ORIGINAL ARTICLE

Surgical Site Infection Following Gynecological Oncology Surgery: Microbiological Profile, and Antimicrobial Susceptibility Pattern

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Abstract:

Background: Surgical site infection (SSI) remains one of the most common postoperative complications following gynecological oncology surgery, contributing to increased morbidity, prolonged hospitalization, and healthcare costs. This study aimed to describe the clinical, surgical, and microbiological characteristics of patients who developed SSI following gynecological oncology surgery. Methods: A descriptive observational study was conducted among patients who developed SSI following gynecologic oncology surgery at Bangladesh Medical University in 2024. A total of 29 patients with confirmed SSI were included. Data on socio-demographic characteristics, clinical factors, surgical variables, SSI type, and outcomes were collected. Microbiological culture and antimicrobial susceptibility testing were performed for bacterial isolates. Results: The mean age of patients was 47.0 ± 14.3 years. Most patients had normal BMI (58.6%), while 34.5% were overweight. Anaemia (75.9%), diabetes mellitus (58.6%), and hypertension (58.6%) were common comorbidities. Contaminated wounds accounted for 55.2% of cases, and 72.4% of patients received perioperative blood transfusion. Superficial incisional SSI was more common (75.9%) than deep incisional SSI (24.1%). No statistically significant association was observed between patient or surgical characteristics and SSI depth. Gram-negative organisms predominated, with Escherichia coli/Enterobacteriaceae being the most frequently isolated pathogen, followed by Klebsiella spp., Pseudomonas spp., and Acinetobacter spp., while Gram-positive organisms included Staphylococcus spp., Enterococcus spp., and Corynebacterium spp. High multidrug resistance (MDR) rates were observed among both gram-negative and gram-positive organisms. Conclusion: SSI following gynecological surgery is associated with significant comorbidities, contaminated wounds, and high antimicrobial resistance rates. Strengthening infection prevention practices and antimicrobial stewardship is essential to reduce SSI burden and improve postoperative outcomes.

Key words: Surgical site infection, gynecological oncology, antimicrobial resistance, postoperative infection.

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Introduction

Surgical site infection (SSI) remains one of the most common healthcare-associated infections worldwide and is a major cause of postoperative morbidity, prolonged hospitalization, and increased healthcare costs.[1] Despite advances in surgical

techniques, antimicrobial prophylaxis, and infection prevention strategies, SSIs continue to pose a substantial challenge, particularly in low- and middle-income countries (LMICs), where infection rates are often higher due to resource limitations and gaps in infection control practices.[2] Gynecological oncology surgeries represent a high-risk group for SSI. These procedures frequently involve prolonged operative duration, extensive tissue dissection, and potential entry into contaminated anatomical sites.[3]

In addition, patients undergoing oncologic surgery often have compromised immunity due to malignancy, anemia, malnutrition, or comorbid conditions such as diabetes mellitus and hypertension, increasing susceptibility to postoperative infection.[4,5] Both patient-related factors (advanced age, obesity, anemia, diabetes) and surgical factors (wound contamination, prolonged surgery, perioperative blood transfusion) have been consistently associated with SSI development.[6] The microbiological profile of SSIs has evolved over time. While gram-positive organisms such as Staphylococcus aureus were historically predominant, recent studies from LMICs report increasing isolation of gram-negative pathogens including Escherichia coli, Klebsiella spp., Pseudomonas spp., and Acinetobacter spp.[7-9] Many of these organisms exhibit multidrug resistance, limiting empirical treatment options and underscoring the need for local antimicrobial susceptibility surveillance to guide antibiotic stewardship policies.[10,11]

In Bangladesh and similar LMIC settings, data describing the microbiological spectrum and antimicrobial resistance patterns of SSI following gynecological oncology surgery remain limited. Generating context-specific evidence is essential to optimize perioperative antibiotic selection and strengthen infection prevention strategies. Therefore, this study aimed to describe the microbiological profile and antimicrobial susceptibility pattern of SSI following gynecological oncology surgery and to examine associated clinical and surgical factors.

Materials and Method:

This descriptive observational study included patients diagnosed with SSI following gynecologic oncology surgery. The study was conducted at the Department of Gynecological Oncology at Bangladesh Medical University (BMU).SSI was defined according to Centers for Disease Control and Prevention (CDC) criteria as an infection occurring at or near the surgical incision within 30 days of surgery (or within 90 days if an implant was placed), involving the incision or deep tissues of the operative site.[12] Patients who developed SSI after gynecological oncology surgery during the study period were included.

Data were collected by face-to-face interview and from medical records and microbiology reports using a structured data collection form. Variables include age, cancer characteristics (primary cancer diagnosis, FIGO stage), microbiological findings and antimicrobial susceptibility patterns. Wound samples were processed according to standard microbiological procedures.[13] Organisms were identified, and antimicrobial susceptibility testing was performed using standard laboratory protocols. MDR was defined as resistance to three or more antimicrobial classes.[14] Data were analyzed using descriptive statistics. Continuous variables were presented as mean ± standard deviation, and categorical variables as frequency and percentage.

Ethical approval was obtained from the Institutional Review Board (IRB) of BMU. Written informed consent was obtained from the patients or their legal guardians. Patient confidentiality was maintained throughout the study. The study was conducted in accordance with institutional ethical standards and the principles of the Declaration of Helsinki.

Results:

Table 1 summarizes the demographic and cancer characteristics of the 29 patients who developed SSI. The mean age was 46.97 ± 14.32 years (range: 18–70). Ovarian epithelial malignancy was the most common diagnosis (20.7%), followed by cervical carcinoma/CIN (17.2%). Endometrial carcinoma/hyperplasia and germ cell tumors each accounted for 13.8% of cases, while mixed or other malignancies comprised 10.3%. Notably,

24.1% of patients had benign or non-malignant lesions. The majority of patients (82.8%) were diagnosed at early stages (FIGO I–II), whereas 17.2% had advanced-stage disease (FIGO III–IV).

Table 1: Demographic and cancer characteristics of patients with surgical site infection

Demographic and Clinical Variables	Frequency (n)	Percentage (%)
Age (years)		
< 50 years	15	51.7
≥ 50 years	14	48.3
Mean ± SD (Range)		46.97 ± 14.32
Primary cancer diagnosis		
Cervical carcinoma / CIN	5	17.2
Endometrial carcinoma / hyperplasia	4	13.8
Ovarian epithelial malignancy	6	20.7
Germ cell tumor	4	13.8
Mixed / other malignancies	3	10.3
Benign / cystic / non-malignant lesions	7	24.1
FIGO stage		
I–II	24	82.8
III–IV	5	17.2

CIN=cervical intraepithelial neoplasia

Among culture-positive isolates, Gram-negative organisms predominated, with *Escherichia coli/ Enterobacteriaceae* being the most frequently identified pathogen (24.1%), followed by *Klebsiella spp.* and *Pseudomonas spp.* Gram-positive organisms included *Staphylococcus spp.*, *Enterococcus spp.*, and *Corynebacterium spp.*, which were identified less frequently (Figure 1). High levels of resistance to commonly used antibiotics were observed. Among Gram-positive isolates (n=7), high susceptibility was observed to vancomycin and teicoplanin (100%), while moderate resistance to commonly used antibiotics such as erythromycin, doxycycline, and ciprofloxacin was noted; MDR was detected in 66.7% of both *Staphylococcus* and *Enterococcus* isolates, whereas *Corynebacterium* showed no MDR (Table 2). Among Gram-negative isolates (n=15), carbapenems (meropenem) and polymyxins demonstrated relatively high susceptibility rates, while resistance to ampicillin and third-generation cephalosporins was common, particularly among *Acinetobacter spp.*; MDR was identified in 66.7% of *E. coli/Enterobacteriaceae*, *Klebsiella*, and *Pseudomonas* isolates, and in all *Acinetobacter* isolates (100%) (Table 3).

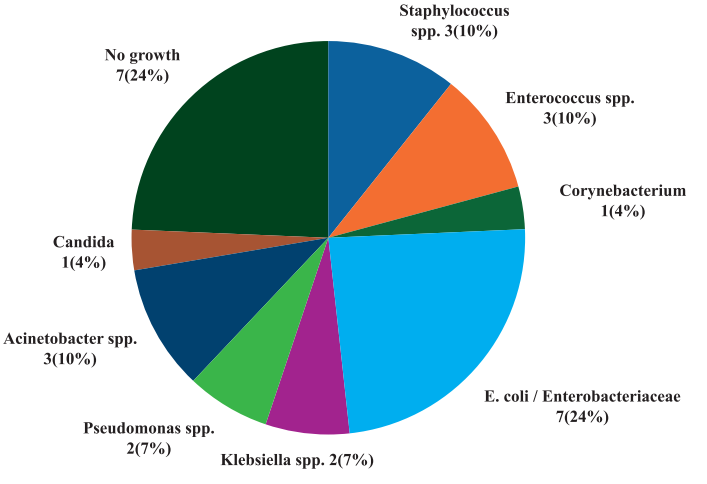

Fig-1: Distribution of bacterial isolates recovered from surgical site infections following surgery

Table 2: Antimicrobial susceptibility and multidrug resistance among bacterial isolates (Gram-positive isolates, n=7)

Organism	E	TE	FOX	OXA	DOX	SXT	CPR	CN	CLI	VAN	LZD	TEC	RIF	CXC	MDR n (%)
Staphylococcus spp. (n=3)	33	—	—	33	33	33	33	33	66	100	33	100	33	33	2 (66.7)
Enterococcus spp. (n=3)	—	33	—	—	33	33	33	33	33	100	—	100	—	—	2 (66.7)
Corynebacterium (n=1)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0 (0.0)

E – Erythromycin, TE – Tetracycline, FOX – Cefoxitin, OXA – Oxacillin, DOX – Doxycycline, SXT – Trimethoprim-Sulfamethoxazole, CPR – Ciprofloxacin, CN – Gentamicin, CLI – Clindamycin, VAN – Vancomycin, LZD – Linezolid, TEC – Teicoplanin, RIF – Rifampicin, CXC – Cloxacillin, MDR – Multidrug resistance.

Table 3: Antimicrobial susceptibility and multidrug resistance among bacterial isolates (Gram-negative isolates, n=15)

Organism	AMP	AMC	CTX	CRO	FEP	CAZ	TZP	GEN	AMK	CIP	LEV	MEM	COL	POL	TGC	DOX	SXT	MDR n (%)
E. coli / Enterobacteriaceae (n=6)	17	33	50	67	67	67	83	67	83	33	33	100	83	83	67	50	50	4 (66.7)
Klebsiella spp. (n=3)	0	33	33	33	67	67	67	33	67	33	33	100	67	67	33	0	33	2 (66.7)
Pseudomonas spp. (n=3)	—	—	—	33	67	100	100	67	67	33	33	100	67	67	—	—	—	2 (66.7)
Acinetobacter spp. (n=3)	0	0	0	0	33	33	33	33	33	33	33	67	67	67	33	0	10	3 (100)

AMP – Ampicillin, AMC – Amoxicillin-Clavulanic Acid, CTX – Cefotaxime, CRO – Ceftriaxone, FEP – Cefepime, CAZ – Ceftazidime, TZP – Piperacillin–Tazobactam, GEN – Gentamicin, AMK – Amikacin, CIP – Ciprofloxacin, LEV – Levofloxacin, MEM – Meropenem, COL – Colistin, POL – Polymyxin B, TGC – Tigecycline, DOX – Doxycycline, SXT – Trimethoprim-Sulfamethoxazole, MDR – Multidrug resistance.

Discussion:

This study describes the demographic characteristics and microbiological profile of SSI following gynecological oncology surgery at BMU. The findings indicate a predominance of gram-negative organisms with a high burden of MDR, underscoring the ongoing challenges of postoperative infection management in resource-constrained settings.

In this cohort, the mean age was 46.97 ± 14.32 years, with a nearly equal distribution between patients aged <50 and ≥50 years. Most patients were diagnosed at early FIGO stages (I–II), suggesting that SSI is not confined to advanced malignancy or highly extensive procedures. Ovarian epithelial malignancy was the most common underlying diagnosis. Although early-stage disease generally requires less radical intervention, gynecological oncologic procedures inherently involve prolonged operative duration and significant tissue handling, which increase SSI risk.[4,15]

Consistent with previous literatures gram-negative organisms predominated among isolates, particularly *Escherichia coli/Enterobacteriaceae*, followed by *Klebsiella, Pseudomonas,* and *Acinetobacter species*. Similar trends have been increasingly reported in LMIC settings, where gram-negative pathogens are emerging as leading causes

of postoperative infections.[7-9] The high proportion of MDR isolates is particularly concerning. All *Acinetobacter* isolates demonstrated MDR, while approximately two-thirds of *E. coli, Klebsiella,* and *Pseudomonas* isolates were multidrug resistant. Resistance to commonly used cephalosporins and fluoroquinolones may substantially limit empirical treatment options and necessitate reliance on broader-spectrum agents.[7-9] Among gram-positive organisms, *Staphylococcus* and *Enterococcus* species also exhibited multidrug resistance, although retained susceptibility to vancomycin and linezolid is reassuring.[10,11]

These findings reinforce the importance of culture-guided therapy and institutional antimicrobial stewardship programs. Overall, the study highlights the evolving microbiological spectrum of SSI in gynecological oncology surgery and emphasizes the need for strengthened infection prevention strategies, rational antibiotic use, and continuous local surveillance to mitigate postoperative morbidity and healthcare burden.

Conclusion:

SSI remains a common complication following gynecological oncology surgery, with a predominance of gram-negative and multidrug-resistant organisms. Strengthened infection prevention measures, culture-guided antibiotic therapy, and ongoing antimicrobial surveillance are essential. Larger prospective studies are needed to identify modifiable risk factors and guide targeted interventions.

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