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Is Previous Postoperative Infection an Independent Risk Factor for a Postoperative Infection after a Second Unrelated Abdominal Operation?

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Abstract

Background—Infections following abdominal surgery remain a significant problem. Although preoperative antibiotic prophylaxis is a primary strategy used to reduce postoperative infections, they are typically prescribed based upon standardized protocols, without attention to previous infection or antibiotic history. Patients with a previous infection after surgery may be at higher risk for infectious complications after subsequent operations owing to antibiotic resistance. We hypothesized that a previous postoperative infection is a significant risk factor for the development of infection following a second unrelated surgery.

Study Design—We performed a retrospective study of patients who had undergone two unrelated abdominal operations at a tertiary care center from 2012-2018. Clinical variables and microbiological culture results were abstracted. Univariate and multivariable regression models were constructed.

Results—Of 758 patients, 15.0% (n=114) developed an infection after the first operation. After the second operation, 22.8% (n=26) of those with a previous infection developed another infection, whereas the incidence of an infection following the second operation was only 9.5% (n=61) in patients that did not develop an infection following the first operation. Multivariable analysis demonstrated that previous infection (OR 2.49, 95% CI1.46-4.25) was associated with future infection risk. Microbiological analysis found that infections following the second surgery were significantly more common to be antibiotic resistant compared to infections following the first surgery (82.3% vs 64.1%; p=.036). Strikingly, 49% of infections after the second surgery were resistant to the antibiotic prophylaxis given at the time of incision.

Conclusions—Previous postoperative infection is an independent risk factor for a subsequent postoperative infection and is associated with resistance to standard prophylaxis. Individualization of antibiotic prophylaxis in patients with a previous postoperative infection is warranted.

PRECIS

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Patients with a previous postoperative infection may be at higher risk for infectious complication after subsequent operations owing to antibiotic resistance or other patient factors. We found that a previous postoperative infection is an independent risk factor for a subsequent postoperative infection and is associated with resistance to standard prophylaxis.

Keywords

Postoperative infection; antibiotic resistance; bacterial resistance

INTRODUCTION

Infections after abdominal surgery are frequent and include surgical site infection, urinary tract infection or pneumonia. Although the incidence of each type of infection varies based upon the type of abdominal procedure, all are associated with increased morbidity, hospital length of stay, readmissions, and health care costs(1–4). Despite advances in preoperative optimization, surgical technique, and enhanced recovery programs, postoperative infections continue to cause significant patient morbidity and mortality.

Prophylactic perioperative antibiotics are a cornerstone of efforts to decrease the risk of postoperative infections(5). While the use of prophylactic antibiotics has routinely been shown to decrease the incidence of postoperative infections in appropriate settings, they are often prescribed on standardized protocols, without attention to previous infection or antibiotic history(6). It has been well known that previous antibiotics may promote colonization with antibiotic resistant organisms(7). Furthermore, exposure to antibiotics coupled with surgical stress and critical illness has been demonstrated to deplete the commensal microbiota and increase the risk for pathogen colonization(8). Recently, Guidry et al, found that previous antibiotic exposure is an independent risk factor for the development of postoperative infection following elective surgery(9). Whether a history of infection after previous surgery, or antibiotic resistance from previous treatment, portends a greater risk of infection after a second operation is poorly studied.

We hypothesized that a history of a postoperative infection is a significant risk factor for the development of another postoperative infection following an unrelated second surgery, and may be associated with the presence of resistant bacteria to protocolized prophylactic antibiotics. The aims of this study were: (1) to determine if a previous postoperative infection is an independent risk factor for an infection following a second unrelated operation and (2) to compare the bacterial culture and resistance profiles between a first and second postoperative infection.

METHODS

Study Design and Data Collection

This was a single center, retrospective cohort study of patients undergoing abdominal surgery at an urban tertiary care academic center. Adult patients over 18 years of age who had undergone two elective unrelated abdominal surgeries between January 1, 2012 to July 21, 2018 were included for this study. An unrelated second operation was defined

as one that occurred greater than 30 days following the initial operation and was not indicated to correct a postoperative infection following the first operation. All colorectal, gastric, hepatobiliary, or small bowel procedures with a predetermined Current Procedural Terminology (CPT) code were included (Supplemental Digital Content 1). To ensure adequate time for resolution of the initial postoperative infection, patients for whom the second operation was less than 30 days from the index operation were excluded. To include only postoperative infections, patients were excluded if a postoperative infection was the indication for either operation or infection was present upon admission for the procedure.

Postoperative infection was initially screened for using International Classification of Diseases (ICD) 9 and 10 codes for postoperative infections within 30 days of the procedure date (Supplemental Digital Content 2). Infection was then confirmed by individual chart review and defined using the American College of Surgeons National Surgical Quality Improvement Project Definitions (NSQIP)(10). Additionally, demographic information and known risk factors for a postoperative infection, such as a diagnosis of diabetes, use of corticosteroids, use of minimally invasive surgery (MIS) and smoking status were manually abstracted from the medical record. Prescription of preoperative antibiotic prophylaxis was also abstracted by manual chart review.

Microbial Culture Analysis

For patients that developed a postoperative infection after either operation, data from microbial cultures, including the source of the culture, organisms isolated, and antibiotic susceptibility and resistance were abstracted. Microbial antibiotic resistance was defined as resistance to one or more class of antibiotics on the microbial laboratory results. Microbial identification and resistance was performed at the University of Chicago Clinical Microbiological laboratory.

Statistical Analysis

For demographic information, comorbidities, and surgical characteristics, appropriate cutoffs for continuous variables were selected. Categorical variables were analyzed using the chi-square test or Fisher’s exact test when five or fewer events were expected. Ordinal variables were analyzed using the Wilcoxon rank sum test. Infection rates after the second operation were compared between those who did and did not have an infection after their first operation, and a multivariable logistic regression for the outcome of infection after the second operation was built.

Logistic regression was performed for the primary outcome presence of postoperative infection after the second operation. A priori confounders of the relationship between presence of infection after the first operation and presence of infection after the second operation were considered based on prior evidence of their effect on postoperative infection. These *a priori* variables included in the multivariable model were a diagnosis of diabetes, smoking status, and whether a laparoscopic approach was used. Variables that differed significantly between those who did develop infections after the first operation and those that did not develop an infection were also included in the model. Additional confounders were first tested with a univariate regression and added to the model when a significant

relationship with the primary outcome was found, or when adding the variable to the multivariable model changed the beta coefficient of presence of infection after the second operation by greater than 10%.

Culture results were compared between infections developed after the first operations and after the second operations. Two sample tests of proportions were used to compare sources of positive culture and rates of antibiotic resistance and resistance to preoperative antibiotic prophylaxis. All analyses were performed using STATA statistical software (StataCorp) 15 using an alpha value of 0.05 for significance.

RESULTS

Study Population

840 adult patients met the inclusion criteria for the study and had undergone two abdominal operations during the study period. From this cohort, 82 adults had an infection that was the indication for surgical intervention and thus were excluded from the study. This resulted in a final group of 758 adult patients for analysis.

Of the 758 patients, 15.0% (n=114) had a confirmed postoperative infection following their first operation. 8 patients had an ICD9/10 codes consistent with an infection but on manual chart review an infection could not be confirmed and were placed into the non-infection cohort. Data on patient demographics, comorbidities, and surgical indication and operative approach is presented in Table 1. Patients who developed an infection after this index operation were more likely to be diabetic and undergo an open procedure. Of the 114 patients who had a postoperative infection after the first operation, 22.8% (n=26) had a postoperative infection after their second operation. Of the 644 patients who did not have an infection after the initial operation, only 9.5% (n=61) had a postoperative infection after their second operation. There were no significant differences in the demographics and comorbidities between patients who had an infection versus those that did not following their second operation (Table 2). Further, there were no significant differences in the location of infection between infection 1 and infection 2: intra-abdominal abscess 35.9% vs. 37.9%, p=0.77; bacteremia 35.1% vs. 42.5%, p=0.28; skin 21.9% vs. 27.6%, p=0.35; urinary 12.2% vs. 17.2%, p=0.32; pneumonia 4.2% vs. 4.6, p=0.83. The mean time between the first procedure and the second procedure was 366.4 days (SD 421.6), and there was significant differences in time to the second procedure between those who developed a second infection and those that did not (mean 328.5 days, SD 350.8 vs. 371.1, SD 429; p=0.38).

Incidence of Postoperative Infection

We next compared the incidence of infection across the various cohorts (Figure 1). The 30-day postoperative infection rate was 15.0% for the first operation and 11.5% for the second operation. The incidence of infection following the second operation was significantly higher in those patients who developed an infection after the initial operation compared to those that did not develop an infection after the first operation (22.8% vs 9.5%; p<0.001). The infection rate after the second operation also significantly associated with infection after the first operation: those with a previous infection had a significantly higher rate of infection

after the second operation (22.8% and 15.0%; p=0.035), whereas those without a previous infection had a significantly lower rate of infection after the second operation (9.9% and 15.0%; p<0.001)

Logistic Regression

To determine if having a previous postoperative infection was an independent risk factor for a postoperative infection following a second operation, a multivariable logistic regression was built (Table 3). Diabetes, operation category, and MIS approach, which were found to be significantly associated with the presence of a postoperative infection after the first operation, were included in the multivariable model. Results demonstrated that infection following the first operation was independently associated with development of an infection following the second operation (OR 2.49; 95% CI 1.46-4.25). Additionally, a MIS approach was protective against a postoperative infection (OR 0.2; 95% CI 0.10-0.41). When the other *a priori* cofounders that were tested in the univariate analysis were added stepwise to this model, no other variables had a significant relationship with occurrence of infection after the second operation.

Microbiology of Postoperative Infections

Microbiological cultures were available in 71.1% (n=143) of the patients who had an infection (Table 4). The source and organisms isolated of microbial cultures from infections after the first and second operations were similar. Tissue or fluid was the most common source of positive cultures. The most common organisms isolated were *Enterococcus* species, *Staphylococcus* species, and *Escherichia coli*, and the majority of positive cultures isolated more than one organism. Infection with *Enterobacter* species were observed more frequently in infections developed after the second operation (p=0.035).

Antibiotic resistance was significantly more common after the second operation compared to infections following the first operation (64.1% and 82.3%, p=0.036) (Table 5). There was no significant difference in the time between the first and second operation between patients who developed a resistance infection verses those that did not (mean 311.1 days, SD 324.7 vs. 333.3, SD 359.8; p=0.82. Resistance to a class of antibiotics given as preoperative prophylaxis was observed more frequently after second operations (32.1% and 49.0%, p=0.078). Of the 25 patients that had a second infection and showed resistance to preoperative prophylaxis given to them during their second procedure, 84% (21/25) had an antibiotic resistant infection following their first operation.

DISCUSSION

Infections following gastrointestinal surgery cause significant resource utilization, increased healthcare costs, and prolonged length of stay(1–3). Identifying patients at an increased risk of infection may be pivotal in reducing patient morbidity following abdominal surgery. In this study, we demonstrated that a previous postoperative infection is an independent risk factor for the development of another postoperative infection after a second, unrelated gastrointestinal operation. Given that nearly 60% of surgical patients will

undergo more than one abdominal surgery over their lifetime, this finding has important clinical implications(11).

Why patients are at risk for a second infection if they have a history of a postoperative infection is unclear. Preoperative antibiotics given prior to incision, are one of the main modalities to prevent postoperative infections and has proven to be very efficacious across disciplines(12–14). For example, a recent Cochrane review of 260 trials showed that preoperative prophylactic antibiotics significantly decreased the incidence of surgical site infections in patients undergoing colorectal surgery (risk ratio 0.34; 95% confidence interval 0.28 - 0.41)(15). Societies such as the Surgical Infection Society (SIS), American College of Surgeons (ACS), and the Centers of Disease Control (CDC) all have given recommendation on the class of preoperative antibiotic based on the location of the incision, wound classification, and local resistance patterns(16, 17). In our study, we found that 50% of the infections following the second operation were resistant to the prophylactic antibiotics that were prescribed preoperatively; almost all of these patients demonstrated antibiotic resistant organisms following their first operation. While this observation is associative, it suggests that the resistant bacteria that colonized during the first infection, may play a causative role in the development of the second infection. If so, further investigation is needed to determine if the risk of a second infection may be reduced by giving preoperative antibiotics tailored to the resistance pattern of the first operation.

The most common clinical situation in which antibiotics are altered due to preoperative resistance is when vancomycin or clindamycin is prescribed to patients that are high-risk for- or colonized with methicillin-resistant *Staphylococcus aureus* (MRSA). This strategy has been shown to be efficacious in reducing postoperative infections and is recommended in most societal guidelines(18, 19). Yet, there is little data as to if other drug-resistant pathogens that recently colonized a patient undergoing surgery should be directly targeted with preoperative antibiotics. Cohen et al. found that a culture proven infection within 90 days of a surgical procedure was associated with the development of a postoperative infection(20). While the authors did not evaluate if the resistance included antibiotics given as perioperative prophylaxis, it does suggest that, as in the case with preoperative MRSA colonization, administrating antibiotics that covered all resistant pathogens from previous infections could decrease the risk of postoperative infection.

Prescription of antibiotics to surgical patients, either as prophylaxis or treatment, must be balanced with the risk of the development of antibiotic resistance. It is well known that antibiotic resistant infections have significantly increased over the last decade(21, 22). Sixty-four percent of patients in our cohort had an antibiotic resistance infection following their first operation, which is in line with previous reports(20). Strikingly, the incidence of antibiotic resistance in our cohort following the second infection was nearly 85%. This alarmingly high rate of antibiotic resistance is likely due to the cumulative exposure of antimicrobials over the course of two surgeries and two postoperative infections as even a single dose or short courses of antibiotics can promote resistance(23, 24). In patients whom have had multiple prior procedures, the risk of an antibiotic resistance infection is extraordinarily high.

Our study has multiple limitations. Culture results were not available in every patient. At our institution, acquisition of microbial cultures is up to the discretion of the surgeon, and thus could have led to selection bias in which the more severe infections had cultures. Further, the retrospective nature of our study relied upon chart review. While we performed a manual chart review to confirm infections and gather microbiological data, irregularities in either coding for the included procedures or infections could have unintentionally omitted patients.

Taken together, our study demonstrates that a previous infection is an independent risk factor for another postoperative infection following an unrelated abdominal surgery. These patients may benefit from an individualized approach where previous culture data drives the choice of prophylactic antibiotics.

CONCLUSIONS

In this manuscript we have demonstrated that a previous postoperative infection is an independent risk factor for a subsequent postoperative infection and is associated with resistance to standard prophylaxis. Individualization of antibiotic prophylaxis in patients with a previous postoperative infection may be warranted.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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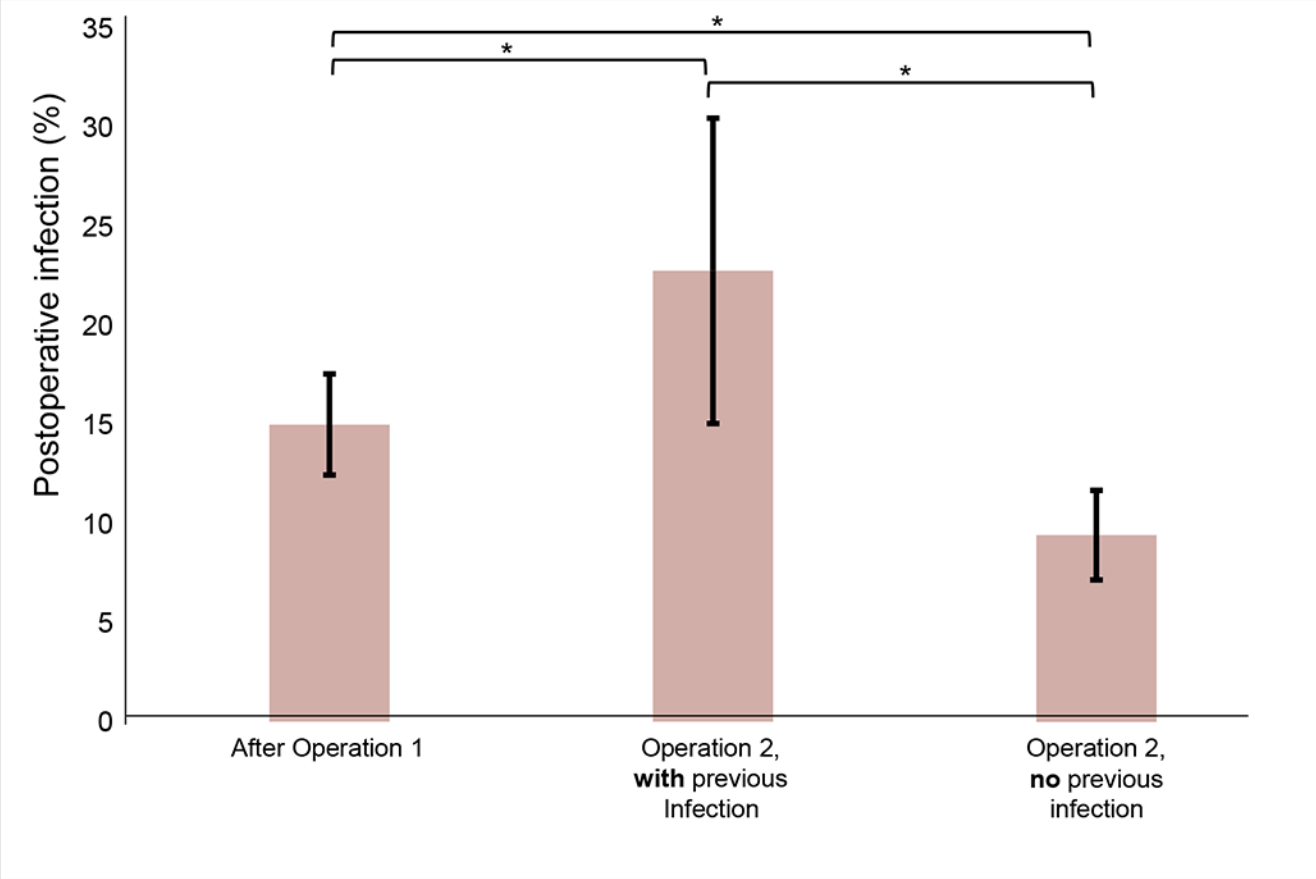

Figure 1.

30-day postoperative infection rate after first abdominal operation and after second operation, stratified by history of postoperative infection after previous operation. Error bars indicate the 95% CI for rate of infection. Brackets above correspond to the infection rates compared. *p Value < 0.05.

Table 1.

Baseline Characteristics of the Cohort after Operation 1

Characteristic	Total cohort (n = 758)	Postoperative infection		p Value
		No (n = 644)	Yes (n = 114)	
Age, y, mean (SD)	49.4 (16.5)	49.2 (16.3)	50.6 (16.6)	0.84
Sex, m, n (%)	359 (47.4)	311 (57.9)	48 (42.1)	0.22
Race, n (%)				
White	509 (67.2)	435 (67.6)	74 (64.1)	0.87
African American	183 (24.1)	152 (23.6)	31 (27.2)	
Other	51 (6.7)	44 (6.8)	7 (6.1)	
Unknown	15 (2.0)	13 (2.0)	2 (1.8)	
Diabetes, n (%)	114 (15.0)	90 (13.8)	24 (22.4)	0.02 *
Smoking, n (%)				
Never	335 (44.2)	285 (44.3)	50 (43.9)	0.91
Former	169 (22.3)	141 (21.9)	28 (24.6)	
Current	94 (12.4)	80 (12.4)	14 (12.3)	
Unknown	160 (21.1)	138 (21.4)	22 (19.3)	
Steroid use, n (%)	338 (44.6)	288 (44.7)	50 (43.9)	0.86
BMI, kg/m^2, mean (SD)	26.7 (8.1)	26.8 (8.2)	26.5 (7.2)	0.71
ASA, n (%)	118 (15.6)	101 (15.7)	17 (14.9)	
1	16 (2.1)	13 (2.0)	3 (2.6)	0.36
2	231 (30.5)	199 (30.9)	32 (28.1)	
3	357 (47.1)	305 (47.4)	52 (45.6)	
4	26.7 (7.6)	26.8 (8.16)	26.5 (4.11)	
5	34 (4.5)	25 (3.9)	9 (7.9)	
Unknown	2 (0.3)	1 (0.2)	1 (0.9)	
Operation, n (%)				
HPB	69 (9.1)	61 (9.5)	8 (7.0)	<0.01 *
CRS	334 (44.1)	279 (43.3)	55 (48.3)	
Gastric	47 (6.2)	44 (6.8)	3 (2.6)	
SB	152 (20.1)	116 (18.0)	36 (31.6)	
Exploratory	156 (20.6)	144 (22.4)	12 (10.5)	
MIS, n (%)	405 (53.4)	374 (58.1)	31 (27.2)	<0.01 *
LOS, d, mean (SD)	8.5 (10.2)	7.6 (9.9)	13.6 (9.8)	<0.01 *

* p Value < 0.05

ASA, American Society of Anesthesiologists Class, CRS, colorectal surgery; HPB, hepatobiliary surgery; LOS, length of stay; MIS, minimally invasive surgery; SB, small bowel surgery

Table 2.

Baseline Characteristics of the Cohort after Operation 2

Characteristic	Surgery 1: Infection				Surgery 1: No infection			
	Total (n = 114)	and Surgery 2: Infection		p Value	Total (n = 644)	and Surgery 2: Infection		p Value
		No (n = 88)	Yes (n = 26)			No (n = 583)	Yes (n = 61)	
Age, y, mean (SD)	51.2 (15.4)	49.4 (13.2)	50.9 (14.5)	0.49	49.8 (14.2)	50.8 (14.8)	49.7 (15.9)	0.55
Sex, m, n (%)	48 (42.1)	39 (44.3)	9 (34.6)	0.49	311 (48.3)	281 (48.2)	30 (49.2)	0.88
Race, n (%)								
White	74 (64.9)	60 (68.2)	14 (53.9)	0.38	435 (67.6)	390 (66.9)	45 (73.8)	0.09
AA	31 (27.2)	21 (23.9)	10 (38.5)		152 (23.6)	144 (24.7)	8 (13.11)	
Other	7 (6.1)	5 (5.7)	2 (7.7)		44 (6.8)	37 (6.4)	7 (11.5)	
Unknown	2 (1.8)	2 (2.3)	0 (0.0)		13 (2.0)	12 (2.1)	1 (1.6)	
Diabetes, n (%)	90 (79.0)	17 (19.3)	7 (26.9)	0.40	83 (12.9)	76 (13.0)	7 (11.5)	0.84
Smoking, n (%)								
Never	50 (43.9)	36 (40.9)	14 (53.9)	0.18	285 (44.3)	262 (44.9)	23 (43.9)	0.61
Former	28 (24.6)	25 (28.4)	3 (11.9)		141 (21.9)	128 (22.0)	13 (21.3)	
Current	14 (12.3)	9 (10.2)	5 (19.2)		94 (14.6)	80 (12.2)	14 (14.8)	
Unknown	22 (19.3)	18 (20.5)	4 (15.4)		138 (21.4)	122 (20.9)	16 (26.2)	
Steroid use, n (%)	50 (43.9)	39 (44.3)	11 (42.3)	0.85	288 (44.7)	263 (45.1)	25 (41.0)	0.54
BMI, kg/m^2, mean (SD)	26.7 (5.7)	26.2 (7.9)	26.9 (6.5)	0.41	27.1 (7.4)	26.8 (8.1)	27.6 (5.4)	0.75
ASA, n (%)								
1	1 (0.9)	1 (1.1)	0 (0.0)	0.19	12 (1.9)	10 (1.7)	2 (3.3)	0.23
2	35 (30.7)	30 (34.1)	5 (19.2)		229 (35.6)	212 (36.4)	17 (27.9)	
3	65 (57.0)	48 (54.6)	17 (65.4)		362 (56.2)	323 (55.4)	39 (63.9)	
4	10 (8.8)	7 (8.0)	3 (11.5)		30 (4.7)	27 (4.6)	3 (4.9)	
5	0 (0.0)	0 (0.0)	0 (0.0)		1 (0.2)	1 (0.2)	0 (0.0)	
Unknown	3 (2.6)	2 (2.3)	1 (3.9)		10 (1.6)	10 (1.7)	0 (0.0)	
Operation, n (%)								
HPB	13 (11.4)	11 (12.5)	2 (7.7)	0.11	61 (9.5)	54 (9.3)	7 (11.5)	0.36
CRS	68 (59.7)	54 (61.4)	14 (53.9)		319 (49.5)	292 (50.1)	27 (44.3)	

Characteristic	Surgery 1: Infection				Surgery 1: No infection			
	Total (n = 114)	and Surgery 2: Infection		p Value	Total (n = 644)	and Surgery 2: Infection		p Value
		No (n = 88)	Yes (n = 26)			No (n = 583)	Yes (n = 61)	
Gastric	3 (2.6)	3 (3.4)	0 (0.0)		47 (7.3)	42 (7.2)	5 (8.2)	
SB	17 (14.9)	14 (15.9)	3 (11.5)		72 (11.2)	61 (10.5)	11 (18.0)	
Exploratory	13 (11.4)	6 (6.8)	7 (26.9)		145 (22.5)	134 (23.0)	11 (18.0)	
MIS, n (%)	31 (27.2)	25 (28.4)	6 (23.1)	<0.01*	374 (58.1)	359 (61.5)	15 (24.5)	<0.01*
LOS, d, mean (SD)	13.4 (9.8)	13.2 (8.9)	14.1 (12)	0.67	8.5 (10.2)	8.3 (10.0)	10 (10.8)	0.21

* p Value < 0.05

ASA, American Society of Anesthesiologists Class; CRS, colorectal surgery; HPB, hepatobiliary surgery; LOS, length of stay; MIS, minimally invasive surgery; SB, small bowel surgery

Table 3.

Multivariable Logistic Regression for Odds of Postoperative Infection after a Second Abdominal Surgery.

Variable	Operation 2: risk of infection, total n (%)	Odds ratio (95% CI)
Infection after operation 1		
No	61 (9.4)	Ref
Yes	26 (22.8)	2.49 (1.46-4.25) *
Diabetes		
No	73 (12.6)	Ref
Yes	14 (15.1)	1.00 (0.52-1.93)
Smoking		
Never	37 (12.4)	Ref
Former	16 (10.5)	0.81 (0.42-1.54)
Current	14 (17.5)	1.26 (0.63-2.49)
Unknown	20 (14.3)	1.18 (0.65-2.15)
MIS		
No	78 (15.7)	Ref
Yes	9 (3.4)	0.20 (0.10-0.41) *
Operation		
HPB	9 (12.2)	0.96 (0.40-2.28)
CRS	41 (10.6)	0.81 (0.44-1.49)
Gastric	5 (10.0)	0.86 (0.30-2.47)
SB	14 (15.7)	1.25 (0.58-2.70)
Exploratory	18 (11.4)	Ref

* p Value < 0.05

CRS, colorectal surgery; HPB, hepatobiliary surgery; MIS, minimally invasive surgery; SB, small bowel surgery

Table 4.

Microbiological Results

Variable	Operation 1: infection	Operation 2: infection	p Value
Source			
DSSI	37 (46.8)	29 (46.8)	0.29
SSSI	16 (20.3)	12 (19.4)	
Urine	13 (16.5)	11 (17.7)	
Respiratory	6 (7.8)	4 (6.5)	
Blood	4 (5.1)	5 (8.1)	
Other	3 (3.8)	1 (1.6)	
Culture			
Enterococcus spp.	22 (27.5)	27 (42.9)	0.16
Escherichia coli	17 (21.3)	9 (14.3)	0.28
Staphylococcus spp.	14 (17.6)	19 (30.1)	0.29
Bacteroides spp.	13 (16.3)	7 (11.1)	0.38
Candida spp.	12 (15.0)	10 (15.9)	0.89
Klebsiella sp	6 (7.5)	10 (15.9)	0.12
Streptococcus spp.	4 (5)	3 (4.8)	0.67
Enterobacter spp.	2 (2.5)	7 (11.1)	0.04

Data presented as n (%)

DSSI, deep surgical site infection; SSSI, superficial surgical site infection

Table 5.

Antibiotic Resistance Observed in Microbial Cultures of Postoperative Infection after First and Second Abdominal Operation

Resistance	Operation 1 infection	Operation 2 infection	p Value
None	19 (35.9)	9 (17.7)	0.03 *
Single-drug	11 (20.8)	10 (19.6)	0.87
Multi-drug	34 (64.1)	42 (82.3)	0.03 *
To drugs given for preoperative antibiotic prophylaxis	17 (32.1)	25 (49.0)	0.07

Data presented as n (%)

* $p < 0.05$