Mucosal Barrier Injury
Laboratory-Confirmed Bloodstream Infection

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Objectives

- Review: How do CLABSi occur?
- How do we measure CLABSI and why does this matter?
- MBI-LCBI
- So What?

How does CLABSI occur?

Where do these bugs come from?

How does CLABSI happen?

1. **Contamination** of the line with microorganism(s) *
2. Biofilm formation
3. Release of pathogen into blood +/- surrounding tissues
4. Signs/symptoms:
   - Fever/rigors and sepsis syndrome
   - Positive peripheral blood cultures
   - +/- Invasion of skin/soft tissue (exit site infection)
Contamination occurs...

- Insertion:
  - Patient's Skin
  - Operator (Spit, Hair, Hands)
  - Environment

- Maintenance:
  - Cap becomes grungy or poorly functioning
  - Operator (Spit, Hair, Hands) during assessments + routine dressing changes
  - Bacterial migration along catheter tract from skin

How does CLABSI happen?

- Hematogenous spread from infection from another source...
- ... And lands on clean catheter → biofilm → ongoing nidus of infection if not removed.

- "Secondary" BSI
  - Blood may be "dirty" from another infected source

OR...

- Blood may be "dirty" from another infected source
NHSN CLABSI = LCBSI + Central Line

- 3 LCBI criteria
  1. Recognized pathogen (1 +cx)
  2. Common skin commensal (≥2 separate +cx with ≤1 day gap between)
  3. Neonates + common skin commensal
- For all: “sign of infection and positive laboratory results are not related to an infection at another site”
  
  CDC/NHSN

The Good News?

- CLABSI incidence is down-trending
- 58% fewer CLABSI in hospital ICU patients in 2009 than in 2001
- Prevention efforts have saved ~3,000-6,000 lives and ~$414 million in extra medical costs (2009 compared with 2001)
The Central Line Bundle

Additional interventions:
- PICC teams
- Tunneled lines
- Data Feedback and “scorecards” for quality
- Daily CHG Bathing in ICUs

Central Line Associated BSI in 2013: High Stakes

- CLABSI is a rare event. Every case is examined for root cause.
- Public reporting is the rule
- Financial penalties for CLABSI are a reality (since 2008)
- Reputation is affected

- Critique of surveillance definitions is at an all-time high.
What definition/method best reflects truth?

Surveillance definition is not ideal!!

- Unambiguous definitions
- Minimal time required to collect
- No noise
- Low to No inter-observer variability
- Clinically relevant
- Validated
- Useful to interested parties and consumers

Edmond, ME. SHEA Training Conference 2012.

How do we measure CLABSI for Public Reporting?

1. CDC/NHSN surveillance definitions
   - Trained infection preventionists
   - Standardized to the degree possible
   - Good sensitivity, traditionally less interested in specificity
2. CMS HAC (per 2008 “no pay” rule)
   - Billing code + present on admission
NHSN CLABSI vs. CMS HAC

Central Line-Associated Infections as Defined by the Centers for Medicare and Medicaid Services' Hospital-Acquired Condition versus Standard Infection Control Surveillance: Why Hospital Compare Seems Conflicted

Overlap 112 (13%)

% Concordance
- Tertiary 13%
- Community 8%

NHSN CLABSI Rate: What factors (other than good prevention practice) affect it?
- Complicated patient populations
- Device utilization
- Culturing practices
- Antimicrobial utilization
- Surveillance practices
- Administrative pressure
- Adjudication

• CLABSI rates are down, however “getting to zero” is not possible with current definitions
• Critical review of each CLABSI – impacts morale
• Bacteremia due to a gut translocation mechanisms will not meet criteria for an NHSN site-specific infection

### Timeline

<table>
<thead>
<tr>
<th>Day</th>
<th>Clinical events</th>
<th>Diagnostics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>Woman admitted to ICU from ED s/p MVA + abd trauma.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central line placed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR for ex lap:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Liver lac  repaired</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Packing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Embolization of gastric arteries (no bowel injury noted)</td>
<td></td>
</tr>
<tr>
<td>Day 2</td>
<td>Back to OR for ex lap:</td>
<td>No intra-op cultures</td>
</tr>
<tr>
<td></td>
<td>Gangrenous GB  removed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bowel ischemia  transverse colon repair</td>
<td></td>
</tr>
<tr>
<td>Day 3</td>
<td>Back to OR for ex lap:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gastric perf  repaired</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hemidiaphragm repair</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No overt indication of infection (no pus)</td>
<td></td>
</tr>
<tr>
<td>Day 4</td>
<td>ICU for supportive care</td>
<td>Blood cultures</td>
</tr>
<tr>
<td></td>
<td>+Fever</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+Proteus mirabilis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+Pantoea agglomerans</td>
<td></td>
</tr>
</tbody>
</table>

**CLABSI**

Infections not specified elsewhere including gallbladder, bile ducts, liver (excluding viral hepatitis), spleen, pancreas, peritoneum, subphrenic or subdiaphragmatic space, or other intraabdominal tissue or area not specified elsewhere

Intraabdominal infections must meet at least 1 of the following criteria:

1. Patient has organisms cultured from purulent material from intraabdominal space obtained during a surgical operation or needle aspiration

2. Patient has abscess or other evidence of intraabdominal infection seen during a surgical operation or histopathologic examination

3. Patient has at least 2 of the following signs or symptoms with no other recognized cause:
   a) organisms cultured from drainage from surgically placed drain (e.g., closed suction drainage system, open drain, T-tube drain)
   b) organisms seen on Gram’s stain of drainage or tissue obtained during surgical operation or needle aspiration
   c) organisms cultured from blood and radiographic evidence of infection (e.g., abnormal findings on ultrasound, CT scan, MRI, or radioactive scans [gallium, technetium, etc] or on abdominal x-ray)
“Gut translocation”: transient or recurrent BSI due to impaired gastrointestinal mucosal barrier. May be due to:

- Immunocompromise
- Bowel surgery
- Bowel ischemia or trauma
- Nutritional status
- Critically ill, ICU patients
- Inflammatory bowel disease (Crohn’s)


Hem/Onc/BMT a “special population”:

Complex patient population
- Highly toxic treatments
- ICU stays
- Complications (infection, bleeding, ADEs)

Device utilization
- True need for central line

Culturing practices
- Bad veins
- Thrombocytopenia

Antimicrobial utilization
- Like water
- Usually appropriate for severity of illness

Surveillance practices
- Variables?

Administrative pressure
- “Protective” of program and reputation

Adjudication
- Clinicians don’t consider many “CLABSI” to be preventable
- Definitions don’t apply well to patient population and leads to rejection of data

CLABSI Rates in Immunocompromised Patients: A Valuable Patient Centered Outcome?
Can we improve the method?

Surveillance

TRUTH

Billing

Clinical

• MBI
  - Term from oncology/BMT literature
  - "Complex and dynamic pathobiological process manifested throughout the entire digestive tract" due to toxicity of chemotherapy
  - Large range of severity: grade 1-4 oral mucositis → diarrhea → typhilitis
  - Severity depends on many factors: type of chemotherapy agents, cytokines, bacterial endotoxins, donor (if BMT)
  - Impacts later development of graft versus host disease


MBI – Neutropenia Relationship

• Inverse
Graft Versus Host Disease (GVHD)

- After BMT, immune cells from the non-identical donor recognize the recipient cells as “foreign” and initiate an immune response that causes disease in the transplant recipient.
- Can attack multiple sites (skin, liver, GI)
- Acute (<100 days post BMT) or Chronic
- **GI GVHD sx**:
  - Abd pain and diarrhea
- **Dx** usually with pathology
- Severity determined by volume of diarrhea

<table>
<thead>
<tr>
<th>GI GVHD Grade</th>
<th>Diarrhea volume (mL/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+1</td>
<td>&gt;500</td>
</tr>
<tr>
<td>+2</td>
<td>&gt;1000</td>
</tr>
<tr>
<td>+3</td>
<td>&gt;1500</td>
</tr>
<tr>
<td>+4</td>
<td>&gt;2000 or severe abd pain +/- ileus</td>
</tr>
</tbody>
</table>

- Usual criteria with pathology
- Severity determined by volume of diarrhea

**LCBSI 1** for specific organisms:
- *Bacteroides* spp., *Candida* spp., *Clostridium* spp.,
- *Enterococcus* spp.,
- *Fusobacterium* spp.,
- *Peptostreptococcus* spp.,
- *Prevotella* spp.,
- *Veillonella* spp.,
- *Enterobacteriaceae*

**MBI criteria** (at least 1 of):
1. s/p allogenic BMT within last 1 year and documented:
   - Grade III or IV GI GVHD
   - ≥1L diarrhea over 24h with onset ≤7 days before the BCx
2. Neutropenic (at least 2d of ANC or WBC <500)
   - ≤3 days before the BCx

**LCBSI 2** when organism is viridans group streptococci alone (not polymicrobial)

**and**

**MBI criteria** (same)
LCBSI 3 In age <1yo, when organism is viridans group streptococci alone

And

MBI criteria (either of):
1. s/p allogenic BMT within the last fy and documented:
   • Grade III or IV GI GVHD or
   • ≥20 mL/kg diarrhea over 24h with onset ≤7 days before the +BCx
2. Neutropenic (at least 2d of ANC or WBC <500)
   • ≤3 days before the +BCx

MBI-LCBI Criteria

MBI-LCBI:

Blood gets "dirty" from a leaky gut

Duke (prelim)

• Jan-Mar 2013
• Facility-wide, 924 beds:
• No MBI were from ICU (i.e. not publically reported).
• 2 in Peds-Hem and 1 in adult BMTU

<table>
<thead>
<tr>
<th>Event</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCBSI (new event, not from ED)</td>
<td>73</td>
</tr>
<tr>
<td>CLABSI</td>
<td>46</td>
</tr>
<tr>
<td>MBI-LCBI</td>
<td>3 (7%)</td>
</tr>
<tr>
<td>Secondary</td>
<td>15</td>
</tr>
<tr>
<td>Non-CLABSI (e.g., PIV)</td>
<td>12</td>
</tr>
</tbody>
</table>
**DICON (prelim)**

- 32 community hospitals reporting for 1-3/2013
- Only 2 MBI (3%) logged so far
- 60 CLABSI / 60616 pt-d
- = 0.99 per 1000 pt-d

**Implications**

- The MBI criteria will only affect institutions (and units) that have hematology/oncology and BMT patient populations
- The MBI criteria only apply to a subset of the whole amount of patients who get CLABSI by a gut translocation mechanism
- It's still important to do CLABSI surveillance and prevention in this patient population.

**Implications**

- For now, MBI-LCBI are still counted in publically reported rates of CLABSI.

Remaining questions:
- How well does this MBI-LCBI definition perform?
- How meaningful is the data? Locally? Nationally?
- Risk adjustment? “Off the hook” in the future?
- How do we prevent MBI-LCBI?
Hem/Onc approach to BSI Prevention?

- Prophylactic antibiotics/antifungals (FQ)
- Enteral Nutrition (even when it hurts)
- Dental hygiene + CHG
- Don’t use such toxic chemo

Take it home

- CLABSI rates are down.
- A subset of CLABSI occur due to spread from gut translocation.
- MBI-LCBIs addresses a special population where a gut translocation mechanism occurs frequently.
- For now, MBI-LCBIs still count for public reporting.
- Effect of the new MBI definition is unknown.
- Continue your vigilant CLABSI prevention efforts and stay tuned.

Thanks!

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