Disclosures

- No pharmaceutical disclosures
- Drug dosing based on body weight discussed which is non-FDA approved.
Objectives

- Acknowledge the importance of SSI
- Define and identify risk factors for SSI
- State principles of antibiotic prophylaxis
- Discuss strategies for prevention
- Identify what YOU will do to prevent SSI at your institution

Importance

- What is the magnitude of the problem of SSI?
  - How common are they?
  - What is the cost?
Effect of SSI on Hospitals

<table>
<thead>
<tr>
<th></th>
<th>With SSI</th>
<th>Without SSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily charge</td>
<td>$7493</td>
<td>$7924</td>
</tr>
<tr>
<td>Length of stay</td>
<td>10.56 days</td>
<td>5.64 days</td>
</tr>
<tr>
<td>Readmission/100</td>
<td>51.94</td>
<td>8.19</td>
</tr>
<tr>
<td>Profit change</td>
<td>$2,268,589</td>
<td></td>
</tr>
</tbody>
</table>


“Costs” of a SSI

- Extreme variation in costs/outcomes
  - $400/case for minor superficial infections noted after discharge
  - $63,135 complex infection related to prosthetic joints
  - $299,237 for mediastinitis after cardiac surgery
  - $6200 for home care after Colon SSI
  - 2006 in Massachusetts $223,000,000-$275,000,00
  - NNIS of 387,000 infections, organ space contributed to death in 89%
Definition

- Define a surgical site infection-
  - Superficial
  - Deep
  - Organ Space

Types of Infection [SSI]
DEFINITION OF SURGICAL SITE INFECTION:

- Purulent drainage from above the fascial layer, deep or superficial
- Organisms isolated from a PRIMARILY closed wound
- Pain/tenderness, redness or heat, and surgeon deliberately opens wound
- Surgeon defines the wound as infected

Inoculation Size

- Normally $10^5$ organisms needed to cause SSI
- Much lower when foreign bodies are present
  - *S. aureus*
    - surgical sutures from $10^6$ to $10^3$
    - PTFE graft 10 CFU
    - 1 CFU with dextran beads
Risk Assessment

- What factors are important in deciding who is at risk of getting a SSI?

**SSI: RISK FACTORS**

**INTRINSIC-PATIENT RELATED**

- Age
- Nutritional status
- Diabetes
- Smoking
- Obesity
- Remote infections
- Endogenous mucosal microorganisms
- Altered immune system
- Preoperative stay-severity of illness
**EXPECTED INFECTION RATES**

- **CLEAN** (Resp, GI, GU, oropharynx not entered, no inflammation, no break in technique) ~ 2%
- **CLEAN-CONTAMINATED** (Resp, GI, GU, or oropharynx entered but no major spillage, minor break in technique) ~ 10%
- **CONTAMINATED** (Gross GI spillage, fresh traumatic wounds; entry into infected GU or biliary tract, major break in technique) ~ 18%
- **DIRTY-INFECTED** (old traumatic wounds, clinical infection, perforated viscous) ~ 42%

**Wound Type**

Types of Infection [SSI]

- Superficial
- Deep
- Organ


NNIS Scoring

- Single Point based on each:
  1) ASA score of 3, 4, 5
  2) Operation Classified as dirty infection
  3) Operation with duration > T hours (>75th percentile of this operation)
Orthopedic Infection Rates

<table>
<thead>
<tr>
<th></th>
<th>N (%)</th>
<th>NNIS 0 N (%)</th>
<th>NNIS 1 N (%)</th>
<th>NNIS 2 N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial SSI</td>
<td>101 (2.5)</td>
<td>46 (2.1)</td>
<td>42 (2.7)</td>
<td>13 (4.5)</td>
</tr>
<tr>
<td>Deep SSI</td>
<td>83 (2.1)</td>
<td>34 (1.6)</td>
<td>33 (2.2)</td>
<td>16 (5.5)</td>
</tr>
<tr>
<td>No SSI</td>
<td>2796 (95.4)</td>
<td>2080 (96.3)</td>
<td>1453 (95.1)</td>
<td>262 (90.0)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3980</strong></td>
<td><strong>2160 (54.3)</strong></td>
<td><strong>1528 (38.4)</strong></td>
<td><strong>292 (7.3)</strong></td>
</tr>
</tbody>
</table>

Skramm I et al. J Hospital Infection 2012:82-243-247
SSI: RISK FACTORS
EXTRINSIC-OPERATION RELATED

- Duration of surgical scrub
- Skin antisepsis
- Preop shaving
- Preop skin prep
- Surgical attire
- Sterile draping
- Surgical technique
- Duration of operation
- Prophylaxis
- Ventilation
- Sterilization of equipment
- Wound class
- Drains

NHSN Modifications

- Procedure specific modifications
- Example: Hip arthroplasty
  - Anesthesia, emergency, trauma, ASA score, wound class, bed size, age, duration, total/partial/revision
- Example colon
  - Anesthesia, endoscope, gender, ASA score, wound class, bed size, age, duration
NON-ANTIBIOTIC FACTORS

- Length of pre-operative stay
- Pre-operative shaving
- Length of operation
- Use of abdominal drains
- Pre-operative showering
- Presence of remote infections
- Normothermia
- Increased oxygenation
- Other factors

What Can I Do and WHY

- Temperature control
- Oxygenation
- Glucose control
- NOT shaving, Clip if needed
- Antibiotic Prophylaxis
  - Right drug, right dose, right time, right duration
Case 1

- 62 yr old man with DM, smoker has a colon cancer and a hemicolecotomy is planned
- What preoperative factors should be considered or modified as they related to infection risk?

- Stop smoking
- Control of glucose
- Ensure no current infections when arrive for surgery
- Preoperative bowel prep
Patient Risk Factors in Colorectal surgery

<table>
<thead>
<tr>
<th>Factor</th>
<th>Adjusted OR [ 95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotic selection*</td>
<td>0.67 [0.47,0.97]</td>
</tr>
<tr>
<td>Postop normothermia</td>
<td>0.40 [0.21,0.79]</td>
</tr>
<tr>
<td>Glucose &gt; 140</td>
<td>1.52 [1.14, 2.01]</td>
</tr>
<tr>
<td>Oral prep + antibiotics</td>
<td>0.54 [0.38,0.77]</td>
</tr>
<tr>
<td>Laparoscopic technique</td>
<td>0.59 [0.44,0.79]</td>
</tr>
<tr>
<td>Open surgical time &gt; 100 min</td>
<td>1.65 [1.22,2.24]</td>
</tr>
<tr>
<td>BMI &gt; 30</td>
<td>1.36 [1.04,1.78]</td>
</tr>
</tbody>
</table>

Cipro/metronidolze, cefazolin/metronidazole, ertapenem all lowered risk


Bowel Prep

Oral and Systemic Antibiotics: Colon Surgery

<table>
<thead>
<tr>
<th>Study</th>
<th>Oral agent</th>
<th>Infection rate</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stellato, 1990</td>
<td>Neomycin-erythromycin</td>
<td>6% vs 4%</td>
<td>1.52 [0.30-9.48]</td>
</tr>
<tr>
<td>Taylor, 1994</td>
<td>Ciprofloxacin</td>
<td>11% vs 18%</td>
<td>0.56 [0.11-1.06]</td>
</tr>
<tr>
<td>McArdle, 1995</td>
<td>Ciprofloxacin</td>
<td>10% vs 23%</td>
<td>0.39 [0.08-0.93]</td>
</tr>
<tr>
<td>Lewis, 2002</td>
<td>Neomycin, metronidazole</td>
<td>5% vs 16.5%</td>
<td>0.29 [0.06-0.83]</td>
</tr>
<tr>
<td>Lewis Meta</td>
<td></td>
<td></td>
<td>0.51 [0.24-0.78]</td>
</tr>
</tbody>
</table>


Case 1

- What should be done in the OR to modify his risk of a SSI?
Case 1

- What about shaving?
- Temperature control?
- Glucose control?
- Oxygenation?
- Skin preparation?
- Does this patient need antibiotics?

Shaving vs Clipping

- SSI- 2.8% (46/1627) shaved vs 1.4% (21/1566) clipped
  \[ \text{RR}=2.03 \ (95\% \ 1.1,3.61) \]
  Shaving should not be performed, when compared to clipping.
- Clipping vs nothing- no difference, 1 trial

Temperature and SSI Following Colectomy

<table>
<thead>
<tr>
<th></th>
<th>Normo (104)</th>
<th>Hypo (96)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSI</td>
<td>6</td>
<td>18</td>
<td>.009</td>
</tr>
<tr>
<td>Collagen dep</td>
<td>328</td>
<td>254</td>
<td>.04</td>
</tr>
<tr>
<td>Time to eat</td>
<td>5.6d</td>
<td>6.5d</td>
<td>&lt;.006</td>
</tr>
</tbody>
</table>

*Kurz. NEJM 1996;334:1209*

Local Warming and SSI after Clean Operations

<table>
<thead>
<tr>
<th></th>
<th>Local</th>
<th>Systemic</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSI*</td>
<td>5 (4%)</td>
<td>8 (6%)</td>
<td>19 (14%)</td>
</tr>
<tr>
<td>Post-op antibiotics*</td>
<td>9 (7%)</td>
<td>9 (7%)</td>
<td>22 (16%)</td>
</tr>
<tr>
<td>Hematoma</td>
<td>4 (3%)</td>
<td>2 (1%)</td>
<td>5 (4%)</td>
</tr>
<tr>
<td>Seroma</td>
<td>7 (5%)</td>
<td>4 (3%)</td>
<td>9 (7%)</td>
</tr>
</tbody>
</table>

* p < 0.01

*Melling. Lancet 2001;358:876*
Hyperglycemia and Infection Risk
Abdominal and Cardiovascular Operations

<table>
<thead>
<tr>
<th>Glucose POD#1</th>
<th>&lt;220 mg%</th>
<th>&gt;220 mg%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Infection</td>
<td>12%</td>
<td>31%</td>
</tr>
<tr>
<td>“Serious” Inf</td>
<td>5.7-fold increase for any glucose ≥ 220 mg%</td>
<td></td>
</tr>
</tbody>
</table>

Pomposelli. JPEN 1998;22:77

Diabetes, Glucose Control, and SSIs
After Median Sternotomy

Latham. ICHE 2001; 22: 607-12
PROXI Trial

Meyhoff CS et al. JAMA. 2009;302(14):1543-1550

FIO2 in Colorectal Surgery

Hovagumian F et al. Anesthesiology 2013; 119:2303
### FIO2 and SSI

<table>
<thead>
<tr>
<th>Study</th>
<th>FIO2-time/#</th>
<th>Control</th>
<th>High FIO2</th>
<th>Absoluate RR</th>
<th>NNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greif</td>
<td>30-80; 2 hr/500</td>
<td>11.2</td>
<td>5.2</td>
<td>6.0</td>
<td>17</td>
</tr>
<tr>
<td>Pryor</td>
<td>35-80; 2 hr/160</td>
<td>11</td>
<td>25</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>Mayzler</td>
<td>30-80; 2 hr/38</td>
<td>15.8</td>
<td>10.5</td>
<td>4.3</td>
<td>23</td>
</tr>
<tr>
<td>Belda</td>
<td>30-80; 6 hr/300</td>
<td>24</td>
<td>14.9</td>
<td>9.1</td>
<td>11</td>
</tr>
<tr>
<td>Meyhoff</td>
<td>30-80/2 hours633</td>
<td>25.1</td>
<td>23.7</td>
<td>1.4</td>
<td>71</td>
</tr>
<tr>
<td>Myles</td>
<td>30-80/2 hr/289</td>
<td>15.1</td>
<td>10.8</td>
<td>4.3</td>
<td>23</td>
</tr>
</tbody>
</table>

### Clinical Effectiveness of Preoperative Preparation

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Evidence</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-surgical showering</td>
<td>3 RCT’s, 4 cohort</td>
<td>Pre-surgical antiseptic showering is effective for reducing skin flora; SSI inconclusive</td>
</tr>
<tr>
<td>Antiseptic vs hygiene</td>
<td>2 RCT</td>
<td>Antisepsis no better</td>
</tr>
<tr>
<td>Choice of antiseptic</td>
<td>5 RCT, a cohort, 2 case-control</td>
<td>Mixed results, choice unclear</td>
</tr>
<tr>
<td>Impregnated drapes</td>
<td>2 RCT’s</td>
<td>Mixed results iodophor-impregnated drapes</td>
</tr>
</tbody>
</table>

Kamel C et al. Infect Control Hosp Epidemiol j 2012, 33, 6; 608-617
Preoperative Shower?

- Bathing with chlorhexidine vs placebo-
  - RR = 0.91 (0.80, 1.04) (7791 patients)
- Soap vs bathing with chlorhexidine
  - RR = 1.02 (0.57, 1.84) (1443 patients)
- Chlorhexidine vs no bathing –
  - RR = 0.36 (0.17, 0.79) (1192 patients)

Webster J, Osborne S. Cochrane Database, 2012, Issue 9, CD 004985

Total body wash with CHG?

- Effect on reducing bloodstream infections: 0.43 [0.26, 0.71]
- Effect on reducing SSI: 0.29 [0.17, 0.49] (apply 2x, ortho surgery)
- Decreasing VRE colonization: 0.42 [0.32, 0.59] (MRSA similar)
- Effect on VRE infection: 0.90 [0.42, 1.93] (MRSA similar)

Karki S et al. Journal of Hospital Infection. 82 (2012) 71-84
Gentamicin Collagen Sponge

- Most common pathogens of SSI (Staph) sensitive to gentamicin
- Levels of >170 ug/ml, then falls to 10 ug/ml for 10 days. Most MIC 4 ug/ml
- US costs $224-$336

Gentamicin-collagen sponges

- 6979 patients studied
- Overall effect OR 0.51 [0.33-0.77], NNT=21
  - Clean 0.53 [0.33-0.87], NNT=30
  - Clean-contaminated 0.43 [0.20-0.93], NNT=9
  - Contaminated 1.12 [0.35-3.58]
- Cardiac surgery OR 0.59 [0.37-0.96]

## Attire et al

<table>
<thead>
<tr>
<th>Issue</th>
<th>Evidence</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrubs outside OR</td>
<td>No RCT’s, Best practice AfPP</td>
<td>Single use cover gown</td>
</tr>
<tr>
<td>Reusable vs single use gowns and drapes</td>
<td>2 RCT, Best practice CEN</td>
<td>Opposite conclusions about effect, RCT, no difference.</td>
</tr>
</tbody>
</table>

McHugh SM et al. The Surgeon 2013 in Press

<table>
<thead>
<tr>
<th>Issue</th>
<th>Evidence</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facemasks and caps to decrease SSI</td>
<td>Settle plates in the OR, CT of &gt;3000,</td>
<td>Little evidence reduces SSI rates. Bacterial contamination has been shown to be decreased</td>
</tr>
<tr>
<td>Double glove reduce SSI</td>
<td>Cochrane review 14 RCT’s, Two cohort &gt;10,000</td>
<td>Double gloving reduces glove perforation rate. Double gloving may reduce SSI rates in procedures where antibiotic prophylaxis is not given.</td>
</tr>
</tbody>
</table>

McHugh SM et al. The Surgeon 2013 in Press
Antibiotics for chest tubes

<table>
<thead>
<tr>
<th>End point</th>
<th>Prolonged Antibiotics (121)</th>
<th>24 hour Antibiotics (124)</th>
<th>Risk Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite end point</td>
<td>13 (10.7)</td>
<td>8 (6.5)</td>
<td>-4.3 [-11.3 to 2.7]</td>
</tr>
<tr>
<td>SSI</td>
<td>6 (5.0)</td>
<td>5 (4.0)</td>
<td>-0.93 [-1.1 TO 4.3]</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>7 (5.8)</td>
<td>3 (2.4)</td>
<td>-3.4 [-8.3 to 1.6]</td>
</tr>
<tr>
<td>Empyema</td>
<td>1 (0.8)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>C difficile</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Does the Prep Matter?

- 409 chlorhexidine vs 440 povidone-iodine
- 9.5 % vs 16.1 % infection
- RR 0.59 [ 95% CI 0.41 to 0.85]
- Important for both superficial (4.2 vs 8.6%) and deep infections (1 vs 3%)

GUIDELINES FOR ANTIBIOTIC PROPHYLAXIS

1. The procedure should carry a significant risk of infection and/or cause significant bacterial contamination.
Relative Benefit from Antibiotic Surgical Prophylaxis

<table>
<thead>
<tr>
<th>Operation</th>
<th>Prophylaxis (%)</th>
<th>Placebo (%)</th>
<th>NNT*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colon</td>
<td>4-12</td>
<td>24-48</td>
<td>3-5</td>
</tr>
<tr>
<td>Other (mixed) GI</td>
<td>4-6</td>
<td>15-29</td>
<td>4-9</td>
</tr>
<tr>
<td>Vascular</td>
<td>1-4</td>
<td>7-17</td>
<td>10-17</td>
</tr>
<tr>
<td>Cardiac</td>
<td>3-9</td>
<td>44-49</td>
<td>2-3</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>1-16</td>
<td>18-38</td>
<td>3-6</td>
</tr>
<tr>
<td>Craniotomy</td>
<td>0.5-3</td>
<td>4-12</td>
<td>9-29</td>
</tr>
<tr>
<td>Total joint</td>
<td>0.5-1</td>
<td>2-9</td>
<td>12-100</td>
</tr>
<tr>
<td>Breast &amp; hernia ops</td>
<td>3.5</td>
<td>5.2</td>
<td>58</td>
</tr>
</tbody>
</table>

* Number Needed to Treat

GUIDELINES FOR ANTIBIOTIC PROPHYLAXIS

2. The antibiotic selected must be active against the major contaminating organisms and should have previously been shown to be effective prophylaxis.

It is **NOT necessary** to cover ALL organisms present.
GUIDELINES FOR ANTIBIOTIC PROPHYLAXIS

3. The antibiotic chosen must achieve concentrations higher than the minimal inhibitory concentration (MIC) of the suspected pathogens *in the wound site at the time of incision.*

GUIDELINES FOR ANTIBIOTIC PROPHYLAXIS

4. The shortest possible course of the most effective least toxic antibiotic must be used for prophylaxis. Must consider distribution and half-life of individual agents.
GUIDELINES FOR ANTIBIOTIC PROPHYLAXIS

5. The newer broader spectrum agents must be saved for therapy of resistant organisms and should not be used for prophylaxis.

WHICH AGENTS: THE PLAYERS

- 1st generation cephalosporins = CEFAZOLIN
- 2nd generation cephalosporins = cefotetan (GI), cefoxitin (GI), cefuroxime(OLHN)
COMPARISON OF HALF-LIVES FOLLOWING IV ADMINISTRATION

<table>
<thead>
<tr>
<th>Drug</th>
<th>Half-Life (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefamandole</td>
<td>0.53</td>
</tr>
<tr>
<td>Cefoxitin</td>
<td>0.75</td>
</tr>
<tr>
<td>Cefazolin</td>
<td>1.4</td>
</tr>
<tr>
<td>Cefotetan</td>
<td>3.5</td>
</tr>
</tbody>
</table>

SERUM LEVELS AFTER 1G IV: CEFAZOLIN VS CEFoxITIN

![Graph showing serum levels of Cefazolin and Cefoxitin over time.]
Operative Duration


Length of Surgery

HOW LONG SHOULD ANTIBIOTICS BE GIVEN?

- Intraoperative dosing:
  - Depends on:
    - Agent, usually if greater than 4 hrs since the first dose
    - Timing of the first dose (should give in the OR to minimize time)
    - Blood loss (if >1500 cc for cefazolin - redose, irrespective of time lapsed)

HOW LONG SHOULD ANTIBIOTICS BE GIVEN?

- Subsequent doses following OR?
  - Little, if ANY, data to support this need
  - Studies comparing 1 or more doses with the same agent have shown no benefit of additional doses
  - Certainly not more than 24 hours is necessary
  - Do not need antibiotics to cover drains, tube lines
Single vs Multiple Dose Surgical Prophylaxis: Systematic Review

Discontinuation of Antibiotics

Patients were excluded from the denominator of this performance measure if there was any documentation of an infection during surgery or in the first 48 hours after surgery.

Case 2

- 38 yr old 120 kg with DM, HTN, ESRD is having a SBO and needs a LOA and small bowel resection.
- What is his risk for a SSI?
- How can this be reduced?
- Should he receive antibiotic prophylaxis? If so, which one, what dose, interval?

SPECIAL CONSIDERATION: MORBID OBESITY

- Cefazolin 1 gram is not the correct dose for everyone
  - At incision and closure 1g, blood and tissue levels all lower than “normal” weight
  - Below MIC for gram pos cocci and gram neg rods
- Cefazolin 2gm good blood and tissue levels
- Wound infection rates from 16.5% to 5.1%

Forse et al.surgery 1989:106,751-767
Case 3

- 68 yr old woman about to undergo hip replacement
- Previously MRSA +
- Only current issue is factor- dysuria
- Should she have screening, decolonization, different prophylaxis?
- Should the case proceed?

The Case FOR MRSA Screening in Joint Replacement

- 1 million joint replacement surgeries
- SSI rate 1.0%, cost of revision $120,000
  - TOTAL= $1.2 BILLION
- Screening PCR $131/person, $131 million
- Treatment failure still occurs 0.4%, $400,00 million
- TOTAL COST SCREENING AND TREATMENT= $531 MILLION

AAOS: Recommendations:
Joint Surgery

- Ask about symptoms - if present send U/A and culture
- If no symptoms but risk factors consider U/A and culture
- May proceed with surgery if:
  - Asymptotic bacteruria and no obstructive symptoms. If CFU >10^3 should treat
  - If symptomatic and CFU < 10^3
  - U/A does not suggest infection

Moucha CS et al. J Bone Joint Surg 2011; 93 (4); 398-304

AAOS: Recommendations:
Joint Surgery

- Consider postponing surgery if:
  - Symptoms related to urinary obstruction
  - Symptomatic bacteruria and CFU >10^3

Moucha CS et al. J Bone Joint Surg 2011; 93 (4); 398-304
Labor and Delivery

- Antimicrobial prophylaxis is recommended for all C sections- Give within 60 minutes
- A single dose of cefazolin recommended unless allergic. Dose adjust for size
  - Clindamycin and aminoglycoside if allergic
- Prolonged rupture of membrane patients should have prophylaxis

Obstetrics Gynecology; 2011; 120; Practice Bulletin: 1472-

Intraop Role

- Selection and timely administration of the correct antibiotic, re-dosing as appropriate
- Intraoperative monitoring of temperature and normothermia
- Oxygen administration (hyperoxia)
- Hand hygiene

Case 4

- 72 yr old man with HTN, DM, CAD, aortic stenosis for CAB x3 and valve. He was MRSA positive in the past.
- Special considerations?

Cefazolin levels and CPB

![Diagram showing serum level mcg/ml at different time points (T1 to T5 and closure) with min and max levels indicated.]

T1 = 5-45 before CPB
T2 = 5-15 after CPB
T3 = 5-15 2nd dose
T4 = 5-15 before end CPB
T5 = 5-15 after CPB
T6 = closure

Fellinger EK et al. Ann Thor Surg;2002;74;1187-90
Cefazolin levels and CPB


Cardiac Surgery and MRSA

<table>
<thead>
<tr>
<th></th>
<th>Infections</th>
<th>Cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA Baseline</td>
<td>32</td>
<td>2767</td>
<td>1.16%</td>
</tr>
<tr>
<td>MRSA Intervention</td>
<td>2</td>
<td>2496</td>
<td>1.28%</td>
</tr>
<tr>
<td>Overall Baseline</td>
<td>59</td>
<td>2767</td>
<td>2.130*%</td>
</tr>
<tr>
<td>Overall Intervention</td>
<td>20</td>
<td>2496</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

Screening, Vancomycin if positive, all receive mupirocin

Extended Time for Cardiac Surgery?

<table>
<thead>
<tr>
<th>Relative Risk</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sternal site infections overall</td>
<td>1.38 [1.13-1.69]</td>
</tr>
<tr>
<td>Mortality</td>
<td>0.92 [0.68-1.25]</td>
</tr>
<tr>
<td>Deep SSI</td>
<td>1.68 [1.12-2.53]</td>
</tr>
<tr>
<td>Infections overall</td>
<td>1.04 [0.89-1.22]</td>
</tr>
<tr>
<td>Adverse events</td>
<td>1.34 [0.68-2.66]</td>
</tr>
</tbody>
</table>

Risk of bias high in 11/12 studies

Mertz D et al. Ann Surg 2011; 254; 48-54

To Screen or Treat: Cost-Effectiveness

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cost ($2005)</th>
<th>QALY</th>
<th>$ per QALY</th>
</tr>
</thead>
<tbody>
<tr>
<td>THA Base Case</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treat all</td>
<td>$24,258</td>
<td>0.7985</td>
<td>$30,379</td>
</tr>
<tr>
<td>Screen, treat+</td>
<td>$24,471</td>
<td>0.7983</td>
<td>$30,655</td>
</tr>
<tr>
<td>Nothing</td>
<td>$24,508</td>
<td>0.7980</td>
<td>$30,709</td>
</tr>
<tr>
<td>TKA Base case</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treat all</td>
<td>$24,378</td>
<td>0.6787</td>
<td>$35,916</td>
</tr>
<tr>
<td>Screen, treat+</td>
<td>$24,611</td>
<td>0.6785</td>
<td>$36,270</td>
</tr>
<tr>
<td>Nothing</td>
<td>$24,667</td>
<td>0.6783</td>
<td>$36,365</td>
</tr>
</tbody>
</table>

TREAT ALL  if mupirocin <$100, cost of screen test $10-200

Courville XF et al. Infect Control Hosp Epidemiol 2012;33(2):152-159
How Do I Improve?

<table>
<thead>
<tr>
<th>Safety Issues Identified</th>
<th>Opportunities to improve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection control (68)</td>
<td>Skin prep, temp control, contamination of bowel contents, antibiotic timing, selection, re-dosing, case length</td>
</tr>
<tr>
<td>Coordination of care (12)</td>
<td>Use of preop eval center, posting accuracy, computer assistance for antibiotics</td>
</tr>
<tr>
<td>Communication and teamwork (12)</td>
<td>Improve communication throughout, empower team to speak up, improve briefings/debriefings, teamwork tools</td>
</tr>
<tr>
<td>Equipment/supplies (2)</td>
<td>Temp probes, glucose monitoring, body warmers, wipes</td>
</tr>
<tr>
<td>Policies/protocols (2)</td>
<td>Standardize care/protocols/policies</td>
</tr>
<tr>
<td>Education/training (2)</td>
<td>Ongoing education (data), checklist</td>
</tr>
</tbody>
</table>


---

How Do I Improve?

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-intervention</th>
<th>Post-intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Operations</td>
<td>278</td>
<td>324</td>
</tr>
<tr>
<td>Overall SSI</td>
<td>76 (27.3%)</td>
<td>59 (18.2%)*</td>
</tr>
<tr>
<td>Superficial SSI</td>
<td>47 (16.9%)</td>
<td>44 (13.6%)</td>
</tr>
<tr>
<td>Deep SSI</td>
<td>4 (1.4%)</td>
<td>2 (0.6%)</td>
</tr>
<tr>
<td>Organ Space</td>
<td>25 (9.0%)</td>
<td>13 (4.0%)</td>
</tr>
</tbody>
</table>

CONCLUSIONS

- SSI most common preventable adverse event and we need to do better
- Must be familiar with principles of prophylaxis and CDC recommendations
- Put systems in place to ensure non-antibiotic and antibiotic factors are followed
- Antibiotics should be administered in the OR
- Morbidly obese patients should receive larger doses of antibiotics

CONCLUSIONS

- Maintenance of normothermia maybe important (Level II)
- Intraoperative and post-operative oxygenation of uncertain benefit (FIO2 80%)
- Patients with PCN allergy can receive cepahlosporins if not IgE mediated, other alternatives
- Most prophylaxis for infective endocarditis no longer recommended
- Consider decolonizing MRSA patients, Vancomycin prophylaxis