Surgical Site Infection (SSI)

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Disclosures

- I do not have any relevant financial relationships with any commercial interest that pertains to the content of my presentation.

Surgical Site Infections (SSI) – It’s a Problem!

- > 500,000 SSIs in the US*
- #1 nosocomial infections after surgery
- 7-10 additional hospital days per SSI
- 3.7 million total excess hospital days
- 2-11x higher risk of death
- $10 billion excess $$$ ($3-29k per SSI)

SSIs are common, adverse and preventable events

Risk factors for SSI

- Patient factors
  - Obesity
  - Tobacco use
  - Hyperglycemia
  - Vascular disease
  - Immunosuppression

- Operative factors
  - Incision size
  - Length of operation
  - ? Transfusion
  - Wound classification

Surgical Site Infections (SSI) – It’s a Problem!

2 - 4 % of operations result in an SSI

- Colorectal surgery 10 - 20%
- CABG 3.5%
- C section 3 - 30%
- Joint arthroplasty with prosthesis 1.5%
SSI Definition
- Infection near surgical site that occurs within 30 days of surgery, or 90 days if an implant was used
- Incisional SSI from skin incision down to muscle layer
- Organ space infections include intraabdominal abscess, anastomotic leak, and infected implant.

Diagnosis
- Incisional SSI
  - Warmth
  - Erythema
  - Swelling
  - Purulent drainage
  - Pain
  - Dehiscence
- Organ Space SSI
  - Malaise
  - Fever
  - Pain
  - Imaging usually required

Management Incisional SSI
- Opening of wound, culture, and subsequent wound care
- Antibiotics rarely required unless cellulitis or signs of systemic illness
- For intestinal surgery, almost always polymicrobial
- Antibiotics should not be narrowed to cultured pathogen
- Once wound opened, no role for culturing open wound

Common pathogens
- Staph aureus
- Strep
- Enterococcus
- For GI: gram negative and anaerobes

Wound care
- Basic wet to dry dressing effective
  - Can be saline or tap water
  - Does not need to be sterile
  - Provides gentle debridement at dressing changes
  - Avoid betadine, hydrogen peroxide, etc as may interfere with wound healing
NWPT (Wound Vac)
- Shorten wound healing times
- Absorb fluid
- Encourage granulation
- Only need to be changed 3x/week

Management Organ Space SSI
- Antibiotics
- Gastrointestinal Surgery
  - Most abscesses can be drained percutaneously
  - Look for evidence ongoing contamination, i.e. occult bowel injury or anastomotic leak

Anastomotic Leak
Simple Abscess
Implant associated SSI
- Orthopedic hardware, hernia mesh, vascular grafts
- Represent 50% of all SSI
- Much harder to treat
- Implant harbors bacteria
- Must weigh the risk of explantation with infection risk

Necrotizing Soft Tissue Infection
- Uncommon in SSI, but requires high level of suspicion
- Severe pain
- Sepsis
- Copious dishwater like drainage
- Skin discoloration
- Hyponatremia
- Requires urgent OR

Not all erythema is SSI
- "Stitch abscess"
- Contact dermatitis
- Normal inflammation
- Dependent inflammation
Seroma
- Can be impressive on physical exam
- Can be tense but lacking erythema or surrounding edema
- Avoid aspiration as can become infected

Surgical Site Infections (SSI) – Prevention

<table>
<thead>
<tr>
<th>Surgical Site Infections (SSI)</th>
<th>NSQIP</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robotic</td>
<td>2.2</td>
<td>.04</td>
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<tr>
<td>Laparoscopic</td>
<td>7.5</td>
<td></td>
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<tr>
<td>Open</td>
<td>15.1</td>
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</tbody>
</table>

Colorectal Resections (NSQIP)

Reducing incision size
Total Abdominal Colectomy with Transanal Extraction

Reducing incision size

History of SSI Reduction Efforts

1970 CDC established National Nosocomial Infections Surveillance (NNIS) System
1999 CDC published 1st Guideline for Prevention of SSI
2002 CDC and CMS instituted Surgical Infection Prevention (SIP) project
2003 CMS, CDC and 10+ org. Surgical Care Improvement Project (SCIP)
2006 CMS/CIP → SCP Expanded processes (hair, glycemic control, normothermia)
2009 US Department of HHS National Action Plan to Prevent Healthcare-Associated Infections
Road Map to Elimination 5-year goal of a 25% reduction in SSIs on admission and readmission
2012 CMS required SSI outcome data through CDC National Healthcare Safety Network (NHSN)
2016 WHO Global guidelines on prevention of SSI. ACS/SIS Guidelines for SSI Prevention
2017 CDC Updated Guidelines

Original SCIP Measures

Right agent → dose → timing → duration

Bundling works better than single process (2010)

Institutional Benefits of SSI Reduction Bundles (2014)

Major reductions in superficial SSIs with SSI Reduction Bundles

### 2015 Meta-Analysis | Clear benefits of SSI bundles

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Cases</th>
<th>Controls</th>
<th>Total</th>
<th>Weight</th>
<th>Risk Ratio</th>
<th>95% CI</th>
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</thead>
<tbody>
<tr>
<td>Antibiotic 2010</td>
<td>156</td>
<td>154</td>
<td>310</td>
<td>0.6%</td>
<td>0.93</td>
<td>0.47, 1.84</td>
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<td>Bart 2011</td>
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<td>12</td>
<td>41.3%</td>
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<td>0.45, 1.87</td>
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<tr>
<td>Cell 2012</td>
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<td>17</td>
<td>39</td>
<td>4.8%</td>
<td>0.91</td>
<td>0.45, 1.87</td>
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<tr>
<td>Cell 2013</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>11%</td>
<td>0.24</td>
<td>0.05, 1.12</td>
</tr>
<tr>
<td>Cell 2014</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>11%</td>
<td>0.24</td>
<td>0.05, 1.12</td>
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<tr>
<td>Cell 2015</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>11%</td>
<td>0.24</td>
<td>0.05, 1.12</td>
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<tr>
<td>Leaper 2014</td>
<td>18</td>
<td>18</td>
<td>36</td>
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<td>0.09, 6.01</td>
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<tr>
<td>Leaper 2015</td>
<td>12</td>
<td>12</td>
<td>24</td>
<td>6.3%</td>
<td>0.50</td>
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<td>Patell 2010</td>
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<td>34</td>
<td>68</td>
<td>9.8%</td>
<td>0.76</td>
<td>0.07, 8.37</td>
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<tr>
<td>Vinnet 2013</td>
<td>12</td>
<td>12</td>
<td>24</td>
<td>3.2%</td>
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<td>0.06, 4.17</td>
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<tr>
<td>VIP 2014</td>
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<td>2</td>
<td>4</td>
<td>2.5%</td>
<td>0.65</td>
<td>0.06, 8.36</td>
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<tr>
<td>Total (95% CI)</td>
<td>4649</td>
<td>4360</td>
<td>9009</td>
<td>100%</td>
<td>0.65</td>
<td>0.46, 0.92</td>
</tr>
</tbody>
</table>

Included 8,515 patients | 2010-2014 | 13 high-quality studies

### Core Themes in SSI Reduction Bundles

1. Effective antibiotic prophylaxis
   - Administered within 1-2 hours before incision
   - Base selection on procedure/local antibiogram
2. Prepare all skin
   - Pre-Op: Full-body bathing for patients
   - Op: Patient skin w alcohol-based antiseptic
   - Op: Surgeon skin w surgical hand scrub
3. Maintenance of normothermia
4. Glycemic control
5. FiO2 (80%) intra-op and post-op

### Summary Points

- SSIs are a major but addressable problem in surgery
- Minimally invasive surgery and smaller incisions reduce SSI
- Interventions exist and work better in bundles
- Superficial SSI generally treated with opening of wound alone
- Organ space SSI need to rule out ongoing source of infection
- Infections involving an implant are particularly challenging to manage and may require long term antibiotics