Journal of Surgical Radiology

Site: https://journalsurgrad.com/

ISSN Print 2156-213X| ISSN Online: 2156-4566 Volume: 04 Issue: 03 Open Access

Research Article

Predictors of Postoperative Morbidity and Mortality in Patients Undergoing Emergency Laparotomy: A Prospective Observational Study

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Article History
Received: 10-06-2025
Revised: 25-06-2025
Accepted: 10-07-2025
Published: 16-07-2025

Citations:
Chitimalla, R., Malsur, B., & Surender, D. (n.d.). Predictors of postoperative morbidity and mortality in patients undergoing emergency laparotomy: A prospective observational study. J Surg Radiol, V4 (3) 26-31

Abstract: ***Introduction:*** Emergency laparotomy is performed for life-threatening abdominal conditions and is accompanied by substantial postoperative complications and death. Early recognition of high-risk patients is essential for perioperative planning and resource allocation.**Objectives:** To determine postoperative morbidity and mortality and identify their clinical, biochemical, and operative predictors among patients undergoing emergency laparotomy.**Methods:** This prospective observational study included 80 adults who underwent emergency laparotomy at Government Medical College and General Hospital, Bhadradri Kothagudem, Telangana, India, from October 2024 to March 2025. Demographic characteristics, comorbidities, physiological status, laboratory findings, operative variables, and postoperative outcomes were recorded. Morbidity was graded using the Clavien-Dindo classification. Univariable analysis and multivariable logistic regression were used to identify independent predictors.**Results:** The mean age was 48.7 ± 16.3 years, and 52 (65.0%) participants were male. Perforation peritonitis was the leading indication (40.0%). Postoperative morbidity occurred in 31 (38.8%) patients; 18 (22.5%) developed major complications. Surgical-site infection was the most frequent complication (17.5%). Nine patients died, producing an in-hospital mortality rate of 11.3%. Independent predictors of morbidity were ASA grade III-IV, presentation after 24 hours, serum albumin below 3.0 g/dL, serum lactate of at least 2 mmol/L, and operative duration exceeding 120 minutes. Preoperative haemodynamic shock, serum lactate of at least 4 mmol/L, and ASA grade IV independently predicted mortality.**Conclusion:** Emergency laparotomy carried a high burden of postoperative morbidity and mortality. Advanced physiological risk, delayed presentation, hypoalbuminaemia, hyperlactataemia, prolonged surgery, and haemodynamic instability identified patients requiring rapid resuscitation, timely surgery, and intensified postoperative surveillance.

Keywords: Emergency laparotomy; postoperative morbidity; mortality; risk factors; serum lactate; hypoalbuminaemia; haemodynamic shock.

INTRODUCTION

Emergency laparotomy remains one of the most demanding procedures in acute surgical care. It is commonly undertaken for perforation peritonitis, intestinal obstruction, bowel ischaemia, abdominal trauma, and other rapidly progressive intra-abdominal conditions. Unlike planned operations, emergency procedures allow limited time for physiological optimization and are frequently performed in patients with sepsis, shock, organ dysfunction, malnutrition, or substantial comorbidity. Emergency general surgery consequently carries a disproportionate burden of postoperative complications, unplanned critical-care use, prolonged hospitalization, and death when compared with elective surgery [1].

The reported outcome after emergency abdominal surgery varies across clinical settings. Large cohort studies have documented considerable morbidity and mortality, reflecting differences in age distribution, disease severity, referral pathways, critical-care access, and perioperative practice [2]. The National Emergency Laparotomy Audit risk model demonstrated that age, physiological derangement, biochemical abnormalities, operative urgency, suspected peritoneal contamination, and American Society of Anesthesiologists (ASA) physical status contribute to short-term mortality risk [3]. Organisational features also influence survival. Consultant involvement, structured perioperative pathways, appropriate postoperative critical-care admission, and coordinated multidisciplinary management have been associated with improved outcomes [4].

Postoperative risk is produced by an interaction between patient vulnerability and the acute surgical insult. Advanced age, higher ASA grade, delayed presentation, haemodynamic instability, anaemia, hypoalbuminaemia,

renal dysfunction, elevated lactate, diffuse contamination, bowel resection, prolonged surgery, and transfusion have all been examined as potential prognostic factors. Several of these variables are available before or during surgery and can support early escalation of care. Elevated serum lactate reflects impaired tissue perfusion and disturbed oxygen utilization, whereas low serum albumin indicates reduced physiological reserve, inflammation, and poor nutritional status. Both abnormalities can accompany severe intra-abdominal sepsis and influence recovery.

Care bundles for emergency laparotomy have emphasized early assessment, antimicrobial therapy, prompt operative source control, haemodynamic optimization, senior decision-making, and planned critical-care support [5]. However, the EPOCH trial showed that implementing a complex quality-improvement pathway across many hospitals did not automatically improve survival when changes in clinical processes were modest, highlighting the importance of local resources and effective implementation [6]. Contemporary ERAS Society guidance similarly supports structured, risk-adapted perioperative care while recognizing that emergency laparotomy populations are heterogeneous [7]. Evidence from Indian public-sector hospitals remains comparatively limited, particularly from developing teaching institutions serving rural and semi-urban populations.

The present study was therefore undertaken to determine the incidence and pattern of postoperative morbidity and in-hospital mortality among adults undergoing emergency laparotomy at a tertiary government hospital. The objectives were to evaluate baseline clinical, biochemical, and operative factors associated with adverse outcomes and to identify independent predictors of postoperative morbidity and mortality.

MATERIALS AND METHODS

Study design and setting: This prospective observational study was conducted in the Department of General Surgery, Government Medical College and General Hospital, Bhadradri Kothagudem, Telangana, India. The hospital provides emergency surgical services to urban, semi-urban, rural, and tribal populations of the surrounding region.

Study period and participants: Consecutive adult patients undergoing emergency laparotomy between October 2024 and March 2025 were screened. Patients aged 18 years or older who required an open emergency abdominal operation for perforation, obstruction, bowel ischaemia or gangrene, abdominal trauma, or another acute intra-abdominal indication were eligible. Patients undergoing elective laparotomy, isolated minor procedures not involving formal abdominal exploration, or surgery with incomplete perioperative records were excluded. Written informed consent was obtained from each participant or an authorized representative.

Sample size: The minimum sample was estimated using the single-proportion formula, $n = Z^2p(1-p)/d^2$. An anticipated postoperative morbidity of 39.2%, based on a previous observational study, 95% confidence level, and 11% absolute precision produced a minimum requirement of approximately 76 patients. Eighty eligible patients were included.

Data collection: A structured case-record form was used to document age, sex, comorbidities, symptom duration, ASA physical status, haemodynamic findings, sepsis, haemoglobin, serum albumin, lactate, creatinine, operative diagnosis, contamination, procedure, operative duration, and transfusion. Presentation after more than 24 hours from symptom onset was classified as delayed. Haemodynamic shock was defined by persistent hypotension with clinical evidence of impaired perfusion requiring active resuscitation. Sepsis was identified using contemporaneous clinical and organ-dysfunction criteria [8].

Outcome assessment: Patients were prospectively followed from admission until discharge or in-hospital death. The primary outcomes were any postoperative morbidity and in-hospital mortality. Complications included surgical-site infection, pulmonary complications, postoperative sepsis, acute kidney injury, anastomotic leakage, wound dehiscence, and cardiovascular events. Severity was graded according to the Clavien-Dindo system [9]; grades III-V were categorized as major morbidity. Intensive-care admission, mechanical ventilation, reoperation, and hospital stay were also recorded.

Statistical analysis: Data were analysed using IBM SPSS Statistics, version 26.0. Continuous variables were summarized as mean ± standard deviation or median with interquartile range according to distribution. Categorical variables were presented as frequency and percentage. Independent-samples t test or Mann-Whitney U test was used for continuous variables. Chi-square test or Fisher exact test was applied to categorical comparisons. Variables with clinical relevance or a univariable p-value below 0.10 were considered for multivariable logistic regression. Adjusted odds ratios with 95% confidence intervals were calculated. A parsimonious mortality model was used because only nine deaths occurred. A two-sided p-value below 0.05 was considered statistically significant.

Ethical considerations: Necessary Permissions were obtained before starting the study. Confidentiality was maintained throughout the study.
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RESULTS

A total of 86 patients undergoing emergency laparotomy were assessed for eligibility. Four patients did not meet the eligibility criteria, and two declined participation. The remaining 80 patients were included in the final analysis. Complete perioperative and outcome data were available for all included participants.

The mean age of the participants was 48.7 ± 16.3 years, and 52 (65.0%) were males. Twenty-eight (35.0%) patients were older than 60 years, and 31 (38.8%) had at least one comorbidity. Perforation peritonitis was the most common indication for emergency laparotomy, followed by intestinal obstruction. Preoperative sepsis was present in 24 (30.0%) patients, while 14 (17.5%) presented with haemodynamic shock. Delayed presentation beyond 24 hours occurred in 30 (37.5%) patients. The baseline clinical, biochemical, and operative characteristics are summarized in Table 1.

Table 1. Baseline clinical and operative characteristics of the participants (N = 80)

Characteristic	Frequency/Mean	Percentage
Age, years, mean ± SD	48.7 ± 16.3	—
Age >60 years	28	35.0
Male sex	52	65.0
At least one comorbidity	31	38.8
Hypertension	21	26.3
Diabetes mellitus	17	21.3
ASA grade I-II	44	55.0
ASA grade III-IV	36	45.0
Presentation after >24 hours	30	37.5
Preoperative sepsis	24	30.0
Haemodynamic shock	14	17.5
Haemoglobin <10 g/dL	29	36.3
Serum albumin <3.0 g/dL	35	43.8
Serum lactate ≥2 mmol/L	37	46.3
Serum creatinine >1.5 mg/dL	11	13.8
Perforation peritonitis	32	40.0
Intestinal obstruction	24	30.0
Bowel ischaemia or gangrene	10	12.5
Abdominal trauma	8	10.0
Other indications	6	7.5
Gross peritoneal contamination	31	38.8
Operative duration >120 minutes	36	45.0
Perioperative blood transfusion	23	28.8

ASA: American Society of Anesthesiologists; SD: standard deviation.

Postoperative morbidity occurred in 31 (38.8%) patients. Surgical-site infection was the most frequent complication, affecting 14 (17.5%), followed by pulmonary complications in 11 (13.8%), postoperative sepsis in 10 (12.5%), and acute kidney injury in 8 (10.0%). Major complications, defined as Clavien-Dindo grade III-V, were observed in 18 (22.5%) patients. Twenty-four (30.0%) required postoperative intensive-care admission, and 17 (21.3%) required mechanical ventilation. Nine patients died during hospitalization, yielding an in-hospital mortality rate of 11.3%. The median hospital stay was 10 days (IQR, 7-16 days) (Table 2).

Table 2. Postoperative morbidity and mortality outcomes

Postoperative outcome	Frequency	Percentage
Any postoperative morbidity	31	38.8
Surgical-site infection	14	17.5
Pulmonary complication	11	13.8
Postoperative sepsis	10	12.5
Acute kidney injury	8	10.0
Anastomotic leakage	5	6.3

Wound dehiscence	4	5.0
Cardiovascular complication	3	3.8
Major complication, Clavien-Dindo grade III-V	18	22.5
Postoperative intensive-care admission	24	30.0
Mechanical ventilation	17	21.3
Reoperation	7	8.8
Postoperative mortality	9	11.3
Hospital stay, days, median (IQR)	10 (7-16)	—

IQR: interquartile range. Individual patients could experience more than one complication.

Patients who developed postoperative morbidity were older than those without morbidity (56.4 ± 14.2 versus 43.8 ± 15.8 years; p<0.001). ASA grade III-IV, delayed presentation, preoperative sepsis, haemodynamic shock, hypoalbuminaemia, elevated lactate, gross peritoneal contamination, prolonged operative duration, and perioperative transfusion were significantly associated with morbidity. Mortality was significantly associated with older age, higher ASA grade, delayed presentation, sepsis, shock, hypoalbuminaemia, elevated lactate, renal dysfunction, prolonged surgery, and blood transfusion. Gross peritoneal contamination was more frequent among non-survivors but did not reach statistical significance (Table 3).

Table 3. Factors associated with postoperative morbidity and mortality

Predictor	Morbidity present (n=31)	Morbidity absent (n=49)	p-value	Non-survivors (n=9)	Survivors (n=71)	p-value
Age, years, mean ± SD	56.4 ± 14.2	43.8 ± 15.8	<0.001	63.2 ± 10.7	46.9 ± 15.7	0.003
Age >60 years	18 (58.1)	10 (20.4)	0.001	7 (77.8)	21 (29.6)	0.007
ASA grade III-IV	24 (77.4)	12 (24.5)	<0.001	8 (88.9)	28 (39.4)	0.009
Presentation after >24 hours	19 (61.3)	11 (22.4)	0.001	7 (77.8)	23 (32.4)	0.012
Preoperative sepsis	16 (51.6)	8 (16.3)	0.001	7 (77.8)	17 (23.9)	0.002
Haemodynamic shock	10 (32.3)	4 (8.2)	0.013	7 (77.8)	7 (9.9)	<0.001
Serum albumin <3.0 g/dL	22 (71.0)	13 (26.5)	<0.001	8 (88.9)	27 (38.0)	0.009
Serum lactate ≥2 mmol/L	23 (74.2)	14 (28.6)	<0.001	9 (100.0)	28 (39.4)	<0.001
Serum creatinine >1.5 mg/dL	7 (22.6)	4 (8.2)	0.069	5 (55.6)	6 (8.5)	0.002
Gross peritoneal contamination	20 (64.5)	11 (22.4)	<0.001	6 (66.7)	25 (35.2)	0.070
Operative duration >120 minutes	21 (67.7)	15 (30.6)	0.001	7 (77.8)	29 (40.8)	0.038
Perioperative blood transfusion	15 (48.4)	8 (16.3)	0.005	6 (66.7)	17 (23.9)	0.013

Values are presented as frequency (percentage) unless otherwise specified. ASA: American Society of Anesthesiologists; SD: standard deviation.

On multivariable analysis, ASA grade III-IV, presentation after 24 hours, serum albumin below 3.0 g/dL, serum lactate of at least 2 mmol/L, and operative duration exceeding 120 minutes remained independent predictors of postoperative morbidity. Elevated lactate had the strongest association with morbidity. In the parsimonious mortality model, preoperative haemodynamic shock, serum lactate of at least 4 mmol/L, and ASA grade IV independently predicted in-hospital death (Table 4).

Table 4. Multivariable predictors of postoperative morbidity and mortality

Outcome	Independent predictor	Adjusted odds ratio	95% confidence interval	p-value
Postoperative morbidity	ASA grade III-IV	3.72	1.20-11.50	0.023
	Presentation after >24 hours	3.11	1.08-8.93	0.036
	Serum albumin <3.0 g/dL	3.54	1.19-10.53	0.023
	Serum lactate ≥2 mmol/L	4.21	1.42-12.49	0.010
	Operative duration >120 minutes	2.88	1.01-8.20	0.048
Postoperative mortality	Preoperative haemodynamic shock	6.84	1.31-35.66	0.023

	Serum lactate ≥4 mmol/L	7.92	1.50-41.82	0.015
	ASA grade IV	5.76	1.04-31.85	0.045

ASA: American Society of Anesthesiologists.

Overall, postoperative morbidity and mortality occurred in 38.8% and 11.3% of patients, respectively. Higher ASA grade, delayed presentation, hypoalbuminaemia, elevated lactate, prolonged surgery, and preoperative haemodynamic instability were the principal predictors of adverse outcomes following emergency laparotomy.

DISCUSSION

This prospective study demonstrated a substantial burden of adverse outcomes after emergency laparotomy. Postoperative morbidity affected 38.8% of patients, major Clavien-Dindo complications occurred in 22.5%, and in-hospital mortality was 11.3%. These estimates are consistent with the recognized high-risk nature of emergency abdominal surgery. Tolstrup et al. reported considerable complication and mortality rates in a large cohort of emergency abdominal operations [2], while Ahmed et al. observed 30-day mortality of 11.7% and identified ASA status as an independent determinant of complication burden [10]. The present findings therefore fall within the range reported from both high-resource and resource-constrained systems.

The morbidity rate closely resembles the 39.2% reported by Gebremedhn et al. in a low-resource setting [11]. Surgical-site infection was the most frequent complication in the present cohort, followed by pulmonary complications and postoperative sepsis. This pattern is clinically plausible because contaminated operations, delayed source control, tissue hypoperfusion, prolonged procedures, and emergency wound closure increase infectious risk. The need for postoperative intensive care in 30.0% and mechanical ventilation in 21.3% further reflects the physiological severity of this population.

Higher ASA grade independently predicted morbidity and mortality. ASA status integrates systemic disease and functional reserve and is a core component of emergency laparotomy risk models [3]. Its prognostic importance has also been demonstrated for long-term survival after emergency laparotomy [14]. Delayed presentation independently increased morbidity, supporting evidence that prolonged disease progression permits contamination, sepsis, dehydration, and organ dysfunction to advance before definitive source control. Rai et al. identified delay, hypotension, azotaemia, coagulopathy, and hypoalbuminaemia as adverse

prognostic factors in perforation peritonitis [12]. Zafar et al. similarly showed that operative delay increased mortality among patients with alimentary tract perforation [13].

Hypoalbuminaemia and elevated lactate were important independent predictors. Low albumin reflects inflammation, nutritional depletion, capillary leakage, and reduced physiological resilience. Elevated lactate identifies impaired perfusion and severe metabolic stress; the stronger mortality threshold of at least 4 mmol/L in this study supports its value for recognizing critically ill patients. Preoperative haemodynamic shock produced nearly sevenfold adjusted odds of mortality, emphasizing the need for immediate resuscitation alongside rapid operative source control. Prolonged operative duration independently predicted morbidity, probably representing greater disease complexity, contamination, blood loss, and surgical stress.

The findings support early senior assessment, structured risk stratification, prompt antibiotics, correction of physiological abnormalities, timely surgery, and planned postoperative critical-care surveillance. Care-bundle studies suggest that coordinated pathways can improve outcomes when implemented effectively [5], although the EPOCH trial showed that limited process change reduces the impact of large quality-improvement programmes [6]. Local protocols aligned with current emergency laparotomy guidance [7] should prioritize modifiable delays and rapid recognition of shock, hyperlactataemia, and poor nutritional reserve.

Limitations

This study was conducted at a single institution with a modest sample and only nine deaths, limiting statistical power and producing wide confidence intervals in the mortality model. Follow-up was restricted to the index hospitalization, so complications or deaths occurring after discharge were not captured. Residual confounding from unmeasured disease-specific and organizational variables remains possible. External validation in larger multicentre cohorts is required.

CONCLUSION

Emergency laparotomy was associated with considerable postoperative morbidity and in-hospital mortality in this prospective cohort. More than one-third of patients developed complications, and approximately one in nine died. Higher ASA grade, presentation after 24 hours, hypoalbuminaemia, elevated lactate, and prolonged operative duration independently predicted morbidity. Preoperative haemodynamic shock, lactate of at least 4 mmol/L, and ASA grade IV independently predicted mortality. These findings support rapid physiological assessment, early resuscitation, prompt antimicrobial therapy and source control, correction of modifiable abnormalities, and planned critical-care surveillance for high-risk patients. Routine use of locally adapted emergency laparotomy pathways could strengthen perioperative decision-making, resource allocation, and postoperative monitoring in government teaching hospitals.

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