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Prevalence and Predictors of Surgical Site Infections in a Tertiary Care Setting: Analysis of 120 Cases

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Abstract
Background: Surgical site infections (SSIs) are a significant cause of postoperative morbidity, prolonged hospital stay, and increased healthcare costs worldwide. Identifying incidence and risk factors in tertiary care settings helps improve preventive strategies.
Objective: To determine the incidence and risk factors associated with SSIs among patients undergoing surgery in a tertiary hospital.
Methods: This prospective observational study included 120 patients undergoing elective or emergency surgeries over a 12-month period. Demographic data, comorbidities, perioperative factors, and postoperative outcomes were recorded. SSI was defined according to CDC criteria. Risk factors were analyzed using univariate and multivariate logistic regression.
Results: The overall SSI incidence was 18.3% (22/120). Emergency surgeries (OR 3.2, 95% CI 1.2-8.5), diabetes mellitus (OR 2.8, 95% CI 1.1-7.2), prolonged operative duration >120 minutes (OR 4.1, 95% CI 1.5-11.2), and ASA score ≥3 (OR 3.5, 95% CI 1.3-9.4) were significant independent risk factors. Gram-negative bacteria, predominantly *Escherichia coli* and *Klebsiella* species, were the most common pathogens.
Conclusion: SSIs remain a notable complication in tertiary hospitals. Awareness of modifiable risk factors, proper perioperative management, and infection control protocols can significantly reduce SSI incidence.

Keywords: Surgical Site Infection, Risk Factors, Tertiary Hospital, Incidence, Postoperative Infection

Introduction
Surgical site infections (SSIs) are one of the most common and serious complications following surgical procedures, contributing significantly to postoperative morbidity, prolonged hospital stay, and increased healthcare costs worldwide [1, 2]. Despite advances in surgical techniques, anesthesia, and perioperative care, SSIs remain a persistent challenge in both developed and developing countries [3]. Globally, the reported incidence of SSIs varies widely, ranging from 2% to 20% in high-income countries and up to 30-40% in low- and middle-income countries, reflecting differences in healthcare infrastructure, patient comorbidities, and infection prevention practices [4, 5].
SSIs are defined as infections occurring at or near the surgical incision within 30 days of surgery or within 90 days if an implant is placed, and they are classified as superficial incisional, deep incisional, or organ/space infections according to the Centers for Disease Control and Prevention (CDC) guidelines [6]. The pathogenesis of SSIs is multifactorial, involving host factors, surgical technique, microbial contamination, and postoperative care. Host-related risk factors include advanced age, malnutrition, diabetes mellitus, obesity, immunosuppression, and coexisting comorbidities [7, 8]. Surgical factors such as prolonged operative duration, emergency procedures, inadequate asepsis, and the type of wound also significantly influence the risk of infection [9, 10].
Microbiologically, SSIs are commonly caused by Gram-positive cocci, particularly *Staphylococcus aureus*, including methicillin-resistant strains (MRSA), and Gram-negative bacilli such as *Escherichia coli*, *Klebsiella* species, and *Pseudomonas aeruginosa* [11, 12]. The prevalence of specific pathogens varies by geographic region, hospital setting, and type of surgery performed. Understanding local microbial patterns and antimicrobial susceptibility is critical for effective prophylactic antibiotic selection and treatment strategies [13].

SSIs not only impact patient outcomes but also impose a substantial economic burden on healthcare systems due to increased resource utilization, prolonged hospitalization, and the need for additional interventions such as wound care, reoperation, or long-term antibiotic therapy [14]. Furthermore, SSIs are associated with psychological stress and reduced quality of life for affected patients, highlighting the importance of prevention and early identification [15].

Tertiary care hospitals, often serving as referral centers for complex and emergency cases, are particularly susceptible to higher SSI rates due to a concentration of high-risk patients, more invasive procedures, and increased exposure to multidrug-resistant organisms [16]. Despite extensive research on SSI risk factors in developed countries, there is limited prospective data in tertiary hospitals in low- and middle-income settings, where resource constraints and patient demographics differ significantly [17].

This study aims to determine the incidence of SSIs in a tertiary care hospital and identify patient-related and perioperative risk factors associated with infection. By elucidating these factors, this research seeks to inform evidence-based strategies for SSI prevention, optimize patient outcomes, and reduce the burden of postoperative infections in high-risk hospital settings.

Materials and Methods

Study Design and Setting

A prospective observational study was conducted over 12 months (January-December 2024) at a Department of Surgery, Shaheed Suhrawardy Medical College Hospital, Dhaka, Bangladesh. Ethical approval was obtained from the Institutional Review Board, and written informed consent was obtained from all participants.

Study Population

A total of 120 patients undergoing elective or emergency surgery were included. Inclusion criteria were age ≥18 years, undergoing clean, clean-contaminated, or contaminated procedures. Patients with pre-existing infections at the surgical site or those refusing consent were excluded.

Data Collection

Patient demographics (age, sex), comorbidities (diabetes, hypertension, obesity), ASA score, type of surgery (elective/emergency), wound class, operative duration, and perioperative antibiotic use were recorded. Postoperative monitoring for SSI was conducted for 30 days for non-implant surgeries and up to 90 days for implant surgeries [8].

Definition of SSI

SSI was defined per CDC criteria: infection occurring within 30 days of surgery (or within 90 days for implant surgery), involving the incision or deep tissue, with purulent discharge, positive cultures, or clinical signs of infection [9].

Microbiological Analysis

Specimens from suspected infections were collected and processed for culture and sensitivity using standard laboratory procedures.

Statistical Analysis

Data were analyzed using SPSS version 25. Continuous variables were expressed as Mean ± SD, and categorical variables as frequencies (%). Univariate analysis used chi-square or Fisher's exact test. Variables with $p<0.05$ were included in multivariate logistic regression to identify independent risk factors. Odds ratios (OR) and 95% confidence intervals (CI) were calculated.

Results

Demographic and Clinical Characteristics

A total of 120 patients were included in the study. The mean age was 45.6±15.2 years (range 18-78 years). Males comprised 68 (56.7%) and females 52 (43.3%) of the study population. Comorbid conditions included diabetes mellitus in 28 (23.3%), hypertension in 34 (28.3%), and obesity (BMI >30) in 15 (12.5%). Thirty-two patients (26.7%) had an ASA score ≥3, and 40 patients (33.3%) underwent emergency surgeries.

Table 1: Demographic and Clinical Characteristics of Patients (n=120)

Variable	Number (%)
Age ≥60 years	28 (23.3%)
Male	68 (56.7%)
Female	52 (43.3%)
Diabetes mellitus	28 (23.3%)
Hypertension	34 (28.3%)
Obesity (BMI>30)	15 (12.5%)
ASA score ≥3	32 (26.7%)
Emergency surgery	40 (33.3%)

Incidence of Surgical Site Infection

The overall incidence of SSI was 18.3% (22/120). Among different wound classes, SSIs occurred in 6% (3/50) of clean wounds, 24% (12/50) of clean-contaminated wounds, and 35% (7/20) of contaminated wounds.

Table 2: SSI Incidence by Wound Class

Wound Class	Total	SSI Cases	Incidence (%)
Clean	50	3	6%
Clean-contaminated	50	12	24%
Contaminated	20	7	35%
Total	120	22	18.3%

The highest SSI rates were observed in contaminated wounds (35%), followed by clean-contaminated wounds (24%). Clean wounds had the lowest incidence (6%). This trend demonstrates the correlation between increasing wound contamination and SSI risk.

Risk Factor Analysis

Univariate Analysis

Univariate analysis identified diabetes mellitus, ASA score ≥3, emergency surgery, prolonged operative duration (>120 minutes), and contaminated wound class as significant factors associated with SSI ($p<0.05$).

Table 3: Univariate Analysis of Risk Factors for SSI

Risk Factor	SSI (n=22)	No SSI (n=98)	p-value
Age ≥60 years	8	20	0.08
Male sex	14	54	0.65
Diabetes mellitus	10	18	0.01*
ASA ≥3	12	20	0.02*
Emergency surgery	12	28	0.03*
Operative duration >120 min	14	26	0.01*
Wound class contaminated	7	13	0.04*

Among patient-related factors, diabetes mellitus significantly increased the risk of SSI (p=0.01). Patients with ASA scores ≥3 also had higher SSI rates (p=0.02). Emergency surgery and prolonged operative duration were associated with elevated infection risk (p=0.03 and p=0.01, respectively). Contaminated wounds showed higher infection rates compared to clean and clean-contaminated wounds (p=0.04). Age and sex did not show significant association with SSI.

Multivariate Logistic Regression

Multivariate analysis revealed that emergency surgery, diabetes mellitus, ASA score ≥3, and operative duration >120 minutes were independent predictors of SSI.

Table 4: Multivariate Logistic Regression of Independent Risk Factors for SSI

Risk Factor	OR	95% CI	p-value
Emergency surgery	3.2	1.2-8.5	0.02
Diabetes mellitus	2.8	1.1-7.2	0.03
ASA ≥3	3.5	1.3-9.4	0.01
Operative duration >120 min	4.1	1.5-11.2	0.004

Patients undergoing emergency surgeries were over three times more likely to develop SSI compared to elective surgeries (OR 3.2, p=0.02). Diabetes mellitus was associated with nearly threefold increased risk (OR 2.8, p=0.03). Higher ASA scores and prolonged operative time were also independent predictors, emphasizing the role of patient health status and surgical complexity in SSI development.

Microbiological Profile

Cultures were positive in 20 of 22 SSI cases. Gram-negative bacteria predominated, with *Escherichia coli* (36%) and *Klebsiella pneumoniae* (27%) as the most common isolates. *Staphylococcus aureus* accounted for 23% of infections, and other organisms (Pseudomonas, Enterococcus) comprised 14%.

Table 5: Microbiological Profile of SSI Cases

Organism	Number of Isolates	Percentage (%)
Escherichia coli	8	36%
Klebsiella pneumoniae	6	27%
Staphylococcus aureus	5	23%
Others (*Pseudomonas, Enterococcus*)	3	14%

Gram-negative organisms were the predominant causative agents of SSI in this cohort, consistent with patterns observed in tertiary care hospitals in low- and middle-income countries. The presence of *Staphylococcus aureus* highlights the continued relevance of Gram-positive coverage in prophylactic antibiotics.

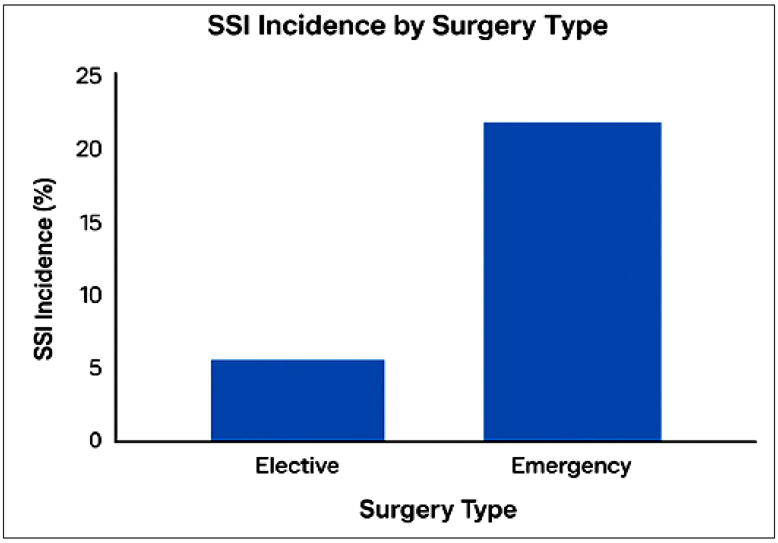

Fig 1: SSI Incidence by Surgery Type (Elective vs Emergency).

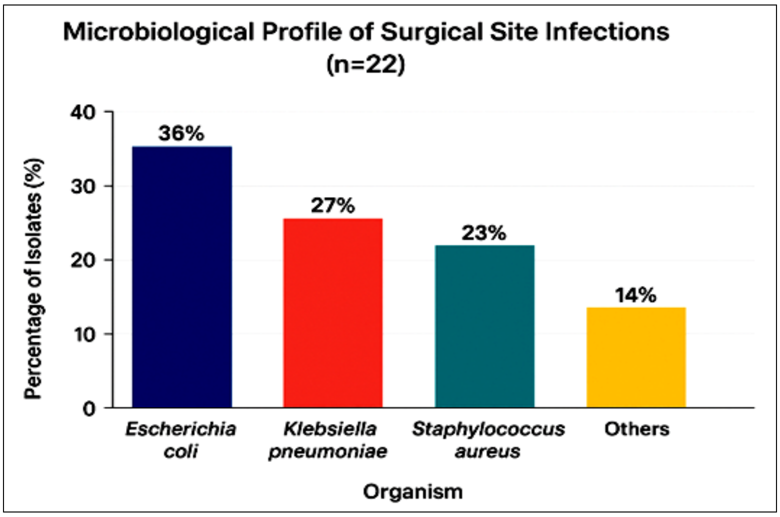

Fig 2: Microbiological Profile of SSIs.

Discussion

Surgical site infections (SSIs) remain a significant cause of postoperative morbidity, prolonged hospitalization, and increased healthcare costs, particularly in tertiary care hospitals where complex and emergency cases are frequently managed [1, 2]. In this study, the overall SSI incidence was 18.3%, which aligns with reports from similar tertiary settings in low- and middle-income countries, where SSI rates have ranged from 15% to 25% [3, 4]. The relatively higher incidence compared to high-income countries likely reflects patient comorbidities, emergency procedures, limited resources, and higher prevalence of contaminated wounds [5].

Our findings highlight a clear correlation between wound contamination and SSI risk. Contaminated wounds exhibited the highest infection rate (35%), followed by clean-contaminated wounds (24%), whereas clean wounds had a low incidence (6%). This trend is consistent with prior studies, which demonstrate that the degree of wound contamination is a major determinant of postoperative infection [6,7]. Effective preoperative preparation, meticulous surgical technique, and appropriate perioperative antibiotics are essential in reducing infections, particularly for clean-contaminated and contaminated procedures.

Among patient-related factors, diabetes mellitus emerged as a significant independent predictor of SSI (OR 2.8). Diabetes is known to impair neutrophil function, reduce tissue perfusion, and delay wound healing, thereby increasing susceptibility to infection [8]. Patients with ASA scores ≥3 also demonstrated higher SSI risk, reflecting the impact of systemic illness and decreased physiological reserve on postoperative outcomes [9]. These findings underscore the importance of preoperative optimization, including glycemic control and careful assessment of comorbid conditions, to minimize infection risk.

Surgical factors were equally important in our cohort. Emergency surgery was associated with over threefold increased risk of SSI (OR 3.2), likely due to inadequate preoperative preparation, limited time for aseptic measures, and higher contamination rates [10]. Prolonged operative duration (>120 minutes) was another independent predictor (OR 4.1), consistent with literature suggesting that longer surgical exposure increases tissue trauma, bacterial contamination, and impaired immune response [11]. These results highlight the need to optimize surgical efficiency and adhere to strict aseptic protocols, particularly in high-risk cases.

Microbiological analysis revealed predominance of Gram-negative organisms, with *Escherichia coli* (36%) and *Klebsiella pneumoniae* (27%) as the most common pathogens, followed by *Staphylococcus aureus* (23%). This pattern aligns with previous reports from tertiary hospitals in similar settings, where Gram-negative infections predominate due to hospital environment exposure and higher contamination in gastrointestinal and emergency surgeries [12, 13]. The findings emphasize the importance of tailoring perioperative antibiotic prophylaxis based on local microbiological patterns to ensure effective coverage.

The study's findings have several clinical implications. Identification of high-risk patients allows for targeted interventions, including optimized preoperative care, stringent infection control measures, judicious antibiotic prophylaxis, and careful monitoring for early signs of infection. Implementing standardized SSI prevention bundles and adhering to guidelines can further reduce postoperative infections and improve patient outcomes [14-17].

Limitations of this study include its single-center design, relatively small sample size, and limited follow-up for deep or implant-related infections. Future multicenter studies with larger cohorts are recommended to validate these findings and explore additional risk factors, including nutritional status, intraoperative blood loss, and postoperative wound care practices.

Conclusion

In conclusion, SSIs remain a notable postoperative complication in tertiary care hospitals, with patient comorbidities, surgical complexity, and wound contamination as major contributors. Awareness of modifiable risk factors and implementation of evidence-based preventive strategies are essential to reduce SSI incidence, improve recovery, and optimize healthcare resources.

References

1. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection. Infection Control and Hospital Epidemiology. 1999; 20:250-278.
2. Kirkland KB, Briggs JP, Trivette SL, Wilkinson WE, Sexton DJ. The impact of surgical-site infections in the 1990s: attributable mortality, excess length of hospitalization, and extra costs. Infection Control and Hospital Epidemiology. 1999; 20:725-730.
3. Rosenthal VD, Guzman S, Migone O, Crnich C. The attributable cost of nosocomial infections in the intensive care unit in developing countries: a multinational study. Infection Control and Hospital Epidemiology. 2003; 24:431-435.
4. Allegranzi B, Bagheri Nejad S, Combescure C, *et al*. Burden of endemic health-care-associated infection in developing countries: Systematic review. Lancet. 2011; 377:228-241.
5. Berríos-Torres SI, Umscheid CA, Bratzler DW, *et al*. Centers for Disease Control and Prevention guideline for the prevention of surgical site infection, 2017. JAMA Surgery. 2017; 152:784-791.
6. Horan TC, Gaynes RP, Martone WJ, Jarvis WR, Emori TG. CDC definitions of nosocomial surgical site infections, 1992: a modification of CDC definitions of surgical wound infections. Infection Control and Hospital Epidemiology. 1992; 13:606-608.
7. Ban KA, Minei JP, Laronga C, *et al*. American College of Surgeons and Surgical Infection Society: Surgical site infection guidelines, 2016 update. Journal of the American College of Surgeons. 2017; 224:59-74.
8. Fry DE. The role of infection in surgical morbidity. American Journal of Surgery. 2002; 183:10-14.
9. Hawn MT, Vick CC, Richman J, *et al*. Surgical site infection after elective surgery: longitudinal study of 5060 patients. Archives of Surgery. 2011; 146:263-269.
10. Alkaaki A, Al-Ajmi H, Al-Mazrou A. Surgical site infections in emergency surgery: risk factors and outcomes. International Journal of Surgery. 2016; 32:28-32.
11. Owens CD, Stoessel K. Surgical site infections: epidemiology, microbiology, and prevention. Journal of Hospital Infection. 2008;70(Suppl 2):3-10.
12. Tadesse BT, Ashagrie MG, Desta AF. Bacterial profile and antibiotic susceptibility of surgical site infections in a tertiary hospital, Northeast Ethiopia. BMC Surgery. 2020; 20:1-9.
13. Weinstein RA. Epidemiology and control of nosocomial infections in adult intensive care units. American Journal of Medicine. 1991; 91:179S-184S.

14. CDC/NHSN. Surgical Site Infection Event. National Healthcare Safety Network. 2023. Available from: https://www.cdc.gov/nhsn/pdfs/pscmanual/9pscssicurrent.pdf
15. Kirkland KB, Briggs JP, Trivette SL, *et al*. Risk factors for surgical site infection in the 1990s: impact of diabetes, obesity, and ASA score. Infection Control and Hospital Epidemiology. 1999; 20:247-250.
16. Allegranzi B, Storr J, Dziekan G, *et al*. Global infection control priorities for low- and middle-income countries. Lancet Infectious Diseases. 2013; 13:570-581.
17. Rosenthal VD, Maki DG, Mehta A, *et al*. Device-associated nosocomial infection rates in intensive care units of developing countries. International Journal of Infectious Diseases. 2006; 10:218-226.

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