

Editorial Opinion

Two senior surgeons' view: prevention of surgical site infection associated with colorectal operations

**KEYWORDS:**

Surgical site infection;
Colorectal surgery;
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Perioperative
antibiotics

Abstract Preventing surgical site infection is perhaps the most direct method of decreasing medical expenses. The following is an attempt at comprehensive ways of decreasing surgical site infection as well as decreasing patient discomfort.

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Surgical site infection (SSI) associated with colorectal surgery is very expensive. Prescriptive methods of process (Surgical Care Improvement Project—SCIP) have been largely ineffective in reducing SSI in a number of commonly performed operations.^{1,2} The incidence of SSI in colorectal surgery, even in a large SCIP series (15,444 colorectal surgeries of 60,853 total SCIP operations), remained stuck at 14%.³ In low anterior resections reported rates are as high as 20%, and the cost of a single SSI may rise to tens of thousands of dollars when organ space infection is involved⁴ (some as high as 50,000 to 60,000). In addition to reducing patient harm, these data suggest that reduction of colorectal operation associated SSI can effect significant cost saving.⁵ Although the majority of data focuses on colon and rectal surgery, the same attention to detail will decrease the incidence of noncolorectal SSI.

Reduction in hospital-acquired infection has been the target of clinicians hoping to avoid patient harm, and of payors attempting to lower the overall cost of medical care in the United States. SSI is now the most common and costly hospital-acquired infection.⁶ Despite the increasing

attention directed toward the application of uniform processes of surgical care, changes in surgical process such as SCIP have not shown the hope for decrease in surgical wound infections.^{3,7} Penalties against institutions, and now surgeons, to get their attention about “avoidable” SSI complications, have not yet been shown to be effective, and SSI risk stratification is in its infancy with respect to punitive economic strictures.

A recent exhaustive review of all SSIs with recommendations and strategies for prevention has been published by the Society for Healthcare Epidemiology of America, in association with the Infectious Disease Association of America, and should be studied by those wishing a detailed review with comprehensive bibliography.⁸

In this brief review, the authors stress those strategies and processes that can be instituted relatively easily (although with strict adherence), and which, when combined and considered in toto, are likely to reduce SSIs associated with ‘colorectal surgery’ but may also be beneficial to all operations. Most of these recommendations have a strong foundation in clinical and/or experimental evidence. Personal preferences are so noted.

Preoperative preparation

The patient should be nutritionally adequate with a serum albumin of at least 3.3 and preferably 3.5 or better. If the procedure is elective, nutritional supplementation for as

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few as 3 to 5 days will improve outcome.⁹ Supplementation for greater than 7 days in a depleted patient will certainly do so.^{10,11} The surgeon must balance this advantage against the urgency of operation.

1. Skin preparation: Although the majority of colorectal-related SSIs are caused by gut bacteria, we feel that a given hospital's preoperative skin preparation regimen should be applied to colorectal operations for purposes of maintaining uniformity and to also minimize the occurrence of infections caused by skin flora in noncolorectal procedures as well. For elective operations, we recommend the use of chlorhexidine cloths from axillae to groins twice in the 2 days before operation.¹² When this cannot be assured, we recommend washing the patient in the holding area.
2. "Prophylactic parenteral antibiotics" have been shown to be particularly effective in decreasing SSI, and are considered the practice standard for certain operations, for example, joint replacement and cardiac surgery. They are particularly effective in colorectal operations.¹³ The timing, dose, and choice of antibiotics are very important, as the patient's weight, institutional antibiogram, blood loss, and operative time must all be taken into account. Briefly, antibiotic infusion should be started and be completed within the 60 minutes before skin incision (with certain exceptions), dosage should be increased for patients having body mass index greater than 30, and redosing should be considered, depending on the antibiotic's half-life, or when there has been excessive blood loss.¹⁴⁻¹⁶ There are no data supporting the use of prophylactic antibiotics after the conclusion of the operation.
3. "Preoperation bowel preparation" for elective operations has been controversial. It is now clear that mechanical bowel preparation alone offers no protection with regard to SSI, but several studies demonstrate efficacy when combined with the administration of nonabsorbable antibiotics.¹⁷⁻²² Concerns about a possible increased incidence of *Clostridium difficile* infection in patients who have undergone such bowel preparation are overblown.²³⁻²⁵ There are no data with respect to the use of nonabsorbable antibiotics without mechanical preparation of the bowel. It is our recommendation that all compliant patients scheduled for elective colorectal operations undergo mechanical bowel preparation combined with nonabsorbable antibiotics, in addition to parenteral prophylactic antibiotics.
4. There is now compelling experimental and clinical evidence that the incidence of SSI can be reduced by "maximizing wound O₂ tension."²⁶⁻²⁹ Maintenance of intraoperative normothermia by means of warming intravenous fluids and the use of warming fluid or air blanket systems is the standard of care for abdominal operations. There are also data supporting the efficacy

of "preoperative" warming in maintaining intraoperative normothermia, further reducing the risk of infection.^{30,31} It is quite possible that these two interventions, preoperative warming and increased FiO₂, operate synergistically to maintain a high tissue oxygen that results in fewer SSIs. We recommend the application of both modalities in all operations. Warming and continued administration of O₂ should be maintained for 2 hours in the post-anesthesia care unit. Ideally, breathing mask could be used in extubated patients, but they might find this unacceptable, and a simple O₂ humidified mask should be applied for at least 2 hours.

5. Traditional mechanical "handwashing" with antibacterial agents is gradually being replaced by hand rubs with both aqueous and alcohol-containing solutions. A number of comparative studies show little difference among these techniques.³²⁻³⁴ Our only recommendation is that the surgical team pays close attention to the manufacturers' directions when using the newer techniques.

In the Operating Room

1. "The skin should never be shaved." If hair removal is necessary, clipping should be performed outside the operating room. Chlorhexidine-alcohol, povidine iodine, or povidine-alcohol can be used for skin preparation. There appears to be a slight advantage of chlorhexidine-alcohol over povidine-iodine for all operations, although less so in colorectal operations.^{35,36} We prefer chlorhexidine-alcohol for alcohol's immediate universal bactericidal properties, and the combination with the longer lasting chlorhexidine, especially when the latter has been used with previous cloth washes. It is extremely important to allow the prepared area to dry completely for both antibacterial and fire safety reasons.
2. "The skin incision" is usually made with a scalpel rather than electrosurgical energy. Because there is a dearth of compelling studies favoring one method over the another,^{37,38} and there is considerable variability with regard to the energy sources and management of electrosurgery, we strongly favor cold steel.
3. Protection of the wound during operation is important. The data with respect to skin incise drapes are not conclusive, but only the ones with antibacterial adhesive should be used.⁸ There is Level I evidence, however, with respect to the efficacy of wound protectors in both open and minimally invasive operations.³⁹ We strongly recommend their use. A personal practice is to add antibiotic-soaked lap pads and/or towels to the wound edges as well.

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