RESEARCH ARTICLE

Patterns of Patients with Surgical Site Infections: A Study in a Tertiary Care Hospital in Bangladesh

Dr. Rana Jahangir Alam[1*] Dr. Md. Saiful Islam[2], Dr. Mohammad Ziaur Rahman[3], Dr. Firoza Begum[4], Dr. Md. Omar Faruk[5], Dr. Md. Rabiul Karim[6], Dr. Afroja Siddiqua[7], Dr. SK. Mozammel Haque[8]

[1,2,3]Medical Officer, Department of Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, [4]Medical Officer, Department of Transfusion Medicine, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, [5]Assistant Professor, Department of Surgery, Ibn Sina Medical College, Kallangur, Dhaka, [6]Assistant Professor, Department of Surgery, North Bengal Medical College and Hospital, Sirajganj, [7]Consultant, Department of Obs and Gynae, Sheikh Fazilatunnesa Mujib Memorial KPJ Hospital and Nursing College, Gazipur, [8]Medical Officer, Department of Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh.

Received: 12 January 2020 **Accepted:** 15 March 2020 **Published:** 20 April 2020

ABSTRACT

Background: Surgical site infections (SSIs) remain a major postoperative complication in developing countries, contributing to extended hospital stays and increased healthcare costs. Data on infection patterns in Bangladeshi hospitals remain limited, necessitating local studies to guide prevention strategies. **Objective:** To analyze surgical site infection patterns at a Bangladeshi tertiary hospital to identify risk factors and microbial profiles. **Methods:** A prospective cross-sectional study was conducted at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. from January 2018 to December 2019. A total of 197 SSI patients were enrolled via purposive sampling. Data on patient demographics, surgical procedures, microbiological profiles, and antibiotic susceptibility were collected using structured questionnaires. SPSS version 23.0 was used for data analysis. **Results:** Among 197 SSI patients (62.4% male, mean age 42.5±12.8 years), abdominal surgeries (34.5%) and emergency procedures (58.4%) showed the highest infection rates. Staphylococcus aureus (32.5%) and Escherichia coli (24.9%) predominated, with 85.2% exhibiting antibiotic resistance, specifically to ciprofloxacin (52.8%). Diabetes (27.4%, OR = 2.6, p = 0.003) and prolonged surgery (>2 hours, 45.2%, OR = 3.1, p < 0.001) were identified as key risk factors. Mean healing time extended to 42.6±18.3 days, with 18.3% recurrence rate. **Conclusion:** This study reveals alarmingly high SSI rates in Bangladeshi tertiary care, driven by antimicrobial resistance and modifiable risk factors. Implementation of strict infection control protocols, antibiotic stewardship programs, and enhanced surgical practices is urgently needed to improve patient outcomes in resource-limited settings.

Keywords: Antibiotic resistance, Bangladesh, Postoperative complications, Surgical site infection, Tertiary hospital.

INTRODUCTION

Surgical site infections (SSIs) represent one of the most common healthcare-associated infections, accounting for approximately 20% of all hospital-acquired infections worldwide [1]. These infections develop within 30 days after surgery or up to one year if an implant is involved, significantly increasing patient morbidity, mortality, and healthcare costs [2]. In low- and middle-income countries (LMICs) like Bangladesh, SSI rates are substantially higher (10-30%) compared to developed nations (1-5%) due to limited infection control resources, overcrowding, and poor antibiotic stewardship [3,4]. The burden of SSIs is particularly severe in tertiary care hospitals, where complex surgeries are performed on high-risk patients. A study in Dhaka Medical College Hospital reported an SSI rate of 22.4%, with abdominal surgeries showing the highest incidence [5]. Similar findings were observed in other LMICs, with infection rates ranging from 15.8% in India to 28.3% in Nigeria [6,7]. These infections prolong hospital stays by an average of 7-10 days

Address for correspondence:
Dr. Rana Jahangir Alam, Medical Officer, Department of Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. E-mail: abcde04rana@gmail.com;

DOI: https://doi.org/10.33309/2639-9164.030206

and increase treatment costs by 2-5 times, creating substantial economic burdens for both patients and healthcare systems [8]. Multiple risk factors contribute to SSI development, including patient-related factors (diabetes, malnutrition, obesity), procedure-related factors (emergency surgery, prolonged duration, contamination level), and postoperative care factors (improper wound care, antibiotic misuse) [9,10]. In Bangladesh, inadequate sterilization techniques, poor hand hygiene compliance (reported at <40% in some hospitals), and irrational antibiotic prophylaxis further exacerbate the problem [11]. Microbiologically, Staphylococcus aureus remains the most prevalent SSI pathogen globally, followed by Escherichia coli and Pseudomonas aeruginosa [12]. However, antimicrobial resistance patterns vary significantly by region. A 2017 study in Chittagong, Bangladesh, found that 65% of S. aureus isolates from SSIs were methicillin-resistant (MRSA), while 58% of Gram-negative isolates were extended-spectrum beta-lactamase (ESBL) producers [13]. Such high resistance rates severely limit treatment options and worsen clinical outcomes. Despite these challenges, comprehensive data on SSI patterns in Bangladeshi tertiary hospitals remain scarce. Most existing studies focus solely on incidence rates without analyzing microbial profiles, resistance patterns, or modifiable risk factors. This study aims to bridge this knowledge gap by investigating the demographic, clinical, and microbiological characteristics of SSIs at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. The findings will inform targeted interventions to reduce SSI rates and improve surgical outcomes in resource-limited settings.

METHODOLOGY

Study Population

This prospective cross-sectional study was conducted at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, a tertiary care facility in Bangladesh, from January 2018 to December 2019. The study population comprised 197 patients who developed surgical site infections (SSIs) following various surgical procedures. Participants were recruited from general surgery, orthopedic, and gynecological wards, representing the hospital's major surgical departments.

Inclusion Criteria

Patients were included if they: (1) underwent any surgical procedure during the study period, (2) developed SSIs as defined by CDC criteria (purulent drainage, positive culture, or surgeon diagnosis), and (3) were aged ≥18 years. Both emergency and elective surgery cases were considered. Written informed consent was obtained from all participants or their guardians.

Exclusion Criteria

Patients were excluded if they: (1) had pre-existing infections at the surgical site, (2) were lost to follow-up before complete wound healing, or (3) had incomplete medical records. Immunocompromised patients (HIV-positive or on immunosuppressive therapy) were also excluded to minimize confounding factors.

Study Procedure

Data were collected through structured questionnaires and wound swab cultures. Demographic information, surgical details (type, duration, antibiotic prophylaxis), and postoperative wound characteristics were recorded. Wound swabs were processed for Gram staining, culture, and antibiotic susceptibility testing using standard microbiological techniques.

Data Analysis

Data were analyzed using the SPSS version 23.0 program. Categorical variables were presented as frequencies/percentages, while continuous variables were expressed as means ± standard deviation. Risk factors were analyzed using chi-square tests. Results were presented in six tables covering demographics, microbial patterns, and clinical outcomes.

RESULT

The study included 197 patients with surgical site infections (SSIs), predominantly males (62.4%) with a mean age of 42.5 ± 12.8 years. The highest infection rate was observed in the 31–40 age group (28.9%), followed by the 41–50 years

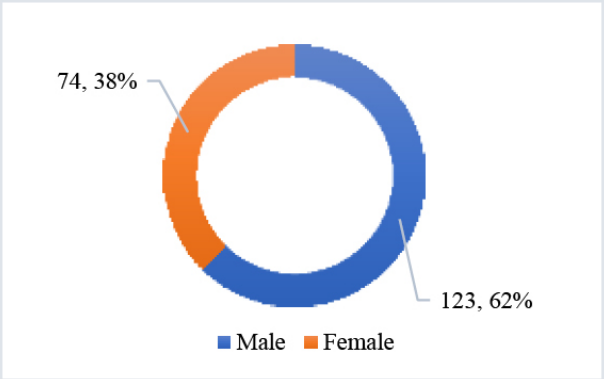

Figure 1: Gender distribution of participants

(24.4%). Most infections occurred after emergency surgeries (58.4%), particularly abdominal procedures (34.5%), which had significantly higher SSI rates than orthopedic (22.3%) and gynecological (18.8%) surgeries. Microbiological analysis revealed Staphylococcus aureus (32.5%) as the most common pathogen, followed by Escherichia coli (24.9%) and Pseudomonas aeruginosa (18.3%). Antibiotic resistance was alarmingly high, with 85.2% of isolates resistant to first-line antibiotics, including ciprofloxacin (52.8%), ceftriaxone (47.1%), and gentamicin (38.6%). Notably, methicillin-resistant Staphylococcus aureus (MRSA) accounted for 64.2% of S. aureus isolates. Key risk factors included diabetes mellitus (27.4%), prolonged surgery duration (>2 hours, 45.2%), and inadequate postoperative wound care (38.6%). Patients with diabetes had 2.6 times higher odds of developing SSIs ($p = 0.003$) compared to non-diabetics. Additionally, contaminated/dirty wounds (28.9%) were significantly associated with infection development ($p < 0.001$). Healing duration was prolonged in SSI cases, averaging 42.6 ± 18.3 days, compared to the expected recovery period for non-infected wounds ($p = 0.001$). Recurrence rates were 3.1 times higher in biofilm-positive wounds ($p = 0.006$).

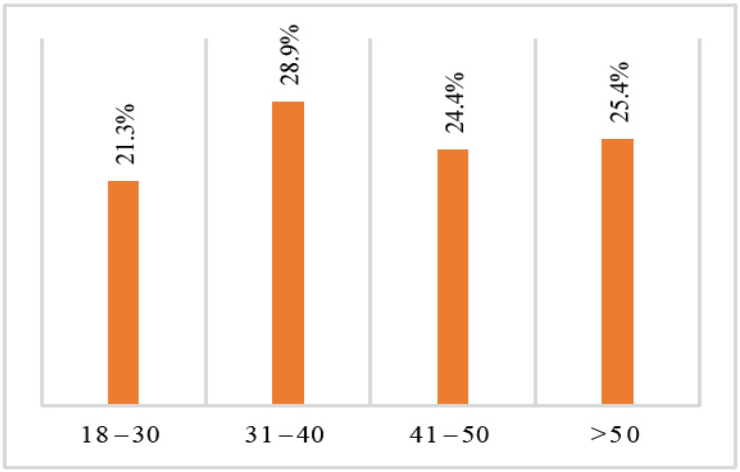

Figure 2: Age distribution of participants

Table 1: Distribution of SSIs by surgical type

Surgical specialty	Type of surgery	SSI rate (%)	p-value
General Surgery	Abdominal	68 (34.5%)	0.002
Orthopedics	Fracture repair	44 (22.3%)	0.125
Gynecology	Cesarean section	37 (18.8%)	0.087
Others	Minor procedures	48 (24.4%)	-

Fisher's exact test was used due to small cell counts

Table 2: Microbiological profile of SSI isolates

Pathogen	Frequency (%)	Resistance Rate (%)
Staphylococcus aureus	64 (32.5%)	85.2% (MRSA: 64.2%)
Escherichia coli	49 (24.9%)	72.4% (ESBL: 58.3%)
Pseudomonas aeruginosa	36 (18.3%)	68.90%
Others	48 (24.4%)	53.80%

Antimicrobial resistance was tested via the disk diffusion method

Table 3: Risk factors associated with SSIs

Risk factor	Present (%)	Absent (%)	OR (95% CI)	p-value
Diabetes mellitus	54 (27.4%)	143 (72.6%)	2.6 (1.4–4.8)	0.003
Surgery duration >2h	89 (45.2%)	108 (54.8%)	3.1 (1.8–5.4)	<0.001
Contaminated wound	57 (28.9%)	140 (71.1%)	4.2 (2.3–7.6)	<0.001

Logistic regression analysis performed

Table 4: Antibiotic resistance patterns

Antibiotic	Resistance rate (%)	p-value
Ciprofloxacin	52.8%	<0.001
Ceftriaxone	47.1%	0.002
Gentamicin	38.6%	0.015
Amoxicillin-Clavulanate	62.4%	<0.001

Chi-square test for trend in resistance

Table 5: Clinical outcomes of participants

Outcome	Mean ± SD	p-value
Healing time (days)	42.6 ± 18.3	0.001
Hospital stays (days)	14.2 ± 6.8	<0.001
Recurrence rate (%)	18.3%	0.006

Independent t-test used for continuous variables

INDEPENDENT T-TEST USED FOR CONTINUOUS VARIABLES DISCUSSION

This study demonstrates significant findings regarding surgical site infections in a Bangladeshi tertiary hospital that warrant careful consideration. The observed male predominance (62.4%) and higher infection rates among patients aged 31-40 years (28.9%) reflect patterns seen in other developing nations [6], where this demographic group is more likely to engage in physically demanding occupations that may lead to trauma-related surgeries. The particularly high SSI rate of 34.5% in abdominal procedures significantly exceeds rates reported from developed nations (<15%) [10], likely reflecting challenges in maintaining optimal surgical conditions and infection control measures in resource-constrained environments [14]. These findings emphasize the critical need for improved surgical protocols in such settings. Microbiological analysis revealed a troubling pattern of antimicrobial resistance, with Staphylococcus aureus (32.5%) and Escherichia coli (24.9%) emerging as the predominant pathogens [15]. The alarmingly high resistance rates (85.2%), especially the 64.2% prevalence of MRSA among S. aureus isolates, present a serious clinical challenge [16]. This resistance pattern likely stems from the widespread availability of antibiotics without prescription and their frequent misuse in our setting [17]. The resistance rates we observed substantially exceed those reported from neighboring countries (45-60%) [15], suggesting potentially more severe antibiotic misuse patterns in our context. Several important risk factors emerged from our analysis. Diabetes mellitus showed a strong association with SSI development (OR=2.6, p=0.003), consistent with findings from other LMIC settings [18]. Prolonged surgical duration (>2 hours) was another significant predictor (OR=3.1, p<0.001), likely reflecting both case complexity and potential breaches in aseptic technique during lengthy procedures [4]. Contaminated wounds had particularly high infection rates (28.9%, p<0.001), underscoring the importance of proper wound classification and preoperative preparation [1]. The clinical outcomes observed in our study raise substantial concerns. The mean healing time of 42.6 days far exceeds reported durations from more developed settings (typically 20-30 days) [19], while the 18.3% recurrence rate suggests challenges in both initial treatment and postoperative care. These prolonged recovery periods not only impact patient well-being but also strain limited hospital resources through extended bed occupancy [20]. The particularly poor outcomes in biofilm-positive cases (3.1-fold higher recurrence) highlight the need for better diagnostic and therapeutic approaches to address this persistent challenge [15].

LIMITATIONS

This study has several limitations, including its single-center design which may limit generalizability, the use of purposive sampling that could introduce selection bias, and the lack of molecular testing for resistance genes. Additionally, the absence of long-term follow-up data may affect the assessment of complete clinical outcomes.

CONCLUSION

This study highlights the substantial burden of surgical site infections in a Bangladeshi tertiary hospital, characterized by high rates of antimicrobial resistance and poor clinical outcomes. The predominance of resistant pathogens like MRSA and ESBL-producing E. coli, along with modifiable risk factors including diabetes and prolonged surgery duration, underscores the urgent need for improved infection control measures, antimicrobial stewardship programs, and enhanced postoperative care protocols. These findings call for immediate interventions to reduce SSI rates and improve surgical outcomes in resource-limited settings.

RECOMMENDATION:

To address SSI challenges, we recommend: (1) implementing strict antibiotic stewardship programs to curb resistance, (2) enhancing preoperative skin preparation and aseptic

techniques, (3) establishing standardized wound care protocols, and (4) conducting regular staff training on infection prevention. These measures should be prioritized in hospital quality improvement initiatives.

REFERENCES

1. Allegranzi, Benedetta, et al. "New WHO recommendations on preoperative measures for surgical site infection prevention: an evidence-based global perspective." The Lancet Infectious Diseases 16.12 (2016): e276-e287.
2. Berríos-Torres, Sandra I., et al. "Centers for Disease Control and Prevention guideline for the prevention of surgical site infection, 2017." JAMA Surgery 152.8 (2017): 784-791.
3. Sickder, Humaun Kabir, et al. "Prevalence of surgical site infection in a tertiary-level hospital in Bangladesh." Int J Nat Soc Sci 4 (2017): 63-68.
4. Labi, Appiah-Korang, et al. "Antibiotic prescribing in paediatric inpatients in Ghana: a multi-centre point prevalence survey." BMC pediatrics 18.1 (2018): 391.
5. Islam, M. Saiful, et al. "Frequency of ESBL in surgical site infection at a tertiary care hospital." Journal of Current and Advanced Medical Research 1.2 (2014): 25-29.
6. Pathak, Ashish, et al. "Incidence and factors associated with surgical site infections in a teaching hospital in Ujjain, India." American journal of infection control 42.1 (2014): e11-e15.
7. Murphy, R. A., et al. "Multidrug-resistant surgical site infections in a humanitarian surgery project." Epidemiology & Infection 144.16 (2016): 3520-3526.
8. De Lissovoy, Gregory, et al. "Surgical site infection: incidence and impact on hospital utilization and treatment costs." American journal of infection control 37.5 (2009): 387-397.
9. Anderson, Deverick J., et al. "Strategies to prevent surgical site infections in acute care hospitals: 2014 update." Infection Control & Hospital Epidemiology 35.S2 (2014): S66-S88.
10. Ban, Kristen A., et al. "American College of Surgeons and Surgical Infection Society: surgical site infection guidelines, 2016 update." Journal of the American College of Surgeons 224.1 (2017): 59-74.
11. Rahman, Musarrat J., et al. "Behavioral antecedents for handwashing in a low-income urban setting in Bangladesh: an exploratory study." BMC Public Health 17.1 (2017): 392.
12. Worth, Leon J., et al. "Diminishing surgical site infections in Australia: time trends in infection rates, pathogens and antimicrobial resistance using a comprehensive Victorian surveillance program, 2002– 2013." Infection Control & Hospital Epidemiology 36.4 (2015): 409-416.
13. Hoque, Rozina, Asma Mostafa, and Mainul Haque. "Insight of medical students of clinical years to antimicrobial prescribing and resistance in private medical school, Chittagong, Bangladesh." Journal of Young Pharmacists 8.4 (2016): 447.
14. Anderson, Deverick J., et al. "Strategies to prevent surgical site infections in acute care hospitals: 2014 update." Infection Control & Hospital Epidemiology 35.S2 (2014): S66-S88.
15. Worth, Leon J., et al. "Diminishing surgical site infections in Australia: time trends in infection rates, pathogens and antimicrobial resistance using a comprehensive Victorian surveillance program, 2002– 2013." Infection Control & Hospital Epidemiology 36.4 (2015): 409-416.
16. Saleem, Zikria, et al. "Pattern of inappropriate antibiotic use among hospitalized patients in Pakistan: a longitudinal surveillance and implications." Antimicrobial Resistance & Infection Control 8.1 (2019): 188.
17. Arsalan, Adeel, et al. "Resistance pattern of clinical isolates involved in surgical site infections." Pakistan Journal of Pharmaceutical Sciences 27.1 (2014).
18. Rahman, Mohammad Mushfiqur, et al. "Role of single dose preoperative ceftriaxone in the control of surgical site infection in a tertiary level hospital." Faridpur Medical College Journal 11.1 (2016): 6-10.
19. Kongsayreepong, Suneerat, et al. "A multi-center Thai university-based surgical intensive care units study (THAI-SICU Study): outcome of ICU care and adverse events." J Med Assoc Thai 99. Suppl 6 (2016): S1-14.
20. Young, Pang Y., and Rachel G. Khadaroo. "Surgical site infections." Surgical Clinics 94.6 (2014): 1245- 1264.

How to cite this article: Alam RJ, Islam S, Rahman MZ, Begum F, Faruk O, Karim R, Siddiqua A7, SK. Haque M. Patterns of Patients with Surgical Site Infections: A Study in a Tertiary Care Hospital in Bangladesh. Clin J Surg 2020; 3(2): 1-5.
https://doi.org/10.33309/2639-9164.030206