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Current Treatment Guidelines for Postoperative Surgical Site Infection: Clinical Considerations in the Surgical Care Improvement Project Era

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The Surgical care Improvement Project (SCIP) has standardized the choices and timing of use of prophylactic antibiotics for elective cardiovascular, gynecological, orthopedic (hip/knee arthroplasty), and colorectal operations with the goals being to reduce the incidence of surgical site infection (SSI) and also limit indiscriminate and overly lengthy use of antibiotics to avoid the development of resistant organisms. We examined the results of the application of the SCIP regimen on SSI rates, microbiology, and outcomes after elective colorectal operations at our institution. We also compared the microbiology of the infections against the empiric regimens recommended by the Surgical Infection Society/Infectious Disease Society of America (SIS/IDSA) guidelines to assess for any emerging trends that would be useful for further study on a larger scale such as could be performed using the American College of Surgeons–National Surgical Quality Improvement Program (ACS-NSQIP) data set.

Medical records were reviewed on all patients who underwent colorectal surgery during the 5-year study period. Cases meeting criteria for inclusion required that they be both elective cases and SCIP-compliant with respect to prophylactic antibiotic choice and duration of administration. This subpopulation was then examined by chart review for documentation of SSI. In cases of documented SSI, culture results, treatment, and outcomes were recorded. SSI was diagnosed and classified according to the Centers for Disease Control criteria as superficial, deep, or organ space.¹ Of note, adjunctive measures to reduce SSI (such as standardization of hair removal technique and method of skin cleansing and maintenance of perioperative supplemental oxygen, perioperative normothermia, and tight glycemic control for example) were also routinely used during the study period, which was our practice before the inception of the Colorectal Surgical Site Infection Project recently conducted by the American College of Surgeons and the Joint Commission. All organ space infections, which were by definition intra-abdominal, were treated empirically according to SIS/IDSA guidelines.

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In all, 2012 colorectal cases were identified to have been performed during the study period. Of these, 1362 were elective and all were found to be SCIP-compliant. In this subgroup, a total of 94 SSIs were documented for an overall incidence of 6.1 per cent. Of these, 66 (79.5%) infections were classified as superficial, one (1.2%) deep, and 16 (19.3%) were determined to be organ space infections.

The microbiology of the recovered organisms is listed in Table 1. The most common organisms included Enterococcal species (25.3%), *Bacteroides fragilis* (21.7%), *Escherichia coli* (19.3%), *Staphylococcus aureus* (18.1%), *Pseudomonas aeruginosa* (12.0%), and *Candida* species (14.4%). The overall in-hospital mortality rate was 6.0 per cent (five deaths) of which four (4.8%) were in patients with both organ space infections and associated invasive fungal infections.

Although this study represents a relatively small single-institutional experience, it does raise questions that may warrant study on a larger scale such as that which could be obtained by analysis of the ACS-NSQIP data set. Our data suggest that the SCIP measures as well as adjunctive measures proposed by the recently formed Colorectal Surgical Site Infection Project, many of which were already in place at our institution, are effective in reducing SSI rates in colorectal surgery, because our 6.1 per cent observed incidence of SSI is below that of recent series.² We suspect that ongoing prospective analysis of these measures will further validate this hypothesis and become the standard of care nationwide.

The second question is more controversial and related to the recommended treatment of SSI in organ space (intra-abdominal) infections. The SIS/IDSA guidelines specifically call for broad-spectrum empiric treatment of healthcare-associated intraabdominal infections (IAI) to include expanded Gram-negative, enterococcal, and anaerobic organisms with appropriate tailoring and de-escalation of the therapy when cultures are finalized. On the contrary, yeast coverage is not recommended unless yeast is identified on final culture specimens, which inevitably delays the institution of therapy by several days. This recommendation stands, despite acknowledgment in the guidelines, and in other published literature, that pre-emptive treatment with fluconazole may indeed decrease the incidence of invasive fungal infections and yeast peritonitis in patients with healthcare-associated IAI.^{3, 4} In this series, albeit small and retrospective, four of the five observed deaths resulted from sequelae of invasive *Candida* infection. Certainly, one must question if earlier institution of antifungal therapy would have benefited these patients.

At any rate, the limitations of this small retrospective series prohibit the formation of any firm conclusions. However, the question of the use of empiric yeast coverage in healthcare-associated IAI is compelling and, in our opinion, warrants further study. As stated previously, a large, risk-adjusted data set such as ACS-NSQIP may provide the ideal method for examining this question on a large enough scale to draw firm, impactful conclusions.

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Table 1

Microbiology of Identified Surgical Site Infections

Organism	No.	Percent
<i>Enterococcus</i> sp.	21	25.3
<i>Bacteroides fragilis</i>	18	21.7
<i>Escherichia coli</i>	16	19.3
<i>Staphylococcus aureus</i>	15	18.1
<i>Candida</i> sp.	12	14.4
<i>Pseudomonas aeruginosa</i>	10	12.0
Coagulase-negative <i>Staphylococcus</i> sp.	6	7.2
<i>Klebsiella pneumoniae</i>	6	7.2
<i>Enterococcus cloacae</i>	4	4.8
Group D, non- <i>Enterococcus</i> sp.	3	3.6
<i>Proteus mirabilis</i>	2	2.4
Viridans streptococci	2	2.4
<i>Arthrobacter</i> sp.	1	1.2
<i>Clostridium perfringens</i>	1	1.2
<i>Eikenella corrodens</i>	1	1.2
<i>Enterobacter agglomerans</i>	1	1.2
<i>Fusobacterium</i> sp.	1	1.2
<i>Streptococcus</i> B sp.	1	1.2
<i>Streptococcus</i> C sp.	1	1.2
<i>Klebsiella oxytoca</i>	1	1.2
Methicillin-resistant <i>S. aureus</i>	1	1.2
<i>Prevotella</i> sp.	1	1.2
<i>Serratia liquefaciens</i>	1	1.2