ANTISEPTIC CATHETERS:
A superior form of infection control

Sarah Judkins, MD
Resident Debate
January 28, 2008
Objectives

- Central Venous Catheters
- Historical Prospective
- Antibiotic-Coated Catheters
  - Literature review
  - CDC guidelines
- Cost Analysis
- Conclusions
Who needs a central line?

- Volume resuscitation
- Nutritional support
- Invasive monitoring
- Medication administration
- Lack of peripheral access
Risks

- **Infection 5-26%**
  - 90% of catheter-related bloodstream infections

- **Mechanical 5-19%**
  - Pneumothorax
  - Hemothorax

- **Thrombosis 2-26%**

Why do we care?

- 3 million CVC inserted each year
- ~200,000 cases of CR-BSI each year
- 10-25% case fatality rate associated with CR-BSI
- Prolongs hospitalization by 7-14 days
- Adds $30,000 to the cost of hospitalization
Sources of Infection

- Insertion
- Contaminated Tubing
- Migrating Skin Flora
- Blood-borne Organisms
Insertion

- **Proper Attire**
  - mask, gown, hat, sterile gloves

- **Chlohexidine Prep**

- **Location**
  - Subclavian, Internal jugular, Femoral

McGee DC, et al, NEJM 2003
Swan-Ganz catheters had heparin bonded with benzalkonium chloride coated catheters CR-BSI 1.0% VS. plain 2.8%

→ Fortuitous surface with antimicrobial activity

Randomized Trial

403 catheters in 158 patients

- 9 CR-BSI in control group
  7.6 / 1000 catheter-days

- 2 CR-BSI in antiseptic catheter group
  1.6 / 1000 catheter-days (p=0.03)

→ reduced nosocomial bloodstream infections by 45%

Risk for Catheter-Related Bloodstream Infection per 100 Catheters

- Control Catheters ($n = 195$)
- Antiseptic Catheters ($n = 208$)

<table>
<thead>
<tr>
<th>Days Catheter in Place</th>
<th>Control</th>
<th>Antiseptic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>195</td>
<td>208</td>
</tr>
<tr>
<td>1-2</td>
<td>193</td>
<td>198</td>
</tr>
<tr>
<td>2-3</td>
<td>184</td>
<td>191</td>
</tr>
<tr>
<td>3-4</td>
<td>168</td>
<td>184</td>
</tr>
<tr>
<td>4-5</td>
<td>154</td>
<td>175</td>
</tr>
<tr>
<td>5-6</td>
<td>111</td>
<td>135</td>
</tr>
<tr>
<td>6-7</td>
<td>78</td>
<td>86</td>
</tr>
<tr>
<td>7-8</td>
<td>51</td>
<td>49</td>
</tr>
<tr>
<td>8-9</td>
<td>34</td>
<td>33</td>
</tr>
<tr>
<td>≥9</td>
<td>23</td>
<td>26</td>
</tr>
</tbody>
</table>
Randomized Trial

- 237 catheters placed in 119 patients
  - 58 AIC
    - 2/100 CR-BSI $\rightarrow$ 1.14/1000 catheter days
  - 61 NIC
    - 18/100 CR-BSI $\rightarrow$ 3.95/1000 catheter days

$\Rightarrow$ 71% reduction in CR-BSI (p=0.31)

Collin G, Chest 1999
1. only AIC were used
2. length of time and fever not used as reasons for exchange
3. only tip was sent for culture

→ CR-BSI 0.6/1000 catheter days
→ 1.5 less catheters/ patient

=$410/ pt or $34,000/ yr

Collin G, Chest 1999
Meta-analysis

- 1966-1998
- 11 randomized trials
- 2603 catheters

\[ \text{Catheter Colonization: OR } 0.44 \]
\[ (95\% \text{CI } 0.36-0.54; P<0.001) \]

\[ \text{CR-BSI: OR } 0.56 \]
\[ (95\% \text{CI } 0.37-0.84; P=0.05) \]

Veenstra DL, JAMA 1999
Meta-analysis

- 1997-2006
- 8 randomized trials

→ CR-BSI: OR 0.23 (95% CI 0.14-0.40; P=0.05)

“... reduction of CR-BSI is significant in the main analysis and in all the subgroup analyses we performed.”

<table>
<thead>
<tr>
<th>Study</th>
<th>OR (fixed) 95% CI</th>
<th>OR (fixed) 95% CI</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raad</td>
<td>0.07 [0.00, 1.17]</td>
<td></td>
<td>1997</td>
</tr>
<tr>
<td>Darouiche (a)</td>
<td>0.08 [0.01, 0.61]</td>
<td></td>
<td>1999</td>
</tr>
<tr>
<td>Chatzinikolaou</td>
<td>0.06 [0.00, 1.03]</td>
<td></td>
<td>2003</td>
</tr>
<tr>
<td>Hanna</td>
<td>0.19 [0.05, 0.68]</td>
<td></td>
<td>2004</td>
</tr>
<tr>
<td>Leon</td>
<td>0.51 [0.18, 1.41]</td>
<td></td>
<td>2004</td>
</tr>
<tr>
<td>Darouiche (b)</td>
<td>0.16 [0.04, 0.76]</td>
<td></td>
<td>2005</td>
</tr>
<tr>
<td>Fraenkel</td>
<td>0.84 [0.22, 3.15]</td>
<td></td>
<td>2006</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>0.23 [0.14, 0.40]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Guidelines

- use antibiotic-coated catheters if expected to remain in place >5 days (1B)
- use aseptic technique (mask, hat, gown, sterile gloves, full sterile body drape) (1A)
- use 2% chlorhexadine for skin prep (1A)
- do NOT routinely replace CVC to prevent infections (1B)
- Subclavian > IJ > Femoral vein insertion (1A)
Cost Analysis

- additional cost of AIC: $25
- CR-BSI: $9738

- CR-BSI: absolute decrease 2.2% (relative 42%)
- mortality: absolute decrease 0.33% (relative 42%)

$196 expected savings cost of catheter

Veenstra DL, et al. JAMA 1999
Our experience: DHMC

- CR-BSI posted in ICU
- 9/1000 catheter days 2005
- central line cart and exclusively AIC
- 3/1000 catheter days 2007
- $35 difference between AIC and NIC
Conclusions

- incidence of CR-BSI
- mortality
- medical care costs
References