

Prospective Study On the Incidence of Surgical Site Infections (SSI) After Emergency Versus Elective Laparotomies

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Abstract:

Introduction: Surgical site infections (SSIs) are major postoperative complications, particularly after emergency laparotomies due to contamination and limited preparation. Elective surgeries have lower SSI rates with better optimization. This study aims to prospectively assess and compare the incidence of SSIs in emergency versus elective laparotomies to guide improved perioperative practices.

Methodology: This prospective randomized controlled trial was conducted at government Medical College, Mahabubabad from January 2024 to April 2025. Adult patients undergoing open abdominal surgeries were included. Baseline demographics, surgery details, contamination status, and SSI outcomes were recorded. Patients were followed for 30 days to assess infection rates, organisms, antibiotic use, and hospital stay.

Results: A total of 52 patients were studied (28 emergency, 24 elective). Emergency surgeries showed higher contamination, longer surgery duration, higher SSI incidence (35.7% vs. 12.5%), longer hospital stay (12.4 vs. 8.1 days), greater antibiotic need (42.9% vs. 16.7%), and longer antibiotic use (10.2 vs. 7.5 days).

Conclusion: Emergency laparotomies were associated with higher contamination, increased SSI rates, prolonged hospital stays, and greater antibiotic use compared to elective procedures. Despite similar baseline characteristics, emergency surgeries posed greater risks. Focused infection control strategies and timely perioperative care are essential to improve outcomes in emergency abdominal surgeries.

Keywords: Surgical Site Infection (SSI), Emergency Laparotomy, Elective Laparotomy, Hospital Stay, Antibiotic Usage.

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Introduction

Surgical site infections (SSIs) represent a significant postoperative complication, contributing to prolonged hospital stays, increased morbidity, and higher healthcare costs globally. They account for approximately 20% of all hospital-acquired infections, despite advances in surgical techniques and infection control measures. [1] Laparotomy, whether performed electively or as an emergency, carries an inherent risk of SSI due to the invasiveness of the procedure and potential contamination. [2]

Emergency laparotomies are associated with a higher incidence of SSIs compared to elective surgeries. Factors such as suboptimal preoperative preparation, contamination from gastrointestinal contents, hemodynamic instability, and delayed initiation of prophylactic antibiotics contribute to this increased risk. [3] Elective laparotomies, on the other hand, typically allow for better patient optimization and adherence to aseptic protocols, thereby reducing the incidence of postoperative infections. [4]

Understanding the difference in SSI rates between emergency and elective laparotomies is crucial for tailoring perioperative management strategies, guiding antibiotic stewardship, and improving surgical outcomes. Previous studies have emphasized the need for aggressive infection control practices, particularly in emergency surgical settings where risk factors are amplified. [5] This prospective study aims to assess and compare the incidence of SSIs in patients undergoing emergency versus elective laparotomies, thereby contributing to existing literature and supporting evidence-based interventions to mitigate infection risks across different surgical contexts.

Methodology

This was a prospective randomized controlled trial conducted in the department of general surgery, government Medical College, Mahabubabad. Study was conducted from January 2024 to April 2025. Study protocol was approved by the Institutional

Ethics committee. An informed written consent was taken from the study members.

Adult patients >18 years undergoing open abdominal surgeries, including both emergency and elective laparotomies were included in the study. Patients undergoing minimally invasive laparoscopic procedures, those with preexisting SSIs, immunocompromised individuals and patients who were lost to follow-up within 30 days postoperatively were excluded.

Baseline data were collected for all enrolled patients, including demographic details such as age and sex, comorbid conditions (diabetes, hypertension, obesity, etc.), indication for surgery, type of procedure (emergency or elective laparotomy), duration of surgery (DOS), and intraoperative contamination status (categorized as clean, clean-contaminated, contaminated, or dirty). The primary outcomes measured were the occurrence of SSI within 30 days postoperatively, classified according to CDC criteria into superficial incisional, deep incisional, or organ/space infections. Secondary outcomes included identification of organisms isolated from wound swabs or cultures, patterns of antibiotic usage (perioperative prophylaxis and postoperative adjustments based on culture sensitivity), and the duration of hospital stay from the time of surgery to discharge.

Patients were monitored throughout their hospital stay and followed up for 30 days after surgery through outpatient visits or telephonic interviews. Clinical signs suggestive of SSI, including redness, swelling, warmth, pain at the surgical site, purulent discharge, and fever, were carefully recorded. In suspected cases, wound swabs or aspirates were obtained under aseptic precautions for gram staining, aerobic culture, and sensitivity testing. Antibiotic prophylaxis was administered at the time of surgery induction as per institutional guidelines, and postoperative antibiotic therapy was modified based on microbial sensitivity results, documenting the agents used, combination therapies, and treatment durations.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS version 21. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean $\pm$ standard deviation. Chi-square test and independent t-test were applied, considering a p-value <0.05 as statistically significant.

Results

Total 52 members were included, 28 underwent in emergency and 24 elective surgeries. The mean age was 45.6 ± 12.3 years in the emergency group and 48.2 ± 11.7 years in the elective group ($p = 0.32$). Males comprised 71.4% and 66.7%, respectively. Comorbidities such as diabetes, hypertension, and obesity were similarly distributed. The mean duration of surgery was slightly longer in emergency cases (105 ± 25 minutes) compared to elective surgeries (95 ± 20 minutes, $p = 0.08$) (Table 1). In the emergency group, 17.9% of surgeries were clean, 28.6% were clean-contaminated, and 53.5% were contaminated or dirty; whereas it was 50%, 29.2% and 20.8%, respectively in the elective group. The differences in clean ($p = 0.01$) and contaminated/dirty ($p = 0.008$) cases were statistically significant, indicating a higher contamination burden in emergency surgeries compared to elective ones. In the emergency group, 17.9% developed superficial incisional infections, 10.7% had deep incisional infections, and 7.1% experienced organ/space infections; it was 8.3%, 4.2% and 0, respectively in the elective group. The total SSI incidence was higher in the emergency group (35.7%) compared to the elective group (12.5%), though not statistically significant ($p = 0.2$). The mean hospital stay was significantly longer in the emergency group (12.4 ± 3.2 days) compared to the elective group (8.1 ± 2.5 days, $p = 0.001$). A higher proportion of emergency patients (42.9%) required additional antibiotics versus elective patients (16.7%, $p = 0.04$). Similarly, the mean duration of antibiotic use was longer in emergency cases (10.2 ± 2.8 days) than in elective cases (7.5 ± 2.2 days, $p = 0.003$).

Table 1: Baseline characteristics of the study participants

Parameter	Emergency	Elective	P value
Age **	45.6 ± 12.3	48.2 ± 11.7	0.32
Male *	20 (71.4)	16 (66.7)	0.7
Diabetes Mellitus *	8 (28.6)	6 (25)	0.78
Hypertension *	7 (25)	5 (20.8)	0.73
Obesity *	6 (21.4)	4 (16.7)	0.68
Mean DOS (min) **	105 ± 25	95 ± 20	0.08
*n (%); ** Mean $\pm$ SD			

Table 2: Contamination status among the groups; n (%)

Parameter	Emergency	Elective	P value
Clean	5 (17.9)	12 (50)	0.01
Clean-contaminated	8 (28.6)	7 (29.2)	0.96
Contaminated/Dirty	15 (53.5)	5 (20.8)	0.008

Table 3: Incidence of SSI among the study members

Parameter	Emergency	Elective	P value
Superficial Incisional	5 (17.9)	2 (8.3)	0.44
Deep Incisional	3 (10.7)	1 (4.2)	0.62
Organ/Space Infection	2 (7.1)	0 (0%)	-
Total	10 (35.7)	3 (12.5)	0.2

Table 4: Hospital stay and antibiotic usage among the study members

Parameter	Emergency	Elective	P value
Hospital stays*	12.4 ± 3.2	8.1 ± 2.5	0.001
Needing antibiotics**	12 (42.9)	4 (16.7)	0.04
Duration of antibiotic use*	10.2 ± 2.8	7.5 ± 2.2	0.003

* Mean ± SD; ** n (%)

Discussion

In this study, the baseline characteristics of patients undergoing emergency and elective laparotomies were comparable. The mean age of patients in the emergency group was 45.6 ± 12.3 years, while in the elective group it was 48.2 ± 11.7 years, with no statistically significant difference ($p = 0.32$). This finding aligns with the observations of Bhatia N et al., who reported that age distribution did not significantly differ between emergency and elective surgical populations, suggesting that age alone may not influence the decision for emergency intervention. [6]

The proportion of male patients was slightly higher in the emergency group (71.4%) compared to the elective group (66.7%), similar to the gender distribution described by Lee JY et al., where male predominance was noted in abdominal surgeries due to higher incidence of gastrointestinal emergencies among men. [7] Comorbidities such as diabetes mellitus, hypertension, and obesity were equally distributed between the two groups, with no significant statistical difference. This uniformity reduces the potential confounding impact of comorbidities on postoperative outcomes, as also emphasized and found that matched comorbidity profiles allow for more accurate comparisons of surgical outcomes. [8] The mean duration of surgery was longer in the emergency group (105 ± 25 minutes) compared to the elective group (95 ± 20 minutes), although the difference was not statistically significant ($p = 0.08$). Longer surgical times in emergency settings may reflect intraoperative complexities typically encountered during urgent interventions.

In this study, a significant difference was observed in the contamination status between emergency and

elective laparotomy groups. Clean surgeries were significantly fewer in the emergency group (17.9%) compared to the elective group (50%) ($p = 0.01$). Similarly, the proportion of contaminated or dirty surgeries was significantly higher in emergency cases (53.5%) than in elective cases (20.8%) ($p = 0.008$). Clean-contaminated surgeries were comparable between groups ($p = 0.96$). These findings are consistent with the observations made by Bhangu A et al., who reported that emergency laparotomies often involve contamination due to bowel perforation, peritonitis, or ischemic bowel, resulting in higher surgical site infection risk. [9]

Furthermore, global audits like the one conducted by the GlobalSurg Collaborative highlighted that emergency surgeries are frequently associated with poor intraoperative conditions, contamination, and subsequent increased postoperative complications compared to elective surgeries where preoperative optimization and bowel preparation can be ensured. [10] Thus, the higher contamination rates in emergency settings reinforce the need for targeted infection control practices in these patients.

This study observed a higher incidence of SSI in the emergency laparotomy group (35.7%) compared to the elective group (12.5%), although the difference did not reach statistical significance ($p = 0.2$). Superficial incisional infections were more common in the emergency group (17.9%) than in the elective group (8.3%), and deep incisional infections also showed a higher trend (10.7% vs. 4.2%). Organ/space infections were reported only in the emergency group (7.1%).

These findings are consistent with the results reported by Korol E et al., who found that emergency surgical procedures significantly increase the risk of SSI due to poor patient

optimization and high contamination rates. [11]. Similarly, Owens CD and Stoessel K highlighted that emergency surgeries inherently carry a greater bacterial burden, contributing to elevated infection rates compared to elective operations. [12]

Moreover, Young PY and Khadaroo RG emphasized that the urgency of surgery, coupled with hemodynamic instability and inadequate perioperative antibiotic timing, plays a crucial role in increasing SSI incidence. [13] Supporting these findings, Allegranzi B et al. through a large meta-analysis noted that emergency abdominal surgeries, particularly in resource-limited settings, experience substantially higher SSI rates compared to elective procedures. [14] Thus, the higher burden of SSI in emergency settings emphasizes the need for stringent aseptic practices, timely antibiotic prophylaxis, and postoperative surveillance to minimize infection-related morbidity.

The present study demonstrated that patients undergoing emergency laparotomy had significantly longer hospital stays and greater antibiotic requirements compared to those undergoing elective procedures. The mean hospital stay was significantly higher in the emergency group (12.4 ± 3.2 days) than in the elective group (8.1 ± 2.5 days) ($p = 0.001$). This finding is consistent with the study by Kirkland KB et al., who reported that surgical site infections and procedure urgency are major contributors to prolonged hospitalization. [15] Additionally, 42.9% of emergency patients required changes or extensions in antibiotic therapy compared to 16.7% in elective cases ($p = 0.04$), reflecting the greater burden of infection in emergency settings. This correlates with findings from Urban JA, who highlighted that patients undergoing contaminated or emergency surgeries often require broader or prolonged antibiotic therapy to manage infections effectively. [16] The duration of antibiotic use was also significantly longer in emergency patients (10.2 ± 2.8 days) versus elective patients (7.5 ± 2.2 days) ($p = 0.003$). As shown by de Lissoyoy G et al., increased antibiotic usage directly correlates with higher postoperative morbidity and costs in cases with postoperative infections. [17]

Conclusion: This prospective observational study highlights that patients undergoing emergency laparotomies experience a higher incidence of surgical site infections (SSIs), longer hospital stays, and greater antibiotic requirements compared to elective laparotomy patients. Emergency procedures were associated with significantly higher contamination rates and infection burdens, contributing to increased morbidity. Despite comparable baseline characteristics, the urgency, contamination, and complexity of emergency surgeries negatively impacted postoperative outcomes. These findings emphasize the critical

need for rigorous perioperative infection control measures, early antibiotic intervention, and postoperative monitoring in emergency settings to minimize complications and improve patient recovery and hospital resource utilization.

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