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Research Article

A Cross-Sectional Study of Surgical Site Infection Rates Following Elective Versus Emergency Abdominal Surgeries at a Tertiary Care Hospital

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ABSTRACT

Background: Surgical site infections (SSIs) are a major cause of postoperative morbidity, particularly following abdominal surgeries. The risk of SSI varies between elective and emergency procedures due to differences in patient optimization, wound contamination, and operative factors. **Aim:** To compare the incidence of surgical site infections following elective and emergency abdominal surgeries at a tertiary care hospital. **Objectives:** To determine SSI rates in elective and emergency abdominal surgeries and to analyze clinical and operative factors influencing SSI occurrence. **Materials and Methods:** This hospital-based cross-sectional study included 80 patients undergoing abdominal surgeries, comprising both elective and emergency procedures. Data on demographics, comorbidities, operative details, wound class, and postoperative outcomes were collected using a structured proforma. SSIs were identified based on standard clinical criteria. Statistical analysis was performed using appropriate tests, with $p < 0.05$ considered statistically significant. **Results:** SSIs occurred in 14.3% of elective surgeries and 36.8% of emergency surgeries, with emergency procedures showing a significantly higher risk of infection. Diabetes mellitus, prolonged operative time (>120 minutes), and contaminated or dirty wounds were significantly associated with SSI. Patients with SSI had a significantly longer hospital stay compared to those without infection. **Conclusion:** Emergency abdominal surgeries carry a substantially higher risk of SSI compared to elective procedures. Identification and modification of key risk factors can help reduce SSI incidence and improve postoperative outcomes.

Keywords: Surgical site infection. Emergency abdominal surgery. Elective abdominal surgery.

INTRODUCTION

Surgical site infections (SSIs) are among the most common healthcare-associated infections and represent a significant cause of postoperative morbidity, prolonged hospital stay, increased healthcare costs, and mortality worldwide. According to the Centers for Disease Control and Prevention (CDC), SSIs

account for nearly 20-30% of all hospital-acquired infections, particularly in patients undergoing abdominal surgeries. Despite advances in surgical techniques, antimicrobial prophylaxis, and perioperative care, SSIs continue to pose a major challenge in both developed and developing countries.[1]

Abdominal surgeries are particularly vulnerable to SSIs due to factors such as contamination from endogenous gastrointestinal flora, longer operative duration, emergency presentation, and patient-related risk factors including comorbidities and nutritional status. The risk of SSI varies considerably depending on whether the surgery is performed electively or on an emergency basis. Elective abdominal surgeries are usually conducted under optimized conditions with adequate preoperative preparation, bowel preparation when indicated, timely antibiotic prophylaxis, and controlled operative environments. In contrast, emergency abdominal surgeries are often performed in the presence of acute infection, perforation, contamination, or hemodynamic instability, with limited time for preoperative optimization, thereby increasing the likelihood of postoperative infections.[2][3]

The burden of SSIs is particularly high in tertiary care hospitals, where complex surgical procedures and emergency referrals are frequently managed. In resource-limited settings, factors such as overcrowding, delayed presentation, limited infection control infrastructure, and antimicrobial resistance further compound the problem. SSIs not only adversely affect patient outcomes but also strain hospital resources by increasing antibiotic use, re-admissions, and surgical revisions.[4]

Aim

To compare the incidence of surgical site infections following elective and emergency abdominal surgeries in a tertiary care hospital.

Objectives

1. To determine the rate of surgical site infections in patients undergoing elective abdominal surgeries.
2. To determine the rate of surgical site infections in patients undergoing emergency abdominal surgeries.
3. To compare associated clinical and operative factors influencing SSI occurrence between elective and emergency surgeries.

MATERIAL AND METHODOLOGY

Source of Data

Data were collected from patients undergoing abdominal surgeries admitted to the general surgery department of the tertiary care hospital. Information was obtained from patient case records, operative notes, postoperative monitoring charts, and microbiology laboratory reports.

Study Design

This study was a hospital-based cross-sectional observational study.

Study Location

The study was conducted in the Department of General Surgery at a tertiary care teaching hospital.

Study Duration

The study was carried out over a period of 12 months.

Sample Size

A total of 80 patients were included in the study, comprising patients undergoing elective and emergency abdominal surgeries.

Inclusion Criteria

- Patients aged ≥18 years undergoing abdominal surgery
- Patients undergoing elective or emergency abdominal surgical procedures
- Patients who provided informed written consent

Exclusion Criteria

- Patients with pre-existing surgical site infection
- Patients undergoing laparoscopic procedures converted to open surgery
- Patients who were immunocompromised (e.g., HIV infection, chemotherapy, long-term steroid therapy)
- Patients lost to postoperative follow-up

Procedure and Methodology

Eligible patients were enrolled after obtaining informed consent. Preoperative evaluation included demographic details, clinical diagnosis, comorbidities, and type of surgery (elective or emergency). All surgeries were performed under standard aseptic precautions. Prophylactic antibiotics were administered according to hospital protocol. Patients were monitored postoperatively for signs of surgical site infection as per CDC criteria, including redness, pain, discharge, fever, and wound dehiscence. Follow-up was done until discharge and during outpatient visits when applicable.

Sample Processing

In cases where SSI was suspected, wound swab samples were collected aseptically and sent to the microbiology laboratory for culture and sensitivity testing. Results were documented for analysis.

Statistical Methods

Data were entered into Microsoft Excel and analyzed using statistical software. Categorical variables were expressed as frequencies and percentages. Continuous variables were expressed as mean ± standard deviation. Comparison between elective and emergency groups was performed using Chi-square test or Fisher's exact test for categorical variables and Student's t-test for continuous variables. A p-value <0.05 was considered statistically significant.

Data Collection

Data were collected using a pre-designed, structured proforma including patient demographics, surgical details, postoperative outcomes, and SSI status.

OBSERVATION AND RESULTS

Table 1. Comparison of Surgical Site Infection (SSI) Between Elective and Emergency Abdominal Surgeries (N = 80)

Variable	Elective Surgery (n = 42) n (%)	Emergency Surgery (n = 38) n (%)	Test of significance	Effect size (95% CI)	p-value
SSI present	6 (14.3)	14 (36.8)	$\chi^2 = 5.42$	RR = 2.57 (1.12-5.91)	**0.020**
SSI absent	36 (85.7)	24 (63.2)			
Mean age (years)	45.6 ± 12.1	48.9 ± 13.4	t = 1.12	Mean diff = -3.3 (-9.2 to 2.6)	0.266
Male sex	27 (64.3)	26 (68.4)	$\chi^2 = 0.15$	RR = 1.06 (0.77-1.47)	0.701

Table 1 compares the incidence of surgical site infections between elective and emergency abdominal surgeries among 80 patients. SSIs were observed in 14.3% of patients undergoing elective surgeries compared to a significantly higher rate of 36.8% in those undergoing emergency surgeries. This difference was statistically significant ($\chi^2 = 5.42$, p = 0.020), with emergency surgeries having a 2.57-fold

higher risk of SSI (RR = 2.57; 95% CI: 1.12-5.91). The mean age of patients did not differ significantly between the elective and emergency groups (45.6 ± 12.1 vs. 48.9 ± 13.4 years; p = 0.266). Similarly, the distribution of male patients was comparable between the two groups (64.3% vs. 68.4%; p = 0.701), indicating that age and sex were not confounding factors in SSI occurrence

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Table 2: Rate of Surgical Site Infection in Elective Abdominal Surgeries (n = 42)

Variable	SSI Present (n = 6)	SSI Absent (n = 36)	Test of significance	Effect size (95% CI)	p-value
Mean age (years)	52.3 ± 11.8	44.5 ± 12.0	t = 1.43	Mean diff = 7.8 (-3.1 to 18.7)	0.159
Diabetes mellitus	4 (66.7)	10 (27.8)	$\chi^2 = 4.21$	RR = 2.40 (1.08-5.33)	**0.040**
Operative time >120 min	5 (83.3)	11 (30.6)	$\chi^2 = 6.08$	RR = 2.72 (1.39-5.31)	**0.014**
Clean-contaminated wound	4 (66.7)	12 (33.3)	$\chi^2 = 2.52$	RR = 2.00 (0.93-4.29)	0.112

Table 2 evaluates factors associated with SSI among patients undergoing elective abdominal surgeries. Patients who developed SSI were older than those without SSI, although the difference in mean age was not statistically significant (52.3 ± 11.8 vs. 44.5 ± 12.0 years; p = 0.159). Diabetes mellitus was significantly more common in patients with SSI (66.7%) compared to those without SSI (27.8%), with a relative risk of 2.40 (95% CI: 1.08-5.33; p = 0.040). A prolonged operative time exceeding 120 minutes was also strongly associated with SSI, being present in 83.3% of SSI cases versus 30.6% of non-SSI cases (RR = 2.72; 95% CI: 1.39-5.31; p = 0.014). Although clean-contaminated wounds were more frequent among SSI cases, this association did not reach statistical significance (p = 0.112).

Table 3: Rate of Surgical Site Infection in Emergency Abdominal Surgeries (n = 38)

Variable	SSI Present (n = 14)	SSI Absent (n = 24)	Test of significance	Effect size (95% CI)	p-value
Mean age (years)	51.8 ± 13.6	46.9 ± 12.9	t = 1.09	Mean diff = 4.9 (-4.1 to 13.9)	0.282
Perforation peritonitis	9 (64.3)	7 (29.2)	$\chi^2 = 4.61$	RR = 2.20 (1.05-4.60)	**0.032**
Operative time >120 min	11 (78.6)	8 (33.3)	$\chi^2 = 6.59$	RR = 2.36 (1.31-4.26)	**0.010**
Dirty wound class	10 (71.4)	6 (25.0)	$\chi^2 = 7.82$	RR = 2.86 (1.42-5.74)	**0.006**

Table 3 analyzes the rate and determinants of SSI in emergency abdominal surgeries. Patients with SSI were slightly older than those without SSI, but the difference was not statistically significant (51.8 ± 13.6 vs. 46.9 ± 12.9 years; p = 0.282). Perforation

peritonitis was significantly associated with SSI, occurring in 64.3% of infected cases compared to 29.2% of non-infected cases (RR = 2.20; 95% CI: 1.05-4.60; p = 0.032). Prolonged operative time (>120 minutes) showed a strong association with SSI (78.6% vs. 33.3%; p = 0.010). Additionally, dirty wound class was significantly more common in patients who developed SSI (71.4%) compared to those who did not (25.0%), with nearly a threefold increased risk (RR = 2.86; 95% CI: 1.42-5.74; p = 0.006).

Table 4: Comparison of Clinical and Operative Factors Influencing SSI Between Elective and Emergency Surgeries (N = 80)

Factor	SSI Present (n = 20) n (%)	SSI Absent (n = 60) n (%)	Test of significance	Effect size (95% CI)	p-value
Emergency surgery	14 (70.0)	24 (40.0)	$\chi^2 = 5.06$	RR = 1.75 (1.08-2.83)	**0.024**
Diabetes mellitus	12 (60.0)	18 (30.0)	$\chi^2 = 5.37$	RR = 2.00 (1.16-3.44)	**0.020**
Operative time >120 min	16 (80.0)	22 (36.7)	$\chi^2 = 9.74$	RR = 2.18 (1.41-3.37)	**0.004**
Contaminated/dirty wound	15 (75.0)	21 (35.0)	$\chi^2 = 8.31$	RR = 2.14 (1.35-3.40)	**0.006**
Mean hospital stay (days)	11.6 ± 3.9	6.2 ± 2.8	t = 6.21	Mean diff = 5.4 (3.6-7.2)	**<0.001**

Table 4 compares overall clinical and operative factors influencing SSI occurrence across both elective and emergency surgeries. Emergency surgery was significantly associated with SSI, with 70.0% of SSI cases occurring after emergency procedures compared to 40.0% in the non-SSI group (p = 0.024). Diabetes mellitus was also significantly more prevalent among patients with SSI (60.0% vs. 30.0%; p = 0.020). Prolonged operative time exceeding 120 minutes was a strong predictor of SSI, observed in 80.0% of infected cases versus 36.7% of non-infected cases (p = 0.004). Contaminated or dirty wounds were significantly associated with SSI (75.0% vs. 35.0%; p = 0.006). Furthermore, patients who developed SSI had a significantly longer mean hospital stay compared to those without SSI (11.6 ± 3.9 vs. 6.2 ± 2.8 days; p < 0.001), highlighting the substantial clinical and resource burden associated with surgical site infections.

DISCUSSION

In **Table 1**, the incidence of SSI was significantly higher in emergency surgeries (36.8%) compared to elective surgeries (14.3%), with emergency procedures carrying a 2.57-fold increased risk of SSI. This observation is consistent with previous reports that have shown SSI rates to be substantially higher in emergency abdominal surgeries due to inadequate preoperative preparation, higher wound contamination, and underlying sepsis or perforation at presentation. Owens and Stoessel reported SSI rates nearly two to three times higher in emergency procedures compared to elective surgeries. Similarly, a study by Saad DA *et al.*(2022)[5] demonstrated that emergency surgery independently increased the risk of SSI after major abdominal operations. The

absence of a significant difference in age and sex distribution between the groups suggests that the increased SSI risk was primarily attributable to surgical urgency rather than demographic factors, a finding also noted by Li Z *et al.*(2021)[6].

Table 2 highlights factors influencing SSI in elective abdominal surgeries. Diabetes mellitus and prolonged operative time (>120 minutes) were significantly associated with SSI. Diabetes has been consistently recognized as a major risk factor due to impaired wound healing and immune dysfunction. Sriranjani KS *et al.*(2021)[4] emphasized poor glycemic control as a modifiable risk factor for SSI prevention. Prolonged operative duration increases tissue exposure and bacterial contamination, findings that align with studies by Marzoug OA *et al.*(2023)[7], who identified operative time as a strong predictor of SSI even in elective cases. Although clean-contaminated wounds showed a higher proportion of SSI, this association did not reach statistical significance, possibly due to the smaller number of infected cases in the elective group.

In **Table 3**, emergency surgery-specific risk factors were analyzed. Perforation peritonitis, prolonged operative time, and dirty wound class were all significantly associated with SSI. These findings are well supported in the literature. Perforation and peritonitis markedly increase bacterial load and systemic inflammation, thereby elevating infection risk. A study by Kassahun WT *et al.*(2022)[8]. reported that dirty wounds and intra-abdominal contamination were among the strongest predictors of SSI following emergency laparotomy. The strong association with dirty wound class observed in the present study further corroborates CDC wound classification as a reliable predictor of postoperative infection.

Table 4 provides a combined analysis of factors influencing SSI across both elective and emergency surgeries. Emergency surgery, diabetes mellitus, prolonged operative time, and contaminated/dirty wounds were all independently associated with higher SSI rates. These results mirror findings from large multicenter studies, including the WHO Global SSI Surveillance study, which identified emergency surgery and wound contamination as key determinants of SSI worldwide. Additionally, patients with SSI had a significantly longer hospital stay, underscoring the clinical and economic burden of SSIs. Similar increases in hospital stay associated with SSI have been reported by Jindal R *et al.*(2020)[9] & Zhang J *et al.*(2023)[10], who noted nearly a twofold increase in hospitalization duration among infected patients.

CONCLUSION

This cross-sectional study demonstrated that surgical site infections (SSIs) were significantly more common following emergency abdominal surgeries compared to elective procedures in a tertiary care hospital setting. Emergency surgeries were associated with a more than twofold increased risk of SSI, highlighting the impact of urgency, wound contamination, and limited preoperative optimization. Diabetes mellitus, prolonged operative duration, and contaminated or dirty wound class emerged as significant determinants of SSI across both elective and emergency surgeries. Patients who developed SSI also experienced a substantially longer hospital stay, underscoring the clinical and economic burden of postoperative infections. These findings emphasize the need for stringent infection control practices, optimization of modifiable risk factors, timely antibiotic prophylaxis, and focused perioperative strategies particularly for emergency surgical cases to reduce SSI rates and improve surgical outcomes.

LIMITATIONS OF THE STUDY

1. The cross-sectional study design limited the ability to establish causal relationships between risk factors and SSI occurrence.
2. The relatively small sample size from a single tertiary care center may limit the generalizability of the findings.
3. Follow-up was confined to the hospital stay and early postoperative period; late-onset SSIs after discharge may have been missed.
4. Microbiological profiles and antimicrobial resistance patterns were not analyzed in detail.
5. Potential confounders such as nutritional status, smoking, and precise glycemic control parameters were not fully evaluated.

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