YNHH Initiative to Reduce Surgical Site Infections (SSI)
In spite of advances in infection prevention practices, surgical site infections (SSIs) remain a substantial cause of morbidity and mortality among patients. A systematic approach must be applied with the awareness that SSI risk is influenced by characteristics of the patient, operation, personnel, and healthcare setting.
Background: Scope of Problem

- Estimated 24 million surgical procedures/year
- 2 to 5% of operations are complicated by an SSI
- SSIs account for 24% of all Hospital Acquired Infections (HAI)
  - Third most frequent HAI
  - Most costly HAI
- SSIs prolong hospital stay an average of 7-10 days
- Patients with an SSI have a 2-11 times higher risk of death compared with operative patients without an SSI
- Total cost may exceed $10 billion/yr
  - Attributable costs vary: $3000-$29,000

SSI Definition: CDC National Healthcare Safety Network (NHSN)

• General definition:
  ✓ Inflammatory changes
    ➢ Pain
    ➢ Warmth
    ➢ Swelling
    ➢ Redness
  ✓ Wound dehiscence
  ✓ Purulent drainage or abscess formation
  ✓ Usually within 30 days of operation
    ➢ Up to 1 year if foreign body implanted

• SSIs are classified as follows:
  ✓ Superficial incisional
    ➢ Involving only skin or subcutaneous tissue
  ✓ Deep incisional
    ➢ Involving fascia and/or muscular layers
  ✓ Organ-space
Surveillance for SSI

• Direct methods (daily wound examinations) are rarely used in practice
  ✓ Impractical
  ✓ Resource utilization requirements

• Indirect methods consist of a combination of the following:
  ✓ Review microbiology reports and individual patient medical records
  ✓ Surgeon and/or patient surveys
  ✓ Screening for readmission of surgical patients
  ✓ Other information such as coded diagnoses or operative reports
  ✓ Sensitivity 84-89%, specificity 99.8%

• Measure SSI rates for the first 30 days following procedures that do not involve inserting implantable devices
  ✓ Measure SSI rates for one year following procedures that involve the insertion of implantable devices

• About 70% of SSIs manifest themselves post-discharge
  ✓ Rate varies by type of operation and type of SSI
Pathogenesis of Surgical Site Infections

• Microbial contamination of the surgical site is a necessary precursor of SSI.
  ✓ **Dose of bacterial contamination x virulence** = risk of SSI
  Resistance of the host patient
  ✓ The risk of SSI is increased if a surgical site is contaminated with $>10^5$ organisms per gram of tissue.
  ✓ Dose of contaminating organism required to produce infection may be much lower when foreign material is present.

• Endogenous sources of pathogens include the patient’s skin, mucous membranes, or hollow viscera

• Exogenous sources of pathogens include:
  ✓ Surgical personnel
  ✓ Operating room environment
  ✓ Tools, instruments and materials brought to the sterile field during an operation
## SSI Risk Factors

<table>
<thead>
<tr>
<th>Wound Classification</th>
<th>Infection Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean</td>
<td>&lt;2%</td>
</tr>
<tr>
<td>Clean contaminated</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>Contaminated</td>
<td>20%</td>
</tr>
<tr>
<td>Dirty</td>
<td>30 to 40%</td>
</tr>
</tbody>
</table>
SSI Risk Factors

• **Endogenous**
  - Diabetes mellitus
  - Advanced age
  - Obesity
  - Malnutrition, recent weight loss
  - Cancer
  - Immunosuppressed (e.g., steroid use)
  - Other remote site of infection

• **Exogenous**
  - Prolonged preoperative stay
  - Preoperative hair removal by shaving
  - Length of operation
  - Maintenance of body temperature
  - Surgical technique
  - Incorrect use of prophylactic antibiotics
SSI Prevention Strategies: Pre-operative Measures

- Pre-operative antibiotics: "Timing is everything"

<table>
<thead>
<tr>
<th>Antibiotic given</th>
<th>SSI rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early (2-24 hours before incision)</td>
<td>3.8%</td>
</tr>
<tr>
<td><strong>Within 2 hours before incision</strong></td>
<td><strong>0.6%</strong></td>
</tr>
<tr>
<td>Within 3 hours after incision</td>
<td>1.4%</td>
</tr>
<tr>
<td>Post-op</td>
<td>3.3%</td>
</tr>
</tbody>
</table>

Classen et al. (NEJM 1992)
SSI Prevention Strategies

- Minimize patient microbial burden
  - Surgical site disinfection before incision
  - Pre-operative antibiotic prophylaxis
  - Smoking cessation
- Optimize wound condition
- Optimize patient immune defenses
  - Control blood glucose in diabetics
Surgical Care Improvement Project (SCIP)

- SCIP tracks all of the following at YNHH
  - Antibiotics received *within 1 hour prior to incision* for those procedures where antibiotics are indicated
    - For quinolones and vancomycin a 2 hour time frame is acceptable
  - Antibiotic selection
    - CABG, other cardiac and vascular -> cefazolin, cefuroxime, or vancomycin*
    - Hysterectomy -> cefotetan, cefazolin, cefoxitin, cefuroxime, or ampicillin/sulbactam
    - Hip/knee arthroplasty -> cefazolin, cefuroxime, vancomycin*
Surgical Care Improvement Project (SCIP)

- SCIP tracks all of the following at YNHH
  - Antibiotic selection
    - Colon operations -> cefotetan, cefoxitin, ampicillin/sulbactam, ertapenam, or cefazolin, cefuroxime and metronidazole
    - For beta-lactam allergic patients alternative recommendations are available
    - *Reason for use of vancomycin must be documented by physician/APRN/PA if patient not beta-lactam allergic*
Surgical Care Improvement Project (SCIP)

- SCIP tracks all of the following at YNHH
  - Antibiotic discontinuation
    - Antibiotics must be stopped within 24 hours of surgery end time for elective surgical cases
    - For cardiac surgery antibiotics must be stopped within 48 hours of surgery end time
  - Cardiac surgery patients must have blood glucose < 200 mg/dl at 6AM on post-operative day #1 and day #2.
  - Hair removal must be with clippers or depilatory only (no shaving), only if necessary and performed immediately prior to incision.
  - Colorectal surgery patients must have a temperature ≥ 96.8°F within 15 minutes of leaving the operating room.
Background: Regulation and Reporting

- CMS no longer reimburses for SSIs in the following instances:
  - Mediastinitis after coronary artery bypass grafting
  - Total knee replacement
  - Laparoscopic gastric bypass and gastroenterostomy
  - Ligation and stripping of varicose veins

- Some states have requirements for public reporting of SSI rates post hysterectomy, knee and hip replacements, coronary artery bypass graft

- The 2009 Joint Commission (TJC) National Patient Safety Goals (NPSG)
  - Mandates education for nursing and physician providers, who care for surgical patients, upon hire and annually
  - Mandates patient and family education
  - Administer antimicrobial gents for prophylaxis for a particular procedure or disease according to evidence based best practices
  - When hair removal is necessary, use clipper or depilatories; *shaving is an inappropriate hair removal method*
Background: Regulation and Reporting

• Reduction of SSIs is one of several components of hospital-wide efforts to reduce Hospital Acquired Infections (HAIs)

• Data on YNHH SSIs is provided to physicians, nursing staff, and hospital leadership
  ✓ National Surgical Quality Improvement Program (NSQIP) – reports to Department of Surgery quarterly
  ✓ Cardiac surgery (CABG, valves) SSI reported on the weekly QISS HAIReport
    ➢ Annual report to Cardiac Surgery, more often if trends or concerns identified on interim analysis
  ✓ Pilot SSI surveillance projects (e.g., liver and kidney transplant, university OB service C-section) reported to the appropriate department/section
Components of Efforts to Reduce SSI

- **Patient and Family Education**
  - All surgical patients must be educated regarding measures to prevent SSIs.
    - Educational materials that have been developed specifically for patients should be used.
- **Whiteboard**
  - Pre-operative antibiotic choice (if indicated), timing, duration; follow evidence based guidelines
  - Hair removal – no shaving, razors removed from OR
  - Normothermia
  - Glucose control
- **Monitor compliance with best practices or evidence based guidelines**
  - Everyone is empowered to stop a procedure if there has been a breach in sterile technique or any non-adherence with checklists/protocol.
YNHH Initiative to Reduce Surgical Site Infections (SSI)

Review Questions
Question #1

- Patient factors that increase the risk of a surgical site infection (SSI) include all of the following except:
  A. Obesity
  B. Diabetes Mellitus
  C. Low albumin
  D. Coronary artery disease
  E. Cancer
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  D. Coronary artery disease
  E. Cancer

(D) Explanation: Diabetes, advanced age, obesity, malnutrition, cancer, immunosuppression (e.g., steroids) and other remote site of infection are all endogenous risk factors for SSI. Coronary artery disease is not a SSI risk factor.
Question #2

- Which of the following documented findings would not be considered a superficial SSI by NSQIP criteria
  A. Purulent drainage from the wound
  B. An erythematous, tender, warm wound
  C. Isolation of bacteria from an aseptically obtained wound culture.
  D. Wound opened by the surgeon with a negative culture
  E. B and D
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(D)
Question #3

Which of the following are characteristics of SSIs

A. Complicate 8-10% of all surgical interventions.
B. Are an uncommon example of a hospital acquired infection.
C. Are associated with both a longer hospital length of stay and increased patient mortality.
D. Nationally cost 3-5 million dollars per year.
E. Source is often the surgeon’s naso-pharyngeal flora.
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(C) Explanation: SSIs are estimated to complicate 2-5% of all surgical interventions and account for 24% of hospital acquired infections at a cost of $10 billion/year. Sources of organisms causing SSIs are both endogenous (the patient’s own flora) and exogenous (personnel, instruments, environment).
Question #4

Which of the following are components of efforts to reduce SSIs?

A. Administer pre-operative antibiotic prophylaxis (if indicated) within 60 minutes before incision (2 hours for vancomycin or quinolones).

B. Do not use shaving as a method of hair removal.

C. Maintain normothermia for colo-rectal surgery patients.

D. Maintain glucose control for cardiac surgery patients.

E. All of the above.

(E)
Question #5

Which of the following is correct?

A. Most SSIs manifest themselves before patients are discharged home.

B. Patients and their families don’t need to be educated regarding measures to prevent SSIs if they don’t ask for the information.

C. Pre-operative antibiotic prophylaxis should be continued until the patient is discharged.

D. Everyone is empowered to stop a procedure if there has been a breach in sterile technique or any non-adherence with checklists/protocol.
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  D. Everyone is empowered to stop a procedure if there has been a breach in sterile technique or any non-adherence with checklists/protocol.

(D) Explanation: The majority of SSIs manifest themselves after patients are discharged. All surgical patients and their families must be educated regarding measures to prevent SSIs. Pre-operative antibiotic prophylaxis must be stopped within 24 hours of surgery end time for elective surgical cases (exception: within 48 hours of surgery end time for cardiac surgery).

✓ Everyone is empowered to stop a procedure if there has been a breach in sterile technique or any non-adherence with checklists/protocol.