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Clinical Profile, Risk Factors, and Outcomes of Surgical Site Infection After Emergency Laparotomy: A Prospective Observational Study in a Tertiary-Care Hospital

Dr. Kodali Tirumala Prasad[1], Dr. Kodali Akhila[2], Dr. Kodali Alekhy[a3], Dr. R V Durga Prasad[4]

[1]HOD & Chief Consultant- General & Laparoscopic surgery, Robotic Surgery, Tirumala Medicover hospitals PVT LTD, Vizianagaram, Andhara Pradesh India 535001.

[2]IInd year Postgraduate, Department of General Surgery, Kasturba Medical College, Manipal , Karanataka, India.

[3]IInd year Postgraduate, Department of General Medicine, Kasturba Medical College, Manipal , Karanataka, India.

[4]Senior Consultant & HOD, Department of Anesthesiology, Cardiac Anaesthesiologist, Tirumala Medicover Hospital, Vizianagaram, Andhra Pradesh, India 535001.

Correspondence:
Dr. Kodali Tirumala Prasad
HOD & Chief Consultant-General & Laparoscopic Surgery, Robotic Surgery, Tirumala Medicover hospitals PVT LTD, Vizianagaram, Andhara Pradesh India 535001.
Email: drtirumala@gmail.com

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Abstract

Background: Background: Surgical site infection (SSI) remains a frequent complication after emergency laparotomy and contributes to prolonged hospitalization, reintervention, and mortality, especially in contaminated abdominal procedures.
Objectives: To describe the clinical profile, preoperative risk factors, microbiological pattern, and postoperative outcomes of SSI after emergency laparotomy in a tertiary-care hospital. ***Methods***: This prospective observational study was conducted with 100 consecutive adults undergoing emergency laparotomy were enrolled. Demographic data, operative indications, selected preoperative risk factors, SSI occurrence, infection type, wound culture results, duration of hospital stay, reoperation, and mortality were recorded. SSI was classified using standard clinical criteria, and results were summarized descriptively. ***Results***: Patients aged 46-60 years constituted the largest group (32%), and 64% were male. Hollow viscus perforation was the commonest indication for surgery (36%), followed by intestinal obstruction (26%). Smoking (30%), anemia (28%), hypertension (26%), hypoalbuminemia (24%), and diabetes mellitus (22%) were frequent risk factors. SSI developed in 24% of patients; among these, superficial incisional SSI accounted for 62.5%, deep incisional SSI for 25.0%, and organ-space SSI for 12.5%. Escherichia coli was the most frequently isolated organism (37.5%), followed by Staphylococcus aureus (25.0%). Prolonged hospitalization beyond 14 days occurred in 20% of patients overall. Reoperation was required in 6%, and mortality was 5%. ***Conclusion***: SSI after emergency laparotomy was common in this cohort and was predominantly superficial incisional infection. Enteric organisms, particularly Escherichia coli, were prominent. The findings highlight the importance of risk-factor optimization, meticulous perioperative infection-prevention practices, and early wound surveillance to improve surgical outcomes.

Keywords: emergency laparotomy; surgical site infection; abdominal surgery; risk factors; microbiology; outcomes.

INTRODUCTION

Surgical site infection (SSI) remains one of the most important healthcare-associated complications after abdominal surgery and continues to impose a substantial burden on patients, surgeons, and hospitals [1-6]. It affects wound healing, prolongs recovery, increases antibiotic exposure, and raises the likelihood of reoperation, critical care use, and death [2-6]. The problem is particularly relevant in low- and middle-income settings, where emergency surgery frequently involves delayed presentation, peritoneal contamination, anemia, nutritional compromise, and limited physiologic reserve. Even with advances in asepsis, perioperative antibiotics, and standardized care bundles, SSIs continue to account for considerable postoperative morbidity [2-6].

Emergency laparotomy represents a high-risk operative context for SSI because it is commonly performed for perforation, obstruction, peritonitis, ischemia, or trauma, often under urgent conditions that limit preoperative optimization [4,9-14]. In these patients, contamination of the operative field, fluid and electrolyte disturbances, tissue edema, bowel handling, and hemodynamic instability can adversely affect tissue oxygenation and host defense. In addition, open abdominal access itself is associated with a greater wound burden than minimally invasive surgery, and the need for rapid decision-making can constrain compliance with some preoperative measures. Published abdominal surgery cohorts have consistently

identified emergency procedures, wound contamination, smoking, diabetes, anemia, hypoalbuminemia, and delayed or inadequate antibiotic prophylaxis as important contributors to SSI risk [3,8-14].

The microbiological profile of SSI after abdominal surgery also has practical relevance because enteric procedures frequently yield Gram-negative bacilli and mixed flora, while Staphylococcus aureus remains an important pathogen in incisional wound infection [4,9,10,14]. Knowledge of local bacteriological trends can guide empiric antimicrobial choices, improve antibiotic stewardship, and support infection-control planning. At the same time, standardized definitions remain essential for meaningful surveillance. Contemporary CDC and WHO guidance emphasizes consistent SSI classification, timely prophylaxis, perioperative skin preparation, normothermia, glycemic control, and surveillance-based quality improvement as core elements of prevention [2,3,6,8].

Despite this growing body of evidence, local prospective data from emergency laparotomy populations remain valuable because case mix, microbial ecology, comorbidity patterns, and perioperative practice vary across institutions. Hospital-specific data help clinicians understand the magnitude of SSI, identify prevalent risk factors, and evaluate outcome burdens such as prolonged stay, reoperation, and mortality. Such information is particularly relevant in tertiary-care hospitals that manage a large proportion of acute abdominal emergencies and resource-intensive postoperative care.

The objectives of the present study were to describe the clinical profile of patients undergoing emergency laparotomy, determine the frequency and pattern of surgical site infection, document selected preoperative risk factors and wound culture isolates, and assess important postoperative outcomes including length of hospital stay, reoperation, and mortality at Tirmula Medicover Hospital, Vizianagaram, Andhra Pradesh.

METHODOLOGY

Study design and setting. This prospective observational study was conducted in the Department of General Surgery at Tirmula Medicover Hospital, Vizianagaram, Andhra Pradesh, India, over a 6-month period from January 2025 to June 2025. The study was designed to evaluate the clinical profile, selected risk factors, microbiological pattern, and short-term outcomes of surgical site infection after emergency laparotomy.

Study population. Consecutive adult patients aged 18 years and above who underwent emergency laparotomy during the study period were screened for inclusion. Patients undergoing elective abdominal procedures, laparoscopic procedures without conversion to open surgery, and those with pre-existing abdominal wall infection at the intended incision site were excluded. Patients who declined consent or had incomplete core outcome documentation were also excluded. A total sample of 100 eligible patients was included in the final analysis.

Data collection. Baseline demographic details, indication for emergency laparotomy, and selected preoperative clinical risk factors were recorded using a structured proforma. The predefined risk factors included diabetes mellitus, hypertension, smoking, anemia (hemoglobin <10 g/dL), and hypoalbuminemia based on routine preoperative biochemical evaluation. Operative details and postoperative wound status were documented prospectively by the treating surgical team. Patients were monitored during their hospital stay and were also assessed during postoperative follow-up up to 30 days for evidence of SSI in accordance with standard surveillance recommendations [1-3,6].

Definition of outcomes. Surgical site infection was defined and categorized using standard CDC-based criteria into superficial incisional SSI, deep incisional SSI, and organ-space SSI [1,2]. The primary outcome variable was occurrence of SSI following emergency laparotomy. Secondary outcome measures included type of SSI, bacteriological isolate from infected wounds, duration of hospital stay, reoperation due to complications, and in-hospital mortality. Length of hospital stay was grouped as <=7 days, 8-14 days, and >14 days.

Microbiological assessment. In patients with clinically suspected SSI, wound discharge or pus samples were collected under aseptic precautions and sent to the microbiology laboratory for culture and organism identification using standard hospital protocols. The microbiological profile was recorded to characterize the predominant pathogens associated with postoperative wound infection in this cohort. These findings were interpreted in the context of abdominal surgery literature, where enteric Gram-negative organisms and Staphylococcus aureus commonly predominate [4,9,10,14].

Statistical analysis. Data were entered into a spreadsheet and analyzed using descriptive statistical methods. Categorical variables were summarized as frequencies and percentages. Because the present dataset was structured primarily around categorical clinical variables and outcomes, the results are presented in tabular and narrative form to highlight the observed distribution of SSI, risk factors, organisms, and postoperative outcomes.

Ethical considerations. The study was conducted in accordance with institutional ethical principles for clinical observational research. Written informed consent was obtained from eligible participants or their legally authorized attendants before enrollment. Confidentiality of patient information was maintained throughout data collection, analysis, and reporting.

RESULTS

A total of 100 patients who underwent emergency laparotomy were included in the present prospective observational study. The results describe the demographic characteristics, clinical indications, selected preoperative risk factors, microbiological profile, and postoperative outcomes related to surgical site infection.

The demographic profile of the study population is presented in Table 1. Patients aged 46-60 years constituted the largest age group (32%), followed by 31-45 years (28%). Males accounted for 64% of the cohort, indicating a clear male predominance among patients undergoing emergency laparotomy.

Table 1. Demographic characteristics of the study population (N = 100)

Variable	Category	n	%
Age group (years)	18-30	18	18.0
	31-45	28	28.0
	46-60	32	32.0
	>60	22	22.0
Sex	Male	64	64.0
	Female	36	36.0
	Female	36	36.0

The major clinical indications for emergency laparotomy are shown in Table 2. Hollow viscus perforation was the most common indication (36%), followed by intestinal obstruction (26%). Acute appendicitis with complications, abdominal trauma, and peritonitis due to other causes each contributed a smaller but clinically relevant share of cases.

Table 2. Clinical indications for emergency laparotomy (N = 100)

Indication	n	%
Hollow viscus perforation	36	36.0
Intestinal obstruction	26	26.0
Acute appendicitis with complications	14	14.0
Abdominal trauma	12	12.0
Peritonitis due to other causes	12	12.0

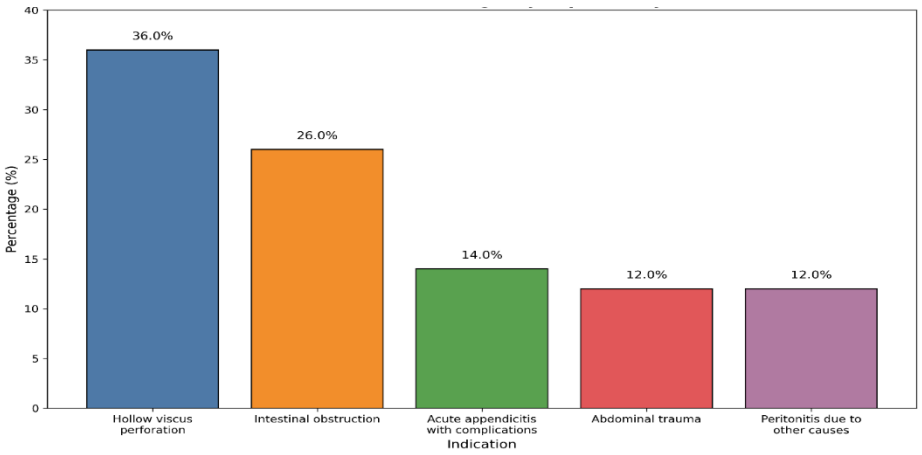

Figure 1: Clinical Indicators for Emergency Laprotomy

Selected preoperative risk factors identified in the cohort are summarized in Table 3. Smoking was the most frequent risk factor (30%), followed by anemia (28%), hypertension (26%), hypoalbuminemia (24%), and diabetes mellitus (22%). These factors were common among patients admitted for emergency abdominal surgery and were considered relevant to postoperative wound healing and infection risk.

Table 3. Preoperative risk factors among study participants (N = 100)

Risk factor	n	%
Diabetes mellitus	22	22.0
Hypertension	26	26.0
Smoking	30	30.0
Anemia (Hb <10 g/dL)	28	28.0
Hypoalbuminemia	24	24.0

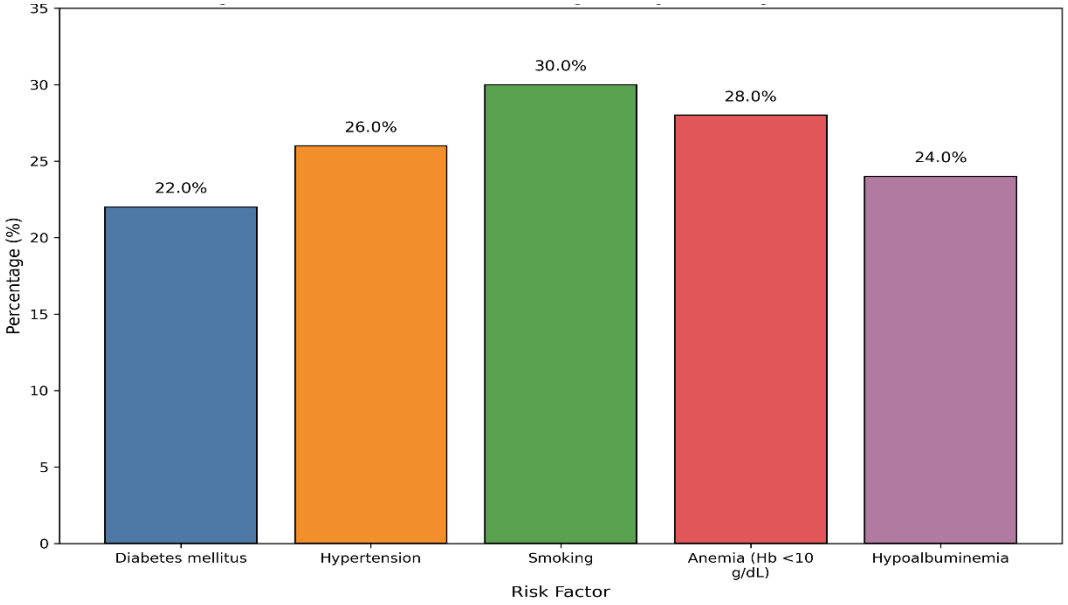

Figure 2: Preoperative risk factors among study participants

The overall incidence of surgical site infection after emergency laparotomy is shown in Table 4. SSI developed in 24 patients, yielding an incidence of 24.0%, while 76 patients had no evidence of SSI during the study period.

Table 4. Incidence of surgical site infection after emergency laparotomy (N = 100)

SSI status	n	%
SSI present	24	24.0
No SSI	76	76.0

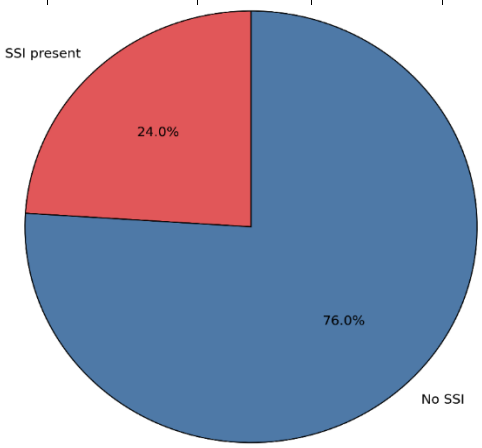

Figure 3: Incidence of surgical site infection after emergency laparotomy

Among patients who developed SSI, superficial incisional infection was the predominant category, as detailed in Table 5. Superficial incisional SSI accounted for 62.5% of infected cases, whereas deep incisional SSI and organ-space SSI accounted for 25.0% and 12.5%, respectively.

Table 5. Type of surgical site infection among affected patients (n = 24)

Type of SSI	n	%
Superficial incisional SSI	15	62.5
Deep incisional SSI	6	25.0
Organ-space SSI	3	12.5

The microbiological profile of infected wounds is presented in Table 6. Escherichia coli was the most frequently isolated organism (37.5%), followed by Staphylococcus aureus (25.0%), Klebsiella species (20.8%), and Pseudomonas aeruginosa (12.5%). This pattern indicates a predominance of enteric Gram-negative organisms in postoperative wound infections following emergency laparotomy.

Table 6. Microbiological profile of surgical site infections (n = 24)

Organism isolated	n	%
Escherichia coli	9	37.5
Staphylococcus aureus	6	25.0
Klebsiella species	5	20.8
Pseudomonas aeruginosa	3	12.5
Others	1	4.2

Postoperative outcomes are summarized in Table 7. Overall, 44% of patients had a hospital stay of 7 days or less, whereas 20% remained hospitalized for more than 14 days. Reoperation due to complications was required in 6% of patients, and the overall mortality rate was 5%. Patients with SSI contributed disproportionately to prolonged hospitalization and adverse postoperative course.

.Table 7. Postoperative outcomes (N = 100)

Outcome variable	Category	n	%
Length of hospital stay	<=7 days	44	44.0
	8-14 days	36	36.0
	>14 days	20	20.0
Reoperation due to complications	Yes	6	6.0
	No	94	94.0
Mortality	Yes	5	5.0
	No	95	95.0

DISCUSSION

The present prospective observational study found that surgical site infection developed in 24% of patients undergoing emergency laparotomy. This confirms that SSI remains a major postoperative problem in open abdominal emergency surgery. The observed burden is broadly consistent with abdominal surgery literature, where SSI rates remain substantial and are often higher in emergency and contaminated procedures than in elective operations [9-14]. Our findings therefore reinforce the view that emergency laparotomy is a distinctly vulnerable setting for postoperative wound complications.

The demographic pattern showed male predominance and the largest contribution from patients aged 46-60 years. This likely reflects the profile of acute abdominal surgical admissions in tertiary-care hospitals, where perforation, obstruction, and peritonitis frequently occur in middle-aged and older adults with coexisting illness. Hollow viscus perforation was the commonest indication for surgery, followed by intestinal obstruction. This distribution is clinically important because perforation-related laparotomy often involves heavy bacterial contamination, inflammatory tissue edema, and urgent source control, all of which can increase wound infection risk. Similar concerns have been emphasized in abdominal surgery studies and prevention guidelines [2-6,9,10,13,14].

Among the predefined risk factors, smoking, anemia, hypertension, hypoalbuminemia, and diabetes mellitus were common. Although the present results are descriptive, these factors are biologically plausible contributors to SSI. Smoking impairs tissue perfusion, anemia reduces oxygen delivery to healing tissue, diabetes alters host defense and glycemic stability, and hypoalbuminemia reflects poor nutritional reserve and impaired wound repair [3,5,6,11,14]. Previous studies in abdominal surgery and emergency laparotomy have also identified smoking, anemia, nutritional compromise, and medical comorbidity as important determinants of postoperative infection [10-14]. These observations support rapid preoperative risk recognition and perioperative optimization whenever feasible, even in urgent settings.

Superficial incisional SSI was the predominant infection type, followed by deep incisional and organ-space infection. This pattern aligns with cohort studies in which superficial wound infection accounts for the largest share of postoperative SSI after abdominal surgery [9,10,13,14]. The microbiological profile was dominated by Escherichia coli, with Staphylococcus aureus and Klebsiella species also contributing substantially. Such findings are expected in laparotomy for acute abdominal pathology because the incision is exposed to both endogenous enteric flora and skin flora [4,9,10,14]. These results underscore the importance of timely antibiotic prophylaxis, appropriate empiric coverage, and careful review of local microbiological trends [3,6,8].

Outcome data also demonstrate the clinical impact of SSI. A notable proportion of patients had hospitalization extending beyond 14 days, and reoperation and mortality were observed in 6% and 5% of the cohort, respectively. Earlier work has shown that SSI prolongs hospital stay and increases the likelihood of additional procedures and adverse postoperative events [5,9,13]. Our findings point in the same direction and highlight that SSI after emergency laparotomy is not merely a wound problem but a broader marker of postoperative burden. Strengthening adherence to CDC- and WHO-aligned prevention measures, surveillance, antibiotic timing, and early wound evaluation remains essential for reducing SSI-related morbidity in tertiary-care surgical practice [2,3,6,8].

Limitations

This was a single-center study with a sample size of 100, which restricts broader generalizability. Several perioperative variables such as wound class, ASA grade, operative duration, drain use, and exact antibiotic timing were not analyzed in the presented dataset. Culture sensitivity patterns were described only for infected wounds, and post-discharge surveillance relied on scheduled follow-up, which can undercapture late superficial infections.

CONCLUSION

Surgical site infection represented a substantial postoperative burden after emergency laparotomy in this tertiary-care cohort. One in four patients developed SSI, with superficial incisional infection forming the largest subgroup. Hollow viscus perforation was the leading indication for surgery, and smoking, anemia, hypertension, hypoalbuminemia, and diabetes were common accompanying risk factors. Escherichia coli was the predominant isolate, reflecting the enteric contamination profile of emergency abdominal surgery. The associated pattern of prolonged hospitalization, reoperation, and mortality highlights the need for vigilant perioperative infection-prevention practices, early wound surveillance, timely antimicrobial therapy, and focused optimization of modifiable risk factors. Institution-level surveillance, standardized wound care, and adherence to evidence-based perioperative protocols remain central to improving surgical outcomes after emergency laparotomy.

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