Preventing Surgical Site Infections: Implementing a Multidisciplinary Evidence-Based Strategy

Cindy Kildgore, RN, BSN, MSHA, CNOR
Perioperative Services VOR Director
Vanderbilt University Medical Center,
Nashville, TN
FACULTY DISCLOSURE

- Cynthia L. Kildgore, MSHA, BSN, RN, CNOR- Eloquest Healthcare Speaker Bureau
Objectives

• Identify strategies to implement surgical site infection (SSI) care bundles

• Describe tactics for overcoming barriers to change in clinical process

• Describe future technologies to aid in SSI prevention
Clinical Case Study (1)

- SD 68 yo F c/o 30 lb. weight loss over 6 months and hematochezia; colonoscopy demonstrates constricting lesion in the proximal transverse colon
- No previous abdominal operations, no contributory medical history
- Preoperative instructions:
  - Sage wipes after showering the morning of surgery
  - Magnesium citrate one bottle at 5pm day before surgery
  - Admitted for elective laparoscopic colectomy
Clinical Case Study

- Uneventful perioperative course
  - Operative time 1:45p
  - Cefoxitin 2 Gm infused 5 minutes prior to incision
  - Lowest intraoperative temperature 36.3°C
  - Wound Class 2: Clean-contaminated
  - After PACU was taken to colorectal surgery unit

- POD 1-3 “doing well except for ileus; await flatus”
- POD 4-5 advancing diet slowly; activity, pain management
- POD 7: Abdominal pain, general malaise. CT and contrast enema demonstrate anastomotic leak.
Clinical Case Study

Return to OR on POD 7; ex lap, washout, repair of leak, loop ileostomy
Infected ascites, 2mm leak at anastomosis, abdominal sepsis
Transferred to ICU after surgery
Postoperative course complicated by sepsis, vein thrombosis
Discharged on POD 21 (first operation)/14 (second operation)
Event Analysis

- No institutional guidelines regarding perioperative care of colorectal surgery patients
- Surgeon’s routine practices were followed:
  - Sage wipes x 1
  - Mag citrate prior to surgery
  - NPO after midnight
  - IV antibiotics prior to incision
  - Intraoperative normothermia
SSI Surveillance Programs

- Public reporting of data based on CDC-NHSN colon and abdominal hysterectomy outcomes
  - Only deep and organ/space SSI are included
  - Superficial is surveyed and reported, but not public
- Optional reporting of NSQIP Colectomy, LE Bypass, elderly (death, serious morbidity)
- Both are risk-adjusted, but with different models
- Surveillance methodology may differ in some hospitals
# VUMC NHISN and NSQIP Coloectomy Surveillance Procedure Comparison

![Image showing a chart comparing colorectal outcomes from VUMC NHISN and NSQIP]

## Data Analysis

### Colorectal 01/01/11 - 12/31/11

<table>
<thead>
<tr>
<th>Hospital Outcome Ratio</th>
<th>1.19</th>
<th>1.94</th>
<th>0.64</th>
<th>1.59</th>
<th>2.36</th>
<th>1.24</th>
</tr>
</thead>
</table>

**Outlier and Decile Status**

- **COLORECT Mortality**
- **COLORECT Morbidity**
- **COLORECT Length of Stay**
- **COLORECT UTI**
- **COLORECT SSI**
- **COLORECT RGR**

**Report/Site:** 5749 / 0030

![Image of medical professionals]
2012 Q1-Q3, Comparison to USNWR 2013 Honor Roll Hospitals

Colon SSI SIR vs CDC Mean

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Colon SSI SIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>VUH</td>
<td>2.26</td>
</tr>
<tr>
<td>Indiana Univ Health Hospital</td>
<td>2.19</td>
</tr>
<tr>
<td>Hospital of Univ of Penn</td>
<td>2.08</td>
</tr>
<tr>
<td>UCLA</td>
<td>1.94</td>
</tr>
<tr>
<td>UPMC</td>
<td>1.67</td>
</tr>
<tr>
<td>Cleveland Clinic</td>
<td>1.33</td>
</tr>
<tr>
<td>UCSF Med Ctr</td>
<td>1.31</td>
</tr>
<tr>
<td>Thomas Jefferson</td>
<td>1.15</td>
</tr>
<tr>
<td>Northwestern</td>
<td>1.06</td>
</tr>
<tr>
<td>Case Medical Center</td>
<td>0.99</td>
</tr>
<tr>
<td>NYU</td>
<td>0.80</td>
</tr>
<tr>
<td>Mayo Clinic</td>
<td>0.76</td>
</tr>
<tr>
<td>Medical Ctr</td>
<td>0.76</td>
</tr>
<tr>
<td>Brigham and Women's Hospital</td>
<td>0.59</td>
</tr>
<tr>
<td>Barnes-Jewish Medical Center</td>
<td>0.47</td>
</tr>
<tr>
<td>Cedars-Sinai Medical Ctr</td>
<td>0.35</td>
</tr>
<tr>
<td>Johns Hopkins Hospital</td>
<td>0.33</td>
</tr>
<tr>
<td>Not Reported</td>
<td></td>
</tr>
</tbody>
</table>
“The data is wrong”

• “We have more IBD patients, and they’re more likely to have infections.”
• “We’re a level 1 trauma center.”
• “We’re a regional referral center for ‘catastrophes.’”
• “Surveillance over-counts clinical infection. XX Medical Center doesn’t count infections the way you do.”
Improving Performance

• Review existing guidelines
• Literature review
• Identify gaps in current practice
• Reduce variability
Agreeing on the Evidence

Antibiotic Prophylaxis in Colorectal Surgery

Guideline Recommendations:

SCIP: Oral: neomycin plus erythromycin base or neomycin plus metronidazole; parenteral: cefoxitin or cefotetan or cefazolin plus metronidazole. Currently, none of the guidelines address antimicrobial prophylaxis for those patients with documented beta-lactam allergy. Cefmetazole is not available in the United States. Although a recent study indicates that the combination of oral prophylaxis with parenteral antimicrobial prophylaxis may result in lower wound infection rates, this is not specified in any of the published guidelines (see Lewis study below).

Reccs: For oral antimicrobial prophylaxis, use neomycin plus erythromycin base or
The Challenge

• Move from “Show me why I should do it” to “Show me why you should not”

• Standardize practices
Standardization of Expected Practices

• Based in literature/guidelines
• Multidisciplinary
• Determine what should occur for any case
• Understand where variability necessary – try to limit the degree of variability
Action Steps to Prevent Surgical Site Infections

- Standardization of surgical team members
- Prep standardization: Chlorhexidine + alcohol
- Bowel isolation prep and training
- Intra-operative handling of contaminated materials
- Antibiotic administration
- Temperature management
- Reduction of OR foot traffic
- Coaching hand hygiene and hand scrub practice
Bowel Isolation Technique

- The Surgical Technologist changes gloves and assists other team members with changing both gowns and gloves.
  - Attending surgeon
  - Resident surgeon
  - Students

Bowel Isolation Technique

Once bowel is closed and anastomosis is complete:

- Return all instruments and supplies, (sponges, suction tip, staplers and towels) that were used during the anastomosis, back into the blue basin.

- Close isolation needle counter and place inside of basin.

- Basin with dirty instruments, supplies and needle counter are handed off of the surgical field.
Continued Pursuit of Zero SSI’s

• The preceding slides detail the changes and progress we’ve made in our journey from worst to best, but we’re constantly evaluating ways and tools that can help us reach our goal of zero SSIs. One that I’m excited about evaluating in 2018 is ReliaTect Post-Op Dressing with CHG.
Looking Ahead

- ReliaTect Post-Op Dressing with CHG – a new product that has our interest because it supports the delivery of CHG (the same product used during prep) throughout the perioperative continuum of care to reduce post-op wound contamination, as well as providing the unique combination of transparency and absorbency to facilitate post-op assessment and monitoring of the incision site
100% Case Review

- Identify signals
- Any practice lapses
- Multidisciplinary
# VUMC Recommendations for Elective Colorectal Surgery

<table>
<thead>
<tr>
<th>Preoperative</th>
<th>Intraoperative (Anesthesia)</th>
<th>Intraoperative (Surgical Team)</th>
<th>Postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preadmission</strong></td>
<td>Administer appropriate IV antibiotic within 1 hour prior to incision (2 hours if quinolone antibiotics are given.)</td>
<td>Use chlorhexidine and alcohol-based prep for skin cleansing in the OR unless contraindicated.</td>
<td>Supplemental oxygen in PACU as indicated by patient status.</td>
</tr>
<tr>
<td>CHG Wipes night before and morning of surgery</td>
<td>Redose based on duration of operation and agent.</td>
<td>Wound protectors are used when appropriate.</td>
<td>Discontinue prophylactic antibiotics within 24 hours of surgery.</td>
</tr>
<tr>
<td>Mechanical bowel prep until effluent clears.</td>
<td>Maintain temp ≥ 36° throughout the operation.</td>
<td><strong>At time of anastomosis/bowel opening:</strong></td>
<td>For patients with diabetes and/or postoperative hyperglycemia, monitor and maintain serum glucose &lt; 200 mg/dl during hospitalization.</td>
</tr>
<tr>
<td>Oral antibiotic prep after mechanical prep is complete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Neomycin 1 Gm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Metronidazole 1 Gm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR Erythromycin Base 1 Gm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 2pm, 4pm, 10pm day before surgery.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preop day of surgery</td>
<td>Check intraoperative glucose ≤ 1 hour if patient is hyperglycemic prior to surgery. Goal: glucose &lt; 200; Target: 140 – 180 mg/dl.</td>
<td>Once the contaminated portion of the case is over</td>
<td></td>
</tr>
<tr>
<td>Check blood glucose in holding; notify provider for BG &gt; 180.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forced air warming to maintain T ≥ 36°.</td>
<td>Intraoperative FIO2 at .80.</td>
<td>Anastomosis testing when applicable</td>
<td></td>
</tr>
</tbody>
</table>

*Approved Antibiotics: cefotetan, cefoxitin, ampicillin/sulbactam OR cefazolin or cefuroxime + metronidazole
| If β-lactam allergy: | | | |
| cefazolin or cefuroxime + metronidazole | | | |
| clindamycin + aminoglycoside OR | | | |
| clindamycin + quinolone OR | | | |
| clindamycin + aztreonam OR | | | |
| metronidazole with aminoglycoside, or metronidazole + quinolone | | | |

Revised 6/2015
Work in Progress

![Graph showing data trends over quarters from Q1 2011 to Q2 2012. The graph compares two datasets: NSQIP and NHSN. The NSQIP data is represented by a blue line, while the NHSN data is represented by an orange line. The graph highlights fluctuations in the data over time.]
Policy and Culture

• The best bundle doesn’t work without a culture supporting it
  – Encourage vigilance for all members of the team
  – Create a culture where speaking up is expected
Impact of intraoperative behavior on surgical site infections

Guido Beldi, M.D.,* Sonja Bisch-Knaden, Ph.D., Vanessa Banz, M.D., Kathrin Mühlemann, M.D., Ph.D., Daniel Candinas, M.D.

Table 4  Multivariate analysis of risk factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Odds ratio (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (≤30 kg/m² → &gt;30 kg/m²)</td>
<td>2.00 (1.22–3.20)</td>
<td>.006</td>
</tr>
<tr>
<td>Surgeon (consultant → fellow)</td>
<td>1.27 (.80–2.03)</td>
<td>.32</td>
</tr>
<tr>
<td>Duration of surgery (≤3 h → &gt;3 h)</td>
<td>3.34 (1.82–6.14)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Discipline score (0 → ≥1)</td>
<td>2.02 (1.05–3.88)</td>
<td>.04</td>
</tr>
<tr>
<td>Intestinal anastomosis</td>
<td>6.74 (3.42–13.30)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

BMI = body mass index; CI = confidence interval.

Figure 1  Distribution of lapses in discipline in the study population.

The American Journal of Surgery, Vol 198, No 2, August 2009
Challenges: Physician Champion

- Must be involved and vested
  - Helps with peers
  - Understands the clinical practice
  - Will be at frontline as advocate
Challenges: Physician “Champion”

Initial “champion” was not a champion

• Disagreement with outcome measures
• Rationalization that “our patients are sicker”
• “We see more folks with inflammatory bowel disease”
• “Other facilities have higher rates than CDC benchmark”
• “Other facilities don’t look as hard for SSI as we do”
• “We’re operating in a dirty space”
The Value of the Champion

- Sought to understand the surveillance metrics
- Provides insight to improvement team
- Provides insight to clinicians (practices, documentation)

New Colorectal Surgeon Champion’s Case Review Spreadsheet
Lessons Learned: Target the Program

- Start focal, then broaden
- Early lesson:
  - Attempted to addressing SSI prevention across all procedures (not just colorectal)
- Focus on early adopters/engaged champions
Two major services perform colorectal surgery (CRS – Colorectal Surgery and EGS – Emergency General Surgery) yet other services also involved.

Need to involve these groups to 1) raise awareness of bundle practice expectations and 2) identify unique aspects of practice that may need to be addressed.
Lessons Learned: Capture Practices Across Transitions of Care

- Map out patient flow across clinical areas
- Standardize across transitions
- Anticipate varying entry points (e.g. admitted pt vs. elective admission vs. emergent case)
Tracking Bundle Compliance

• Once standards developed → how do you know they are being followed?

• Must
  – Track compliance
  – Understand variations in practice
  – Feedback data to stakeholders
  – Develop accountability
Colorectal Bundle Compliance Dashboard

Provides breakout by bundle element
Drill down to service, surgeon
Challenges:
Data availability
How to share surgeon data
Understand “non-compliance”
PACU O₂
Expansion to Other Procedures

<table>
<thead>
<tr>
<th>Preoperative</th>
<th>Postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preparation:</strong></td>
<td></td>
</tr>
<tr>
<td>Administration:</td>
<td>Administer appropriate IV antibiotic within 1 hour prior to incision. Do not wait to administer until cord clamping.</td>
</tr>
<tr>
<td>C-IVG wipes the night before surgery:</td>
<td>Adjust antibiotic doses for increased risk. Use 2g of cefazolin for weight up to 120kg, 1g for weight &gt;120 kg.</td>
</tr>
<tr>
<td><strong>Pre-op day of surgery:</strong></td>
<td></td>
</tr>
<tr>
<td>C-IVG wipes the day of surgery:</td>
<td>Traffic control: Limit the number of personnel in room and restrict nonessential personnel.</td>
</tr>
<tr>
<td>Preparation, site marker at the surgical site the night before surgery prior to entering the OR:</td>
<td></td>
</tr>
<tr>
<td>Site preparation:</td>
<td>Discontinuance of prophylactic antibiotics within 24 hours after surgery.</td>
</tr>
</tbody>
</table>

**Standardized Bundle Implemented**

- **2012Q4:** 4.79%
- **2013Q1:** 1.01%
- **2014Q2:** 2.0%
- **2014Q3:** 3.0%
Surgical Site Infection Service Line Report
*Procedures using SSI Complex Risk Model*

**Standardized Infection Ratio (Line) and Procedure Volume (Bar)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
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<tbody>
<tr>
<td>2015</td>
<td>23</td>
<td>10</td>
<td>16</td>
<td>22</td>
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<td>21</td>
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<td>14</td>
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<tr>
<td>2016</td>
<td>21</td>
<td>20</td>
<td>10</td>
<td>20</td>
<td>19</td>
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<td>25</td>
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</table>

**Fiscal YTD Performance**
- Observed SSI: 70
- Predicted SSI: 88.94
- SIR: 1
- Procedures: 7,405

**Standardized Infection Ratio (SIR)** is defined as the number of observed infection events divided by the number of predicted infection events. Predicted SSI events are calculated based on the number of procedures within a time period, with consideration of certain risk variables associated with each procedure.

Report URL: [https://tableau.prod.mc.vander](https://tableau.prod.mc.vander)
Prior to surgery patient should shower or bathe with soap or antiseptic agent the night before
Antimicrobial prophylaxis should be administered only when indicated based on published clinical practice guidelines and times such that a bacterial concentration of the agent is established in the serum and tissues when incision is made
Skin preparation in the OR should be performed using an alcohol-based agent unless contraindicated
For clean/contaminated procedures, additional prophylactic antimicrobial agent doses should not be administered after the surgical incision is closed, even in the presence of a drain
Topical antimicrobial agents should not be applies to the surgical incision
During surgery, glycemic control should be implemented using blood glucose target levels less than 200mg/dl
Normothermia should be maintained in all patients
Increased fraction of inspired O2 should be administered during surgery and after extubation in the immediate postoperative period for patients with normal pulmonary function
Transfusion of blood products should not be withheld from surgical patients as means to prevent SSI
Future Challenges

- Maintaining vigilance
- Incorporating new clinicians
- Dealing with desire to identify which “bundle elements matter” in order to remove components

New fellows began (errors in documentation and closure technique)
Clinical Case Study (2)

- OP 61yo M with rectal adenocarcinoma presented for low anterior resection s/p neoadjuvant therapy.
- PMH: PAD, lymphedema, chronic anticoagulation
- PSH includes lower extremity bypass, femoral aneurysm
- Preoperative instructions:
  - Neomycin / metronidazole orally x 3 doses day prior to surgery
  - Peg-electrolyte solution 4 liters until clear
  - Chlorahexadine wipes night before and morning of surgery
- Uneventful perioperative course, discharged on POD 4.
- Last clinic visit (22 months postop); no new problems
Evidence-Based References


Questions?

• Please send your questions to: Clinical.Education@CriticalCareCareers.com or Clinical.Education@WoundCareJobs.com