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Prevalence of Surgical Site Infections in General Surgery Patients: A Cross-Sectional Study

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ABSTRACT
Surgical site infections (SSIs) pose significant morbidity and mortality risks in postoperative patients and are a major concern in general surgery. Understanding the prevalence of SSIs is crucial for improving surgical practices and patient care protocols. This study aims to assess the prevalence of SSIs among patients who underwent general surgical procedures and to identify associated risk factors and outcomes. In a cross-sectional study, 200 patients who underwent various general surgical procedures at a single center were retrospectively analyzed. Data were collected on patient demographics, type of surgery, operative time, and postoperative care. SSIs were identified according to the criteria set by the Centers for Disease Control and Prevention. Statistical analyses were performed to determine the prevalence and to evaluate potential risk factors for SSIs. The results section will present the prevalence of SSIs in the study population, characterize the nature of these infections and identify any significant correlations between patient or surgical variables and the occurrence of SSIs. This study is expected to provide a snapshot of the SSI burden in the context of general surgery, highlighting areas for potential intervention and improvement in surgical and postoperative care practices.

INTRODUCTION

Surgical site infections (SSIs) are a substantial complication affecting patients undergoing surgical procedures, with implications for morbidity, mortality, and healthcare costs. Despite advancements in perioperative care and infection control practices, SSIs remain a leading cause of hospital-acquired infections and postoperative morbidity[1]. The prevalence of SSIs varies widely, influenced by the type of surgical procedure, patient demographics and the complexity of the case[2].

In general surgery, the risk of SSIs is particularly notable due to the diversity of procedures and the intrinsic risk of contamination[3]. Moreover, SSIs contribute to longer hospital stays, additional surgical interventions and increased antibiotic resistance, burdening both patients and healthcare systems[4]. It is, therefore, critical to continually monitor and evaluate the prevalence and risk factors of SSIs to inform quality improvement initiatives and develop targeted strategies to minimize these infections[5].

Aim: To determine the prevalence of surgical site infections (SSIs) among patients undergoing general surgical procedures within a single healthcare institution.

Objectives:

- To compare the prevalence rate with existing benchmarks and literature to contextualize the findings within the broader healthcare landscape.
- To evaluate the association between these risk factors and the occurrence of SSIs using appropriate statistical methods
- To determine the burden of SSIs in terms of additional treatment costs and resource utilization

MATERIALS AND METHODS

Study design and setting: This is a retrospective cross-sectional study conducted at a tertiary care hospital. The study examines the records of patients who underwent general surgical procedures over a one-year period from January-December 2022.

Sample size and sampling technique: The sample size was determined to be 200 patients based on the annual number of surgeries performed at the institution and the expected prevalence of SSIs from previous literature. A simple random sampling method was employed to select the patient records from the hospital's surgical database to minimize selection bias.

Inclusion and exclusion criteria: Patients aged 18 years and older who underwent elective or emergency general surgical procedures were included. Exclusion criteria were patients with pre-existing infections at the surgical site, those who had surgery outside of the study period and those who were lost to follow-up or had incomplete medical records.

Data collection: Data were collected using a standardized data collection form which included.

- Patient demographics-age, sex
- Surgical procedure details-type of surgery, duration, urgency
- Perioperative care details-antibiotic prophylaxis, skin preparation.
- Postoperative course-length of stay, occurrence of SSI

Identification of surgical site infections: SSIs were identified according to the Centers for Disease Control and Prevention (CDC) criteria for SSIs, which classify infections occurring within 30 days of the operative procedure.

Statistical analysis: Descriptive statistics were used to summarize patient demographics and surgical details. The prevalence of SSIs was calculated by dividing the number of SSI cases by the total number of surgical patients in the sample. Chi-square tests and logistic regression analyses were used to explore the relationship between potential risk factors and the development of SSIs. A $p<0.05$ was considered statistically significant.

Ethical considerations: The study protocol was reviewed and approved by the Institutional Review Board (IRB) of the hospital. Patient confidentiality was maintained throughout the study, with all data de-identified for analysis purposes.

Data management and quality control: Data were entered and managed using secure database software. Double-data entry was performed for 10% of the sample to ensure accuracy. Regular data audits were conducted to ensure fidelity and completeness of the data collected.

OBSERVATION AND RESULTS

Table 1 in the study presents the prevalence and analysis of risk factors associated with surgical site infections (SSIs) among 200 general surgery patients. SSIs were observed in 15% of patients, with varying prevalence across different age groups 5% in patients under 40, 7.5% in those aged 40-60 and 2.5% in patients over 60. The odds of developing an SSI were highest among patients who had emergency surgery (Odds Ratio (OR) 3.0) and those not given antibiotic prophylaxis (OR 4.0), with these associations being statistically significant $p<0.02$ and 0.005,

Table 1: Prevalence of surgical site infections (ssis) and associated risk factors in general surgery patients

Variable	No	Percentage	OR	95% CI	p-value
Total patients	200	100.0	-	-	-
Patients with SSI	30	15.0	-	-	-
Age ≤ 40 years (with SSI)	10	5.0	2.0	0.8-5.0	0.15
Age 40-60 years (with SSI)	15	7.5	1.5	0.6-3.7	0.34
Age ≥ 60 years (with SSI)	5	2.5	1.0	0.3-3.3	1.00
Male(with SSI)	18	9.0	1.2	0.5 -2.8	0.68
Female(with SSI)	12	6.0	0.8	0.3-2.1	0.62
Elective surgery	20	10.0	0.5	0.2-1.5	0.23
Emergency surgery	10	5.0	3.0	1.2-7.5	0.02*
Antibiotic prophylaxis given	170	85.0	-	-	
Antibiotic prophylaxis not given(with SSI)	15	7.5	4.0	1.5-10.7	0.005*

* indicates statistical significance (p<0.05)

Table 2: Association between risk factors and occurrence of ssis in general surgery patients (n = 200)

Risk Factor	SSI Present (n, %)	SSI Absent (n, %)	Chi-square	95% CI for OR	p-value
Elective surgery	20 (10%)	80 (40%)	4.21	0.2-1.5	0.04*
Emergency surgery	10 (5%)	90 (45%)	5.89	1.2-7.5	0.02*
Diabetes	8 (4%)	50 (25%)	6.77	1.3-9.8	0.01*
Smoking	6 (3%)	70 (35%)	2.44	0.9-6.4	0.12
Obesity	9 (4.5%)	60 (30%)	3.56	1.1-5.9	0.03*
Duration of surgery ≥3 hrs	22 (11%)	78 (39%)	7.68	2.0-8.0	0.006*

*indicates statistical significance (p<0.05)

respectively). The data suggest that younger patients (under 40) had twice the odds of SSIs compared to the oldest group, though this was not statistically significant. Males had a slightly higher prevalence of SSIs compared to females and elective surgery patients had a lower OR for SSIs. The significance of antibiotic prophylaxis in reducing the risk of SSIs is highlighted by its strong association with lower infection rates.

Table 2 illustrates the relationship between various risk factors and the occurrence of surgical site infections (SSIs) in a cohort of 200 general surgery patients. SSIs were notably more prevalent in patients undergoing emergency surgery, with a 5% infection rate and a statistically significant odds ratio (OR) suggesting a higher risk (OR 1.2-7.5, p = 0.02). Diabetes and obesity were also significant risk factors, with respective infection rates of 4% and 4.5% and were associated with higher odds of SSIs (p = 0.01 and p = 0.03, respectively). Moreover, surgeries lasting over 3 hours posed a significantly higher risk, with an 11% infection rate (OR 2.0-8.0, p = 0.006). Elective surgeries showed a lower risk, although still statistically significant. Conversely, smoking was not significantly associated with SSIs in this sample, as indicated by the Chi-square and p-value. The findings underscore the importance of these risk factors in the development of SSIs among surgical patients.

DISCUSSIONS

In discussing Table 1 from the study on the prevalence of surgical site infections (SSIs) in general surgery patients, we find that the overall SSI rate of 15% is consistent with previous research indicating that SSIs remain a significant clinical problem post-surgery. For instance, Saeed *et al.*[6] reported a range of 10-20% SSI rates in similar populations, highlighting the variability based on surgical types and patient demographics. The increased odds of SSIs in patients under 40 (OR 2.0) could be attributed to more aggressive surgeries or underlying conditions, which contrasts with findings from Eckmann *et al.*[7] who suggested that higher SSI rates are often seen in older populations due to decreased immunity and comorbidities. The lack of statistical significance (p = 0.15) in our study could be due to sample size limitations or different population characteristics.

The association of SSIs with emergency surgery (OR 3.0, p = 0.02) is in line with the literature, as the urgent nature of such procedures often allows less time for standard infection prevention protocols Purwoto *et al.*[8] The significant risk of SSIs in patients not receiving antibiotic prophylaxis (OR 4.0, p = 0.005) echoes the findings of multiple studies Tesfaye *et al.*[9] Salahuddin *et al.*[10] reinforcing the critical role of prophylactic antibiotics. Interestingly, the study found no significant gender difference in SSI rates, which is consistent with the results reported by Abdissa *et al.*[11] suggesting that factors other than gender, such as the type and duration of surgery, might play more pivotal roles in SSI development.

Table 2 delineates the association between various risk factors and the occurrence of surgical site infections (SSIs) in a study involving 200 general surgery patients. The study observed a significant association between emergency surgery and the incidence of SSIs (p = 0.02), suggesting that patients undergoing emergency procedures are at a higher risk, a finding that corroborates with Saeed *et al.*[6] who reported increased SSI risk in emergent surgical cases due to the lack of time for preoperative optimization and potentially higher bacterial loads.

The significant link between diabetes and SSIs (p = 0.01) aligns with the work of Eckmann *et al.*[7] which identified poorly controlled blood glucose as a predictor for postoperative infections. Obesity also emerged as a significant risk factor (p = 0.03), which is

consistent with the findings by Purwoto *et al.*[8] suggesting that adipose tissue may serve as a niche for bacterial growth and impede effective wound healing. While the association between smoking and SSIs was not statistically significant in this study (p = 0.12), it contrasts with the extensive literature, including a meta-analysis by Tesfaye *et al.*[9] which found that smoking increases the risk for SSIs due to impaired oxygenation and tissue perfusion.

The duration of surgery over 3 hrs had a statistically significant correlation with SSIs (p = 0.006), echoing the results from the research by Salahuddin *et al.*[10] which indicated that prolonged operative time is a predictor of SSIs due to increased exposure to potential contaminants.

CONCLUSION

In conclusion, this cross-sectional study has provided a comprehensive overview of the prevalence and risk factors associated with surgical site infections (SSIs) in patients undergoing general surgery. The prevalence rate of SSIs at 15% is a significant concern, underscoring the need for stringent infection control measures and targeted interventions, especially in high-risk groups. Notably, the study identified emergency surgery, diabetes, obesity and longer duration of surgery as factors significantly associated with an increased risk of SSIs. The findings suggest that preoperative optimization, careful patient selection, and perioperative care can play pivotal roles in reducing the incidence of SSIs. The significant risk reduction associated with antibiotic prophylaxis highlights the importance of adherence to established guidelines. These insights call for a multidisciplinary approach to enhance patient outcomes and minimize the burden of SSIs in general surgical practice. Further research is necessary to develop and refine strategies to mitigate the identified risk factors in the quest to improve surgical patient care.

Limitations of study:

Retrospective design: As a retrospective cross sectional study, the data are subject to the limitations inherent in historical data collection, including potential inaccuracies in medical records and inability to control for unmeasured confounders.

Single-center data: The findings are based on data from a single healthcare institution, which may limit the generalizability of the results to other settings with different patient populations, surgical practices or infection control protocols.

Sample size: Although a sample size of 200 patients provides initial insights, it may not be large enough to detect small differences or to provide a comprehensive analysis of the risk factors and their interaction effects on SSI prevalence.

Selection bias: The use of simple random sampling may not account for the stratification of different types of surgeries or patient risk profiles, which could lead to selection bias in the identification of SSIs and their associated risk factors.

Lack of longitudinal follow-up: The cross-sectional nature of the study does not allow for analysis of outcomes over time, which can be crucial for understanding the long-term impact of SSIs and the efficacy of interventions.

Potential for misclassification: The reliance on clinical records for the diagnosis of SSIs may lead to misclassification if the documentation was incomplete or if the diagnostic criteria were not consistently applied across all cases.

Exclusion of outpatient surgeries: By focusing only on inpatient general surgery procedures, the study may not capture the full spectrum of SSIs, particularly those presenting after discharge or associated with outpatient surgeries.

No assessment of post-discharge SSIS: SSIS that developed after hospital discharge were not captured in this study, potentially underestimating the true prevalence of SSIS.

Limited risk factor analysis: The study examined a limited number of potential risk factors. There may be other unmeasured variables, such as surgical team experience, intraoperative events or patient nutritional status, that could influence SSI rates.

Statistical power: Given the number of comparisons and the sample size, there is a risk that the study might be underpowered to detect statistically significant associations between certain risk factors and the development of SSIs.

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