What Ursidae is the most insouciant...

Arek Wiktor M.D.
PGY-4
Chlorhexidine + Alcohol (ChloraPrep)

VS

All Other Skin Preparations for Prevention of Surgical Site Infections
Objectives

- Surgical site infections
- Chlorhexidine gluconate
- Fun Game: Which one…?
- Literature review
- Conclusions
Beware of Pandas...

Suckers...

Hey, let's tell people iodine is a great skin prep…what a joke!
Surgical Site Infection (SSI)

- 2.6% of 30 million operations
- #1 Nosocomial infection in surgical patients – 77% of deaths
- Increase hospital stay by an average of 7-12 days and add over $3,000 - $5000 in excess charges
- $1.5 Billion annual cost

http://www.ihi.org/IHI/Topics/PatientSafety/SurgicalSiteInfections

Digison MB. Plastic Surgical Nursing, 2007; 27(4): 185-189
CDC SSI Definitions

Meakins JL.  ACS Surgery Principles and Practice, 2008; Chapter 1-1: pg 1-20
Determinants of the Infectious Process

Bacteria

Host Defense Mechanisms

Surgical Site

Adapted from Meakins JL. ACS Surgery Principles and Practice, 2008; Chapter 1-1: pg 1-20
Classification of Operative Wounds

- **Clean**: No break in sterile field, respiratory, GI, GU tract
- **Clean-Contaminated**: Elective respiratory, GI, GU tract entrance w/ minimal spillage; minor break
- **Contaminated**: Gross spillage; infected urine, bile; trauma <4 hrs old; major break
- **Dirty / Infected**: Purulent inflammation; preoperative perforation; trauma > 4 hrs old
What can we do to prevent SSI?

Meakins JL. ACS Surgery Principles and Practice, 2008; Chapter 1-1: pg 1-20
Skin decontamination

- $10^{13}$ cells
- $10^{14}$ bacteria
- Endogenous bacteria critical SSI
- "Tentative Final Monograph (TFM) for Health-Care Antiseptic Drug Products"

Federal Register, 21 CFR Parts 333 and 369

- 2 Log$_{10}$ reduction for abdominal prep
- 3 Log$_{10}$ reduction for inguinal prep
Skin Decontaminators

- Chlorhexidine gluconate
- Isopropyl alcohol
- Povidone iodine
- Parachlorometaxylenol (PCMX)
- Zinc pyrithione (ZPT)
Chlorhexidine gluconate

$N',N''''-\text{hexane-1,6-diylbis}[N-(4 \text{ chlorophenyl})(\text{imidodicarbonimidic diamide})]$
A Plethora of Chlorhexidine

- **Wide variety of applications**
  - Mouth wash
  - Personal hygiene
  - Pet care

- **Wide variety of applicators**
  - Drums, jugs, bottles, wands

- **Wide variety of colors**
  - Clear, yellow, green, blue, orange, turquoise
Kids love it too!
Which one...?
Which one…

Chlorhexidine  Iodine

was discovered while making a substance to kill people?
Iodine

1811 - Bernard Courtois

Trying to make gunpowder during the Napoleonic Wars
Chlorhexidine

Discovered in a laboratory for the benefit of all mankind
Which one... Chlorhexidine Iodine

in high concentrations can cause severe physiologic disturbances?
Iodine

Iodine is readily absorbed, and can cause hyperthyroidism, metabolic acidosis, renal failure, and hyponatremia.
Chlorhexidine

Very poorly absorbed, no detectable blood levels, no overdose reported, no effect on fetuses

No effect on ability to operate heavy machinery!

Hibiscrub – Summary of Product Characteristics, 2004
Which one…

Chlorhexidine  Iodine

exhibits beta decay?
Iodine

Iodine-131 is one of the most carcinogenic nuclear fission products
Chlorhexidine

Does not have radioactive isotopes
Why Chloraprep?
(2% Chlorhexidine + 70% Alcohol)
Why ChloraPrep?

Hibbard et al. Journal of Infusion Nursing, 2002: 25(4): 244-249
**CFU reductions on the Groin**

- Healthy Volunteers
- CFU counts pre and post treatment

<table>
<thead>
<tr>
<th>Drug / P value</th>
<th>Mean R value Log_{10} Reduction from Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 minutes</td>
</tr>
<tr>
<td><strong>ChloraPrep n=18</strong></td>
<td>3.41</td>
</tr>
<tr>
<td><em>p</em></td>
<td>&lt;.01</td>
</tr>
<tr>
<td><strong>Povidone-iodine n=19</strong></td>
<td>2.44</td>
</tr>
<tr>
<td><em>p</em></td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

Conclusions

“In one study, infection rates were significantly lower when skin was prepared using chlorhexidine compared with iodine… Further research is needed.”

Oh, oh... new data...
Randomized trial

849 patients

6 hospitals

Clean-contaminated cases (colorectal, SB, GI, biliary, thoracic, gynecologic, urologic)

Darouiche et al. NEJM, 2010; 362 (1):18-26
Results

<table>
<thead>
<tr>
<th>Type of Infection</th>
<th>Chlorhexidine-Alcohol (N=409)</th>
<th>Povidone-Iodine (N=440)</th>
<th>Relative Risk (95% CI)*</th>
<th>P Value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any surgical-site infection</td>
<td>39 (9.5)</td>
<td>71 (16.1)</td>
<td>0.59 (0.41–0.85)</td>
<td>0.004</td>
</tr>
<tr>
<td>Superficial incisional infection</td>
<td>17 (4.2)</td>
<td>38 (8.6)</td>
<td>0.48 (0.28–0.84)</td>
<td>0.008</td>
</tr>
<tr>
<td>Deep incisional infection</td>
<td>4 (1.0)</td>
<td>13 (3.0)</td>
<td>0.33 (0.11–1.01)</td>
<td>0.05</td>
</tr>
<tr>
<td>Organ-space infection</td>
<td>18 (4.4)</td>
<td>20 (4.5)</td>
<td>0.97 (0.52–1.80)</td>
<td>&gt;0.99</td>
</tr>
<tr>
<td>Sepsis from surgical-site infection</td>
<td>11 (2.7)</td>
<td>19 (4.3)</td>
<td>0.62 (0.30–1.29)</td>
<td>0.26</td>
</tr>
</tbody>
</table>

Darouiche et al. NEJM, 2010; 362 (1):18-26
41% Risk Reduction!!!
# Type of Surgery

Darouiche et al. NEJM, 2010; 362 (1):18-26

<table>
<thead>
<tr>
<th>Type of Surgery</th>
<th>Chlorhexidine–Alcohol</th>
<th>Povidone–Iodine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total No. of Patients</td>
<td>Patients with Infection no. (%)</td>
</tr>
<tr>
<td>Abdominal</td>
<td>297</td>
<td>37 (12.5)</td>
</tr>
<tr>
<td>Colorectal</td>
<td>186</td>
<td>28 (15.1)</td>
</tr>
<tr>
<td>Biliary</td>
<td>44</td>
<td>2 (4.6)</td>
</tr>
<tr>
<td>Small intestinal</td>
<td>41</td>
<td>4 (9.8)</td>
</tr>
<tr>
<td>Gastroesophageal</td>
<td>26</td>
<td>3 (11.5)</td>
</tr>
<tr>
<td>Nonabdominal</td>
<td>112</td>
<td>2 (1.8)</td>
</tr>
<tr>
<td>Thoracic</td>
<td>44</td>
<td>2 (4.5)</td>
</tr>
<tr>
<td>Gynecologic</td>
<td>42</td>
<td>0</td>
</tr>
<tr>
<td>Urologic</td>
<td>26</td>
<td>0</td>
</tr>
</tbody>
</table>
Probability of No Infection

Darouiche et al. NEJM, 2010; 362 (1):18-26
Risk Factor Analysis

- Use of povidone-iodine
- Preoperative shower with povidone-iodine
- Abdominal surgery
- Alcohol abuse
- Liver cirrhosis
- Cancer
- Diabetes mellitus
- Malnutrition
- Gastrointestinal disease
- Longer duration of surgery, surgical drains

Darouiche et al. NEJM, 2010; 362 (1):18-26
NEJM Editorial

“The weight of evidence suggests that chlorhexidine-alcohol should replace povidone-iodine as the standard for preoperative surgical scrubs.”

Wenzel RP. NEJM, 2010; 362(1):75-77
Systematic review and meta-analysis of preoperative antisepsis with chlorhexidine *versus* povidone–iodine in clean-contaminated surgery

A. Noorani¹, N. Rabey³, S. R. Walsh¹ and R. J. Davies²

- 6 studies
- 5031 patients
- General surgery, OB-GYN
- Pooled odds ratio 0·68, 95 per cent confidence interval 0·50 to 0·94; \( P = 0·019 \)
Chlorhexidine vs Povidone iodine

Noorani et al. British Journal of Surgery, 2010; 97:1614-1620
Chlorhexidine vs Povidone iodine

<table>
<thead>
<tr>
<th>Reference</th>
<th>Odds ratio</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paocharoen et al.</td>
<td>0.62 (0.16, 2.18)</td>
<td>0.62 (0.16, 2.18)</td>
</tr>
<tr>
<td>Darouiche et al.</td>
<td>0.42 (0.23, 0.72)</td>
<td>0.42 (0.23, 0.72)</td>
</tr>
<tr>
<td>Swenson et al.</td>
<td>1.06 (0.69, 1.61)</td>
<td>1.06 (0.69, 1.61)</td>
</tr>
<tr>
<td>Culligan et al.</td>
<td>1.17 (0.00, 0.00)</td>
<td>1.17 (0.00, 0.00)</td>
</tr>
<tr>
<td>Brown et al.</td>
<td>0.74 (0.40, 1.35)</td>
<td>0.74 (0.40, 1.35)</td>
</tr>
<tr>
<td>Berry et al.</td>
<td>0.62 (0.40, 0.96)</td>
<td>0.62 (0.40, 0.96)</td>
</tr>
<tr>
<td>Combined</td>
<td>0.68 (0.50, 0.94)</td>
<td>0.68 (0.50, 0.94)</td>
</tr>
</tbody>
</table>

Noorani et al. British Journal of Surgery, 2010; 97:1614-1620
“Chlorhexidine should be used preferentially for preoperative antisepsis in clean-contaminated surgery.”
Conclusions

- It’s 2011, we need 21st Century science and solutions for 21st Century problems
- Chlorhexidine + Alcohol (ChloroPrep) is superior to povidone-iodine in preventing SSI
- CDC already recommends ChloroPrep for central lines…
- Don’t trust a Panda bear
Thank you!
Beware of Pandas…

Hee, hee, hee…

Hey, people will believe whatever we say because we are so cute and cuddly…