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Original Research

Predictors of Surgical Site Infections in Emergency General Surgery Cases: An Observational Study

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Abstract
Background: Surgical Site Infections (SSIs) are a significant cause of morbidity in emergency general surgery. Identifying predictors of SSIs can guide interventions to reduce their occurrence and improve patient outcomes.
Methods: This observational study included 100 emergency general surgery cases. Patient demographics, comorbidities, surgical details, and outcomes were recorded. The incidence and predictors of SSIs were analyzed using univariate and multivariate logistic regression. Statistical significance was set at $p < 0.05$.
Results: The mean age of the patients was 45.3 ± 12.8 years, with 60% males and 40% females. The overall SSI incidence was 25%, including superficial SSIs (60%), deep SSIs (32%), and organ/space SSIs (8%). Diabetes (45%, $p = 0.02$), obesity (35%, $p = 0.04$), contaminated wounds (50%, $p < 0.001$), open surgery (35%, $p = 0.01$), and prolonged surgeries (>3 hours, 40%, $p = 0.005$) were significant predictors of SSIs. Multivariate analysis identified diabetes (OR = 2.5, $p = 0.01$), open surgery (OR = 3.0, $p = 0.004$), contaminated wounds (OR = 4.2, $p < 0.001$), and prolonged surgery (OR = 2.8, $p = 0.008$) as independent predictors. Patients with SSIs had a significantly longer mean hospital stay (14 ± 4.5 days vs. 8 ± 3.2 days, $p < 0.001$) and higher mortality (12% vs. 3%, $p = 0.03$).
Conclusions: Diabetes, open surgery, contaminated wounds, and prolonged surgery were identified as significant predictors of SSIs in emergency general surgery. Targeted strategies addressing these factors may reduce the SSI burden and improve outcomes.
Keywords: Surgical Site Infections, Emergency Surgery, Predictors, Open Surgery, Contaminated Wounds, Prolonged Surgery, Patient Outcomes

Introduction

Surgical Site Infections (SSIs) remain a significant contributor to postoperative morbidity and healthcare costs, particularly in emergency general surgery cases[1]. These infections, defined as infections occurring at the surgical site within 30 days of surgery, are associated with prolonged hospital stays, increased healthcare costs, and higher patient mortality. In emergency surgical scenarios, the risk of SSIs is heightened due to factors such as limited preoperative preparation, the presence of contaminated or dirty wounds, and the urgency of surgical intervention[2,3].

Several patient- and procedure-related factors contribute to the development of SSIs. Comorbid conditions such as diabetes mellitus and obesity have been shown to compromise immune response and wound healing, increasing the risk of infection[4]. Similarly, open surgical techniques and prolonged operative times are associated with higher SSI rates compared to minimally invasive approaches. Contaminated or dirty surgical wounds are particularly prone to infections due to microbial contamination at the site[5].

Understanding the predictors of SSIs is essential for developing targeted strategies to mitigate their

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occurrence. While numerous studies have evaluated SSIs in elective surgeries, limited data are available on the predictors specific to emergency general surgery. This knowledge gap emphasizes the need for further research in this domain to inform evidence-based clinical practices.

This observational study aims to identify the incidence and predictors of SSIs in emergency general surgery cases. By exploring patient demographics, surgical details, and postoperative outcomes, this study seeks to provide insights into modifiable risk factors that could reduce the burden of SSIs and improve patient outcomes in emergency settings.

Methodology

Study Design and Setting: This observational study was conducted at the Andhra Medical College, Visakhapatnam, from May 2022 to April 2023. The study included patients undergoing emergency general surgery during this period.

Study Population: A total of 100 patients who underwent emergency general surgery were included in the study. Patients of all age groups and genders were eligible for inclusion. Exclusion criteria included elective surgeries, patients with pre-existing infections at the surgical site, and those lost to follow-up within 30 days post-surgery.

Data Collection: Detailed information was collected using a structured proforma, including:

Patient Demographics: Age, gender, and comorbidities such as diabetes mellitus, hypertension, and obesity.

Surgical Details: Type of surgery (gastrointestinal, abdominal wall, trauma-related), wound classification (clean, clean-contaminated, contaminated, or dirty), surgical technique (open or laparoscopic), and duration of surgery[6].

Postoperative Data: Occurrence of SSIs (superficial, deep, or organ/space), length of hospital stay, and mortality[7].

SSIs were diagnosed based on CDC criteria, which include purulent discharge, signs of infection, and positive microbial culture results.

Statistical Analysis

Data were analyzed using SPSS software version 25. Categorical variables were expressed as percentages, and continuous variables were presented as mean ± standard deviation.

Univariate Analysis: Chi-square test was used to identify significant associations between potential predictors and SSIs.

Multivariate Analysis: Logistic regression was performed to identify independent predictors of SSIs.A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the concerned authorities.Written informed consent was obtained from all patients or their legal guardians before participation. Patient confidentiality was maintained throughout the study.

Results

Patient Demographics and Clinical Data

The study included 100 emergency general surgery cases. The mean age of the patients was 45.3 ± 12.8 years, with 60% males and 40% females. Comorbidities such as diabetes mellitus (35%), hypertension (28%), and obesity (20%) were commonly observed (Table 1).

Table 1: Patient Demographics and Clinical Data

Category	Data
Total Cases	100
Mean Age (years)	45.3 ± 12.8
Male (%)	60
Female (%)	40
Diabetes Mellitus (%)	35
Hypertension (%)	28
Obesity (BMI > 30) (%)	20

Table 2: Surgical Data

Type of Surgery	Percentage (%)
Gastrointestinal	45
Abdominal Wall	30
Trauma-related Surgeries	25
Open Surgery	70
Laparoscopic Surgery	30

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Table 3: Surgical Site Infection (SSI) Incidence

Category	Data (%)
Total SSI Cases (%)	25
Superficial SSI (%)	60
Deep SSI (%)	32
Organ/Space SSI (%)	8

Table 4: Predictors of Surgical Site Infections

Predictor	Percentage (%)	p-value
Diabetes (with SSI)	45	0.02
Obesity (with SSI)	35	0.04
Open Surgery (SSI)	35	0.01
Laparoscopic Surgery (SSI)	10	0.01
Contaminated/Dirty Wounds (SSI)	50	<0.001
Surgeries >3 hours (SSI)	40	0.005

Table 5: Post-Operative Outcomes

Outcome	With SSI	Without SSI	p-value
Mean Hospital Stay (days)	14 ± 4.5	8 ± 3.2	<0.001
Mortality Overall (%)	-	-	-
Mortality with SSI (%)	12	-	0.03
Mortality without SSI (%)	-	3	-

Table 6: Multivariate Analysis for Predictors of SSI

Predictor	Odds Ratio (OR)	95% CI	p-value
Diabetes	2.5	1.2–5.0	0.01
Open Surgery	3.0	1.4–6.5	0.004
Contaminated Wounds	4.2	2.0–8.8	<0.001
Prolonged Surgery (>3 hours)	2.8	1.3–6.1	0.008

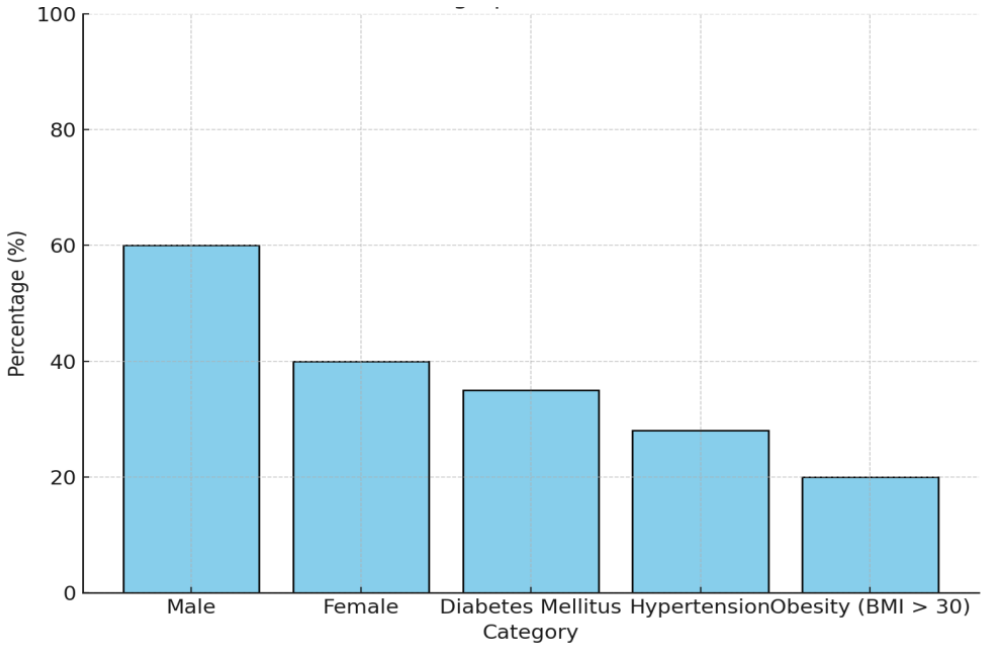

Figure No:1 Patient Demographics and Clinical Data

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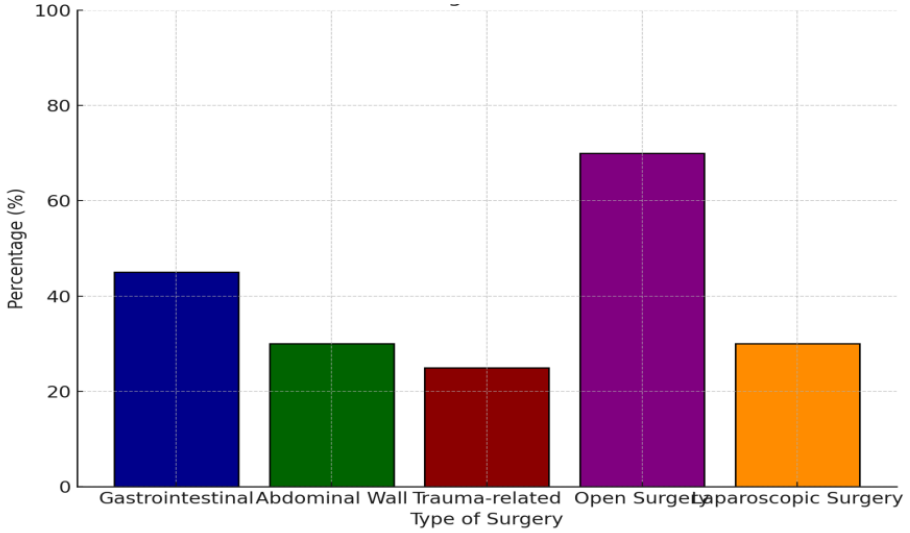

Figure No:2 Surgical Data

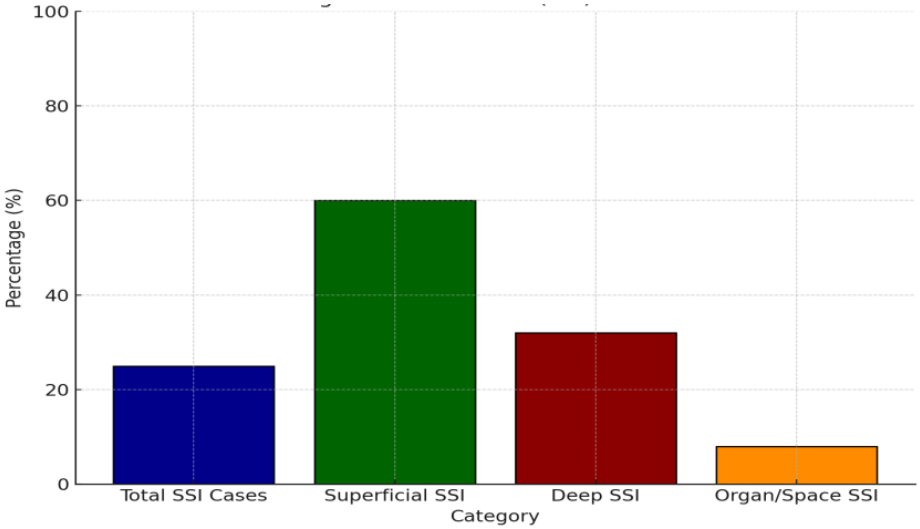

Figure No:3.Surgical Site Infection Incidence

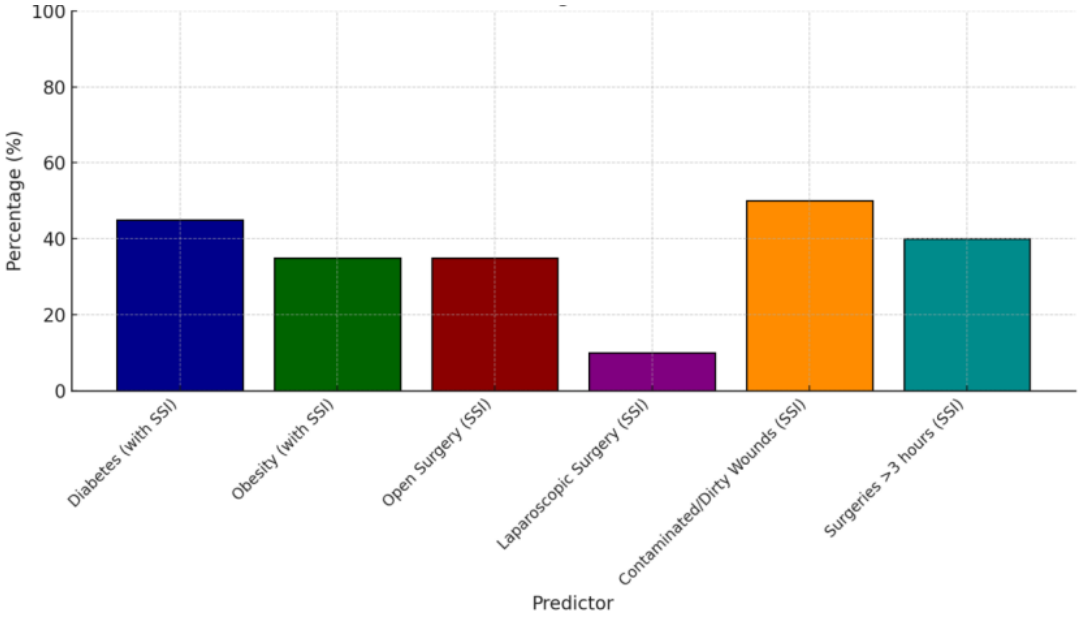

Figure No:4. Predictors of Surgical Site Infection

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Surgical Data

The majority of surgeries were gastrointestinal (45%), followed by abdominal wall surgeries (30%) and trauma-related surgeries (25%). Open surgeries accounted for 70% of cases, while laparoscopic surgeries comprised 30% (Table 2).

Surgical Site Infection (SSI) Incidence

Surgical site infections were observed in 25% of cases. Among these, superficial SSI was the most common type (60%), followed by deep SSI (32%) and organ/space SSI (8%) (Table 3).

Predictors of Surgical Site Infections

Several factors were identified as significant predictors of SSI. Patients with diabetes had an SSI rate of 45% ($p = 0.02$), while obesity was associated with a 35% SSI rate ($p = 0.04$). Open surgeries were significantly more prone to SSI (35%) compared to laparoscopic surgeries (10%, $p = 0.01$). Contaminated or dirty wounds showed the highest SSI rate at 50% ($p < 0.001$). Surgeries lasting more than 3 hours were associated with a 40% SSI rate ($p = 0.005$) (Table 4).

Post-Operative Outcomes

Patients with SSI had a significantly longer mean hospital stay (14 ± 4.5 days) compared to those without SSI (8 ± 3.2 days, $p < 0.001$). Mortality was higher among patients with SSI (12%) compared to those without SSI (3%, $p = 0.03$) (Table 5).

Multivariate Analysis

Multivariate logistic regression identified independent predictors of SSI. Diabetes (OR = 2.5, 95% CI: 1.2–5.0, $p = 0.01$), open surgery (OR = 3.0, 95% CI: 1.4–6.5, $p = 0.004$), contaminated wounds (OR = 4.2, 95% CI: 2.0–8.8, $p < 0.001$), and prolonged surgeries exceeding 3 hours (OR = 2.8, 95% CI: 1.3–6.1, $p = 0.008$) were significantly associated with the occurrence of SSI (Table 6).

Discussion

This observational study highlights the incidence and predictors of surgical site infections (SSIs) in emergency general surgery cases at Andhra Medical College, Visakhapatnam. The overall SSI rate of 25% observed in this study aligns with rates reported in similar studies conducted in resource-limited settings, where emergency surgeries are associated with higher infection risks compared to elective procedures.

Key Findings and Their Implications

The study identified several significant predictors of SSIs, including diabetes mellitus, obesity, contaminated wounds, open surgical techniques, and prolonged surgery duration. Diabetes was a key independent risk factor (OR = 2.5, $p = 0.01$), consistent with previous studies indicating impaired wound healing and immune response in diabetic patients. Obesity (35% SSI rate, $p = 0.04$) was another significant factor, likely due to poor vascularization and increased wound tension in obese individuals[8].

Open surgery was associated with a significantly higher risk of SSIs (35%, $p = 0.01$) compared to laparoscopic surgery (10%). This finding underscores the advantages of minimally invasive techniques in reducing infection risks. Similarly, contaminated or dirty wounds showed the highest SSI rate (50%, $p < 0.001$), reaffirming the critical role of intraoperative sterility and proper wound management in mitigating infections[9].

Prolonged surgeries exceeding 3 hours (SSI rate of 40%, $p = 0.005$) emerged as an important predictor. Longer surgeries increase the risk of microbial contamination and compromise tissue perfusion, emphasizing the need for efficient surgical planning and execution[10].

Postoperative Outcomes

Patients with SSIs had longer hospital stays (14 ± 4.5 days vs. 8 ± 3.2 days, $p < 0.001$) and higher mortality rates (12% vs. 3%, $p = 0.03$), indicating the significant impact of SSIs on patient recovery and healthcare resources. Early identification and management of high-risk patients could improve outcomes and reduce costs.

Comparison with Literature

The findings of this study are consistent with previous research on SSIs in emergency surgery. Studies from similar resource-constrained settings have reported comparable risk factors, including comorbidities, contaminated wounds, and prolonged surgeries. However, this study uniquely highlights the high SSI burden in a rural Indian setting, emphasizing the need for targeted interventions tailored to such populations[8,9].

Strengths and Limitations

The study's strengths include its focus on emergency general surgery cases, a population often underrepresented in SSI research, and the use of a structured methodology to identify independent predictors. However, the study has limitations, including the relatively small sample size and the single-center design, which may limit the generalizability of the findings. Additionally, the absence of molecular-level analysis of microbial strains limits insights into pathogen-specific factors.

Conclusion

This study identified significant predictors of surgical site infections (SSIs) in emergency general surgery cases, including diabetes mellitus, obesity, contaminated wounds, open surgical techniques, and prolonged surgery duration. SSIs were associated with longer hospital stays and higher mortality, emphasizing their impact on patient outcomes and healthcare resources. Open surgeries and contaminated wounds showed the highest infection rates, highlighting the need for improved perioperative management and wound care protocols. Prolonged surgeries and comorbid conditions like diabetes and obesity require targeted interventions, such as optimized surgical planning and strict

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glycemic control. Implementing these strategies can significantly reduce the burden of SSIs.

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