### Frequency of Intravascular Catheter-Related Infections

<table>
<thead>
<tr>
<th>Incidence vs Incidence Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLABSI in two groups of 100 catheters each</td>
</tr>
<tr>
<td>Unit A</td>
</tr>
<tr>
<td>Incidence</td>
</tr>
<tr>
<td>Density</td>
</tr>
<tr>
<td>Duration of cath</td>
</tr>
</tbody>
</table>

**Incidence** refers to the number of catheter-related bloodstream infections per 100 catheters. **Incidence Density** refers to the number of catheter-related bloodstream infections per 1000 catheter-days.

**CLABSI** = Central Line-Associated Bloodstream Infections
Magnitude of the Problem

- United States: 15 million of central vascular catheter (CVC) days in intensive care units (ICUs) each year
- Catheter-associated bloodstream infections (CRBSI)
  - increase hospital costs
  - increase length of stay
  - no clear increase in mortality

Magnitude of the Problem

- In ICUs: 80,000 CRBSIs/year
- In entire hospitals: 250,000 CRBSIs/year
- Goal: to eliminate CRBSI

Good News!

In US, Central Line Associated Bloodstream Infection (CLABSI) Rates in ICUs are Going DOWN!

But......What About Central Line-Associated Infections Outside of the ICU?
A prospective study of peripheral arterial catheter infection and colonization with concurrently sited central venous catheters

Table 1. Colonization and catheter-related bloodstream infection (CR-BSI) associated with arterial and central venous catheters

<table>
<thead>
<tr>
<th>Catheter Type</th>
<th>No. of Catheters</th>
<th>Total Catheter-Days</th>
<th>Colonization</th>
<th>CR-BSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterial catheters</td>
<td>321</td>
<td>1062</td>
<td>17</td>
<td>1.05</td>
</tr>
<tr>
<td>Central venous catheters</td>
<td>618</td>
<td>4060</td>
<td>68</td>
<td>11.0</td>
</tr>
</tbody>
</table>

What About Other Catheters?
Peripheral Venous Catheter-Related Staphylococcus aureus Bacteremia

T. Tony Frisch, MD, Philip A. Davis, MD,1* Osami Edwards, MD,1† Brian Hollis, PhD,2†† Italia Chiang, MD1
Nancy Nelli, RN, Julie A. Jefferson, RN, MPH, Leonard A. Rosenfeld, MD, MPH1

OBJECTIVES: To understand the incidence, risk factors, and outcomes of peripheral venous catheter (PVC)-related bloodstream infections (BSIs).

METHODS: Retrospective study of PVC-related BSIs across two institutions in a pediatric population (Jan 2004 through Dec 2005). A point-prevalence survey was performed every 8 months to assess incidence in addition to the PVC-acquired infections with PVC removed in children to assess risk factors for PVC-related S. aureus bacteremia.

RESULTS: Seventy-nine patients were included.

RECOMMENDATIONS: Special care should be taken when dealing with patients who are neutropenic following chemotherapy.

Discussion

We found significant differences in the microbiology of NHSN-defined CLABSIs in nonneutropenic patients compared with that in patients with neutropenia following chemotherapy. The organisms that were overrepresented in the neutropenic group include common residents of the gastrointestinal tract. These findings provide supporting evidence that many BSIs meeting the NHSN criteria for CLABSI in the setting of neutropenia may represent translocation of gut organisms and also support the efforts by the NHSN to modify the CLABSI definition. The lack of relapse of CLABSI in any patient whose line was not removed during or immediately following treatment of the BSI, particularly for E. coli and streptococcal BSIs, also suggests a source of infection other than the catheter.

On the basis of our findings, we propose that the organisms to attribute to translocation and exclude from the CLABSI definition in the setting of neutropenia and mucosal disruption include E. coli, streptococci, and enterococci. Half (33/70) of these BSIs were caused by E. coli, and 40% (28/70) of these BSIs were caused by streptococci. These findings suggest that the CLABSI definition should be modified to exclude E. coli and streptococci from the list of organisms attributed to translocation.

Table 1. Distribution of Pathogens in Central Line-Associated Bloodstream Infections (CLABSIs) among Patients with and without Neutropenia

<table>
<thead>
<tr>
<th>Organism</th>
<th>Nonneutropenic (n = 264)</th>
<th>Neutropenic (n = 60)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulase-negative staphylococci</td>
<td>8 (3.0%)</td>
<td>12 (18.2%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>40 (15.2%)</td>
<td>6 (9.1%)</td>
<td>0.234</td>
</tr>
<tr>
<td>Methicillin-resistant S. aureus</td>
<td>23 (8.7%)</td>
<td>5 (7.6%)</td>
<td></td>
</tr>
<tr>
<td>Methicillin-susceptible S. aureus</td>
<td>13 (5.0%)</td>
<td>1 (1.5%)</td>
<td>0.323</td>
</tr>
<tr>
<td>Enterococcus species (total)</td>
<td>37 (13.0%)</td>
<td>4 (6.1%)</td>
<td></td>
</tr>
<tr>
<td>Z. faecalis</td>
<td>22 (8.4%)</td>
<td>4 (6.1%)</td>
<td></td>
</tr>
<tr>
<td>Z. lividans</td>
<td>15 (5.7%)</td>
<td>2 (3.0%)</td>
<td></td>
</tr>
<tr>
<td>Enterococcus faecalis</td>
<td>15 (5.7%)</td>
<td>2 (3.0%)</td>
<td></td>
</tr>
<tr>
<td>Vancocin-resistant enterococci</td>
<td>12 (4.5%)</td>
<td>11 (18.2%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Streptococcus species</td>
<td>6 (2.3%)</td>
<td>1 (1.5%)</td>
<td></td>
</tr>
<tr>
<td>Group A streptococci</td>
<td>4 (1.5%)</td>
<td>1 (1.5%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>2 (0.8%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Data are no. (%). Boldface type indicates statistical significance.

a Refers to the number of CLABSIs determined using standard surveillance definitions. Because some infections were polymicrobial, the total number of isolates exceeds the total number of CLABSIs. There were 286 isolates among 244 CLABSIs in the nonneutropenic group and 74 isolates among 66 CLABSIs in the neutropenic group.

b Fisher exact test.

c Includes Morganella, Providencia, and Proteus.

d Includes Bacillus, Corynebacterium, Pantoea, Eubacterium, Lactobacillus, Leuconostoc, and Staphylococcus lugdunensis.

e Includes Bacillus, Clostridium, Corynebacterium, Fusarium, Rothia, Stenotrophomonas (2), and Stomatococcus.
Pathogen-Specific Outcome of Catheter-Related Bloodstream Infection

- Coagulase-negative Staph are most common causes of CRBSI, but...
- Majority of complications from CRBSI due to *S. aureus* or *Candida*

Preventive Strategies Should be Based on Understanding Pathogenesis

Which of the following would you recommend regarding the site of CVC placement?
1. Recommend femoral vein insertion, this site appears to have a lower risk of infection and thrombosis compared with other sites.

2. Recommend subclavian vein insertion, this site appears to have a lower risk of infection compared with other sites.

3. Recommend internal jugular vein insertion, this site appears to have a lower risk of infection compared with other sites.

Meta-analysis of subclavian insertion and nontunneled central venous catheter-associated infection risk reduction in critically ill adults*

Jean-Jacques Parienti, MD, PhD; Denis du Cheyron, MD; Jean-François Timsit, MD, PhD; Guillaume Traoré, MD; Pierre Kalfon, MD; Olivier Mimoz, MD, PhD; Leonard A. Mermel, DO, ScM, AM (Hon)

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Barrier Precautions

- Use barrier precautions for central venous catheter insertion
  - mask, gown, gloves, hat, eye protection and large sheet drape

Efficacy of Barrier Precautions During CVC Insertion

<table>
<thead>
<tr>
<th>Barrier precautions</th>
<th>Minimal</th>
<th>Maximal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cath colonization</td>
<td>7.2%</td>
<td>2.3%*</td>
</tr>
<tr>
<td>Cath sepsis</td>
<td>3.6%</td>
<td>0.6%*</td>
</tr>
</tbody>
</table>

* p<0.05

Raad et al, ICHE 1994

Skin disinfection

- Disinfect the skin prior to catheter insertion

Meta-Analysis: Prospective, Randomized Studies of Alcoholic Chlorhexidine vs Povidone-Iodine Cutaneous Antisepsis

Maiwald & Chan PLOS ONE 2012
### Extra measures

- Bathe patients daily with chlorhexidine-based product rather than soap and water
- Use chlorhexidine-containing dressings at catheter insertion sites

### Problem:

- Use alcoholic chlorhexidine to clean the skin prior to catheter insertion

**Chlorhexidine everywhere??**

- Use chlorhexidine-containing dressings at catheter insertion sites
  - Real potential of development of Chlorhexidine resistance!!

### Catheter Hubs and Connectors

- Clean catheter hubs and connectors before accessing them
- Consider alcohol-impregnated port protector

### Impregnated catheters

- Consider use in individual patients or patient populations with a high incidence of CLABSI despite compliance with basic infection control practice
- Balance pro and con of using more chlorhexidine and local antibiotics
Second generation CSS: as first generation + chlorhexidine on internal surface

First generation CSS: chlorhexidine and silver on external surface

Recommendations

- Line cart or kit with all components needed for aseptic catheter insertion
- Check list for catheter insertion
- Maximal barrier precautions for CVC insertion
- Disinfect skin before catheter insertion
- Minimize femoral line placement
- Catheter insertion & maintenance using a hospital-wide approach to infection prevention by ‘bundling’ multiple evidence-based strategies

Idle central venous catheter-days pose infection risk for patients after discharge from intensive care

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David Pilcher MBBS, MBChB, FRACP, FRICM 3

Daily assessment of catheter use

208/794 days = 26% of the time CVCs were idle!
Remove catheters as soon as possible!!

Compendium & Guidelines for Prevention of Intravascular Catheter-Related Infections