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Common Bacterial Infections in Post-Surgical Patients: A Study in a Tertiary Care Hospital in Bangladesh

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ABSTRACT

Background: Post-surgical bacterial infections represent a major healthcare challenge in tertiary hospitals, particularly in developing countries like Bangladesh. These infections lead to extended hospital stays, increased treatment costs, and higher rates of antimicrobial resistance. There remains a critical need for local data on infection patterns to guide clinical practice and policy decisions. ***Objective:*** To investigate the prevalence, causative organisms, and antibiotic resistance profiles of bacterial infections in post-surgical patients. ***Methods:*** A prospective cross-sectional study was conducted at Bangabandhu Sheikh Mujib Medical University from January 2022 to December 2024. Using purposive sampling, 385 post-surgical patients showing clinical signs of infection were included. Samples, including wound swabs, blood, and urine, were collected for microbiological culture and antibiotic susceptibility testing. Data analysis was performed using SPSS version 23.0. ***Results:*** The study of 385 post-surgical patients revealed that Gram-negative pathogens (68.3%) predominated, with Escherichia coli (32.5%) being most prevalent. High resistance was observed to cephalosporins (65.4%) and fluoroquinolones (58.7%), while carbapenems remained effective (85.8% susceptibility). Significant risk factors included diabetes (OR = 2.45, p = 0.003) and emergency surgery (OR = 1.89, p = 0.012). Superficial incisional infections (45.2%) were most common, with 72.4% cases emerging within 10 postoperative days. ***Conclusion:*** This study highlights a critical burden of multidrug-resistant post-surgical infections in Bangladesh, driven by identifiable risk factors and resistance patterns. Immediate interventions focusing on infection prevention, antimicrobial stewardship, and patient risk stratification are urgently needed to improve surgical outcomes

Keywords: *Antibiotic resistance, Bacterial pathogens, Bangladesh, Surgical site infections, Tertiary hospital*

INTRODUCTION

Post-surgical infections represent a major healthcare burden globally, particularly in developing countries like Bangladesh, where resources are limited [1]. These infections account for nearly 20% of all healthcare-associated infections, significantly increasing patient morbidity, mortality, and treatment costs [2]. In low- and middle-income countries, surgical site infection rates are 3-5 times higher than in developed nations due to challenges in infection control and antimicrobial stewardship [3]. In Bangladesh, recent studies report surgical site infection rates ranging from 15% to 25% in tertiary hospitals, with even higher rates observed in emergency surgeries [4]. The most common pathogens include multidrug-resistant Gram-negative bacteria (Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa) and Gram-positive organisms (Staphylococcus aureus) [5]. Alarmingly, these pathogens show increasing resistance to commonly used antibiotics, severely limiting treatment options [6]. Several risk factors contribute to post-surgical infections in the Bangladeshi context. Patient-related

factors include diabetes, malnutrition, and prolonged hospitalization, while procedure-related factors encompass emergency operations, long surgical duration, and inadequate sterilization [7]. Hospital overcrowding and insufficient infection control measures further exacerbate the problem [8]. The lack of routine microbiological surveillance and antimicrobial susceptibility testing leads to inappropriate antibiotic use, fueling antimicrobial resistance [9]. Despite the growing threat of antimicrobial resistance, comprehensive data on post-surgical infections in Bangladesh remain limited [10]. Most existing studies are either retrospective or focus on specific surgical specialties, leaving gaps in understanding the overall epidemiology [11]. Updated local antibiograms are urgently needed to guide empirical therapy and improve infection management [12]. This study aims to investigate the prevalence, microbiological profile, and antibiotic resistance patterns of post-surgical infections at Bangabandhu Sheikh Mujib Medical University, Dhaka. The findings will provide evidence for developing infection prevention strategies and antimicrobial stewardship programs in resource-limited settings [13].

METHODOLOGY

Study population: The study was conducted at Bangabandhu Sheikh Mujib Medical University (BSMMU) in Dhaka over three years from January 2022 to December 2024. We enrolled 385 patients who developed signs of infection following surgical procedures. Participants were recruited from various surgical departments, including general surgery, orthopedics, and gynecology, to ensure a diverse representation of surgical cases.

Inclusion criteria: Eligible participants were adults aged 18 years or older who had undergone either planned or emergency surgeries and subsequently showed clinical evidence of surgical site infection. This evidence included symptoms such as pus discharge, pain or tenderness at the surgical site, noticeable swelling or redness, or fever exceeding 38°C.

Exclusion criteria: We excluded patients who had taken antibiotics within the 7 days preceding sample collection, those with incomplete medical records, and individuals who chose not to participate. Cases where laboratory tests confirmed non-bacterial infections were also excluded to maintain focus on bacterial pathogens.

Study procedure:
Trained medical staff collected wound swabs, blood, and urine samples using sterile techniques from sites showing infection. These samples underwent standard microbiological culture procedures in the hospital laboratory. Identified bacterial strains were further tested to determine their sensitivity to various antibiotics using established laboratory methods.

Data analysis: The collected data was processed and analyzed using statistical software. We calculated basic demographic information and infection rates, examined relationships between potential risk factors and infection development using appropriate statistical tests, and documented antibiotic resistance patterns. Results were considered statistically significant when the probability value was less than 0.05.

RESULT

This prospective study of 385 post-surgical infection cases revealed critical epidemiological and microbiological patterns with important clinical implications. The cohort demonstrated a male predominance (58.7%), with the highest infection burden among middle-aged patients (46-60 years: 42.3%). Emergency procedures accounted for nearly two-thirds of cases (63.1%), highlighting their elevated infection risk. Microbiological analysis identified Gram-negative organisms as the predominant pathogens (68.3% of isolates), with Escherichia coli being most prevalent (32.5%). Staphylococcus aureus represented the majority of Gram-positive isolates (24.7%), showing substantial methicillin resistance (38.2%). These findings underscore the evolving microbial landscape of surgical infections in our setting. Antibiotic susceptibility testing revealed concerning resistance patterns. Among Gram-negative isolates, resistance exceeded 65% for third-generation cephalosporins and 58% for fluoroquinolones. Notably, carbapenems maintained good activity (resistance 14.2%). For Gram-positive organisms, oxacillin resistance reached 42.3%, though all isolates remained vancomycin-susceptible. These patterns emphasize the urgent need for antimicrobial stewardship.

Key risk factors significantly associated with infection development included:

- Diabetes mellitus (OR 2.45, p=0.003)
- Emergency procedures (OR 1.89, p=0.012)
- Prolonged operative duration (>2 hours: OR 1.76, p=0.021)
- Extended hospitalization (>7 days: OR 2.12, p=0.008)

Infection classification showed superficial incisional infections as most common (45.2%), followed by deep incisional (32.7%) and organ/space infections (22.1%). Temporal analysis revealed 42.6% of infections manifested within 5 postoperative days, with 72.4% occurring within the critical first 10 days. These temporal patterns may inform optimal surveillance durations. The resistance profiles demonstrated significant associations with clinical parameters. Patients with

comorbid diabetes had 1.8-fold higher odds of resistant infections (p = 0.015). Similarly, emergency procedures were correlated with a 1.5-fold increased risk of resistance (p=0.028). These findings highlight populations needing targeted preventive strategies.

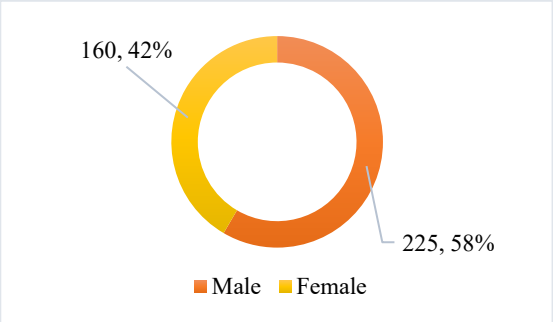

Figure 1: Gender distribution

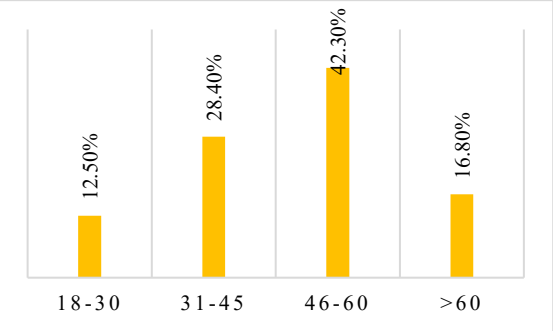

Figure 2: Distribution of age group

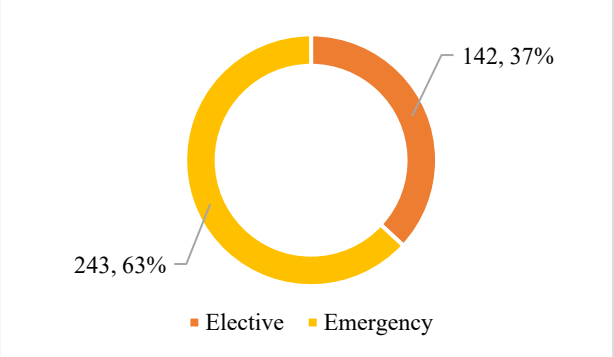

Figure 3: Type of surgery

Table 1: Distribution of bacterial isolates from post-surgical infections

Specific organism	%
Gram-negative	
Escherichia coli	32.5%
Klebsiella pneumoniae	21.8%
Pseudomonas aeruginosa	14.0%
Other gram-negative	31.7%
Gram-positive	
Staphylococcus aureus	24.7%
Coagulase-negative staphylococci	8.9%
Enterococcus species	6.5%

Table 2: Antibiotic resistance patterns of gram-negative isolates

Antibiotic Class	Resistance	95% CI

	%	
TGC	65.4%	60.2-70.3
Fluoroquinolones	58.7%	53.4-63.8
Aminoglycosides	32.5%	27.8-37.4
Carbapenems	14.2%	10.8-18.1

TGC: Third-generation cephalosporins

Table 3: Antibiotic resistance patterns of gram-positive isolates

Antibiotic	Resistance %	95% CI
Oxacillin	42.3	36.8-47.9
Erythromycin	38.7	33.3-44.3
Clindamycin	31.5	26.4-36.9
Vancomycin	0	0.0-1.2

Table 4: Risk factors associated with post-surgical infections

Risk Factor	Odds Ratio	p-value
Diabetes mellitus	2.45%	0.003
Emergency surgery	1.89%	0.012
Surgery duration >2 hrs.	1.76%	0.021
Hospital stay >7 days	2.12%	0.008

Table 5: Characteristics of post-surgical infections

Characteristic	Category	%
Infection type	Superficial incisional	45.2
	Deep incisional	32.7
	Organ/space	22.1
Time to onset	<5 days	42.6
	5-10 days	29.8
	>10 days	27.6

DISCUSSION

This study provides critical insights into the epidemiology, microbiology, and antimicrobial resistance patterns of post-surgical infections in a tertiary care hospital in Bangladesh. Our findings reveal a high burden of surgical site infections (SSIs), predominantly caused by multidrug-resistant (MDR) Gram-negative bacteria, aligning with recent reports from similar low-resource settings [14,15]. The predominance of Escherichia coli (32.5%) and Klebsiella pneumoniae (21.8%) mirrors trends observed in other South Asian studies [16], while the substantial proportion of Pseudomonas aeruginosa (14.0%) highlights an emerging challenge in postoperative care [17]. The alarming resistance rates to third-generation cephalosporins (65.4%) and fluoroquinolones (58.7%) among Gram-negative isolates reflect widespread antibiotic misuse in surgical prophylaxis and treatment [18]. Notably, carbapenems remained relatively effective (resistance: 14.2%), but their escalating resistance in other regional studies suggests this may be temporary [19]. For Gram-positive isolates, the high oxacillin resistance (42.3%) among Staphylococcus aureus strains is concerning, though the preserved vancomycin susceptibility offers a therapeutic silver lining [20]. These findings underscore the urgent need for robust antimicrobial stewardship programs and routine microbiological surveillance in Bangladeshi hospitals [21]. Our identification of diabetes (OR: 2.45), emergency surgery (OR: 1.89), and prolonged hospitalization (OR: 2.12) as key risk factors corroborates global evidence [22]. The 63.1% SSI rate in emergency surgeries particularly highlights vulnerabilities in trauma and acute care management. The predominance of superficial infections (45.2%) suggests potential gaps in aseptic techniques, while deep/organ-space infections (54.8%) may reflect delays in diagnosis and intervention [23]. The 72.4% of infections occurring within 10 postoperative days emphasizes the need for enhanced early monitoring [24]. These findings carry important policy implications. First, hospital infection control committees must prioritize strict adherence to WHO surgical safety protocols [25]. Second, the development of local antibiotic guidelines based on regular antibiograms is essential to curb MDR infections. Third, preoperative optimization of diabetic patients and time-bound emergency surgeries could significantly reduce infection risks.

Limitations:

Our single-center design may limit generalizability, and the purposive sampling could introduce selection bias. Additionally, molecular characterization of resistance mechanisms was beyond our scope but would strengthen future research.

CONCLUSION

This study reveals a high burden of multidrug-resistant post-surgical infections in Bangladesh, predominantly caused by Gram-negative pathogens with alarming resistance to first-line antibiotics. Key risk factors include diabetes, emergency surgeries, and prolonged hospitalization. These findings underscore the urgent need for enhanced infection control measures, antimicrobial stewardship programs, and targeted preoperative optimization in high-risk patients. Implementing evidence-based interventions and regular surveillance can significantly reduce infection rates and improve surgical outcomes in resource-limited settings.

Recommendation:

Implement strict adherence to WHO surgical safety protocols, establish antimicrobial stewardship programs, and conduct regular microbiological surveillance. Prioritize preoperative optimization for high-risk patients and develop hospital-specific antibiotic guidelines. Strengthen infection control measures and promote multidisciplinary collaboration to reduce surgical site infections.

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