

Original Research Article

FACTORS ASSOCIATED WITH POSTOPERATIVE COMPLICATIONS FOLLOWING EMERGENCY LAPAROTOMY: A PROSPECTIVE COHORT STUDY

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ABSTRACT

Background: Emergency laparotomy is associated with considerable postoperative morbidity because patients frequently present with sepsis, anemia, comorbidities, and physiological instability. Early identification of factors associated with complications may facilitate timely intervention and closer postoperative monitoring. The aim is to identify clinical, laboratory, and operative factors associated with postoperative complications following emergency laparotomy.

Materials and Methods: A prospective cohort study was conducted among 120 patients undergoing emergency laparotomy in the Department of General Surgery, Government Medical College, Korba, Chhattisgarh, over 8 months. Demographic, clinical, laboratory, and operative variables were recorded, and postoperative complications were assessed. Associations were analyzed using appropriate statistical tests.

Results: Postoperative complications occurred in 45 (37.5%) patients. Surgical-site infection was the most frequent complication (20, 16.7%), followed by prolonged ileus (15, 12.5%) and respiratory complications (12, 10.0%). Significant associations were observed between postoperative complications and comorbidity ($p=0.022$), preoperative anemia ($p<0.001$), and preoperative sepsis ($p<0.001$). Age, sex, ASA grade, operative indication, duration, and procedure type were not significant.

Conclusion: Preoperative sepsis, anemia, and comorbidities were significantly associated with postoperative complications and should be recognized early to improve perioperative management and outcomes.

Keywords: Emergency laparotomy; Postoperative complications; Sepsis; Anemia; Comorbidity; Risk factors.

INTRODUCTION

Emergency laparotomy is one of the most challenging procedures in general surgery because it is frequently performed in patients with acute intra-abdominal pathology, physiological derangement, sepsis, and limited opportunity for preoperative optimization. Despite advances in surgical and perioperative care, emergency laparotomy continues to be associated with substantial postoperative morbidity and mortality. A scoping systematic review involving more than 157,000 patients reported a pooled 30-day mortality of approximately 13%, with increasing age, higher American Society of Anesthesiologists (ASA) grade, sepsis,

comorbidities, dependency, malignancy, and abnormal renal, hematological, and nutritional parameters identified as important adverse prognostic factors.^[1]

Postoperative complications following emergency laparotomy are diverse and may include surgical-site infection, intra-abdominal sepsis, wound dehiscence, anastomotic leakage, respiratory complications, acute kidney injury, cardiovascular events, and prolonged ileus. Recent evidence suggests that major complications occur in a substantial proportion of patients undergoing emergency laparotomy, emphasizing the importance of early identification of individuals at increased risk.^[2] Furthermore, prospective multicentre data have demonstrated

postoperative complication rates approaching 40%, highlighting the considerable burden of adverse outcomes in emergency surgical populations.^[3]

Patient-related factors such as advanced age, frailty, comorbid illness, poor nutritional status, and sarcopenia may substantially influence postoperative recovery. Meta-analyses have demonstrated that sarcopenia is associated with increased postoperative complications, mortality, intensive-care utilization, and prolonged hospital stay following emergency laparotomy.^[4,5] In addition, the severity of the underlying disease, preoperative sepsis, physiological instability, operative findings, and intraoperative complications may further increase postoperative risk.

Although several risk-assessment tools have been developed for emergency laparotomy, their performance varies across populations, and contemporary systematic evidence emphasizes the need for appropriate local validation and clinically relevant predictors.^[6]

The present study aims to identify the clinical, laboratory, and operative factors associated with postoperative complications in patients undergoing emergency laparotomy. It also seeks to assess the frequency and pattern of postoperative complications, evaluate the influence of patient-related and perioperative factors on outcomes, and identify patients at higher risk who may benefit from closer monitoring, timely intervention, and improved perioperative management.

MATERIALS AND METHODS

Study design: Prospective cohort study.

Study population: Patients presenting with acute surgical conditions and undergoing emergency laparotomy under the Department of General Surgery.

Sample size: A total of 120 patients undergoing emergency laparotomy were included in the study.

Study duration: The study was conducted over a period of 8 months.

Study setting/location: The study was carried out in the Department of General Surgery, Government Medical College, Korba, Chhattisgarh, India.

Inclusion Criteria

1. Patients aged ≥ 18 years.
2. Patients undergoing emergency laparotomy.
3. Patients operated for an acute intra-abdominal surgical condition.
4. Patients undergoing surgery during the study period.
5. Patients who provided informed consent for participation.

Exclusion Criteria

1. Patients undergoing elective laparotomy.
2. Patients aged < 18 years.
3. Patients who had undergone previous laparotomy during the same hospital admission.
4. Patients with incomplete clinical records.
5. Patients with incomplete postoperative follow-up data.

Statistical Analysis: Data were entered and systematically compiled in Microsoft Excel and subsequently analyzed using SPSS version 27.0 (SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages. Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test, as applicable. For comparison of continuous variables between two independent groups, the independent-samples Student's t-test was used for normally distributed data, while the Mann-Whitney U test was used for non-normally distributed data. A p-value < 0.05 was considered statistically significant.

RESULTS

Table 1: Baseline demographic and clinical characteristics of the study population

Parameter	Category	Number of patients (n)	Percentage (%)
Age group (years)	<40	24	20
	41–50	28	23.3
	51–60	30	25
	61–70	25	20.8
	>70	13	10.8
Sex	Male	70	58.3
	Female	50	41.7
Comorbidity	Present	30	25
	Absent	90	75
Preoperative anemia	Present	30	25
	Absent	90	75
Preoperative sepsis	Present	40	33.3
	Absent	80	66.7
ASA grade	I–II	60	50
	III	50	41.7
	IV	10	8.3
Total		120	100

Table 2: Association between demographic/clinical factors and postoperative complications

Parameter	Category	Complication Present n (%)	No Complication n (%)	p-value
Age group (years)	<40	12 (50.0)	12 (50.0)	0.263
	41–50	15 (53.6)	13 (46.4)	
	51–60	14 (46.7)	16 (53.3)	
	61–70	8 (32.0)	17 (68.0)	
	>70	3 (23.1)	10 (76.9)	
Sex	Male	28 (40.0)	42 (60.0)	0.633
	Female	17 (34.0)	33 (66.0)	
Comorbidity	Present	17 (56.7)	13 (43.3)	0.022
	Absent	28 (31.1)	62 (68.9)	
Preoperative anemia	Present	22 (73.3)	8 (26.7)	<0.001
	Absent	23 (25.6)	67 (74.4)	
Preoperative sepsis	Present	30 (75.0)	10 (25.0)	<0.001
	Absent	15 (18.8)	65 (81.2)	
ASA grade	I–II	20 (33.3)	40 (66.7)	0.683
	III	15 (30.0)	35 (70.0)	
	IV	5 (50.0)	5 (50.0)	

Table 3: Operative characteristics and their association with postoperative complications

Operative parameter	Category	Complication Present n (%)	No Complication n (%)	p-value
Indication for laparotomy	Perforation peritonitis	12 (60.0)	8 (40.0)	0.11
	Intestinal obstruction	15 (50.0)	15 (50.0)	
	Ischemia/strangulation	10 (33.3)	20 (66.7)	
	Traumatic/other acute abdomen	8 (26.7)	22 (73.3)	
	Other intra-abdominal pathology	5 (50.0)	5 (50.0)	
Duration of surgery	<2 hours	10 (50.0)	10 (50.0)	0.511
	2–4 hours	18 (36.0)	32 (64.0)	
	>4 hours	22 (44.0)	28 (56.0)	
Type of procedure	Bowel resection/anastomosis	10 (33.3)	20 (66.7)	0.424
	Stoma/repair procedure	25 (41.7)	35 (58.3)	
	Other procedures	15 (50.0)	15 (50.0)	

Table 4: Frequency and pattern of postoperative complications following emergency laparotomy

Postoperative complication	Number of events (n)	Percentage (%)
Surgical-site infection	20	16.7
Prolonged ileus	15	12.5
Respiratory complications	12	10
Wound dehiscence	10	8.3
Intra-abdominal collection/sepsis	8	6.7
Acute kidney injury	7	5.8
Anastomotic leak	5	4.2
Cardiovascular complications	4	3.3
Re-exploration required	4	3.3
Other complications	3	2.5
Patients with ≥1 complication	45	37.5
Patients without complication	75	62.5
Total study population	120	100

The study included 120 patients undergoing emergency laparotomy. The largest age group was 51–60 years (30, 25.0%), followed by 41–50 years (28, 23.3%), 61–70 years (25, 20.8%), <40 years (24, 20.0%), and >70 years (13, 10.8%). Males constituted 70 (58.3%) patients and females 50 (41.7%). Comorbidities were present in 30 (25.0%) patients, while 90 (75.0%) had no comorbidity. Preoperative anemia and sepsis were observed in 30 (25.0%) and 40 (33.3%) patients, respectively. Regarding ASA grade, 60 (50.0%) were grade I–II, 50 (41.7%) were grade III, and 10 (8.3%) were grade IV.

Overall, 45 (37.5%) patients developed at least one postoperative complication, while 75 (62.5%) had an uncomplicated recovery. Complications occurred in 12 (50.0%) patients aged <40 years, 15 (53.6%) aged 41–50 years, 14 (46.7%) aged 51–60 years, 8 (32.0%) aged 61–70 years, and 3 (23.1%) aged >70 years

(p=0.263). Complications were seen in 28 (40.0%) males and 17 (34.0%) females (p=0.633). Patients with comorbidities had significantly more complications (17/30, 56.7%) than those without comorbidities (28/90, 31.1%; p=0.022). Preoperative anemia was strongly associated with complications (22/30, 73.3% vs. 23/90, 25.6%; p<0.001). Similarly, complications occurred in 30/40 (75.0%) patients with preoperative sepsis compared with 15/80 (18.8%) without sepsis (p<0.001). ASA grade was not significantly associated with complications (p=0.683).

Among the indications for emergency laparotomy, complications occurred in 12 (60.0%) patients with perforation peritonitis, 15 (50.0%) with intestinal obstruction, 10 (33.3%) with ischemia/strangulation, 8 (26.7%) with traumatic/other acute abdominal conditions, and 5 (50.0%) with other intra-abdominal pathologies (p=0.110). Regarding operative duration,

complications occurred in 10 (50.0%) patients whose surgery lasted <2 hours, 18 (36.0%) with 2–4 hours, and 22 (44.0%) with >4 hours ($p=0.511$). By procedure type, complications were observed in 10 (33.3%) patients undergoing bowel resection/anastomosis, 25 (41.7%) undergoing stoma/repair procedures, and 15 (50.0%) undergoing other procedures ($p=0.424$). None of these operative variables demonstrated a statistically significant association.

Surgical-site infection was the most frequent postoperative complication, affecting 20 (16.7%) patients, followed by prolonged ileus in 15 (12.5%), respiratory complications in 12 (10.0%), wound dehiscence in 10 (8.3%), intra-abdominal collection/sepsis in 8 (6.7%), acute kidney injury in 7 (5.8%), anastomotic leak in 5 (4.2%), and cardiovascular complications and re-exploration in 4 (3.3%) each. Other complications occurred in 3 (2.5%) patients. Overall, 45 (37.5%) patients experienced at least one postoperative complication, whereas 75 (62.5%) had no complications.

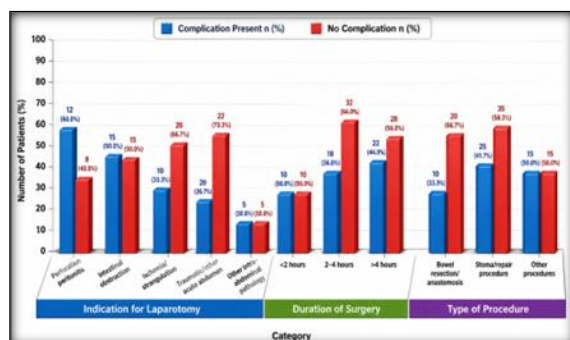


Figure 1: Operative Factors and Postoperative Complications

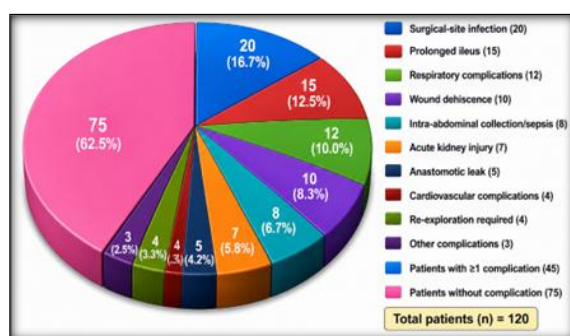


Figure 2: Distribution of Postoperative Complications Following Emergency Laparotomy

DISCUSSION

The present prospective cohort study found that 45 of 120 patients (37.5%) developed at least one postoperative complication following emergency laparotomy. This substantial morbidity is consistent with the recognized high-risk nature of emergency abdominal surgery. Ylimartimo et al. reported complications in 58% of 674 emergency laparotomy patients, with both medical and operation-related complications contributing substantially to morbidity

[7]. Similarly, Ahmed et al. demonstrated that emergency laparotomy carries considerable postoperative morbidity, with higher ASA status and unplanned postoperative intensive-care escalation associated with greater complication burden.^[8] The somewhat lower rate in the present study may reflect the smaller sample size and differences in case mix and definitions of complications.

In the present study, the largest proportion of patients was aged 51–60 years (30, 25.0%), while 13 (10.8%) were older than 70 years. Age was not significantly associated with postoperative complications ($p=0.263$). This finding differs from the study by Ylimartimo et al., in which increasing age was associated particularly with medical postoperative complications.^[7] Likewise, higher age has been incorporated into several emergency laparotomy risk-prediction models. However, the absence of statistical significance in our cohort may be explained by the relatively small number of elderly patients and the limited statistical power of the study.

Male patients constituted 70 (58.3%) of the cohort compared with 50 (41.7%) females. Complications occurred in 28 (40.0%) males and 17 (34.0%) females, with no significant association ($p=0.633$). This is broadly comparable with the multicentre prospective study by Hailu et al., where males also predominated among emergency laparotomy patients, although sex itself was not consistently identified as an important determinant of poor outcome.^[9] These findings suggest that sex is less important than physiological condition and disease severity in determining postoperative morbidity.

A significant association was observed between comorbidity and postoperative complications. Complications occurred in 17 (56.7%) patients with comorbidities compared with 28 (31.1%) without comorbidities ($p=0.022$). This finding agrees with Hailu et al., who found comorbidity to be a strong predictor of postoperative complications, with patients having coexisting disease showing markedly greater odds of adverse outcomes.^[9] The result also supports the broader evidence that chronic disease reduces physiological reserve and may impair recovery after emergency surgery.

Preoperative anemia was significantly associated with postoperative complications. In the present study, 22 of 30 anemic patients (73.3%) developed complications compared with 23 of 90 (25.6%) non-anemic patients ($p<0.001$). This strong association is supported by Boyd-Carson et al., who analyzed more than 86,000 emergency laparotomy patients and found that preoperative anemia was associated with increased mortality, prolonged hospital stay, and greater need for return to theatre.^[10] Anemia may compromise tissue oxygen delivery and therefore contribute to impaired wound healing and postoperative organ dysfunction. Indian data have similarly identified anemia as a significant risk factor for surgical-site infection after emergency laparotomy.^[11]

The strongest association in the present study was observed with preoperative sepsis. Complications occurred in 30 (75.0%) of the 40 patients presenting with sepsis, compared with only 15 (18.8%) of 80 patients without sepsis ($p < 0.001$). This finding is clinically plausible because sepsis is accompanied by systemic inflammation, circulatory dysfunction and varying degrees of organ impairment. Rai et al. reported that shock, renal dysfunction and coagulopathy were associated with adverse outcomes after emergency laparotomy for perforation peritonitis.^[12] These observations reinforce the importance of early recognition, aggressive resuscitation and timely source control in septic emergency surgical patients.

The present study did not demonstrate significant associations between ASA grade ($p = 0.683$), operative indication ($p = 0.110$), duration of surgery ($p = 0.511$), or type of procedure ($p = 0.424$) and postoperative complications. This differs somewhat from Ahmed et al., who identified ASA status as independently associated with postoperative morbidity,^[8] and from studies linking longer operative duration and higher ASA classification with poorer outcomes.^[13] The discrepancy may reflect the relatively small sample of 120 patients and the distribution of patients across operative subgroups.

Regarding the pattern of complications, surgical-site infection was the most frequent complication (20, 16.7%), followed by prolonged ileus (15, 12.5%), respiratory complications (12, 10.0%), wound dehiscence (10, 8.3%), intra-abdominal collection/sepsis (8, 6.7%) and acute kidney injury (7, 5.8%). Garale et al., in a prospective Indian study, reported an SSI incidence of 17.12% following emergency laparotomy and identified anemia, hypoproteinemia, overweight and tobacco use as significant risk factors.^[11] Ylimartimo et al. also found infections to be the leading operation-related complications, while respiratory dysfunction and pneumonia were prominent medical complications.^[7] An Indian tertiary-centre study evaluating the Emergency Surgery Score likewise found SSI, lower respiratory tract infection, wound dehiscence, sepsis and AKI among important postoperative complications.^[14]

The findings also support the growing importance of preoperative risk stratification in emergency laparotomy. Hewitt et al., after reviewing 82 studies involving 17 risk-assessment tools, emphasized the potential value of structured preoperative assessment for identifying patients at increased risk and guiding perioperative decision-making.^[15] Kokkinakis et al. similarly developed and internally validated a clinical prediction model for serious complications following emergency laparotomy, demonstrating the feasibility of identifying high-risk patients before adverse outcomes occur.^[16] Overall, the present study suggests that preoperative sepsis, anemia and comorbidity are significantly associated with postoperative complications, while demographic and

operative variables showed weaker associations. Early identification and optimization of these high-risk patients may therefore help improve postoperative surveillance and outcomes.

CONCLUSION

This prospective cohort study demonstrated that postoperative complications remain a substantial concern among patients undergoing emergency laparotomy. Surgical-site infection was the most common complication, followed by prolonged ileus and respiratory complications. Preoperative sepsis, anemia, and comorbidities were significantly associated with postoperative morbidity, whereas demographic and several operative factors showed no significant association. These findings highlight the importance of early identification of high-risk patients, prompt resuscitation, correction of reversible abnormalities, appropriate antimicrobial management, and careful postoperative monitoring. A structured perioperative approach may help reduce complications, facilitate timely intervention, improve recovery, and ultimately enhance outcomes in patients undergoing emergency laparotomy.

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