Think Like a Surgeon: Incorporating Evidence into Your Surgical Practice

Sarah M. Temkin, MD
Director, Gynecologic Oncology
Virginia Commonwealth University
I have nothing to disclose
Surgeons hate change.

Quality improvement in the operating room has historically been incremental.

“I’ll be performing the operation. This is the anesthesiologist.”
“Single-use shoe covers are removed and discarded immediately after use” - AORN

Footwear practices and operating room contamination.

Copp G1, Slezak L, Dudley N, Mailhot CB.

Abstract
The extent of bacterial transfer into the clean confines of the operating room (OR) was studied by comparing the use of protective footwear (i.e., polypropylene shoe covers and OR restricted shoes) with unprotected street shoes over a 5-week period. The study was divided into two experimental times: (a) early morning (disinfected floor) and (b) midmorning (dirty floor). Data obtained from the early morning experiment showed that OR restricted shoes and shoe covers transferred fewer bacteria onto the disinfected study area than unprotected street shoes; similar findings were obtained from the midmorning experiment for shoe covers, but not for OR restricted shoes. A comparison of changes in bacterial counts obtained from OR restricted shoes and shoe covers worn from the changing room through a common corridor to the disinfected study area did not differ significantly from OR restricted shoes and shoe covers that were put on immediately before walking through the study area at both experimental times. Overall results indicated that protective footwear may act to reduce bacterial contamination on OR floors.

PMID: 3671124

The use of shoe covers has never been proven to decrease the risk or incidences of surgical site infection, or to decrease the bacterial counts of the operating room floors. Shoe covers do protect the footwear and feet from exposure to blood and body fluids.
Just because you have always done it that way doesn’t mean it isn’t stupid.
Choosing your suture

- **Bladder**: 92% at 28 days
- **Stomach**: 80% at 23 days
- **Colon**: 70% at 120 days
- **Epidermis**: 100% at 560 days
- **Fascia**: 83% at 360 days
Fascial closure – type of suture?

(Average of size 6-0, 2-0, and 1)
Panacryl size 2: 60% at 6 months; 45% at 9 months; 31% at 12 months
Fascia: 83% at 12 months
Suture is stronger than your knot – use a loop

<table>
<thead>
<tr>
<th>Suture</th>
<th>Square Knot</th>
<th>Surgeon’s Knot</th>
<th>Double Knot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Ethilon</td>
<td>10</td>
<td>54</td>
<td>100</td>
</tr>
<tr>
<td>Dermalon</td>
<td>16</td>
<td>77</td>
<td>100</td>
</tr>
<tr>
<td>Prolene</td>
<td>19</td>
<td>100</td>
<td>37</td>
</tr>
<tr>
<td>Vicryl</td>
<td>50</td>
<td>100</td>
<td>40</td>
</tr>
<tr>
<td>Dexon</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>PDS</td>
<td>11</td>
<td>100</td>
<td>17</td>
</tr>
</tbody>
</table>

- Complex knots have twice the security of simple knots
- In vivo the knot is the determining factor in suture strength in 95% of sutures tested
The placement of your sutures matters

When a = 1.5 cm
b = 1.5 cm
SL/ WL = 4.12

An incision (vertical line) sutured in an over-and-over fashion (solid and dashed line). Suture length to wound length ratio (SL:WL) may be calculated with the Pythagorean theorem applied to the shaded triangle: $(SL)^2 = (a/2)^2 + (2b)^2$, where $a = $ stitch interval and $b = $ width of tissue bite; $WL = a/2$.

Incisional Hernia

Hernia Rate

PDS nylon

There is a correct way to close fascia

- Continuous closure
- Delayed absorbable
- SL:WL > 4
- Double surgeons knots

And it’s faster!
Bowel prep and laparotomy

• Largely fell out of favor 10 years ago
  • Uncomfortable
  • Led to hypovolemia
  • No decrease in anastomotic leak rates
  • No decrease in postoperative intra-abdominal abscess rates
  • Increase in SSI rates

• In gynecologic surgery – bowel injury rates are 1/500 cases.

Bowel prep and laparoscopy

• No improvement in visualization
• With only harms to the patient

Bowel prep summary: HARMS >> BENEFITS

2012 ASC NSQIP data – benefit to mechanical bowel prep plus oral antibiotics?

Thirty-day postoperative incisional SSI rate for patients undergoing elective colorectal resection, stratified by preoperative bowel preparation status. AOR 0.33 (95% CI (0.23,0.47), P<0.01

Thirty-day postoperative anastomotic leak rate for patients undergoing elective colorectal resection, stratified by preoperative bowel preparation status. AOR 0.48 (95% CI 0.32, 0.73), p<0.01

Thirty-day postoperative mortality rate for patients undergoing elective colorectal resection, stratified by preoperative bowel preparation status. AOR 0.40 (95% CI 0.14, 1.18), p=0.10

NPO after midnight?

Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures

An Updated Report by the American Society of Anesthesiologists Task Force on Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration*

- Pulmonary aspiration is rare
- Little relation between fasting duration and gastric volume or pH
- Prolonged fasting may have adverse effects
- Liquids and solids are eliminated differently from the stomach

- Minimum preoperative fasting for healthy people
  - Clear liquids – two hours
    - Water, fruit juice without pulp, clear tea, black coffee
  - Light meal (toast + liquid) – six hours
  - Regular meal (fried or fatty food) – eight hours

Anesthesiology 2017; 126:376-93
27 studies and included the outcomes of 1976 participants.

Patients given carbohydrates before planned surgical procedures went home between 0.04 and 0.56 days sooner than those receiving a placebo drink or having nothing to eat or drink before surgery.

Carbohydrate supplements had little or no effect on complication rate or on how people feel in-hospital during recovery from surgery.

Aspiration pneumonitis was not reported in any patients, regardless of treatment group allocation.

### Length of Hospital Stay

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Carbohydrates Mean [days]</th>
<th>Placebo or fasting Mean [days]</th>
<th>Total Weight</th>
<th>Mean Difference N, Random, 95% CI [days]</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yi et al. 2005</td>
<td>6</td>
<td>3.66</td>
<td>10</td>
<td>-0.44 [0.62, -0.26] 2005</td>
<td></td>
</tr>
<tr>
<td>Nisbet et al. 2006</td>
<td>7.5</td>
<td>6.14</td>
<td>15</td>
<td>0.36 [0.30, -0.06] 2006</td>
<td></td>
</tr>
<tr>
<td>Motzur 2010</td>
<td>0.80</td>
<td>0.80</td>
<td>20</td>
<td>0.00 [0.00, 0.00] 2010</td>
<td></td>
</tr>
<tr>
<td>Kaske 2010</td>
<td>11</td>
<td>8.51</td>
<td>24</td>
<td>-3.40 [0.40, -3.40] 2010</td>
<td></td>
</tr>
<tr>
<td>Costerlitz 2012</td>
<td>1.80</td>
<td>1.80</td>
<td>30</td>
<td>-3.00 [0.00, -3.00] 2012</td>
<td></td>
</tr>
<tr>
<td>Ortona 2012</td>
<td>14.2</td>
<td>14.2</td>
<td>21</td>
<td>0.00 [0.00, 0.00] 2012</td>
<td></td>
</tr>
<tr>
<td>Pepe-Machado 2013</td>
<td>8.7</td>
<td>7.02</td>
<td>14</td>
<td>1.68 [1.58, 1.78] 2013</td>
<td></td>
</tr>
<tr>
<td>Lister 2013</td>
<td>8</td>
<td>8.30</td>
<td>22</td>
<td>-0.00 [0.00, -0.00] 2013</td>
<td></td>
</tr>
<tr>
<td>(Continued)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Test for overall effect: Z = 3.47 (P = 0.001)

Favors Carbohydrates Favors Control

*Cochrane Database Syst Rev. 2014 Aug 14;(8)*
Early postoperative feeding

- Retroperitoneal dissection with transient clamping of renal pedicle
- Bipolar electrodes placed through the GI tract of stump-tail monkeys – electrical activity measured

<table>
<thead>
<tr>
<th>Area of GI tract</th>
<th>Decrease in motility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric antrum</td>
<td>Transient</td>
</tr>
<tr>
<td>Small bowel</td>
<td>Hours</td>
</tr>
<tr>
<td>Right colon</td>
<td>24 hours</td>
</tr>
<tr>
<td>Sigmoid colon</td>
<td>72 hours</td>
</tr>
</tbody>
</table>

Early Postop Feeding

• Decreased length of hospital stay
• Improved patient satisfaction
• No increase in ileus rates
Chewing gum

- Decreased time to first flatus

- Decreased LOS
Can evidence-based surgery be bundled?
SSI reductions – bundles gynecologic oncology

**Preoperative measures**
1. Chlorhexidine wash using 4% chlorhexidine gluconate wipes
   - A. One washcloth used for: 1) neck, chest, and abdomen; 2) both arms; 3) left leg; 4) right leg; 5) back; 6) back and forth over surgical area for 3 min
   - B. Applied the night before surgery and the morning of surgery.
2. Mechanical bowel preparation with oral antibiotics
   - 1. One bottle of Miralax powder (230 g) and four tablets bisacodyl, 5-mg tablets and antibiotics (nine tablets of neomycin sulfate, 500-mg tablets and 12 tablets erythromycin, 250-mg tablets)
   - 2. Begin 24 h before surgery with clear liquid diet followed by a combination of antibiotics and laxatives

**Intraoperative measures**
3. Antibiotic and skin preparation administration
   - 1. Intravenous cefazolin (1–3 g, weight-based) and metronidazole 500 mg IV administered within 30 min of procedure
   - 2. Cefazolin redosing when applicable (i.e., every 3 h, when greater than 1,500 estimated blood loss has occurred, or both)
   - 3. Skin, vaginal, and anogenital preparation with a 4% chlorhexidine solution
4. Adoption of enhanced sterile techniques during intestinal resection and wound closure
   - 1. Gown and glove change by surgical team after intestinal surgery
   - 2. Change of instruments for wound closure

**Postoperative measures**
5. Strict postoperative wound management
   - 1. Appropriate timing of dressing removal by nursing
   - 2. Enhanced attention to wound care by housestaff and nursing
   - 3. Strict glycemic control to keep blood sugars less than 180 mg/dL

**Table 3**
Rates of surgical site infection and wound dehiscence in PRE and POST bundle cohorts.

<table>
<thead>
<tr>
<th>Postoperative event</th>
<th>PRE (n = 115)</th>
<th>POST (n = 118)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSI ≤30 days</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superficial</td>
<td>20 (47%)</td>
<td>5 (36%)</td>
<td></td>
</tr>
<tr>
<td>Deep</td>
<td>6 (14%)</td>
<td>5 (36%)</td>
<td></td>
</tr>
<tr>
<td>Organspace</td>
<td>7 (16%)</td>
<td>3 (21%)</td>
<td></td>
</tr>
<tr>
<td>Combination</td>
<td>10 (23%)</td>
<td>1 (7%)</td>
<td></td>
</tr>
<tr>
<td>Wound dehiscence</td>
<td>30 (26%)</td>
<td>2 (2%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Type of Surgery

<table>
<thead>
<tr>
<th>Prebundle</th>
<th>Postbundle</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSI among all patients with ovarian cancer</td>
<td>18/91 (20%)</td>
<td>4/128 (3%)</td>
</tr>
<tr>
<td>SSI among patients with ovarian cancer who had colon surgery</td>
<td>14/42 (33%)</td>
<td>3/46 (7%)</td>
</tr>
</tbody>
</table>

SSI, surgical site infection. * Fisher exact test.

Impact on gyn surgery/cesarean delivery

Pre-Op Activities
- Provide "Preventing SSI" pamphlet
- Hibiclens® shower night before and day of surgery
- Chlorhexidine cloths at AM admission (GYN surgeries and scheduled Cesareans)

Intra-Op Activities
- Ensure Surgical Care Improvement Project (SCIP) compliance
- Correct antibiotics
- Administer 60 minutes prior to incision
- Discontinue within 24 hours
- Ensure re-dose of cefazolin within 3-4 hours after incision (GYN surgeries)
- Use closing tray for closure of fascia and skin
- Glove change by staff before closure

Post-Op Activities
- Practice good hand hygiene
- Ensure dressing removal within 24 to 48 hours
- Patient shower with Hibiclens® after dressing removal
- Hand cleansing agent readily available

Post-Dismissal Activities
- Dismiss with 4 oz bottle of Hibiclens®
- Patient education on wound care and recognizing infection symptoms
- Follow-up phone call from nurses

SSI Reduction Closing Trays

<table>
<thead>
<tr>
<th>Gynecology Surgery Closing Tray</th>
<th>Cesarean Delivery Closing Tray</th>
</tr>
</thead>
<tbody>
<tr>
<td>#4 Kocher/straight clamps</td>
<td>#2- Two prong retractors</td>
</tr>
<tr>
<td>#2 6-inch Mayo Haeger needle drivers</td>
<td>#3- Straight clamps</td>
</tr>
<tr>
<td>#2 8-inch Mayo Haeger needle drivers</td>
<td>#1- Needle Driver</td>
</tr>
<tr>
<td>#1 medium DeBakey forceps</td>
<td>#1- Suture scissors</td>
</tr>
<tr>
<td>#1  pick-up with teeth</td>
<td>#2 Addison pick-ups</td>
</tr>
<tr>
<td>#2 Adson forceps</td>
<td></td>
</tr>
<tr>
<td>#2 bowel pickups</td>
<td></td>
</tr>
<tr>
<td>#1 short Metzenbaum scissors</td>
<td></td>
</tr>
<tr>
<td>#1 long suture scissors</td>
<td></td>
</tr>
<tr>
<td>#2 two-prong retractors</td>
<td></td>
</tr>
</tbody>
</table>

OB Cesarean SSI – IPAC Data

Mayo Clinic 2017 (abstract)
Enhanced recovery after surgery (ERAS) - the ultimate bundle

- Multidisciplinary (anesthesia, surgeon + nursing)
- Multiple, common sense, evidence based interventions
Fluid management is an essential component to ERAS pathways

## Fluid Management
- Place locked peripheral IV catheter
- Patients without heart failure may consume up to 400 mL clear carbohydrate drink or water until 2 hours prior to predicted surgery start.
- Water only for patients with diabetes

## Maintain Normothermia
- Place Bair Hugger, blankets
- Travel to OR with warmed blankets

## Prevent Venous Thromboembolism
- Apply bilateral knee length SCD sleeves

## Glycemic Management
- Point of Care glucose testing for patients with diabetes.

## Analgesia
- Acetaminophen
- Gabapentin

## Prevent Nausea and Vomiting
- When ordered, Scopolamine transdermal patch for patients < 65 years.

## Goal-Directed Fluid Therapy
- Maintenance fluids via IV pump. No gravity drips.
- Use non-invasive cardiac output monitors to guide fluid therapy.
- Weigh patient immediately post-op—in the OR. Prior to transferring patient to the bed, zero-balance the bed scale.
- Document post-op weight.

## Antibiotic Prophylaxis
- Start antibiotics within 60 minutes prior to surgical incision.
  - Cefazolin, 2,000mg (wt ≤120 kg)- intra-op re-dosing—CrCl ≥ 35ml/min-4 hours
  - Cefazolin, 3,000mg (wt >120kg)- no intra-op re-dosing—CrCl <35ml/min and
  - Metronidazole, 500mg, IV—Intra-operative re-dosing at 12 hours.
- Betalactam allergy
  - Gentamicin, 5mg/kg (Use ideal body weight), IV No re-dosing and
  - Clindamycin, 900mg, IV—Intra-operative re-dosing at 6 hours and
  - Metronidazole, 500mg, IV—Intra-operative re-dosing at 12 hours.

## Anesthesia and Analgesia
- Recommended midazolam dosing (minimize):
  - <65 years: <2mg
  - ≥65 years: <1mg
- Neuraxial catheters - No fluid pre-load with catheter placement.

## Infection Prevention: Surgical Wound
- Wound Protector—use at the incision site on open cases to prevent contamination and trauma to abdominal wall.

## Infection Prevention: Wound Irrigation
- Prior to closure, irrigate abdominal surgical wound
  - 500ml warm NaCl

## Infection Prevention: Surgical Closing
1. After anastomosis: Change suction tip
2. After anastomosis: Change surgeon’s gown, gloves
3. Replace light handle covers
4. Use separate, new instrument tray for wound closure
5. Re-towel around the surgical wound
6. Use new suction and cautery
Successful implementation of an Enhanced Recovery After Surgery program shortens length of stay and improves postoperative pain, and bowel and bladder function after colorectal surgery.

Table 5 Primary Outcome Measures

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pre-ERAS group (Jun-12 to Aug-13)</th>
<th>ERAS Group (Dec-13 to Nov-14)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median total hospital length of stay from admission to discharge, days (range)</td>
<td>6.4 (0.2–197.7)</td>
<td>4.4 (1.0–80.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Median post procedure length of stay from end of procedure to discharge, days (range)</td>
<td>6.0 (0.1–161.5)</td>
<td>4.1 (0.8–47.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Readmission rate 30 day all cause readmission rate, n (%)</td>
<td>64 (21 %)</td>
<td>29 (9.4 %)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Reoperation rate for any indication within 30 days, n (%)</td>
<td>5 (2 %)</td>
<td>6 (2.1 %)</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 6 Secondary Outcome Measures - Pain management

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pre-ERAS group (Jun-12 to Aug-13)</th>
<th>ERAS Group (Dec-13 to Nov-14)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median opioid consumption Intraoperative (mg per morphine equivalent)</td>
<td>99.0 (60–605)</td>
<td>68.0 (20–293)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Median opioid consumption from POD 0 to POD 2 (mg per morphine equivalent)</td>
<td>142.2 (0–1964)</td>
<td>75.0 (0–316)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Median Duration of Epidural catheterization (hours)</td>
<td>299.3 (7.6–1017)</td>
<td>209.8 (7.8–788.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Median Duration of Epidural catheterization – median hours</td>
<td>95.0 (25–264)</td>
<td>52.0 (3–261)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Median Patient self-reported pain scores from 10 (worst) to 0 (no pain)</td>
<td>3.2 (8–0.8)</td>
<td>2.1 (0–9.3)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 7 Secondary Outcome Measures - Bowel and Bladder function

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pre-ERAS group (Jun-12 to Aug-13)</th>
<th>ERAS Group (Dec-13 to Nov-14)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need for postoperative antispasmodics</td>
<td>181 (60.7 %)</td>
<td>207 (68.9 %)</td>
<td>0.13</td>
</tr>
<tr>
<td>Patient self reported postoperative nausea and vomiting</td>
<td>125 (41.9 %)</td>
<td>74 (23.9 %)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Percentage of patient ordered nothing by mouth (NPO) post-operatively</td>
<td>184 (61.7 %)</td>
<td>79 (25.0 %)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Patients NPO on POD 0, n (%)</td>
<td>92 (30.9 %)</td>
<td>45 (14.5 %)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Patients NPO on POD 1, n (%)</td>
<td>36 (12.1 %)</td>
<td>29 (9.4 %)</td>
<td>0.13</td>
</tr>
<tr>
<td>Days from admission to 1st solid meal</td>
<td>4.7 (0–23.7)</td>
<td>2.7 (0–8.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Duration of urinary catheterization with a Foley Catheter (in hours)</td>
<td>74 (2–649)</td>
<td>46 (1–2262)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Decreased LOS and Readmission Rates

Improved pain control with fewer narcotics

Less nausea and vomiting, early postop feeding
Surgical thinking does not have to be magical thinking

**MAGICAL THINKING;**

Magical thinking is believing that one event happens as a result of another without an acceptable link. It is an irrational belief that everything is connected in some way. People can put artificial reasons on things because we can’t deal with randomness.

What cannot be cured with medicaments is cured by the knife, what the knife cannot cure is cured with the searing iron, and whatever this cannot cure must be considered incurable.

**Hippocrates** (460-370 BC)
The bundle is as good as its components

- Preoperative bathing – is chlorhexidine our modern holy water?

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Chlorhexidine 4%</th>
<th>Bar soap</th>
<th>Risk Ratio (M-H;Random,95% CI)</th>
<th>Weight</th>
<th>Risk Ratio (M-H;Random,95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earnshaw 1989</td>
<td>8/31</td>
<td>4/35</td>
<td>19.0 %</td>
<td>2.26 [0.75, 6.77]</td>
<td></td>
</tr>
<tr>
<td>Hayek 1987</td>
<td>62/6189</td>
<td>80/626</td>
<td>48.6 %</td>
<td>0.70 [0.51, 0.96]</td>
<td></td>
</tr>
<tr>
<td>Randall 1983</td>
<td>12/32</td>
<td>10/30</td>
<td>32.4 %</td>
<td>1.13 [0.57, 2.21]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>752</td>
<td>691</td>
<td>100.0 %</td>
<td>1.02 [0.57, 1.84]</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 82 (Chlorhexidine 4%), 94 (Bar soap)
Heterogeneity: Tau² = 0.16; Chi² = 5.02, df = 2 (P = 0.08); I² = 60%
Test for overall effect: Z = 0.07 (P = 0.94)
Test for subgroup differences: Not applicable

Be an agent for change

Think critically

The most dangerous phrase in the language is "We've always done it this way."
MEDICINE

Researchers Find Women Make Better Surgeons Than Men

Alice Park
Oct 10, 2017

For more, visit TIME Health.