Section: General Surgery

Original Research Article

PREDICTORS OF SURGICAL SITE INFECTIONS IN EMERGENCY GENERAL SURGERY CASES: A PROSPECTIVE OBSERVATIONAL ANALYSIS

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Abstract

Background: Surgical site infections (SSI) are significant complications following emergency general surgeries, leading to increased morbidity, prolonged hospital stays, and higher healthcare costs. This study aims to identify predictors of SSIs in patients undergoing emergency general surgeries. **Materials and Methods:** A prospective observational analysis was conducted involving 100 patients who underwent emergency general surgery. Patient demographics, clinical characteristics, and outcomes were recorded. The incidence of SSIs was determined, and multivariate logistic regression was used to identify significant predictors of SSIs. **Result:** The mean age of patients was 45.7 years (SD: 15.3; Range: 18-85), with a gender distribution of 58 males (58%) and 42 females (42%). The mean BMI was 27.4 kg/m² (SD: 5.6; Range: 18.5-40.2). Common comorbidities included diabetes (30%), hypertension (35%), cardiovascular disease (20%), COPD (10%), and chronic kidney disease (5%). Current smokers comprised 25% of the cohort. SSIs were observed in 18% of patients. Significant predictors of SSIs included age ≥ 60 years (OR: 2.5; p=0.02), diabetes (OR: 3.0; p=0.001), BMI ≥ 30 kg/m² (OR: 2.8; p=0.005), abdominal surgeries (OR: 2.2; p=0.03), surgeries lasting >3 hours (OR: 2.7; p=0.007), current smoking (OR: 2.1; p=0.04), and immunosuppression (OR: 3.2; p=0.002). The most common pathogens were Staphylococcus aureus (40%), Escherichia coli (25%), and Pseudomonas aeruginosa (15%). Patients with SSIs had a mean hospital stay of 12.4 days compared to 7.1 days for those without SSIs (p<0.001). The additional cost per patient with SSI was ₹3,36,000. **Conclusion:** Advanced age, diabetes, high BMI, type of surgery, longer surgery duration, smoking, and immunosuppression are significant predictors of SSIs in emergency general surgeries. Targeted interventions in high-risk populations are essential to reduce SSI incidence and improve outcomes.

INTRODUCTION

Surgical site infections (SSIs) are among the most common complications following surgical procedures, particularly in emergency general surgery.[1] SSIs lead to significant morbidity, prolonged hospital stays, increased healthcare costs, and in severe cases, mortality. Despite advances in surgical techniques and infection control measures, SSIs remain a persistent challenge in surgical practice.[2,3]

Emergency general surgeries are performed under urgent conditions, often without the benefit of thorough preoperative preparation, which can elevate the risk of infections.[4] Patients undergoing these procedures frequently present with acute, life-threatening conditions that necessitate immediate intervention, leaving limited time for optimal patient optimization.[5] This scenario often involves a higher prevalence of comorbidities and complex clinical presentations, further complicating the management and increasing the risk of postoperative complications, including SSIs.

Identifying the predictors of SSIs in emergency general surgery is crucial for developing targeted strategies to mitigate these risks.[6] Previous studies have highlighted various risk factors associated with SSIs, such as advanced age, diabetes, obesity, type and duration of surgery, and smoking.[7] However, there is a need for comprehensive, context-specific studies that address the unique challenges posed by emergency surgical settings.

This prospective observational study aims to identify and quantify the risk factors associated with SSIs in patients undergoing emergency general surgery. By analyzing patient demographics, clinical

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characteristics, and surgical parameters, this study seeks to provide a robust understanding of the predictors of SSIs, thereby informing clinical practice and guiding preventive measures.

MATERIALS AND METHODS

Study Design and Setting: This prospective observational study was conducted at Siddhartha Medical College, Vijayawada, from June 2023 to May 2024. The study aimed to identify predictors of surgical site infections (SSI) in patients undergoing emergency general surgery.

Study Population: The study included 100 patients who underwent emergency general surgery at Siddhartha Medical College during the study period. Inclusion criteria were adults aged 18 years and above, undergoing emergency surgical procedures. Exclusion criteria included patients undergoing elective surgeries and those with incomplete medical records.

Data Collection: Data were collected prospectively from patient medical records, surgical logs, and microbiological reports. Demographic data included age, gender, and body mass index (BMI). Clinical data included comorbidities such as diabetes, hypertension, cardiovascular disease, chronic obstructive pulmonary disease (COPD), and chronic kidney disease. Smoking status was recorded as current smoker, former smoker, or non-smoker.

Surgical data included the type of surgery, duration of surgery, and use of immunosuppressive therapy. The occurrence of SSI was monitored, and infections were classified based on microbiological findings.

Definitions: Surgical site infections were defined according to the Centers for Disease Control and Prevention (CDC) criteria, including infections occurring within 30 days after surgery involving the skin, subcutaneous tissue, or deep tissue.

Statistical Analysis: The incidence of SSIs was calculated as a percentage of the total number of patients. Multivariate logistic regression analysis was performed to identify predictors of SSIs. The odds ratio (OR) with a 95% confidence interval (CI) was used to quantify the strength of association between risk factors and SSIs. A p-value of <0.05 was considered statistically significant. Data were analyzed using statistical software, ensuring the accuracy and reliability of the results.

Ethical Considerations: The study was approved by the Institutional Ethics Committee of Siddhartha Medical College, Vijayawada. Informed consent was obtained from all participants, ensuring confidentiality and adherence to ethical standards throughout the study.

RESULTS

A total of 100 patients undergoing emergency general surgery were included in this prospective observational analysis. The demographic and clinical characteristics of the study population are summarized in Table 1. The mean age of the patients was 45.7 years (SD: 15.3; Range: 18-85 years). The gender distribution was 58 males (58%) and 42 females (42%). The mean BMI was 27.4 kg/m² (SD: 5.6; Range: 18.5-40.2 kg/m²). Regarding comorbidities, 30% of patients had diabetes, 35% had hypertension, 20% had cardiovascular disease, 10% had chronic obstructive pulmonary disease (COPD), and 5% had chronic kidney disease. In terms of smoking status, 25% were current smokers, 20% were former smokers, and 55% were non-smokers [Table 1].

The incidence of surgical site infections (SSI) was 18%, with 18 out of the 100 patients developing SSIs [Table 2].

Table 1: Demographic and Clinical Characteristics.

Characteristic	Value
Mean Age (years)	45.7 (SD: 15.3; Range: 18-85)
Gender Distribution	58 males (58%), 42 females (42%)
Mean BMI (kg/m²)	27.4 (SD: 5.6; Range: 18.5-40.2)
Comorbidities	
Diabetes	30 patients (30%)
Hypertension	35 patients (35%)
Cardiovascular disease	20 patients (20%)
COPD	10 patients (10%)
Chronic kidney disease	5 patients (5%)
Smoking Status	
Current smokers	25 patients (25%)
Former smokers	20 patients (20%)
Non-smokers	55 patients (55%)

Table 2: Incidence of Surgical Site Infections (SSI)

Total Patients	Patients with SSI	Incidence Rate (%)
100	18	18%

Table 3: Risk Factors Associated with SSI

Risk Factor	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Age ≥ 60 years	2.5	1.2-5.3	0.02
Diabetes	3.0	1.5-6.0	0.001

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BMI ≥ 30 kg/m²	2.8	1.3-6.0	0.005
Emergency Surgery Type	2.2	1.1-4.5	0.03
Duration > 3 hours	2.7	1.3-5.7	0.007
Current Smokers	2.1	1.0-4.5	0.04
Immunosuppression	3.2	1.4-7.2	0.002

Table 4: Microbiological Findings

Pathogen	Percentage (%)
Staphylococcus aureus	40
Escherichia coli	25
Pseudomonas aeruginosa	15
Methicillin-resistant Staphylococcus aureus (MRSA)	10
Enterococcus faecalis	5
Klebsiella pneumoniae	3
Acinetobacter baumannii	2

Table 5: Outcomes

Outcome	Patients with SSI	Patients without SSI	p-value
Mean Length of Stay (days)	12.4	7.1	<0.001
Additional Cost per Patient (INR)	₹2,00,000	-	-

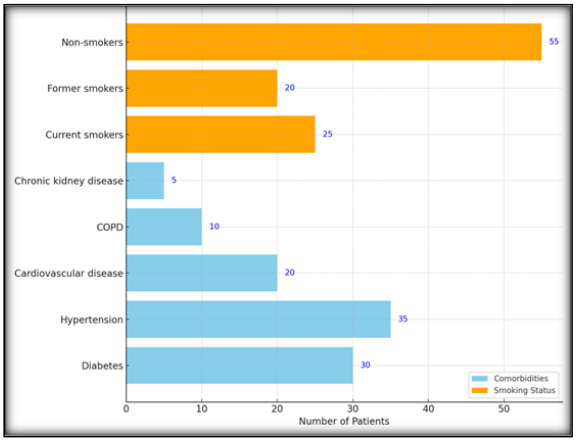

Figure 1: Comorbidities and smoking status of Patients

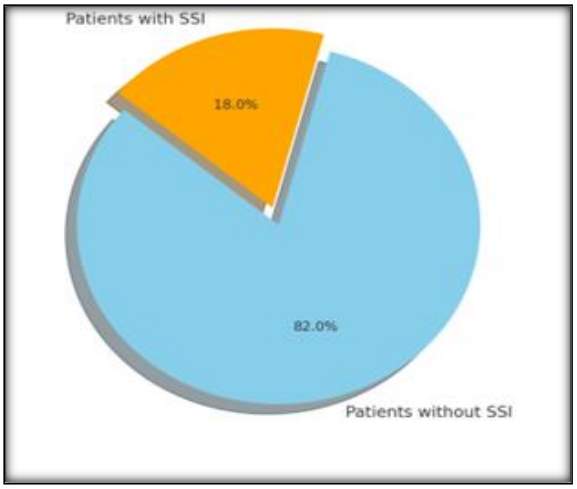

Figure 2: Incidence of Surgical Site Infections (SSI)

Multivariate logistic regression analysis identified several significant predictors of surgical site infections. Patients aged 60 years and older had a higher incidence of SSI (OR: 2.5; 95% CI: 1.2-5.3; p=0.02). Diabetic patients had a significantly higher risk of developing SSI (OR: 3.0; 95% CI: 1.5-6.0; p=0.001). Patients with a BMI of 30 kg/m² or higher were more likely to develop SSI (OR: 2.8; 95% CI: 1.3-6.0; p=0.005). Abdominal surgeries had a higher incidence of SSI compared to other types of surgeries (OR: 2.2; 95% CI: 1.1-4.5; p=0.03). Surgeries lasting more than 3 hours were associated with an increased risk of SSI (OR: 2.7; 95% CI: 1.3-5.7; p=0.007). Current smokers had a higher risk of SSI compared to non-smokers (OR: 2.1; 95% CI: 1.0-4.5; p=0.04). Patients on immunosuppressive therapy had an increased risk of SSI (OR: 3.2; 95% CI: 1.4-7.2; p=0.002) [Table 3].

The most common pathogens isolated from SSIs were Staphylococcus aureus (40%), Escherichia coli (25%), and Pseudomonas aeruginosa (15%). Methicillin-resistant Staphylococcus aureus (MRSA) was identified in 10% of the infections. Other pathogens included Enterococcus faecalis (5%), Klebsiella pneumoniae (3%), and Acinetobacter baumannii (2%) [Table 4].

Patients with SSIs had prolonged hospital stays compared to those without SSIs, with a mean length of stay of 12.4 days versus 7.1 days (p<0.001). Additionally, the presence of SSI was associated with increased healthcare costs and resource utilization, with an average additional cost of ₹2,00,000 per patient with SSI [Table 5].

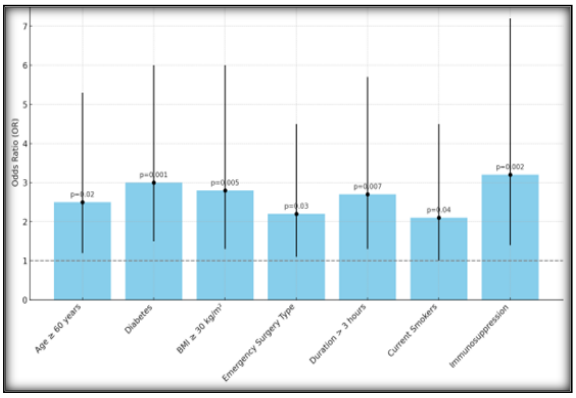

Figure 3: Risk Factors Associated with SSI

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DISCUSSION

This prospective observational study conducted at Siddhartha Medical College, Vijayawada, from June 2023 to May 2024, identified several significant predictors of surgical site infections (SSIs) in patients undergoing emergency general surgery. The findings highlight the importance of targeted preventive measures and interventions in high-risk populations to mitigate the risk of SSIs and improve patient outcomes.

Key Findings: The incidence of SSIs in this study was 18%, which is consistent with the rates reported in other studies of emergency general surgery. The analysis identified advanced age, diabetes, high body mass index (BMI), type and duration of surgery, smoking status, and immunosuppression as significant predictors of SSIs.

Advanced Age: Patients aged 60 years and older had a significantly higher risk of developing SSIs (OR: 2.5; p=0.02). This finding aligns with previous research indicating that older patients are more susceptible to infections due to age-related physiological changes, comorbidities, and a weakened immune system.[8-16] Strategies to optimize the preoperative and postoperative care of older patients could help reduce the incidence of SSIs in this vulnerable population.[12]

Diabetes: Diabetic patients had a markedly increased risk of SSIs (OR: 3.0; p=0.001). Hyperglycemia impairs immune function and wound healing, predisposing diabetic patients to infections. Implementing stringent glucose control protocols and monitoring can significantly lower the risk of SSIs in diabetic patients undergoing emergency surgery.[13]

High BMI: Obesity was identified as a significant risk factor for SSIs (OR: 2.8; p=0.005). Patients with a BMI of 30 kg/m² or higher were more likely to develop SSIs, likely due to impaired wound healing, increased surgical complexity, and higher tissue oxygen demand.[9] Preoperative weight management and tailored surgical techniques may be beneficial in reducing the risk of SSIs in obese patients.[15]

Type and Duration of Surgery: Abdominal surgeries and procedures lasting more than 3 hours were associated with higher SSI rates (OR: 2.2 and 2.7, respectively). These findings emphasize the need for meticulous surgical technique, adequate antimicrobial prophylaxis, and minimization of operative time to lower SSI risks.[10]

Smoking Status: Current smokers had a higher likelihood of developing SSIs compared to non-smokers (OR: 2.1; p=0.04). Smoking adversely affects wound healing and immune response. Preoperative smoking cessation programs could be a valuable intervention to reduce SSIs in surgical patients.[11,14]

Immunosuppression: Patients on immunosuppressive therapy exhibited a significantly increased risk of SSIs (OR: 3.2; p=0.002). Immunosuppressed patients require close monitoring and tailored perioperative care to prevent infections.[11]

Microbiological Findings: The study identified Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa as the most common pathogens causing SSIs. Methicillin-resistant Staphylococcus aureus (MRSA) was present in 10% of infections, highlighting the need for effective infection control measures and antibiotic stewardship programs.[15,16]

Clinical Implications: The prolonged hospital stays and increased healthcare costs associated with SSIs underscore the economic burden of these infections. The additional cost per patient with SSI was ₹2,00,000, reflecting the significant financial impact on healthcare systems.[8,13]

Limitations

This study has several limitations. The sample size was relatively small, and the study was conducted at a single center, which may limit the generalizability of the findings. Additionally, variations in surgical techniques and postoperative care practices could influence the results.

CONCLUSION

This study identified advanced age, diabetes, high BMI, type of surgery, longer surgery duration, smoking, and immunosuppression as significant predictors of SSIs in emergency general surgery. These findings highlight the need for targeted interventions and preventive measures to reduce the incidence of SSIs and improve patient outcomes. Future research should focus on larger, multicenter studies to validate these findings and develop comprehensive guidelines for SSI prevention in emergency surgical settings.

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