody>
</table>

Your patient has been identified as having *Staphylococcus aureus* bacteremia. Please use the *Staphylococcus aureus* bacteremia order set for further management recommendations in compliance with national guidelines for optimal care.

*Staphylococcus aureus* bacteremia Bundle

- Daily blood cultures until blood culture negative
- Removal of intravascular catheters
- Transthoracic echocardiogram to evaluate for endocarditis
- Infectious Diseases should be consulted

**Acknowledge reason:**

- Clinically not indicated
- I am not a Primary Provider
- Order set contents already ordered

**Open Order Set:** Adult *Staphylococcus Aureus* Bacteremia
Prompt Infectious Disease consultation has been shown to dramatically reduce morbidity and mortality in this situation, and is therefore strongly recommended.

<table>
<thead>
<tr>
<th>Consults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeat blood cultures</td>
</tr>
<tr>
<td>Line management (source control)</td>
</tr>
<tr>
<td>Echocardiograph</td>
</tr>
<tr>
<td>Antibiotics</td>
</tr>
</tbody>
</table>
## Intervention Analysis

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pre-Bundle (n=117)</th>
<th>*Post-Bundle (n=75)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-hospital all-cause mortality, n (%)</td>
<td>14 (12.0)</td>
<td>5 (6.7)</td>
</tr>
<tr>
<td>30-day readmission rate, n (%)</td>
<td>30 (25.6)</td>
<td>12 (16.0)</td>
</tr>
<tr>
<td>Hospital LOS (days), median (IQR)</td>
<td>16 (10-32)</td>
<td>17 (10-25)</td>
</tr>
<tr>
<td>Infection-related LOS (days), median (IQR)</td>
<td>13 (9-25)</td>
<td>15 (10-21)</td>
</tr>
<tr>
<td>SAB order set utilization, n (%)</td>
<td>N/A</td>
<td>52 (69.3)</td>
</tr>
</tbody>
</table>

*preliminary data
Intervention Analysis

• In progress
  – Overall Total Bundle Compliance
  – Individual Bundle Element Compliance

• Present data to various groups
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