Microbiological Profile, Antimicrobial Resistance, And Clinical Correlates of Resistant Abdominal Surgical-Site Infections: A Retrospective Study

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Received on: 26 August 2026; Accepted on: 30 September 2026; Published on: 15 October 2026

ABSTRACT

Background: Abdominal surgical-site infections (SSIs) have high morbidity, and the spread of antimicrobial resistance is becoming more complicated. The aim of this study was to assess the spectrum of microorganisms, their antimicrobial susceptibility patterns and clinical associations of resistant abdominal SSIs.

Materials and methods: The 300 patients with abdominal SSI were included in a retrospective observational study. Data regarding demographics, operation, clinical history, microbiological and outcome parameters were obtained from the medical records. Standardized laboratory methods were used to identify bacteria and test the antimicrobial susceptibility. A multivariable logistic regression model was created to assess for factors that were independently associated with antimicrobial-resistant SSI.

Results: Culture positivity was observed in 184/300 patients (61.3%) with 205 isolates, of which 82.1% were monomicrobial. Gram-negative bacilli were found in 70.2% of isolates, the most common of which were Escherichia coli 30.2% and Klebsiella pneumoniae 16.6%. E. coli was 69.4% resistant to ceftriaxone and 79.4% resistant to K. pneumoniae. The rate of meropenem resistance was 12.9% and 20.6%, respectively, and 69.2% for Acinetobacter baumannii. 32.3% of Staphylococcus aureus were methicillin resistant. Independent correlates of resistant SSI included age per 10-year increase (aOR 1.15; P=0.034), emergency surgery (aOR 1.73; P=0.035), dirty/infected wounds (aOR 2.48; P=0.004), operative duration >120 min (aOR 1.82; P=0.019), ASA III–IV status (aOR 1.69; P=0.046), recent hospitalization (aOR 2.08; P=0.036), and prior antibiotic exposure (aOR 2.71; P<0.001).

Conclusion: There was a predominance of gram-negative pathogens and significant antimicrobial resistance for abdominal SSI. A risk-stratified microbiological surveillance and culture-directed antimicrobial stewardship are recommended.

Keywords: Abdominal surgery, surgical-site infection; Escherichia coli, Klebsiella pneumonia, multidrug resistance, antimicrobial susceptibility, antimicrobial resistance.

INTRODUCTION

Surgical-site infection (SSI) is a common postoperative event of surgery and a major contributor of preventable morbidity, length of hospital stays, rehospitalization, health care cost, and antimicrobial exposure. SSI is a significant healthcare-associated infection (HCAI) and in low- and middle-income countries, it imposes a significant burden, with about 11% of all surgical patients likely to develop an infection.[1] The risk of infection is also high following gastrointestinal and abdominal surgeries, as endogenous gastrointestinal flora, presentation as an emergency, tissue handling, surgery time, and anastomotic complication can all affect the risk of infection.[2,3] A large systematic review of general surgical populations had estimated the pooled incidence of SSI to be ~11% overall, but this varied by surgical site, surgical approach and surgery urgency.[4]

Abdominal SSI is a microbiologically complex entity because infections can be from skin flora, endogenous gut flora, or health care associated organisms. Gram negative bacilli (Escherichia coli, Klebsiella spp., Pseudomonas aeruginosa, and Acinetobacter spp.) can be present in addition to the Gram-positive organisms (Staphylococcus aureus, enterococci). The relative importance of any pathogen depends on the nature of the operation, degree of contamination, patient factors, exposure to health care environments, and local antimicrobial ecology.[2,5] Therefore, microbiological surveillance still plays a role in understanding the pathogen spectrum and thus in deciding empiric and definitive antimicrobial therapy.

The resistance to antimicrobial agents (AMR) has also made the management of postoperative abdominal infections more difficult. The rising incidence of extended-spectrum β-lactamase (ESBL) producing Enterobacterales, carbapenem-resistant Gram-negative organisms, and methicillin-resistant S. aureus (MRSA) often severely limit the treatment options.[6,7] An Indian tertiary care study found ESBL production in 64% of E. coli and Klebsiella isolates, and proportion of carbapenem resistance in Gram-negative bacilli, thus emphasizing the need for site-specific susceptibility data for guiding empirical treatment.[7,8,9] In this way, research that focused specifically on abdominal SSIs has shown significant growth of bacteria and a significant presence of S. aureus and E. coli in wound isolates.[10,11]

The growing diversity and resistance of the microorganisms that cause postoperative infections highlight the need for good antimicrobial stewardship and institution-specific microbiological surveillance. Existing data have highlighted that antibiotic selection should consider the local susceptibility patterns while the antibiotic selection/microbiological results should be used for modification or de-escalation of the antibiotics when possible.[6,12] Pathogen distribution and resistance patterns can, however, differ greatly between hospitals and geographic regions, making the generalised susceptibility patterns less applicable.

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How to cite this article: Kumar R. Retrospective Quality-by-Design Optimization of Memantine-Loaded PEGylated PLGA Liposomal Formulation for Enhanced Nose-to-Brain Delivery in Alzheimer's Disease. Adv. Med. Res. Pract. 2026;1(1):35-41. https://doi.org/10.21276/amrp.2026.v1.i1.7
Source of support: Nil
Conflict of interest: Non

Hence, the present retrospective study was conducted to describe the microbiological spectrum of ASSIs, antimicrobial resistance patterns and their correlation with pertinent clinical features. This information can inform the local microbial ecology of abdominal SSIs, may determine empiric antimicrobial treatment selection, may guide empiric treatment of SSIs, may guide infection-control strategies, and may guide antimicrobial stewardship.

MATERIALS AND METHODS

Study design and Population

This Retrospective observational study was conducted among 300 patients who underwent abdominal surgery within the set time frame. The Centers for Disease Control and Prevention (CDC) criteria were used to identify patients who developed SSI within 30 days of surgery from surgical records and postoperative follow-up documentation. Those patients who had sufficient clinical and microbiological data were included. Patients with incomplete records or infections not related to the surgical procedure were excluded.

Clinical and Microbiological Assessment

Demographic and clinical data recorded from the medical history included: age, sex, type and urgency of surgery, operating time, wound classification, comorbidities, postoperative complications and length of hospital stay. According to the CDC classifications, SSI was classified as superficial incisional, deep incisional or organ/space infections. Aseptic techniques were used to collect specimens from clinically suspected infected wounds. The samples were processed by using standard microbiological techniques for identification of organisms and antimicrobial susceptibility testing. The final microbiological analysis only included clinically significant isolates.

Antibiotic sensitivity and resistance testing

Antimicrobial susceptibility testing was done routinely according to the laboratory's standard method and interpreted based on the applicable Clinical and Laboratory Standards Institute (CLSI) or EUCAST breakpoints for the period of the study. The definitions of multidrug-resistant organisms were adopted from those accepted on an international level. The distribution of bacterial pathogens, their antimicrobial susceptibility patterns and the presence of ESBL-producing Enterobacterales, CPE, MRSA and other clinically relevant patterns of resistance were analyzed.

Statistical Analysis

Data were analyzed by SPSS v29 and presented as mean ± SD, median (IQR), and frequencies and percentages. The associations were analyzed by chi-square/Fisher's exact test for categorical variables and Student's t-test or Mann–Whitney U test for continuous variables, as appropriate. Clinically relevant or statistically significant associations in univariable analysis were considered for multivariable logistic regression, as appropriate. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated and $P<0.05$ was regarded as statistically significant.

RESULTS

A total of 300 patients with abdominal SSI were included in the analysis. The mean age of the cohort was 48.6±16.2 years, and 60.3% of those in the cohort were male. Most patients (59.3%) had an elective procedure, while 40.7% had an emergency procedure. Operations were performed on 78.3% of patients who had open or converted procedures. The most prevalent wound type was clean-contaminated wounds (42.0%) and dirty/infected wounds (23.7%). The mean operative time was 124.7±58.6 min, while 38.7% of the patients had ASA grade III–IV. Documentation of peri-operative antibiotic prophylaxis was obtained in 91.3% of patients. The median length of hospitalisation was 11 days (IQR 8–17) and the median time to diagnosis of SSI was 8 days (IQR 5–12) after surgery. [Table 1]

The clinical characteristics and outcomes

The most common type of infection was superficial incisional SSI (47.3%), followed by deep incisional (30.3%) and organ/space infections (22.3%). The most common clinical signs were purulent wound discharge (61.3 %), erythema of the wound (57.0 %), and local tenderness/pain (53.0 %). In 184/300 patients (61.3%) the microbiological confirmation was obtained. In 42.0% of cases procedural intervention was necessary, with operative drainage/debridement in 14.3%. 38.3% of patients had elevated WBC counts (>10×109/L) and 39.7% had elevated CRP (>50 mg/L). Table 2 shows that 15.7% of the cohort were readmitted, 11.3% were admitted to ICU and 4.0% died after SSI.

Microbiological findings

There were 184 culture positive infections, with 151 (82.1%) monomicrobial and 33 (17.9%) polymicrobial infections, which in total accounted for 205 isolates. Gram-negative bacilli were more predominant with 144/205 isolates (70.2%), while the Gram-positive cocci were 55/205 (26.8%). Escherichia coli was the most frequently isolated pathogen (62/205, 30.2%), followed by Klebsiella pneumoniae (34/205, 16.6%), Staphylococcus aureus (31/205, 15.1%), and Pseudomonas aeruginosa (22/205, 10.7%). Acinetobacter baumannii represented 6.3% and Enterococcus spp. 8.8% of the isolates. The other isolates were coagulase-negative Staphylococcus, Enterobacter, Proteus, Candida, Gram-positive bacilli, and other Gram-negative microbes. [Table 3; Figure 1]

Antimicrobial resistance and clinical correlates

Enterobacterales were highly resistant. The resistance rates for K. pneumoniae and E. coli were 79.4% for ceftriaxone, 70.6% for ciprofloxacin, and 67.6% for cefepime; for E. coli, the corresponding rates were 69.4%, 67.7%, and 58.1%, respectively. The percentage of E. coli and K. pneumoniae resistant to meropenem was relatively low but not absent (12.9% and 20.6%, respectively). A. baumannii was highly resistant to all the agents tested with 76.9% CPE-EPIM and 69.2% CPE-Cip/Mero resistance. In S. aureus, 32.3% were resistant to oxacillin/cefoxitin while 100% were susceptible to linezolid and vancomycin. 16.7 percent of Enterococcus spp. isolates were found to be vancomycin resistant, with

all isolates being susceptible to linezolid. [Table 4; Figure 2]

On multivariable analysis, there were multiple factors associated with antimicrobial-resistant SSI that were independent from each other. Each 10-year increase in age was associated with higher odds of resistance (adjusted OR [aOR], 1.15; 95% CI, 1.01–1.31; P=0.034). Emergency surgery (aOR, 1.73; 95% CI, 1.04–2.89; P=0.035), dirty/infected wounds (aOR, 2.48; 95% CI, 1.34–4.59; P=0.004), operative duration >120 min (aOR, 1.82; 95% CI, 1.10–3.01; P=0.019), ASA III–IV status (aOR, 1.69; 95% CI, 1.01–2.82; P=0.046), hospitalization within the preceding 90 days (aOR, 2.08; 95% CI, 1.05–4.12; P=0.036), and prior antibiotic exposure (aOR, 2.71; 95% CI, 1.53–4.79; P<0.001) remained independently associated with antimicrobial resistance. Sex, open/converted surgical approach, chronic kidney disease, malignancy, and contaminated wounds were not independently associated with resistance [Figure 3], but there was a borderline association with diabetes (aOR, 1.67; 95% CI, 0.98–2.84; P=0.059).

Table 1: Baseline Demographic, Clinical, and Operative Characteristics

Variable	Category	n (%)
Age, years	Mean ± SD	48.6 ± 16.2
	<30	35 (11.7)
	30–39	48 (16.0)
	40–49	67 (22.3)
	50–59	72 (24.0)
	≥60	78 (26.0)
Sex	Male	181 (60.3)
	Female	119 (39.7)
BMI, kg/m²	Mean ± SD	24.8 ± 4.1
	<18.5	22 (7.3)
	18.5–24.9	154 (51.3)
	25.0–29.9	91 (30.3)
	≥30.0	33 (11.0)
Diabetes mellitus	Yes	76 (25.3)
Hypertension	Yes	82 (27.3)
Chronic kidney disease	Yes	24 (8.0)
Chronic liver disease	Yes	19 (6.3)
Malignancy	Yes	42 (14.0)
Smoking/tobacco exposure	Yes	96 (32.0)
Type of surgery	Elective	178 (59.3)
	Emergency	122 (40.7)
Surgical approach	Open	217 (72.3)
	Laparoscopic	65 (21.7)
	Converted to open	18 (6.0)
Wound classification	Clean-contaminated	126 (42.0)
	Contaminated	103 (34.3)
	Dirty/infected	71 (23.7)
Operative duration, min	Mean ± SD	124.7 ± 58.6
	≤60	42 (14.0)
	61–120	126 (42.0)
	>120	132 (44.0)
ASA physical status	I	38 (12.7)
	II	146 (48.7)
	III	96 (32.0)
	IV	20 (6.7)
Perioperative antibiotic prophylaxis	Administered	274 (91.3)
	Not administered	26 (8.7)
Postoperative hospitalization, days	Median (IQR)	11 (8–17)
SSI onset, days	Median (IQR)	8 (5–12)

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index; IQR, interquartile range; SSI, surgical-site infection; SD, standard deviation.

Table 2: Clinical Characteristics and Outcomes of Abdominal SSI

Variable	Category	n (%)
SSI classification	Superficial incisional	142 (47.3)
	Deep incisional	91 (30.3)
	Organ/space	67 (22.3)
Clinical presentation	Purulent wound discharge	184 (61.3)
	Wound erythema	171 (57.0)
	Local tenderness/pain	159 (53.0)
	Wound dehiscence	73 (24.3)
	Fever ≥38°C	112 (37.3)
	Abdominal pain/tenderness	94 (31.3)
	Intra-abdominal collection	61 (20.3)
SSI diagnosis	Clinical diagnosis	116 (38.7)

	Microbiologically confirmed	184 (61.3)
Procedural intervention	None	174 (58.0)
	Bedside opening/drainage	83 (27.7)
	Operative drainage/debridement	43 (14.3)
Postoperative wound management	Dressing/local care	158 (52.7)
	Negative-pressure wound therapy	49 (16.3)
	Re-suturing/secondary closure	38 (12.7)
	Other	55 (18.3)
WBC, ×10⁹/L	<4	8 (2.7)
	4–10	177 (59.0)
	>10	115 (38.3)
CRP, mg/L	<10	38 (12.7)
	10–50	143 (47.7)
	>50	119 (39.7)
SSI-related readmission	Yes	47 (15.7)
ICU admission related to SSI	Yes	34 (11.3)
SSI-related mortality	Yes	12 (4.0)

Table 3: Microbiological Characteristics of Culture-Positive Abdominal SSI

Characteristic	Category	n (%)
Culture result	Positive	184 (61.3)
	No growth	116 (38.7)
Culture-positive infection	Monomicrobial	151 (82.1)
	Polymicrobial	33 (17.9)
Gram classification	Gram-negative bacilli	144 (70.2)
	Gram-positive cocci	55 (26.8)
	Gram-positive bacilli	3 (1.5)
	Candida spp.	3 (1.5)
Total isolates	—	205 (100.0)

Table 4: Clinical Factors Independently Associated with Antimicrobial-Resistant SSI

Predictor	Resistant SSI n/N (%)	Adjusted OR (95% CI)	P value
Age, per 10-year increase	—	1.15 (1.01–1.31)	0.034
Male sex	69/181 (38.1)	1.19 (0.74–1.92)	0.468
Diabetes mellitus	38/76 (50.0)	1.67 (0.98–2.84)	0.059
Chronic kidney disease	14/24 (58.3)	1.74 (0.74–4.10)	0.204
Malignancy	22/42 (52.4)	1.61 (0.78–3.34)	0.199
Emergency surgery	57/122 (46.7)	1.73 (1.04–2.89)	0.035
Open/converted approach	91/235 (38.7)	1.31 (0.74–2.31)	0.354
Contaminated wound	52/103 (50.5)	1.63 (0.93–2.86)	0.085
Dirty/infected wound	43/71 (60.6)	2.48 (1.34–4.59)	0.004
Operative duration >120 min	67/132 (50.8)	1.82 (1.10–3.01)	0.019
ASA III–IV	61/116 (52.6)	1.69 (1.01–2.82)	0.046
Prior hospitalization within 90 days	31/52 (59.6)	2.08 (1.05–4.12)	0.036
Prior antibiotic exposure	48/72 (66.7)	2.71 (1.53–4.79)	<0.001

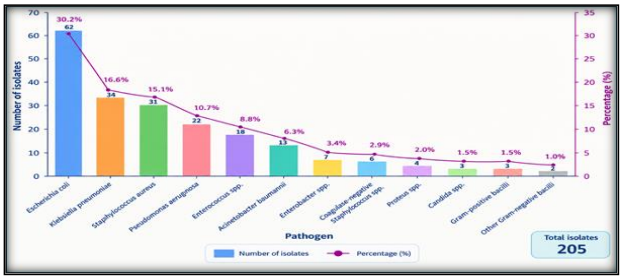


Figure 1: Distribution of Microbiological Isolates in Culture-Positive Abdominal SSI

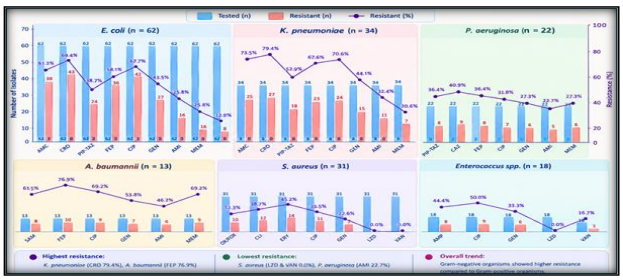


Figure 2: Antimicrobial Resistance Profile of Major Isolates

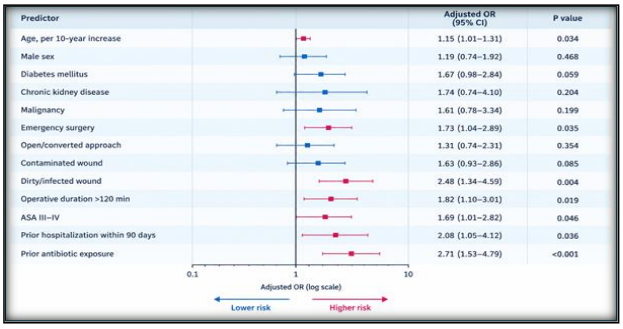


Figure 3: Adjusted Associations with Antimicrobial-Resistant SSI

DISCUSSION

The microbiological profile revealed that Gram-negative organisms were the predominant organism with 70.2% of all recovered organisms. Escherichia coli (30.2%) was the most common organism, followed by Klebsiella pneumoniae (16.6%), Staphylococcus aureus (15.1%), Pseudomonas aeruginosa (10.7%) and Enterococcus spp. (8.8%). 61.3% of the patients were culture positive, and

most culture-positive infections were monomicrobial (82.1%). The pattern is like what has been described for abdominal SSI, where the endogenous gastrointestinal flora often is a predominating gram-negative microorganism. E. coli and S. aureus were reported as the major organisms in abdominal SSI in a hospital in India by Ratnesh et al. and Shrestha et al. also showed that Gram-negative organisms were the major ones responsible for SSI after gastrointestinal surgery.[6,7] Based on the present results, the need for local microbiological surveillance in the description of abdominal postoperative infections is thus confirmed.

In the present study, gram-negative bacilli were predominant, which was also like other larger studies with surveillance-oriented objectives. A multicentre prospective study from Ethiopia, conducted by Worku et al., found a significant burden of Gram-negative bacterial SSI and resistance to antimicrobial agents in addition to finding that bacterial profile and susceptibility varied by geographic location.[8] Mohamed et al. in particular have shown that multidrug-resistant bacterial pathogens are an important part of the epidemiology of SSIs and have defined some clinical and healthcare-related exposures as predisposing factors.[9] While pathogen frequencies cannot be directly compared between studies due to variations in surgical populations, specimen collection, laboratory methods, and healthcare settings, this consistent finding of Enterobacterales in all studies suggests their clinical relevance in abdominal SSI.

An important result of the present study was the high resistance of Enterobacterales. The percentage of E. coli and K. pneumoniae isolates that were resistant to ceftriaxone, ciprofloxacin, and cefepime was 69.4%, 67.7%, and 58.1%, respectively, and 79.4%, 70.6%, and 67.6%, respectively. The results suggest high level resistance of β-lactam and fluoroquinolone drugs. Shrestha et al. reported high levels of antimicrobial resistance among bacterial isolates post gastrointestinal surgery and Worku et al. reported that a high proportion of the microorganisms involved in SSI was found to be resistant to the tested antimicrobial agents in a multi-centre study.[7,8,12] Similarly, Palikhey et al. have also reported significant amount of MDR in SSIs patients at tertiary care center.[13] Together, these findings suggest that susceptibility profiles can only be extrapolated from historical or geographically distant data sets with great uncertainty and should be based on current local surveillance.

The rates of resistance to carbapenems were lower than those of third-generation cephalosporins and fluoroquinolones in the present cohort, except for meropenem resistance, which was observed in 12.9% of E. coli and in 20.6% of K. pneumoniae. By contrast, A. baumannii exhibited a wider range of resistance patterns with 69.2% meropenem resistance and 76.9% cefepime resistance. The clinical implication of this finding is that carbapenem-resistant non-fermenting Gram-negative organisms that frequently limit treatment options. In a recent study, Feier et al. also reported the association between antimicrobial resistance and SSI and found that longitudinal monitoring of antimicrobial resistance at the hospital level is important for tracking trends,[12] using six years of hospital data. Resistances proportions, however, are very context-dependent on antimicrobial exposure, patient selection, laboratory techniques and local epidemiology and so the present percentages should not be interpreted as general resistances proportions.

Clinically important microbiological resistance was also identified in the Gram-positive result. In the current study, 32.3% of the S. aureus isolates were oxacillin/cefoxitin resistant, and all S. aureus isolates tested were sensitive to linezolid and vancomycin. Of the Enterococcus spp, 16.7% were vancomycin resistant and all tested isolates were susceptible to linezolid. The results in this study showed that resistant GP organisms were not as common as the GNB, but resistant organisms still significantly affect postoperative antimicrobial therapy. Gram-negative and Gram-positive SSI pathogens were also found to be resistant by Worku et al. and Palikhey et al., respectively.[8,13]

Several independent factors for antimicrobial-resistant SSI were identified. There was an association between age and odds of resistance, with a 15% rise in adjusted odds for each 10-year increase in age. Dirty/infected wounds, long operation time, ASA III-IV, previous hospitalization, and history of antibiotic use were independent factors associated with resistant infection. Prior antibiotic use (aOR 2.71), dirty/infected wounds (aOR 2.48), and hospitalization in the last 90 days (aOR 2.08) were most strongly associated. These findings are biologically and epidemiologically plausible, as previous health-care exposures and antimicrobial exposures could be associated with a higher risk of colonization or infection with resistant microorganisms or because contaminated operative fields and prolonged procedures could be associated with greater exposure to an increased microbial burden.

The observed link between emergency surgery and antimicrobial resistance is also consistent with the literature on the effect of emergency presentation and complexity of surgery as factors related to SSI. In a systematic review of abdominal surgery, Marzoug et al. found several factors linked to SSI related to the patient, surgery conducted and healthcare services provided.[2] Bucataru et al. also highlighted the importance of patient-related factors, wound contamination, surgical factors and perioperative management to the development of SSI.[3] A national cross-sectional study of colorectal surgery in China by Zhang et al., has shown that SSI risk is determined by a combination of patient and operative factors, not just any single one.[5] Importantly, these studies have focused on risk of SSI while the present analysis has focused on antimicrobial resistance among patients that had developed SSI; therefore, any conclusions regarding an association between these factors and development of SSI should not be interpreted as demonstrating that these factors cause SSI itself.

Previous antibiotic history and resistant SSI have significant implications for antimicrobial stewardship. In this population, 66.6% of those with a documented history of antibiotic exposure had resistant SSI and prior antibiotic exposure remained an independent determinant of resistant SSI after controlling for other clinical characteristics. This observation confirms the principle

that empirical antimicrobial therapy should be based on the current local susceptibility data and adjusted based on the culture and susceptibility findings. Seidelman et al. highlighted the need for evidence-based SSI prevention strategies and for appropriate antimicrobial use during the surgical procedure; Dhandapani et al. showed that structured peri-operative antimicrobial care bundles play an important aspect of gastrointestinal surgical infection prevention.[11,14] In the present findings, the local resistance surveillance system is expanded to emphasize the need to combine local resistance surveillance with prevention and antimicrobial stewardship strategies.

The impact of SSI in this population was significant. Over two-fifths of patients needed a procedural intervention, 15.7% were readmitted for an SSI, 11.3% were admitted to the intensive care unit and 4.0% died related to the SSI. These outcomes provide evidence that SSI is not a simple wound complication but can be a significant cause of downstream health service usage. In a systematic review and meta-analysis of 488,594 general surgical patients, Gillespie et al. showed that SSI is a significant global burden.[1] Similarly, Mengistu et al. found that there was a high level of SSI incidence across a range of health care environments worldwide.[4] The present study contributes microbiological and resistance-level data to this well documented burden, with a focus on the experience of abdominal surgery.

The results also highlight the need for regular SSI monitoring. In LMC countries, standardized surveillance of SSI is crucial for obtaining reliable epidemiological data and informing prevention programmed, as outlined by Mehtar et al.[15] Additionally, Forrester et al. reported a high level of variability among national SSI surveillance programmed in LMICs, indicating a need for standardized surveillance programmed.[16] The present study offers locally relevant data on the distribution of pathogens and their antimicrobial susceptibility, and it also aims to define potential associations between patient and operative parameters with the risk of a resistant infection.

Limitations

There are some limitations to this study. Because of its retrospective, single-center design, the authors are limited in their ability to make causal inferences and may not be generalizable for other surgical populations. Factors associated with ARSSI were examined in patients with documented SSI only, thus the factors identified might be associated with ARSSI but not necessarily predictive of all surgical patients acquiring SSI. Culture-negative infections may be due to a combination of pre-antibiotic exposure, specimen quality and non-bacterial etiology. It is difficult to be precise about organism-specific resistance estimates because there are relatively few numbers of individual organisms, especially A. baumannii, Enterococcus and fungal isolates. In addition, residual confounding may have occurred due to exposure to antimicrobials prior to admission, or when taking samples before antibiotic administration. However, the study offers a clinically relevant analysis of the distribution of pathogens, antimicrobial resistance, and their related clinical parameters in a specific group of patients with abdominal SSI.

CONCLUSION

The Gram-negative bacilli were the predominant pathogens in this cohort of 300 patients with abdominal SSI; E. coli and K. pneumonia were the main pathogens, and significant resistance to cephalosporins and fluoroquinolones was seen, as was clinically important resistance of A. baumannii. The following factors were independently associated with AR-SSI: older age, emergency surgery, dirty and/or infected wounds, longer operating time, higher ASA status, recent hospital admission, and prior antibiotic use. The results highlight the importance of microbiological monitoring for wounds, prompt timely collection of suitable wound cultures, locally guided empirical antibiotic use, and targeted culture-based treatment and stewardship. Continuous institutional surveillance is recommended as pathogen distribution and resistance profiles are constantly changing and may be very different for different healthcare institutionsinto EHR-supported decision-support processes.

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