Prevention of Surgical Site Infections

A Review of Recent Evidence and Guidelines

Dale W. Bratzler, DO, MPH, MACOI, FIDSA
Professor and Associate Dean, College of Public Health
Professor, College of Medicine
Chief Quality Officer – OU Physicians Group
Medical Director, Clinical Skills Education and Testing Center
Oklahoma University Health Sciences Center

January 14, 2016
Disclosures

• Dr. Bratzler has no financial relationships to disclose related to surgical site infection prevention.
Objectives

• Review updates and best practices for SSI prevention

• Highlight practical recommendations from recent guidelines for acute care hospitals in prioritizing SSI prevention efforts

• Reinforce the benefit of a multi-modal, bundle approach to SSI prevention
Current SSI Burden

Burden-US
• 160,000 - 300,000 SSIs per year
• 2%-5% of patients undergoing inpatient surgery
• Most common and most costly HAI

Mortality
• 2-11 fold higher risk of death compared to non-infected operative patient
• 77% of deaths among SSI patients are directly attributable to SSI

Length of Hospital Stay
• ~7-11 additional postoperative hospital days

Cost
• Up to $3.5 to 10 billion annually

Factors Affecting Rates of Surgical Site Infections

- **Host factors**
  - age
  - morbid obesity
  - malnutrition
  - prolonged preoperative stay
  - infection at distal sites
  - cancer
  - diabetes
  - immunosuppression
  - ASA score
  - disease severity
  - prior operations, revision vs primary

- **Endogenous flora/Microbial factors**
  - nasal/skin carriage
  - virulence
  - adherence
  - inoculum

- **Surgical procedures**
  - abdominal site
  - wound classification
  - procedure duration
  - poor hemostasis
  - drains/foreign bodies
  - dead space
  - urgency of surgery

- **Surgical team and hospital practice factors**
  - razor shaves
  - intraoperative contamination
  - prophylactic antibiotic timing, selection and duration
  - preoperative cleansing with chlorhexidine
  - pre-operative screening for resistant organisms and decolonization
  - surgeon’s skill
  - surgical volume
Bacteria get into the wound most of the time!

Observations about SSIs

• All surgical wounds are contaminated by bacteria, but only a minority get infection.

• Different operations have different inoculum amounts of contamination, and have different rates of infection.

• Similar operations performed by the same surgeon in different patient populations have different rates of infection.

• Wound infections have varying degrees of severity.
Contamination of the wound almost always occurs in the interval between incision and closure.

Incision made and operation underway

Wound closure at end of operation
# Bacterial Challenge to the Incision

**S. aureus** applied to wound topically (hours)

<table>
<thead>
<tr>
<th></th>
<th>Incisions Infected</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Staples</td>
<td>Subcuticular suture</td>
</tr>
<tr>
<td>0</td>
<td>90%</td>
<td>80%</td>
</tr>
<tr>
<td>0.5</td>
<td>70%</td>
<td>30%</td>
</tr>
<tr>
<td>1</td>
<td>30%</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Experimental study with rat incisions.

Stillman et al, Arch Surg 1980
The Wound Space

Wound space
- Avascular
- Hypoxic
- Contents – interstitial fluid, glucose, blood.....
SSI Risk Varies by Operation

<table>
<thead>
<tr>
<th>Operation</th>
<th>Pooled Mean SSI Rate (%)</th>
<th>25th, 75th Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABG, Chest and Donor Site</td>
<td>4.26</td>
<td>1.33, 5.81</td>
</tr>
<tr>
<td>Colon</td>
<td>7.06</td>
<td>2.38, 9.09</td>
</tr>
<tr>
<td>Abdominal Hysterectomy</td>
<td>4.05</td>
<td>0.00, 4.86</td>
</tr>
<tr>
<td>Hip prosthesis</td>
<td>2.40</td>
<td>0.00, 3.70</td>
</tr>
<tr>
<td>Laminectomy</td>
<td>2.30</td>
<td>0.00, 3.73</td>
</tr>
<tr>
<td>Peripheral Vascular Bypass</td>
<td>6.98</td>
<td>2.75, 8.47</td>
</tr>
</tbody>
</table>

Risk index category “2” operations

Voluntary Reporting to NHSN

# SSI Rate in a Clinical Trial Compared to NHSN Reported SSI Rates

<table>
<thead>
<tr>
<th>Infection</th>
<th>Ertapenem N=338 (%)</th>
<th>Cefotetan N=334 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any SSI</td>
<td>62 (18.1)</td>
<td>104 (31.1)</td>
</tr>
<tr>
<td>Superficial incisional</td>
<td>45 (13.1)</td>
<td>75 (22.4)</td>
</tr>
<tr>
<td>Deep incisional</td>
<td>13 (3.7)</td>
<td>17 (5.1)</td>
</tr>
<tr>
<td>Organ-space</td>
<td>4 (1.2)</td>
<td>12 (3.7)</td>
</tr>
</tbody>
</table>

**Total infections identified** = 166 (24.7%)

**Deep incisional and organ-space** = 46 (6.8%)

**NHSN Pooled Mean** = 7.06%

**NHSN 90th Percentile** = 13.8%

Overall surgical site infection rates were 25.2% pre-intervention vs 26.6% post-intervention (p = 0.82).
Development of National Guidelines for Antimicrobial Prophylaxis and Prevention of SSI
Clinical Practice Guidelines for Antimicrobial Prophylaxis in Surgery

Clinical practice guidelines for antimicrobial prophylaxis in surgery

DALE W. BRATZLER, E. PATCHEN DELLINGER, KEITH M. OLSEN, TRISH M. PERL, PAUL G. AUWAERTER, MAUREEN K. BOLON, DOUGLAS N. FISH, LENA M. NAPOLITANO, ROBERT G. SAWYER, DOUGLAS SLAIN, JAMES P. STEINBERG, AND ROBERT A. WEINSTEIN

Am J Health-Syst Pharm. 2013; 70:195-283

A few principles....... 

• In almost every study for every type of surgery, antibiotic prophylaxis reduces the risk of SSI
  – However for some operations the risk is so low or consequences so trivial, that antibiotic prophylaxis may not be warranted for all operations

• Guideline was developed to be specialty specific and was posted for open public comment
Antimicrobial Prophylaxis

• Antibiotic selection
  – Narrowest spectrum for efficacy
  – Routine use of vancomycin for prophylaxis is not recommended for any procedure.
    – Limit use of vancomycin to patients with known colonization with MRSA, high risk of MRSA, or in patients with beta-lactam allergy
  – No consensus on patients colonized with other MDROs

Addition of Vancomycin to Cefazolin Prophylaxis Is Associated With Acute Kidney Injury After Primary Joint Arthroplasty

P. Maxwell Courtney MD, Christopher M. Melnic MD, Zachary Zimmer MD, Jason Anari MD, Gwo-Chin Lee MD

Published online: 25 November 2014
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Abstract

With increasing prevalence of methicillin-resistant Staphylococcus aureus (MRSA) in patients undergoing hip and knee arthroplasty, some have advocated a dual-antibiotic regimen including vancomycin as prophylaxis against surgical site infections. However, the association between vancomycin prophylaxis and acute kidney injury (AKI) remains to be defined. The aims of this study were to compare the incidence, severity, and recovery of AKI in these two cohorts and to determine independent risk factors for AKI.

Methods We retrospectively evaluated a series of 1828 patients undergoing primary hip and knee arthroplasty over a 2-year period who received either cefazolin (n = 500) or cefazolin and vancomycin (n = 1328) as perioperative prophylaxis.
Use of Vancomycin or Clindamycin

“For procedures where pathogens other than staphylococcus and streptococcus are likely, an additional agent with activity against those pathogens could be considered. For example, if there is surveillance data showing that gram negative organisms are a cause of surgical site infections for the procedure, consider combining clindamycin or vancomycin with another agent (cefazolin if not beta-lactam allergic; aztreonam, gentamicin, or single-dose fluorquinolone if beta-lactam allergic).”

Distribution of complex SSI pathogens following CABG and arthroplasty procedures, NHSN 2006-2009

- CNS: coagulase-negative Staphylococci
- MSSA: methicillin-sensitive Staphylococcus aureus
- MRSA: methicillin-resistant Staphylococcus aureus

Don’t overuse non-beta lactam antibiotics in patients with a history of penicillin allergy, without an appropriate evaluation.

While about 10 percent of the population reports a history of penicillin allergy, studies show that 90 percent or more of these patients are not allergic to penicillins and are able to take these antibiotics safely.
Antimicrobial Timing

• The first dose of prophylaxis should be initiated within 60 minutes prior to incision (120 minutes for vancomycin or fluoroquinolones)

  – Patients receiving therapeutic antibiotics for a remote infection prior to surgery should also be given antibiotic prophylaxis prior to surgery to ensure adequate serum and tissue levels of antibiotics with activity against likely pathogens for the duration of the operation.
Antibiotic Dosing

- Weight-based dosing – very little data upon which to make recommendations
  - Cefazolin ~25 mg/kg
  - Gentamicin 5 mg/kg single preoperative dose based on the dosing weight
  - Vancomycin 15 mg/kg

In general, gentamicin for surgical antibiotic prophylaxis should be limited to a single dose given preoperatively. Dosing is based on the patient’s actual body weight. If the patient’s actual weight is more than 30% above their ideal body weight (IBW), the dosing weight (DW) can be determined as follows: \( DW = IBW + 0.4(\text{actual weight} – IBW) \).
Antimicrobial Prophylaxis

• Re-dosing
  – Specific intervals provided – two half-lives of the drug

• Duration
  – The duration of antimicrobial prophylaxis should be less than 24 hours for all operations

• Topical antibiotics
  – “Superior to placebo but not superior to parenteral administration, and topical administration does not increase the efficacy of parenteral antibiotics when used in combination for prophylaxis.”

Colorectal Surgery

• In most patients undergoing elective colorectal surgery, a mechanical bowel prep combined with oral neomycin sulfate plus oral erythromycin base; or oral neomycin sulfate plus oral metronidazole should be given in addition to intravenous prophylaxis.


Oral antibiotic + IV (n = 2,426) had a lower SSI rate than IV alone (n = 3,324) (6.3% vs 16.7%, p < 0.0001).
These results strongly suggest that preoperative oral antibiotics should be administered for elective colorectal resections.
A Statewide Colectomy Experience

The Role of Full Bowel Preparation in Preventing Surgical Site Infection

Edward K. Kim, BS, Kyle H. Sheetz, BS, Julie Bonn, BS, Scott DeRoo, BA, Christopher Lee, Isaac Stein, BA, Arya Zarinsefat, BA, Shijie Cai, PhD, Darrell A. Campbell, Jr, MD, and Michael J. Englesbe, MD

Rate of SSI comparison: propensity matched

<table>
<thead>
<tr>
<th></th>
<th>No preparation</th>
<th>Full preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep SSI</td>
<td>0.73%</td>
<td>0.73%</td>
</tr>
<tr>
<td>Organ SSI*</td>
<td>3.13%</td>
<td>1.57%</td>
</tr>
<tr>
<td>Superficial SSI*</td>
<td>5.96%</td>
<td>2.93%</td>
</tr>
<tr>
<td>All SSI*</td>
<td>9.72%</td>
<td>5.02%</td>
</tr>
</tbody>
</table>

Postoperative complications comparison: propensity matched

<table>
<thead>
<tr>
<th></th>
<th>No preparation</th>
<th>Full preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clostridium difficile*</td>
<td>1.78%</td>
<td>0.52%</td>
</tr>
<tr>
<td>Prolonged ileus</td>
<td>7.31%</td>
<td>5.22%</td>
</tr>
</tbody>
</table>
**S. aureus Preoperative Screening**

- Patients with nasal carriage of *S. aureus* are at an increased risk of *S. aureus* skin colonization and 2- to 14-fold increased risk for SSI with this microorganism compared with non-carriers.

- Preoperative screening and decolonization
  - “Recent studies confirm that *S. aureus* decolonization of the anterior nares decreases SSI rates in many surgical patients. The data are most compelling in cardiac and orthopedic surgery patients.”
Pre-surgical screening for *S. aureus* colonization of nares.

**MSSA positive** – CHG bathing and mupirocin nasal application for 5 days
Cefazolin for surgical prophylaxis

**MRSA positive** – CHG bathing and mupirocin nasal application for 5 days
Vancomycin + cefazolin for surgical prophylaxis

**Negative screen** – Routine preoperative bath or CHG
Cefazolin for surgical prophylaxis

Figure 1. Pooled Rate of Complex *Staphylococcus aureus* Surgical Site Infections (SSIs) by Admission Month

Hospitals began implementing intervention in June 2012.

- **No. of operations**
  - Within 25th to 75th percentile
  - <25th Percentile
  - >75th Percentile

<table>
<thead>
<tr>
<th>Year</th>
<th>Complex <em>S. aureus</em> SSI Rate (per 10000 Operations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar 2009</td>
<td>0</td>
</tr>
<tr>
<td>July 2009</td>
<td>20</td>
</tr>
<tr>
<td>Jan 2010</td>
<td>40</td>
</tr>
<tr>
<td>July 2010</td>
<td>60</td>
</tr>
<tr>
<td>Jan 2011</td>
<td>80</td>
</tr>
<tr>
<td>July 2011</td>
<td>100</td>
</tr>
<tr>
<td>Jan 2012</td>
<td>120</td>
</tr>
<tr>
<td>July 2012</td>
<td>140</td>
</tr>
<tr>
<td>Jan 2013</td>
<td>160</td>
</tr>
<tr>
<td>July 2013</td>
<td>180</td>
</tr>
<tr>
<td>Jan 2014</td>
<td>200</td>
</tr>
</tbody>
</table>

“The rates of complex *S* aureus SSIs decreased significantly (RR, 0.54 [95%CI, 0.34-0.88]) after operations performed by these surgeons, but not after operations done by surgeons that did not implement any bundle elements (RR, 0.80 [95% CI, 0.33-1.98]).”

• Update of the 1999 HICPAC guideline on Prevention of Surgical Site Infections
  - Core section
  - Arthroplasty section
- Effort started in 2010
Participants

- American College of Surgeons (ACS)
- American Academy of Orthopaedic Surgeons (AAOS)
- Association of periOperative Registered Nurses (AORN)
- Musculoskeletal Infection Society (MSIS)
- Surgical Infection Society (SIS)
- European Union
- Academic Institutions
- CDC/HICPAC
- S. aureus, Biofilm, Environmental External and CDC
- University of Pennsylvania Center for Evidence-based Practice
- HICPAC Leads
- CDC Lead
Study Selection Process – Round 1

- 4961 studies identified in literature search
- 104 studies suggested by content experts
- 168 studies cited in 1999 Guideline

5233 Title and Abstract Screen

5233 Title and Abstract Screen

797 Full Text Review

4436 studies excluded

682 studies excluded

- 564: not relevant to key questions
- 108: study design
- 6: not available as full text article
- 4: not in English

25 Clinical practice guidelines

23 guidelines cited

- 14 identified by writing group
- 16 excluded

133 studies extracted into Evidence and GRADE tables

97 Core and 36 Arthroplasty

43 studies identified from excluded systematic reviews

147 clinical practice guidelines identified by writing group

16 excluded
Study Selection – Round 2

• Updated literature review
  – 500+ abstracts identified
  – 99 articles underwent full-text review by two authors (SBT, DWB)
  – 62 additional articles extracted into grade tables

Most of the new articles address use of triclosan-coated sutures, oxygenation, preoperative bathing, antibiotic duration, and antibiotic timing for C-section.
Our Review of Meta-analyses

• Detailed review of each study in the meta-analysis
  – Specific attention to other factors known to influence rates of SSI (for example, systemic antimicrobial prophylaxis)
  – Evaluation of treatment and control groups – were they equal and were they treated the same way other than the intervention
• **Category IA.** Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.

• **Category IB.** Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies and a strong theoretical rationale; or an accepted practice (e.g., aseptic technique) supported by limited evidence.

• **Category IC.** Required by state or federal regulations, rules, or standards.

• **Category II.** Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

• **Unresolved issue.** Represents an unresolved issue for which evidence is insufficient or no consensus regarding efficacy exists.
Key Topics - Final

CORE
- Antimicrobial Prophylaxis
  - Topical antimicrobials/antiseptics
- Glycemic Control
- Normothermia
- Tissue Oxygenation
- Skin Preparation

ARTHROPLASTY
- Transfusion
- Immunosuppressive Therapy
- Anticoagulation
- Orthopedic exhaust (space) suits
- Antimicrobial prophylaxis duration with drains
- Biofilm
Core Section

(Based on RCTs only)
Parenteral Antimicrobial Prophylaxis

• 1A. Administer preoperative antimicrobial agent(s) only when indicated, based on published clinical practice guidelines and timed such that a bactericidal concentration of the agent(s) is established in the serum and tissues when the incision is made (Category IB)

• 1B. Administer the appropriate parenteral prophylactic antimicrobial agent(s) prior to skin incision in all cesarean sections. (Category IA)
Antimicrobial Prophylaxis (cont)

- No recommendation can be made
  - Weight-adjusted dosing
  - Intraoperative redosing

(No recommendation/unresolved issue)

We did not identify randomized controlled trials (RCTs). Other organizations have made recommendations based on observational and pharmacologic studies.
Antibiotic Duration

• In clean and clean-contaminated procedures, do not administer additional prophylactic antimicrobial agent doses after the surgical incision is closed in the operating room, even in the presence of a drain. (Category IA)

Disclaimer: The findings and conclusions are draft and have been presented at HICPAC but have not been formally disseminated by the CDC and should not be construed to represent any agency determination or policy.
Glucose control

• Implement perioperative glycemic control and use blood glucose target levels < 200 mg/dL in diabetic and non-diabetic surgical patients (Category 1A)
  
  – No recommendation can be made regarding the safety and effectiveness of lower or narrower blood glucose target levels and SSI. (No Recommendation/unresolved issue)
  
  – No recommendation can be made regarding hemoglobin A1C target levels and the risk of surgical site infection in diabetic and non-diabetic patients. (No recommendation/unresolved issue)
Diabetes and Risk of Surgical Site Infection: A Systematic Review and Meta-analysis

Emily T. Martin, MPH, PhD; Keith S. Kaye, MD, MPH; Caitlin Knott, PharmD; Huong Nguyen, PharmD; Maressa Santarossa, PharmD; Richard Evans, BS; Elizabeth Bertran, PharmD; Linda Jaber, PharmD

<table>
<thead>
<tr>
<th>Surgery Type</th>
<th>No. of Studies</th>
<th>Pooled Estimate</th>
<th>95% Prediction Interval</th>
<th>I², %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gynecological</td>
<td>6</td>
<td>1.61</td>
<td>1.15–2.24</td>
<td>4.0</td>
</tr>
<tr>
<td>Colorectal</td>
<td>7</td>
<td>1.16</td>
<td>0.93–1.44</td>
<td>9.5</td>
</tr>
<tr>
<td>Arthroplasty</td>
<td>6</td>
<td>1.26</td>
<td>1.01–1.66</td>
<td>11.7</td>
</tr>
<tr>
<td>Breast</td>
<td>5</td>
<td>1.58</td>
<td>0.91–2.72</td>
<td>2.7</td>
</tr>
<tr>
<td>Cardiac</td>
<td>15</td>
<td>2.03</td>
<td>1.13–4.05</td>
<td>22.4</td>
</tr>
<tr>
<td>Spinal</td>
<td>14</td>
<td>1.66</td>
<td>1.10–2.32</td>
<td>8.1</td>
</tr>
<tr>
<td>Other/Multiple surgery types combined</td>
<td>37</td>
<td>1.46</td>
<td>1.07–2.00</td>
<td>41.5</td>
</tr>
</tbody>
</table>

Normothermia

• Maintain perioperative normothermia (Category 1A)
  – No recommendation can be made regarding the safety or effectiveness of strategies to achieve and maintain normothermia, the lower limit of normothermia, or the optimal timing and duration of normothermia.

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Oxygenation

• 6A. For patients with normal pulmonary function undergoing general anesthesia with endotracheal intubation, administer increased fraction of inspired oxygen (FiO2) both intraoperatively and post-extubation in the immediate postoperative period. To optimize tissue oxygen delivery, maintain perioperative normothermia and adequate volume replacement. (Category IA)

Disclaimer: The findings and conclusions are draft and have been presented at HICPAC but have not been formally disseminated by the CDC and should not be construed to represent any agency determination or policy.
Antiseptic Prophylaxis

• Advise patients to shower or bathe (full body) with either soap (antimicrobial or non-antimicrobial) or an antiseptic agent on at least the night before the operative day. (Category 1B)
Antiseptic Prophylaxis

• Perform intraoperative skin preparation with an alcohol-based antiseptic agent, unless contraindicated. (*Category 1A*)

• Application of an antimicrobial sealant following intraoperative skin preparation is not necessary for the prevention of a surgical site infection. (*Category II*)

• Consider intraoperative irrigation of deep or subcutaneous tissues with aqueous iodophor solution (but not for contaminated or dirty abdominal procedures). (*Category II*)

Disclaimer: The findings and conclusions are draft and have been presented at HICPAC but have not been formally disseminated by the CDC and should not be construed to represent any agency determination or policy.
No Recommendation/Unresolved Issues

• Weight-based antimicrobial dosing
• Intraoperative antimicrobial redosing
• Intraoperative antimicrobial irrigation
• Antimicrobial soaking of prosthetic devices
• Antimicrobial dressings applied to surgical incisions
• Optimal target for blood glucose control
• Value of the HbA1c for predicting SSI
• Best strategy for maintaining normothermia
• Oxygenation in non-endotracheal intubation surgery
• Best mechanism to deliver postoperative oxygen and the optimal FiO$_2$
• Optimal timing of preoperative bathing
• All of the orthopedic key questions except antimicrobial prophylaxis duration. No RCTs identified and only observational studies reviewed.
Triclosan-coated sutures – the evolution

- **July 2013 draft:**
  - Do not use antimicrobial coated sutures for prevention of surgical site infection. *(Category IA)*

- **Mid-2014 Draft:**
  - RCT evidence suggests uncertain tradeoffs between the benefits and harms regarding the use of triclosan-coated sutures for superficial skin closure or for the use of sutures coated or impregnated with antimicrobials other than triclosan for any type of closure to prevent surgical site infection *(No Recommendation/Unresolved issue)*

- **After December 2014 HICPAC meeting:**
  - 2.C.1. Use triclosan-coated sutures for deep/fascial closure in colorectal surgery *(Category IA)*
  - 2.C.2. Consider triclosan-coated sutures for deep/fascial closure in surgical procedures other than colorectal surgery *(Category II)*

- **HICPAC meeting on 05/11/15:**
  - 2.C.1. Use triclosan coated sutures for deep and fascial closure if a triclosan-coated option is available for the suture appropriate to the surgery type and level of closure, and if triclosan is not contraindicated. *(Category IA)*

Disclaimer: The findings and conclusions are draft and have been presented at HICPAC but have not been formally disseminated by the CDC and should not be construed to represent any agency determination or policy.
An intra-operative examination revealed large knotted sutures at the bases of her draining sinuses 16 months after surgery.
(A) Viability staining showing a biofilm (arrow) attached to the suture braids (autofluorescing red). Green and yellow bacteria indicate viable cells at the wound site.

(B) Higher magnification of the crevice region between the braids of the suture showed that the biofilm was polymicrobial, consisting of bacilli and cocci.

Key Question 2C – How safe and effective are antimicrobial-coated sutures?

• Final Recommendation:
  – “Consider the use of triclosan-coated sutures for the prevention of surgical site infection.” (Category II)

Disclaimer: The findings and conclusions are draft and have been presented at HICPAC but have not been formally disseminated by the CDC and should not be construed to represent any agency determination or policy.
Hospitals improved in measures related to appropriate antimicrobial agent selection, timing, and duration; normothermia; oxygenation; euglycemia; and appropriate hair removal. The infection rate decreased 27%, from 2.3% to 1.7% in the first versus last 3 months.

Developing an argument for bundled interventions to reduce surgical site infection in colorectal surgery

Seth A. Waits, MD,§ Danielle Fritze, MD,§ Mousumi Banerjee, PhD,§‡ Wenying Zhang, MA,§ James Kubus, MS,§ Michael J. Englesbe, MD,§ Darrell A. Campbell, Jr, MD,§ and Samantha Hendren, MD, MPH,§ Ann Arbor, MI

This multi-institutional study shows that patients who received all 6 perioperative care measures attained a very low, risk-adjusted SSI rate of 2.0%.
1. Appropriate (Surgical Care Improvement Project [SCIP]-2) selection of intravenous prophylactic antibiotics;
2. Postoperative normothermia (temperature of >98.6°F);
3. Oral antibiotics with mechanical bowel preparation, if used (Nichols preparation);
4. Postoperative day 1 glucose 140 mg/dL;
5. Minimally invasive surgery; and
6. Short operative duration as defined by <100 or >100 minutes as a dichotomous outcome.
There was a strong stepwise inverse association between bundle score and incidence of SSI. Patients who received all 6 bundle elements had risk-adjusted SSI rates of 2.0% (95% confidence interval [CI], 7.9–0.5%), whereas patients who received only 1 bundle measure had SSI rates of 17.5% (95% CI, 27.1–10.8%).
Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update

Deverick J. Anderson, MD, MPH;1 Kelly Podgorny, DNP, MS, RN;2 Sandra I. Berrios-Torres, MD;3 Dale W. Bratzler, DO, MPH;4 E. Patchen Dellinger, MD;5 Linda Greene, RN, MPS, CIC;6 Ann-Christine Nyquist, MD, MSPH;7 Lisa Saiman, MD, MPH;8 Deborah S. Yokoe, MD, MPH;9 Lisa L. Maragakis, MD, MPH;10 Keith S. Kaye, MD, MPH11
Conclusions

• Surgical site infections are the most frequent healthcare-associated infection reported in hospitals
  – Probably far more common than voluntary reporting to NHSN suggests

• Risk of SSI varies by operation type

• There are multiple factors that contribute to the development of SSIs
  – No single intervention is going to be sufficient to prevent SSIs
dale-bratzler@ouhsc.edu