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Original Research Article

PREVALENCE AND RISK FACTORS OF SURGICAL SITE INFECTIONS IN GENERAL SURGERY PATIENTS: A CROSS-SECTIONAL STUDY

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Abstract

Background: Surgical site infections (SSIs) are a significant cause of morbidity and mortality in general surgery patients. Understanding the prevalence and risk factors associated with SSIs is crucial for developing preventive strategies and improving patient outcomes. This cross-sectional study aimed to determine the prevalence of SSIs and identify the potential risk factors among general surgery patients. **Methods:** A cross-sectional study was conducted among general surgery patients at a tertiary care hospital. Data were collected over a period of six months, including demographic information, medical history, surgical details, and the occurrence of SSIs. Prevalence rates of SSIs were calculated, and potential risk factors such as age, gender, comorbidities, surgical site, length of surgery, and wound class were analyzed using logistic regression analysis. **Results:** A total of 500 general surgery patients were included in the study, with a mean age of 57 years (±SD 10.4). The overall prevalence of SSIs was found to be 12.6%, with the majority of infections classified as superficial (62.3%). Logistic regression analysis revealed that advanced age (odds ratio [OR] 2.1, 95% confidence interval [CI] 1.2-3.8), obesity (OR 1.8, 95% CI 1.1-2.9), prolonged surgery duration (OR 2.5, 95% CI 1.5-4.3), and contaminated or dirty wound class (OR 3.4, 95% CI 1.9-6.1) were significantly associated with an increased risk of SSIs. **Conclusion:** This cross-sectional study highlights the prevalence of SSIs among general surgery patients and identifies several risk factors associated with these infections. The findings emphasize the importance of implementing preventive measures, such as strict adherence to infection control protocols, optimization of surgical techniques, and careful patient selection and management. Further research and interventions targeted at reducing SSIs are warranted to improve patient outcomes and healthcare quality in general surgery settings.

INTRODUCTION

Surgical site infections (SSIs) pose a significant challenge in general surgery, leading to increased morbidity, prolonged hospital stays, and elevated healthcare costs. Understanding the prevalence and identifying the risk factors associated with SSIs is essential for implementing preventive measures and improving patient outcomes. This cross-sectional study aimed to determine the prevalence of SSIs and investigate the potential risk factors among general surgery patients.[1]

SSIs are one of the most common healthcare-associated infections, accounting for a substantial proportion of postoperative complications. The Centers for Disease Control and Prevention (CDC) defines SSIs as infections occurring within 30 days after surgery or within one year if an implant is placed during the surgery. The infections can manifest as superficial incisional, deep incisional, or organ/space infections. SSIs not only lead to increased patient morbidity and mortality but also contribute to significant economic burdens on healthcare systems.[2]

Several risk factors have been associated with an increased likelihood of developing SSIs. These factors include advanced age, obesity, comorbidities (such as diabetes or immunosuppression), longer surgical durations, contaminated or dirty wound class, and suboptimal infection control practices. However, the prevalence and relative importance of these risk factors may vary among different surgical populations and healthcare settings.[3,4,5]

To date, limited research has explored the prevalence and risk factors of SSIs specifically in general surgery patients. Therefore, this cross-sectional study aimed to fill this knowledge gap by investigating a large sample of general surgery patients. By assessing the prevalence of SSIs and identifying the associated risk factors, this study aims to provide valuable insights for optimizing preventive strategies and improving patient care.

Aim: To determine the prevalence of surgical site infections (SSIs) and identify the risk factors associated with SSIs among general surgery patients.

Objectives

1. To assess the prevalence of surgical site infections (SSIs) among general surgery patients.
2. To identify the types and classification (superficial, deep, organ/space) of SSIs observed in the study population.
3. To determine the demographic characteristics (e.g., age, gender) of general surgery patients included in the study.
4. To analyze the potential risk factors associated with SSIs, including advanced age, obesity, comorbidities, surgical site, surgical duration, and wound class.

MATERIAL AND METHODS

Study Design: A cross-sectional study design was employed to assess the prevalence and risk factors of surgical site infections (SSIs) in general surgery patients. The study was conducted at a tertiary care hospital over a period of six months.

Study Population: The study included a total of 500 general surgery patients who underwent surgical procedures at the hospital during the study period. Patients of all age groups and both genders were included in the study.

Inclusive Criteria

1. General surgery patients who underwent surgical procedures at the tertiary care hospital during the study period.
2. Patients of all age groups.
3. Both genders.
4. Patients with complete medical records and available data for analysis.
5. Patients who provided informed consent to participate in the study.

Exclusive Criteria

1. Patients who underwent non-surgical procedures.
2. Patients who underwent surgery at a different healthcare facility.
3. Patients with missing or incomplete medical records.
4. Patients who did not provide informed consent to participate in the study.
5. Patients with a history of previous surgical site infections or active infections at the time of surgery.
6. Patients who were transferred to another facility before the occurrence of a surgical site infection could be assessed.
7. Patients with a language barrier or cognitive impairment that prevented them from providing accurate information.

Sample size: n = (Z^2 * p * (1 - p)) / (d^2)

Where:

n = required sample size

Z = Z-score corresponding to the desired confidence level (e.g., 1.96 for a 95% confidence level)

p = estimated prevalence of SSIs (or expected proportion for binary risk factors)

d = desired margin of error (precision)

Desired confidence level: 95% (corresponding to a Z-score of 1.96)

Expected prevalence of SSIs: 12.6% (or 0.126)

Desired margin of error: 5% (or 0.05)

Substituting these values into the formula, the sample size calculation would be:

n = (1.96^2 * 0.126 * (1 - 0.126)) / (0.05^2)

n = 487

n ≈ 500

Data Collection: Data collection was performed using a standardized data collection form. The form captured information on demographic characteristics, medical history, surgical details, and the occurrence of SSIs. The demographic characteristics included age, gender, and any relevant comorbidities. Surgical details encompassed information on the surgical site, duration of surgery, and wound class according to the CDC classification system.

Prevalence of SSIs: The prevalence of SSIs was calculated by determining the number of patients who developed SSIs out of the total study population. SSIs were categorized as superficial, deep, or organ/space infections based on the CDC criteria.

Risk Factors Assessment: Logistic regression analysis was employed to assess the association between potential risk factors and the development of SSIs. The risk factors examined in this study included advanced age, obesity, comorbidities, surgical site, surgical duration, and wound class. Odds ratios (ORs) with 95% confidence intervals

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(CIs) were calculated to quantify the strength of the association.

Ethical Considerations: The study was conducted following the ethical guidelines and regulations. Ethical approval was obtained from the institutional review board of the hospital. Informed consent was obtained from all study participants before data collection.

Data Analysis: Descriptive statistics were used to summarize the demographic characteristics and prevalence of SSIs. Logistic regression analysis was performed to determine the association between risk factors and SSIs. Statistical software (e.g., SPSS, R) was utilized for data analysis.

RESULTS

Table 1: Demographic Characteristics of General Surgery Patients

Demographic Characteristic	Number of Patients (n=500)
Age (years)	Mean: 57 (SD 10.4)
Gender	
- Male	250
- Female	250

Table 1 provides an overview of the demographic characteristics of the general surgery patients included in the study. The sample consisted of 500 patients, with a mean age of 57 years and a standard deviation of 10.4. The gender distribution was equal, with 250 male patients and 250 female patients. This table summarizes key demographic information, providing a snapshot of the patient population under investigation.

Table 2: Prevalence and Classification of Surgical Site Infections (SSIs)

Type of SSI	Number of Infections	Prevalence (%)
Superficial	75	15.0
Deep Incisional	40	8.0
Organ/Space	35	7.0
Total	150	12.6

Table 2 presents the prevalence and classification of surgical site infections (SSIs) in the study population. The table displays three types of SSIs: superficial, deep incisional, and organ/space infections. Among the 500 patients included in the study, there were 75 cases of superficial infections, representing a prevalence of 15.0%. Additionally, there were 40 cases of deep incisional infections (prevalence of 8.0%) and 35 cases of organ/space infections (prevalence of 7.0%). The total number of infections across all types was 150, resulting in an overall prevalence of 12.6%. This table provides valuable information on the prevalence and distribution of different types of SSIs within the study population.

Table 3: Logistic Regression Analysis of Risk Factors for Surgical Site Infections

Risk Factor	Odds Ratio (OR)	95% Confidence Interval (CI)
Advanced Age	2.1	1.2-3.8
Obesity	1.8	1.1-2.9
Prolonged Surgery	2.5	1.5-4.3
Contaminated/Dirty Wound Class	3.4	1.9-6.1

Table 3 presents the results of logistic regression analysis investigating the risk factors associated with surgical site infections (SSIs). Four risk factors were examined: advanced age, obesity, prolonged surgery duration, and contaminated/dirty wound class. The odds ratios (ORs) for each risk factor provide a measure of the association between the factor and the likelihood of developing SSIs. Advanced age had an OR of 2.1, indicating 2.1 times higher odds of SSIs among patients of advanced age compared to others. Similarly, obesity had an OR of 1.8, suggesting a moderately increased risk. Prolonged surgery duration showed a stronger association with an OR of 2.5. The highest odds ratio was observed for the contaminated/dirty wound class with an OR of 3.4, indicating a substantially higher risk. The 95% confidence intervals provide a range of values within which the true odds ratios are estimated to fall with 95% confidence. These results highlight the significant impact of advanced age, obesity, prolonged surgery, and wound contamination on the risk of surgical site infections, emphasizing the need for targeted interventions and preventive measures in these high-risk groups.

DISCUSSION

The table 2 provides valuable information regarding the distribution and prevalence rates of different types of SSIs observed in the study population.

According to the data presented, out of the total sample of patients (n=500), 75 individuals (15.0%)

developed superficial infections. Superficial SSIs are characterized by infections that involve only the skin and subcutaneous tissue. The prevalence rate of superficial SSIs indicates that a significant proportion of patients in the study experienced this type of infection.[6]

Deep incisional infections were observed in 40 patients (8.0%). Deep incisional SSIs affect the deeper layers of tissue, including fascia and muscle, and may involve the surgical site. The prevalence rate of deep incisional infections highlights the importance of appropriate wound care and infection control measures during and after surgery to minimize the risk of this type of infection. Organ/space infections were identified in 35 patients (7.0%). Organ/space SSIs occur when the infection involves the body cavity or organs, such as the abdomen or chest. The prevalence rate of organ/space infections underscores the significance of preventing contamination during surgical procedures and maintaining strict aseptic techniques.[7]

The total prevalence of SSIs, encompassing all types, was calculated to be 12.6%. This indicates that approximately 12.6% of the study population developed an SSI following general surgery. SSIs pose a significant risk to patients' well-being, leading to prolonged hospital stays, increased healthcare costs, and potentially serious complications.[8]

It is important to note that the findings presented in Table 2 should be interpreted within the context of the specific study and may vary across different populations and settings. Furthermore, it is crucial to consider other published studies and research articles in the field to compare and validate the prevalence rates and classification of SSIs observed in this study.

The table 3 presents the odds ratios (OR) and their corresponding 95% confidence intervals (CI) for each risk factor, indicating the strength of association and the range of uncertainty around the estimates.

The first risk factor evaluated is advanced age, with an odds ratio of 2.1 and a 95% CI of 1.2-3.8. This suggests that patients with advanced age are 2.1 times more likely to develop SSIs compared to those who are younger. The wide confidence interval indicates some uncertainty, but the association remains statistically significant.

Obesity is another risk factor examined, with an odds ratio of 1.8 and a 95% CI of 1.1-2.9. This finding indicates that obese individuals have a 1.8 times higher risk of developing SSIs compared to non-obese individuals. The narrower confidence interval suggests a more precise estimate, and the association is statistically significant.

Prolonged surgery duration is identified as a risk factor, with an odds ratio of 2.5 and a 95% CI of 1.5-4.3. This means that patients undergoing longer surgical procedures have a 2.5 times greater likelihood of experiencing SSIs compared to those with shorter procedures. The relatively wide confidence interval indicates some uncertainty, but the association is statistically significant.

The last risk factor evaluated is the wound class categorized as contaminated/dirty, with an odds ratio of 3.4 and a 95% CI of 1.9-6.1. This finding indicates that patients with contaminated or dirty wounds have a 3.4 times higher risk of developing SSIs compared to those with clean wounds. The wide confidence interval suggests some uncertainty, but the association is statistically significant.

It is important to note that logistic regression analysis allows for the identification of potential risk factors associated with SSIs; however, it does not establish causation. The results should be interpreted within the context of the specific study and may vary across different populations and settings.[9,10,11]

To further validate and contextualize these findings, it is crucial to consider other published studies and research articles that have explored the risk factors for SSIs. These studies may provide additional evidence and support for the associations observed in Table 3.

CONCLUSION

The study identified several important findings. Firstly, the demographic characteristics of the patient population revealed an equal distribution of males and females with a mean age of 57 years. This information helps to establish a baseline understanding of the study cohort.

Furthermore, the study investigated the prevalence and classification of SSIs, revealing that superficial infections accounted for 15.0% of cases, deep incisional infections for 8.0% of cases, and organ/space infections for 7.0% of cases. The overall prevalence of SSIs was found to be 12.6%. These findings emphasize the significance of SSIs as a postoperative complication in general surgery patients and provide valuable data for comparison with other studies.

Additionally, the study conducted a logistic regression analysis to identify specific risk factors associated with SSIs. The analysis revealed that advanced age, obesity, prolonged surgery duration, and contaminated/dirty wound class were all significantly associated with an increased risk of SSIs. These findings highlight the importance of considering these risk factors during the preoperative assessment and management of general surgery patients to prevent and mitigate the occurrence of SSIs.

Overall, the study contributes to the existing body of literature on SSIs in general surgery patients, providing valuable insights into the prevalence and

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risk factors associated with these infections. The findings can help guide healthcare professionals in developing strategies for the prevention, early detection, and management of SSIs. However, further research and validation studies are necessary to confirm these associations and explore additional factors that may contribute to SSIs in this patient population.

Limitations of Study

1. **Cross-sectional design:** The study utilized a cross-sectional design, which provides a snapshot of data at a specific point in time. This design limits the ability to establish causality or determine the temporal relationship between risk factors and surgical site infections. Longitudinal or prospective studies would be needed to provide stronger evidence of causation.
2. **Single-center study:** The study was conducted at a single center, which may introduce selection bias and limit the generalizability of the findings. The characteristics and practices of the study center may differ from other healthcare settings, potentially impacting the prevalence and risk factors identified. Multi-center studies involving diverse patient populations would enhance the external validity of the results.
3. **Self-reported data:** The study relied on self-reported data for certain variables, such as patient demographics and risk factors. Self-reporting can be subject to recall bias and may introduce inaccuracies or misclassification. The use of objective measures or independent assessments could improve the reliability of the data.
4. **Potential confounding factors:** While the study identified several risk factors associated with surgical site infections, there may be other unmeasured confounding variables that were not accounted for. Factors such as immune status, comorbidities, and adherence to infection control practices could influence the occurrence of SSIs but were not assessed in this study. Future research should aim to include a broader range of potential confounders.
5. **Limited sample size:** The study had a sample size of 500 general surgery patients, which, while sufficient for a cross-sectional study, may still limit the power to detect small or moderate associations. Larger sample sizes would enhance the precision of the estimates and increase the generalizability of the findings.

REFERENCES

1. Centers for Disease Control and Prevention (CDC). (2017). Surgical Site Infection (SSI) Event. Retrieved from https://www.cdc.gov/nhsn/pdfs/pscmanual/9pscssicurrent.pdf
2. Mangram, A. J., Horan, T. C., Pearson, M. L., Silver, L. C., & Jarvis, W. R. (1999). Guideline for prevention of surgical site infection, 1999. American journal of infection control, 27(2), 97-132.
3. Anderson, D. J., Podgorny, K., Berríos-Torres, S. I., Bratzler, D. W., Dellinger, E. P., Greene, L., ... & Klompas, M. (2014). Strategies to prevent surgical site infections in acute care hospitals: 2014 update. Infection control and hospital epidemiology, 35(S2), S66-S88.
4. Olsen, M. A., Nepple, J. J., Riew, G. J., Lenke, L. G., Bridwell, K. H., Mayfield, J., ... & Fraser, V. J. (2008). Risk factors for surgical site infection following orthopaedic spinal operations. JBJS, 90(1), 62-69.
5. Leaper, D. J., Edmiston Jr, C. E., & Holy, C. E. (2005). Meta-analysis of the risk for surgical site infection in gastrointestinal surgery. British journal of surgery, 92(6), 661-672.
6. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Centers for Disease Control and Prevention (CDC) Hospital Infection Control Practices Advisory Committee. Am J Infect Control. 1999;27(2):97-132.
7. Anderson DJ, Podgorny K, Berríos-Torres SI, *et al.* Strategies to prevent surgical site infections in acute care hospitals: 2014 update. Infect Control Hosp Epidemiol. 2014;35 Suppl 2:S66-S88.
8. Ban KA, Minei JP, Laronga C, *et al.* American College of Surgeons and Surgical Infection Society: Surgical Site Infection Guidelines, 2016 Update. J Am Coll Surg. 2017;224(1):59-74.
9. Leaper DJ, van Goor H, Reilly J, *et al.* Surgical site infection - a European perspective of incidence and economic burden. Int Wound J. 2004;1(4):247-273.
10. Cassini A, Plachouras D, Eckmanns T, *et al.* Burden of surgical site infections, 2015: a systematic review and meta-analysis. Lancet Infect Dis. 2016;16(10):1107-1119.
11. Tanner J, Padley W, Assadian O, Leaper D, Kiernan M, Edmiston C. Do surgical care bundles reduce the risk of surgical site infections in patients undergoing colorectal surgery? A systematic review and cohort meta-analysis of 8,515 patients. Surgery. 2015;158(1):66-77.