e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(8); 249-253

Original Research Article

Predictors of Postoperative Surgical Site Infection Following Elective and Emergency Abdominal Surgeries: A Prospective Observational Study

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Received: 01-05-2026 / Revised: 15-06-2026 / Accepted: 21-07-2026

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Conflict of interest: Nil

Abstract

Background: Surgical site infection (SSI) is one of the most common postoperative complications following abdominal surgery and is associated with increased morbidity, prolonged hospitalization, higher treatment costs, and poorer clinical outcomes. The risk of SSI varies according to patient characteristics and operative factors, particularly between elective and emergency procedures.

Objective: To identify the predictors of postoperative surgical site infection following elective and emergency abdominal surgeries and to evaluate their impact on postoperative outcomes.

Materials and Methods: A prospective observational study was conducted on 180 patients undergoing abdominal surgery at the Department of General Surgery, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamil Nadu, India, over a period of 18 months. Demographic, clinical, and operative variables were recorded, and patients were followed for 30 days to detect SSI. Statistical analysis was performed using SPSS version 26.0.

Results: SSI occurred in 32 (17.8%) patients and was significantly more common after emergency surgeries. Diabetes mellitus, obesity, contaminated wounds, prolonged operative duration, higher ASA grade, and delayed prophylactic antibiotic administration were significant predictors. Patients with SSI had longer postoperative hospital stays and increased wound-related complications.

Conclusion: Emergency surgery and several modifiable perioperative factors significantly increase the risk of SSI. Early identification and optimization of these predictors may reduce postoperative infections and improve patient outcomes.

Keywords: Surgical Site Infection; Abdominal Surgery; Elective Surgery; Emergency Surgery; Risk Factors; Postoperative Complications.

DOI: 10.25258/ijcpr.18.8.38

Introduction

Surgical site infection (SSI) is one of the most common healthcare-associated infections following operative procedures and continues to be a major cause of postoperative morbidity despite advances in surgical care. Patients with SSI often experience delayed wound healing, prolonged hospitalization, increased healthcare costs, and poorer clinical outcomes. [1]

Abdominal surgeries are particularly susceptible to SSI because of exposure to endogenous gastrointestinal flora and the varying degree of wound contamination. The incidence of SSI is generally higher after emergency procedures than elective operations owing to inadequate preoperative optimization and increased contamination. [2]

Several patient- and procedure-related factors have been associated with SSI, including diabetes mellitus, obesity, smoking, malnutrition, prolonged operative duration, contaminated wounds, higher ASA grade, and inappropriate timing of prophylactic antibiotics. Early identification of these predictors can facilitate targeted preventive measures and improve postoperative outcomes. [3]

Recent studies have emphasized the importance of evidence-based perioperative infection prevention

strategies, including timely antibiotic prophylaxis, strict aseptic techniques, glycaemic control, and standardized wound care protocols to reduce SSI rates. [4]

However, the relative contribution of these predictors may differ between elective and emergency abdominal surgeries because of variations in patient condition, operative urgency, and wound contamination. Evidence from prospective studies comparing both surgical groups remains limited, particularly in tertiary care settings. [5]

Therefore, the present prospective observational study was undertaken to identify the predictors of postoperative surgical site infection following elective and emergency abdominal surgeries and to evaluate their association with postoperative clinical outcomes. [6]

Materials and Methods

This hospital-based prospective observational study was conducted in the Department of General Surgery, Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamil Nadu, India, over a period of 18 months from January 2025 to June 2026. A total of 180 consecutive patients undergoing elective and emergency abdominal surgeries were enrolled after obtaining informed consent. Demographic characteristics, clinical profile, comorbidities, operative findings, wound classification, perioperative antibiotic use, duration of surgery, and postoperative outcomes were recorded using a predesigned proforma. Patients were followed for 30 days after surgery for the occurrence of surgical site infection, which was diagnosed according to the Centers for Disease Control and Prevention (CDC) criteria.

Inclusion Criteria

- Patients aged ≥18 years undergoing elective or emergency abdominal surgery.
- Patients willing to provide written informed consent.
- Patients available for postoperative follow-up for 30 days.

Exclusion Criteria

- Patients with pre-existing surgical wound infection before surgery.
- Patients undergoing minor procedures not requiring an abdominal incision.
- Patients lost to follow-up during the study period.
- Patients with incomplete clinical or operative records.

Statistical Analysis: Statistical analysis was performed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages.

Comparisons between groups were carried out using the independent t-test for continuous variables and the Chi-square test or Fisher's exact test for categorical variables, as appropriate. A p-value <0.05 was considered statistically significant.

Results

A total of 180 patients undergoing elective and emergency abdominal surgeries were included in the study and completed the follow-up period.

Among them, 110 (61.1%) underwent elective surgery, while 70 (38.9%) underwent emergency surgery. Overall, 32 (17.8%) patients developed postoperative surgical site infection, whereas 148 (82.2%) had an uneventful postoperative wound recovery. The detailed demographic characteristics, operative variables, predictors, and postoperative outcomes are presented in the following tables.

Table 1: Baseline Demographic and Clinical Characteristics of the Study Population (N = 180)

Variable		Frequency (n)	Percentage (%)
Age (years)	18–40	58	32.2%
	41–60	76	42.2%
	>60	46	25.6%
Gender	Male	108	60%
	Female	72	40%
Type of Surgery	Elective	110	61.1%
	Emergency	70	38.9%
Diabetes Mellitus	Yes	52	28.9%
	No	128	71.1%
Obesity (BMI ≥30 kg/m²)	Yes	40	22.2%
	No	140	77.8%

Most patients were aged 41–60 years (42.2%), with a male predominance (60%). Elective abdominal surgeries constituted 61.1% of procedures, while diabetes mellitus and obesity were present in 28.9% and 22.2% of patients, respectively.

Table 2: Incidence of Surgical Site Infection According to Operative Variables

Variable		SSI Present n (%)	SSI Absent n (%)	p-value
Type of Surgery	Elective (n=110)	12 (10.9%)	98 (89.1%)	0.008
	Emergency (n=70)	20 (28.6%)	50 (71.4%)	
Duration of Surgery	<2 hours (n=95)	10 (10.5%)	85 (89.5%)	0.015
	≥2 hours (n=85)	22 (25.9%)	63 (74.1%)	
Wound Classification	Clean/Clean-contaminated	11 (9.8%)	101 (90.2%)	0.003
	Contaminated/Dirty	21 (30.9%)	47 (69.1%)	

Surgical site infection occurred significantly more frequently following emergency surgery, prolonged operative duration (≥2 hours), and contaminated or dirty wounds ($p<0.05$).

Table 3: Predictors Associated with Postoperative Surgical Site Infection

Predictor	SSI (n=32)	No SSI (n=148)	p-value
Diabetes mellitus	17 (53.1%)	35 (23.6%)	0.002
Obesity	14 (43.8%)	26 (17.6%)	0.004
ASA Grade III–IV	16 (50%)	39 (26.4%)	0.012
Delayed antibiotic prophylaxis	15 (46.9%)	27 (18.2%)	0.001

Diabetes mellitus, obesity, higher ASA grade, and delayed administration of prophylactic antibiotics were significantly associated with postoperative surgical site infection.

Table 4: Postoperative Outcomes According to Surgical Site Infection Status

Outcome	SSI (n=32)	No SSI (n=148)	p-value
Mean hospital stay (days)	12.8 ± 3.6	7.1 ± 2.4	<0.001
Wound dehiscence	8 (25%)	6 (4.1%)	<0.001
Reoperation	4 (12.5%)	3 (2%)	0.018

Patients who developed SSI had significantly longer hospital stays and higher rates of wound dehiscence and reoperation compared with those without SSI.

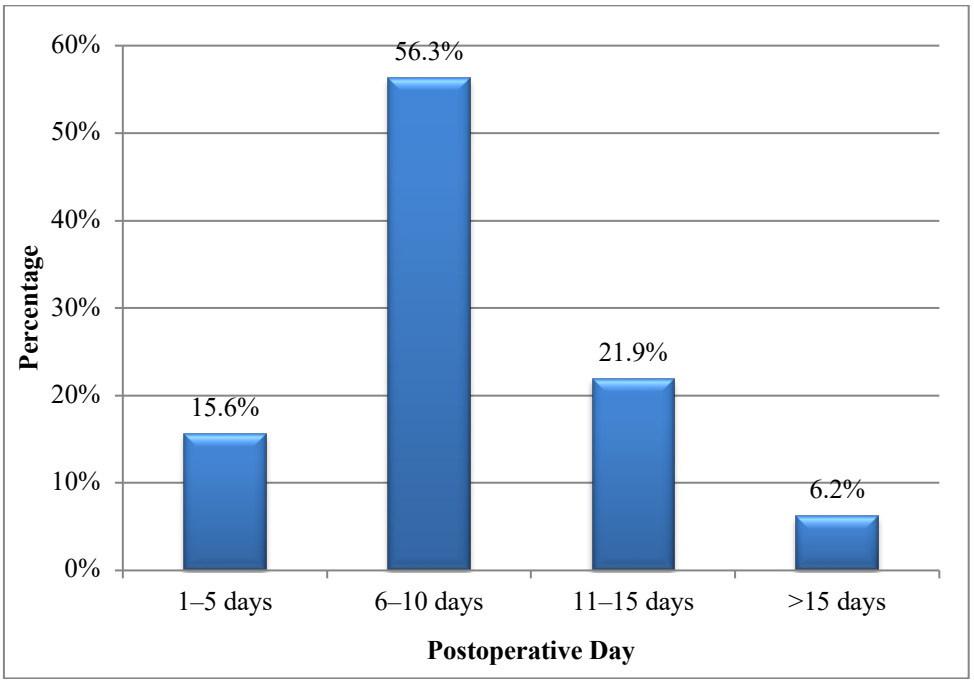

Figure 1: Distribution of Surgical Site Infection According to Postoperative Day of Diagnosis (n = 32)

More than half of the surgical site infections (56.3%) were diagnosed between the 6th and 10th postoperative days, indicating that this period represents the highest risk for SSI detection following abdominal surgery.

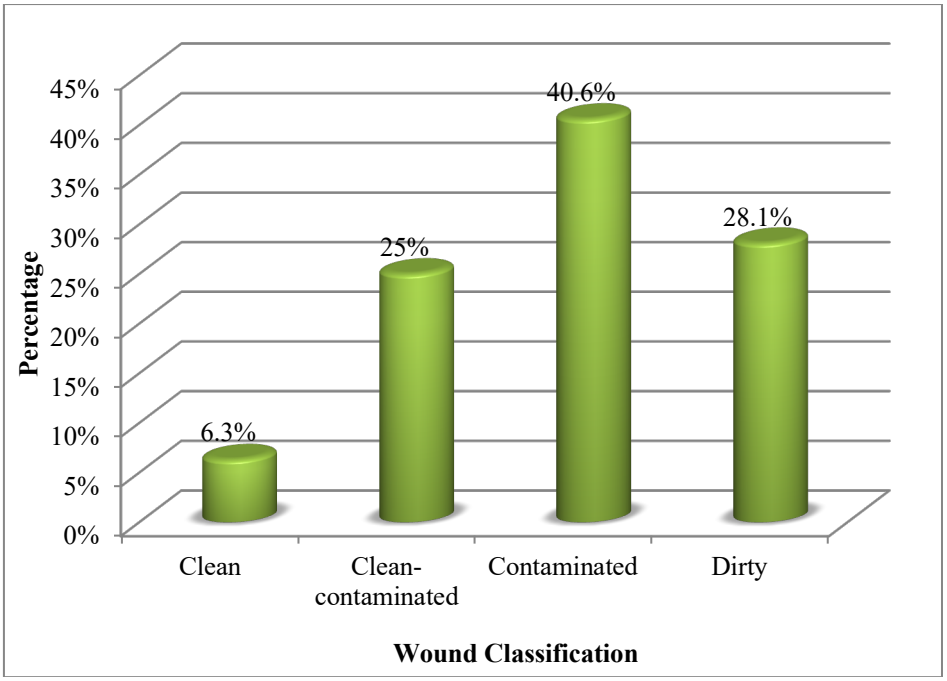

Figure 2: Distribution of Surgical Site Infection Cases According to Wound Classification (n = 32)

Surgical site infections were most frequently observed in contaminated wounds (40.6%), followed by dirty wounds (28.1%), suggesting that increasing wound contamination was associated with a greater burden of postoperative infection.

Discussion

The present prospective observational study demonstrated an overall surgical site infection (SSI) rate of 17.8% following abdominal surgeries, with a significantly higher incidence among patients undergoing emergency procedures than elective surgeries. Similar findings have been reported in recent studies, which have shown that emergency operations are associated with increased wound contamination, inadequate preoperative optimization, and greater physiological stress, all of which contribute to a higher risk of postoperative infection. [7]

Diabetes mellitus emerged as one of the strongest predictors of SSI in the present study. Poor glycaemic control impairs leukocyte function, delays wound healing, and increases susceptibility to bacterial infection. Comparable observations have been reported in contemporary studies evaluating postoperative outcomes after abdominal surgery, emphasizing diabetes as an independent risk factor for SSI. [8] Obesity was also significantly associated with postoperative SSI. Excess adipose tissue reduces tissue perfusion, increases wound tension, and prolongs operative exposure, thereby predisposing patients to infection. Similar associations between obesity and SSI have been consistently documented in recent literature involving abdominal and gastrointestinal surgical procedures. [9] The present study further demonstrated that prolonged operative duration, contaminated or dirty wounds, higher ASA grade, and delayed administration of prophylactic antibiotics were significantly associated with SSI. Longer operations increase tissue handling and bacterial exposure, while contaminated wounds inherently carry a higher microbial burden. Appropriate timing of antibiotic prophylaxis remains an essential component of SSI prevention, and delayed administration has been linked to poorer postoperative outcomes in several recent investigations. [10] Patients who developed SSI had significantly longer hospital stays and experienced a higher frequency of wound-related complications, including wound dehiscence and reoperation. These findings are consistent with previous reports demonstrating that SSI contributes substantially to postoperative morbidity, increased healthcare utilization, and additional treatment costs. [11]

The strengths of the present study include its prospective design and comprehensive evaluation of both patient-related and operative predictors among elective and emergency abdominal surgeries. However, the study was conducted at a single tertiary care centre with a relatively modest sample size, which may limit the generalizability of the findings. Multicentre studies with larger populations are warranted to validate these observations and further refine strategies for SSI prevention. [12]

Conclusion

Postoperative surgical site infection remains a common complication following abdominal surgeries, particularly after emergency procedures.

Diabetes mellitus, obesity, prolonged operative duration, contaminated wounds, higher ASA grade, and delayed prophylactic antibiotic administration were significant predictors of SSI. Early identification of these risk factors and adherence to evidence-based perioperative infection prevention measures may reduce SSI incidence, improve postoperative outcomes, and shorten hospital stay.

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