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EARLY PREDICTORS OF MORBIDITY AND MORTALITY FOLLOWING EMERGENCY ABDOMINAL SURGERY: A PROSPECTIVE COHORT STUDY

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ABSTRACT

Background: Emergency abdominal surgery is associated with substantial postoperative morbidity and mortality. Patients frequently present with sepsis, haemodynamic instability, advanced intra-abdominal pathology, and organ dysfunction. Early identification of patients at increased risk may facilitate timely resuscitation, appropriate surgical management, and postoperative critical care. This study evaluated early clinical, laboratory, and perioperative predictors of morbidity and mortality following emergency abdominal surgery.

Materials and Methods: A prospective observational cohort study was conducted in the Department of General Surgery, Dr Ulhas Patil Medical college, Jalgaon, Maharashtra, India, over a period of 2 years. A total of 30 consecutive adult patients undergoing emergency abdominal surgery were included. Demographic characteristics, duration of symptoms, comorbidities, haemodynamic parameters, preoperative sepsis and shock, and laboratory investigations were recorded. Intraoperative variables including operative diagnosis, peritoneal contamination, bowel resection, operative duration, and intraoperative hypotension were documented. Patients were followed until hospital discharge or death for postoperative complications, ICU admission, mechanical ventilation, reoperation, length of hospital stay, and in-hospital mortality. Associations between potential predictors and postoperative outcomes were assessed using appropriate statistical tests, with $p<0.05$ considered statistically significant.

Results: Of the 30 patients, 20 (66.7%) were male and 10 (33.3%) were female. Postoperative morbidity occurred in 14 (46.7%) patients, while 5 (16.7%) patients died during hospitalisation. Tachycardia, hypotension, preoperative sepsis, total leukocyte count >15,000/mm³, serum creatinine >1.5 mg/dL, and serum lactate >2 mmol/L were significantly associated with postoperative morbidity. Generalised peritonitis, bowel resection, operative duration >2 hours, and intraoperative hypotension were also significantly associated with morbidity. Preoperative shock was strongly associated with mortality ($p<0.001$). Preoperative sepsis ($p=0.045$), tachycardia ($p=0.041$), elevated serum lactate ($p=0.048$), and intraoperative hypotension ($p=0.030$) were significantly associated with mortality. ICU admission was required in 12 (40.0%) patients and mechanical ventilation in 6 (20.0%).

Conclusion: Emergency abdominal surgery carries a substantial risk of postoperative morbidity and mortality. Early markers of physiological deterioration, particularly shock, sepsis, tachycardia, hypotension, renal dysfunction, and elevated serum lactate, may help identify high-risk patients. Prompt resuscitation, timely source control, and appropriate postoperative critical-care monitoring may improve risk stratification and perioperative management. Larger prospective multicentric studies are required to validate these predictors.

Keywords: Emergency abdominal surgery; postoperative morbidity; mortality; predictors; sepsis; shock; serum lactate; emergency laparotomy.

INTRODUCTION

Emergency abdominal surgery represents one of the most challenging areas of acute surgical care and is associated with substantially greater morbidity and mortality than elective abdominal surgery. Patients frequently present with advanced disease, physiological derangement, sepsis, haemodynamic instability, and multiple comorbidities, leaving limited opportunity for comprehensive preoperative optimisation.[1-3] The urgency of operative intervention, together with the severity of the underlying pathology, contributes to the high risk of postoperative complications and death.[3]

The spectrum of conditions requiring emergency abdominal surgery is broad and includes perforation peritonitis, intestinal obstruction, acute appendicitis, strangulated hernia, bowel ischemia, intra-abdominal sepsis, and other acute surgical pathologies. The clinical condition at presentation may vary considerably among patients, and postoperative outcomes are influenced by a combination of patient-related, disease-related, and treatment-related factors. Advanced age, pre-existing comorbidities, delayed presentation, haemodynamic instability, organ dysfunction, sepsis, and extensive intra-abdominal contamination have all been associated with adverse outcomes.[4-6]

Early identification of patients at high risk is therefore an important component of emergency surgical management. Several physiological and laboratory parameters can provide valuable information regarding the severity of systemic illness.[7] Hypotension, tachycardia, altered mental status, elevated serum lactate, leukocytosis, renal dysfunction, electrolyte abnormalities, and evidence of tissue hypoperfusion may indicate an increased risk of postoperative complications and mortality.[8] Serum lactate, in particular, has been investigated as a marker of tissue hypoperfusion and disease severity in critically ill surgical patients, although its prognostic value needs to be interpreted in conjunction with the overall clinical picture.[9,10]

Various scoring systems have been developed to quantify physiological derangement and predict outcomes in patients undergoing emergency surgery. The Physiological and Operative Severity Score for the enUmeration of Mortality and morbidity (POSSUM) and its modifications, including Portsmouth-POSSUM, have been extensively evaluated for risk prediction in general surgical patients.[11,12] The National Emergency Laparotomy Audit and other large-scale studies have further demonstrated that emergency laparotomy carries a considerable risk of postoperative complications and mortality, with substantial variation according to patient characteristics, physiological status, operative findings, and postoperative care.[13,14]

In addition to preoperative factors, early postoperative events may provide important prognostic information. The development of postoperative sepsis, respiratory failure, acute kidney injury, prolonged mechanical ventilation, haemodynamic instability, and the requirement for intensive care are associated with prolonged hospitalisation and increased mortality.[15] Early recognition of these factors allows clinicians to intensify monitoring, optimise organ function, initiate appropriate antimicrobial therapy, and consider timely escalation of care.[16,17]

Despite advances in anaesthesia, perioperative resuscitation, antimicrobial therapy, critical care, and surgical techniques, emergency abdominal surgery continues to carry a significant burden of postoperative morbidity and mortality, particularly in resource-constrained settings.[18,19] In India, variations in healthcare access, delayed presentation, referral patterns, and differences in perioperative resources may further influence outcomes. Identifying simple and readily available predictors of adverse outcomes may therefore be particularly useful in routine emergency surgical practice.[19]

The present prospective cohort study was undertaken to evaluate early clinical, physiological, laboratory, and perioperative factors associated with morbidity and mortality following emergency abdominal surgery at **Dr Ulhas Patil Medical college, Jalgaon, Maharashtra, India**. Identification of such predictors may facilitate early risk stratification and help clinicians prioritise monitoring and perioperative interventions for patients at increased risk of adverse outcomes.

Objectives

Primary Objective

1. To identify early clinical, physiological, laboratory, and perioperative predictors of **postoperative morbidity and mortality** following emergency abdominal surgery.

Secondary Objectives

1. To study the demographic and clinical profile of patients undergoing emergency abdominal surgery.
2. To assess the association of preoperative and intraoperative factors with postoperative morbidity and mortality.
3. To evaluate early postoperative complications and their association with adverse outcomes.

MATERIALS AND METHODS

Study Design: This study was conducted as a **prospective observational cohort study**.

Study Setting: The study was conducted in the **Department of General Surgery, Dr Ulhas Patil Medical college, Jalgaon, Maharashtra, India**.

Study Duration: The study was conducted over a period of 2 **years** (November 2022 to November 2024)

Study Population: The study population will consist of adult patients presenting to the hospital with acute abdominal surgical conditions requiring **emergency abdominal surgery** during the study period.

Sample Size: A total of **30 consecutive eligible patients** undergoing emergency abdominal surgery was included in the study.

Given the exploratory nature and limited sample size of the study, the findings will primarily be used to identify clinically relevant associations and potential early predictors of adverse postoperative outcomes.

Sampling Technique

A **consecutive sampling technique** was used. All patients fulfilling the eligibility criteria during the study period was considered for inclusion until the required sample size of 30 patients is achieved.

Inclusion Criteria

Patients fulfilling all of the following criteria was included:

1. Patients aged **≥18 years**.
2. Patients presenting with an acute abdominal surgical condition requiring emergency operative intervention.
3. Patients undergoing emergency abdominal surgery during the study period.
4. Patients willing to participate in the study.
5. Patients providing written informed consent.

Exclusion Criteria

The following patients were excluded:

1. Patients undergoing elective abdominal surgery.
2. Patients managed successfully with conservative treatment without operative intervention.
3. Patients undergoing emergency procedures unrelated to abdominal surgery.
4. Patients with incomplete essential clinical or laboratory records.
5. Patients who refuse to provide informed consent.

Study Protocol

This prospective observational cohort study was conducted in the **Dr Ulhas Patil Medical college, Jalgaon, Maharashtra, India** over a period of 2 years. A total of 30 consecutive adult patients undergoing emergency abdominal surgery was enrolled after obtaining written informed consent. Patients aged ≥18 years presenting with acute abdominal conditions requiring emergency operative intervention was included, while patients undergoing elective abdominal surgery, those managed conservatively without surgery, and those with incomplete essential clinical or laboratory records was excluded. At admission, demographic details, presenting symptoms, duration of illness, provisional diagnosis, comorbidities, vital signs, haemodynamic status, and clinical evidence of sepsis or shock was documented. Routine preoperative investigations including haemoglobin, total leukocyte count, platelet count, serum creatinine, blood urea, serum electrolytes, blood glucose, liver function tests, coagulation profile, and serum lactate where available was recorded. During surgery, the operative diagnosis, type of procedure, surgical approach, presence and extent of peritoneal contamination, perforation, bowel ischemia or gangrene, bowel resection, anastomosis or stoma formation, operative duration, estimated blood loss, blood transfusion, and intraoperative haemodynamic instability was documented. Following surgery, patients were prospectively monitored for early postoperative complications, including surgical-site infection, wound dehiscence, anastomotic leak, intra-abdominal infection, sepsis or septic shock, respiratory complications, acute kidney injury, and need for reoperation. Requirement for ICU admission, mechanical ventilation, vasopressor support, duration of ICU stay, duration of hospitalisation, and in-hospital mortality will also be recorded. Postoperative morbidity was assessed using the Clavien–Dindo classification wherever applicable. Patients were followed until hospital discharge or death, and clinical, laboratory, operative, and postoperative variables were analysed to identify factors associated with postoperative morbidity and mortality. Statistical analysis will include appropriate descriptive and inferential tests, with a p-value <0.05 considered statistically significant.

Follow-up

Patients were followed from the time of admission through the perioperative period until discharge or death. Postoperative complications, requirement for critical care, re-intervention, duration of hospitalisation, and mortality documented prospectively.

Statistical Analysis

Data entered into a structured database and analysed using appropriate statistical software. Continuous variables expressed as **mean ± standard deviation** or **median with interquartile range**, depending on the distribution of data. Categorical variables were expressed as **frequencies and percentages**. Associations between categorical variables and postoperative outcomes were assessed using the **Chi-square test or Fisher's exact test**, as appropriate. Continuous variables were compared using the **Student's t-test** for normally distributed data or the **Mann–Whitney U test** for non-normally distributed data. Potential predictors of postoperative morbidity and mortality was assessed using appropriate univariate analysis. Given the relatively small sample size of **30 patients**, multivariable modelling was considered cautiously and only if the number of outcome events permits reliable analysis. A **p-value <0.05** was considered statistically significant.

RESULTS

Table 1: Demographic and Clinical Profile of Study Participants (n=30)

Variable	Category	n (%)
Age (years)	<40	9 (30.0)
	40–59	12 (40.0)
	≥60	9 (30.0)
Sex	Male	20 (66.7)
	Female	10 (33.3)
Duration of symptoms	≤24 hours	11 (36.7)
	25–48 hours	10 (33.3)
	>48 hours	9 (30.0)
Comorbidities	Present	13 (43.3)
	Absent	17 (56.7)
Preoperative sepsis	Present	11 (36.7)
	Absent	19 (63.3)
Preoperative shock	Present	7 (23.3)
	Absent	23 (76.7)

The study included a total of **30 patients** who underwent emergency abdominal surgery. The majority of patients were males (**20, 66.7%**), while females accounted for **10 (33.3%)** patients. Regarding age distribution, 12 (40.0%) patients were aged 40–59 years, while 9 (30.0%) each were aged below 40 years and ≥60 years. Symptoms had been present for ≤24 hours in 11 (36.7%) patients, 25–48 hours in 10 (33.3%), and for >48 hours in 9 (30.0%) patients. Comorbidities were present in 13 (43.3%) patients. Preoperative sepsis was documented in 11 (36.7%) patients, whereas **7 (23.3%) patients presented with preoperative shock**.

Table 2: Preoperative Clinical and Laboratory Parameters and Their Association with Postoperative Morbidity (n=30)

Parameter	Morbidity Present (n=14)	No Morbidity (n=16)	p-value
Age ≥60 years	6 (42.9%)	3 (18.8%)	0.152
Tachycardia (>100/min)	10 (71.4%)	5 (31.3%)	**0.028**
Hypotension (SBP <90 mmHg)	6 (42.9%)	1 (6.3%)	**0.021**
Preoperative sepsis	8 (57.1%)	3 (18.8%)	**0.028**
Hb <10 g/dL	7 (50.0%)	4 (25.0%)	0.159
TLC >15,000/mm³	9 (64.3%)	4 (25.0%)	**0.03**
Serum creatinine >1.5 mg/dL	6 (42.9%)	2 (12.5%)	**0.043**
Serum lactate >2 mmol/L	8/11 (72.7%)	2/10 (20.0%)	**0.024**

Postoperative morbidity occurred in 14 (46.7%) patients. Tachycardia, hypotension, preoperative sepsis, leukocytosis, and elevated serum creatinine were significantly associated with postoperative morbidity. Tachycardia (>100/min) was observed in 10 (71.4%) patients with morbidity compared with 5 (31.3%) without morbidity (p=0.028). Hypotension (SBP <90 mmHg) was present in 6 (42.9%) patients with morbidity compared with only 1 (6.3%) patient without morbidity (p=0.021). Preoperative sepsis was significantly more frequent among patients who developed morbidity (57.1% vs. 18.8%; p=0.028). Similarly, TLC >15,000/mm³ was observed in 64.3% of patients with morbidity compared with 25.0% of those without morbidity (p=0.030). Elevated serum creatinine (>1.5 mg/dL) was also associated with morbidity (42.9% vs. 12.5%; p=0.043). Among the 21 patients in whom serum lactate was available, lactate >2 mmol/L was significantly more common among patients with morbidity (72.7% vs. 20.0%; p=0.024). Age ≥60 years and haemoglobin <10 g/dL did not demonstrate statistically significant associations with postoperative morbidity.

Table 3: Intraoperative Findings and Their Association with Postoperative Morbidity (n=30)

Intraoperative factor	Morbidity Present (n=14)	No Morbidity (n=16)	p-value
Generalised peritonitis	9 (64.3%)	4 (25.0%)	**0.03**
Bowel perforation	8 (57.1%)	4 (25.0%)	0.078
Bowel ischemia/gangrene	5 (35.7%)	2 (12.5%)	0.125
Bowel resection	9 (64.3%)	4 (25.0%)	**0.03**
Stoma formation	6 (42.9%)	2 (12.5%)	**0.071**
Operative duration >2 hours	10 (71.4%)	5 (31.3%)	**0.028**
Intraoperative hypotension	7 (50.0%)	2 (12.5%)	**0.019**
Blood transfusion required	6 (42.9%)	3 (18.8%)	0.135

Several intraoperative factors were associated with an increased frequency of postoperative morbidity. Generalised peritonitis was present in **9 (64.3%)** patients who developed morbidity compared with 4 (25.0%) patients without morbidity (**p=0.030**). Bowel resection was also significantly more frequent among patients with morbidity (**64.3% vs. 25.0%; p=0.030**). An operative duration exceeding 2 hours

was observed in 10 (71.4%) patients with morbidity compared with 5 (31.3%) patients without morbidity (**p=0.028**). Intraoperative hypotension demonstrated a significant association with postoperative morbidity, occurring in 7 (50.0%) patients with morbidity compared with 2 (12.5%) without morbidity (**p=0.019**). Bowel perforation, bowel ischemia/gangrene, stoma formation, and requirement for blood transfusion showed higher frequencies among patients with morbidity, although these associations did not reach statistical significance.

Table 4: Postoperative Complications Among Study Participants (n=30)

Postoperative complication	n (%)
Any postoperative morbidity	14 (46.7)
Surgical-site infection	6 (20.0)
Postoperative sepsis	5 (16.7)
Acute kidney injury	4 (13.3)
Respiratory complications	4 (13.3)
Wound dehiscence	3 (10.0)
Intra-abdominal collection	3 (10.0)
Anastomotic leak	2 (6.7)
Reoperation	3 (10.0)
Mechanical ventilation	6 (20.0)
ICU admission	12 (40.0)

Among the 30 patients, 14 (46.7%) developed at least one postoperative complication. Surgical-site infection was the most frequently observed complication, occurring in 6 (20.0%) patients, followed by postoperative sepsis in 5 (16.7%). Acute kidney injury and respiratory complications were each observed in 4 (13.3%) patients. Wound dehiscence and intra-abdominal collections occurred in 3 (10.0%) patients each, while anastomotic leak was documented in 2 (6.7%) patients. Three patients (10.0%) required reoperation during the postoperative period. ICU admission was required in 12 (40.0%) patients, while 6 (20.0%) patients required mechanical ventilation. As some patients developed more than one complication, the individual complication percentages are not mutually exclusive.

Table 5: Factors Associated with Postoperative Mortality (n=30)

Predictor	Survivors (n=25)	Deaths (n=5)	p-value
Age ≥60 years	6 (24.0%)	3 (60.0%)	0.119
Preoperative shock	3 (12.0%)	4 (80.0%)	**<0.001**
Preoperative sepsis	7 (28.0%)	4 (80.0%)	**0.045**
Tachycardia >100/min	11 (44.0%)	5 (100%)	**0.041**
TLC >15,000/mm³	9 (36.0%)	4 (80.0%)	0.099
Creatinine >1.5 mg/dL	5 (20.0%)	3 (60.0%)	0.082
Lactate >2 mmol/L	6/18 (33.3%)	4/3 (80.0%)	**0.048**
Generalised peritonitis	9 (36.0%)	4 (80.0%)	0.08
Intraoperative hypotension	5 (20.0%)	4 (80.0%)	**0.03**
ICU admission	8 (32.0%)	4 (80.0%)	**0.047**
Mechanical ventilation	3 (12.0%)	3 (60.0%)	**0.032**

There were 5 postoperative deaths (16.7%) among the 30 patients. Preoperative shock was strongly associated with mortality, being present in 4 (80.0%) patients who died compared with 3 (12.0%) survivors (p<0.001). Preoperative sepsis was also more frequent among patients who died (80.0% vs. 28.0%; p=0.045). Tachycardia was present in all patients who died compared with 44.0% of survivors (p=0.041). Elevated serum lactate (>2 mmol/L) was significantly associated with mortality among patients with available lactate measurements (p=0.048). Intraoperative hypotension was observed in 80.0% of patients who died compared with 20.0% of survivors (p=0.030). ICU admission and mechanical ventilation were also significantly more frequent among patients who died (p=0.047 and p=0.032, respectively). Although older age, leukocytosis, elevated creatinine, and generalised peritonitis were more frequent among non-survivors, these associations did not reach statistical significance.

Table 6: Overall Postoperative Outcomes (n=30)

Outcome	Result
Total patients	30
Patients with postoperative morbidity	14 (46.7%)
Patients without morbidity	16 (53.3%)
ICU admission	12 (40.0%)
Mechanical ventilation	6 (20.0%)
Reoperation	3 (10.0%)
In-hospital mortality	5 (16.7%)

Median hospital stay	10 days (IQR 7–16)
Mean ICU stay	5.2 ± 3.1 days

Overall, 14 (46.7%) of the 30 patients developed postoperative morbidity, while 16 (53.3%) had an uncomplicated postoperative course. Twelve patients (40.0%) required ICU admission and 6 (20.0%) required mechanical ventilation. Reoperation was necessary in 3 (10.0%) patients. There were 5 in-hospital deaths, giving an overall postoperative mortality of 16.7%. The median duration of hospital stay was 10 days (IQR 7–16 days), while the mean ICU stay among patients requiring intensive care was 5.2 ± 3.1 days. Overall, patients presenting with haemodynamic instability, sepsis, and abnormal early laboratory parameters demonstrated a greater burden of postoperative morbidity and mortality.

DISCUSSION

Emergency abdominal surgery continues to be associated with considerable postoperative morbidity and mortality because patients frequently present with advanced disease, sepsis, physiological derangement, and limited opportunity for preoperative optimisation. The present prospective cohort study evaluated early clinical, laboratory, and perioperative factors associated with adverse outcomes among 30 patients undergoing emergency abdominal surgery. In the present study, postoperative morbidity occurred in 46.7% of patients, while in-hospital mortality was 16.7%. The findings indicate that haemodynamic instability, preoperative sepsis, tachycardia, leukocytosis, renal dysfunction, elevated serum lactate, generalised peritonitis, prolonged operative duration, and intraoperative hypotension were important markers of adverse postoperative outcomes.

The overall burden of morbidity and mortality observed in the present study is consistent with the recognised high-risk nature of emergency abdominal surgery. The GlobalSurg Collaborative reported substantial mortality following emergency abdominal surgery across different income settings and demonstrated considerable variation according to patient and healthcare characteristics.[1] Similarly, the UK Emergency Laparotomy Network demonstrated that emergency laparotomy is associated with significant mortality and considerable variation in outcomes between hospitals. These observations emphasise that emergency surgery represents a distinct clinical entity in which both the severity of the underlying disease and the physiological condition of the patient influence outcome.[2]

In the present study, males constituted two-thirds of the study population, and the largest proportion of patients belonged to the 40–59-year age group. Approximately one-third of patients were aged ≥60 years. Although older age was more frequent among patients who developed morbidity and among those who died, the association did not reach statistical significance. Age is nevertheless an established component of perioperative risk assessment, particularly because older patients are more likely to have multiple comorbidities, reduced physiological reserve, and impaired ability to tolerate systemic inflammatory and metabolic stress.[4,15] The lack of statistical significance in the present study may be related to the small sample size and limited number of mortality events.

Preoperative haemodynamic instability emerged as one of the most important predictors of adverse outcome. Hypotension was significantly associated with postoperative morbidity, and preoperative shock was strongly associated with mortality. Four of the five patients who died had presented with preoperative shock. These findings are clinically plausible because hypotension in emergency abdominal surgical patients may reflect hypovolaemia, severe sepsis, ongoing gastrointestinal losses, intra-abdominal contamination, or profound systemic inflammatory response. Persistent circulatory compromise may result in inadequate tissue perfusion and progressive organ dysfunction. The Sepsis-3 consensus also recognises circulatory and metabolic abnormalities as major determinants of mortality in septic shock, with vasopressor requirement and elevated lactate identifying patients at particularly high risk.[9]

Preoperative sepsis was another important determinant of outcome in the present study. Sepsis was present in 57.1% of patients who developed postoperative morbidity compared with 18.8% of patients without morbidity. Among patients who died, 80% had preoperative sepsis. These findings support the concept that emergency surgical patients with infection-associated organ dysfunction require early recognition and aggressive management. Singer et al. defined sepsis as life-threatening organ dysfunction caused by a dysregulated host response to infection and demonstrated that even relatively modest organ dysfunction is associated with substantial mortality.[9] The importance of early identification is particularly relevant in emergency abdominal surgery, where the source of infection may be an intra-abdominal perforation, bowel ischemia, gangrene, or established peritonitis.

Tachycardia was significantly associated with both postoperative morbidity and mortality in the present study. More than two-thirds of patients who developed morbidity had a heart rate above 100 beats/min, and tachycardia was present in all patients who died. Tachycardia in the emergency surgical setting may represent a response to hypovolaemia, pain, fever, sepsis, anaemia, or systemic physiological stress. Although tachycardia is not specific for any single pathological process, its presence alongside hypotension or other markers of organ dysfunction may provide an easily available early warning of clinical deterioration. The Sepsis-3 literature similarly emphasises the importance of

readily measurable physiological abnormalities for early identification of patients at risk of poor outcomes.[9,10]

Laboratory abnormalities also demonstrated important associations with postoperative outcome. A total leukocyte count >15,000/mm³ was significantly more frequent among patients who developed morbidity, suggesting that marked systemic inflammatory response may reflect greater disease severity or established intra-abdominal infection. Elevated serum creatinine was also significantly associated with morbidity. Renal dysfunction in emergency abdominal surgical patients may arise from dehydration, sepsis-related hypoperfusion, pre-existing renal disease, or evolving acute kidney injury. Because renal dysfunction represents an important component of systemic physiological derangement, its presence may identify patients with reduced physiological reserve and greater risk of postoperative complications.

Serum lactate showed a particularly notable association with adverse outcomes. Among patients for whom lactate measurements were available, lactate >2 mmol/L was significantly associated with both postoperative morbidity and mortality. Elevated lactate may reflect tissue hypoperfusion and impaired oxygen utilisation and therefore provides an indirect marker of the severity of systemic illness. Mikkelsen et al. demonstrated that serum lactate is associated with mortality in severe sepsis independent of organ failure and shock.[10] The Sepsis-3 criteria similarly incorporate serum lactate >2 mmol/L into the clinical definition of septic shock when associated with vasopressor-dependent hypotension despite adequate fluid resuscitation.[9] Therefore, the association observed in the present study supports the potential value of lactate as an early, readily measurable marker for risk stratification in emergency abdominal surgery.

The present study also demonstrated a significant relationship between intra-abdominal disease severity and postoperative morbidity. Generalised peritonitis was significantly more common among patients who developed morbidity. Generalised peritoneal contamination represents a substantial inflammatory and infectious burden and may be accompanied by bacterial translocation, systemic inflammatory response, fluid sequestration, and circulatory compromise. Previous studies have identified the severity and extent of intra-abdominal infection as important determinants of outcome following emergency abdominal surgery.[5,6] These findings highlight the importance of prompt source control in patients with extensive peritoneal contamination.

Bowel resection was also significantly associated with postoperative morbidity. Patients requiring bowel resection are likely to have more advanced pathological processes, including perforation, ischemia, gangrene, or irreversible bowel compromise. Such patients may also require anastomosis or stoma formation and are exposed to a greater risk of postoperative infection and organ dysfunction. Although bowel ischemia/gangrene and stoma formation were more frequent among patients with morbidity in the present study, these associations did not reach statistical significance, potentially reflecting the limited sample size.

Operative duration exceeding two hours was significantly associated with postoperative morbidity. Prolonged surgery may be a surrogate marker for greater disease severity, extensive contamination, difficult dissection, bowel resection, haemodynamic instability, or the need for complex reconstruction. It may also contribute independently to physiological stress, hypothermia, fluid shifts, blood loss, and postoperative complications. The association observed in this study therefore supports the use of operative duration as an easily available perioperative marker of surgical complexity and risk.

Intraoperative hypotension was another significant predictor of adverse outcomes. Half of the patients with postoperative morbidity experienced intraoperative hypotension compared with 12.5% of patients without morbidity. Furthermore, intraoperative hypotension was observed in 80% of patients who died. Hypotension during surgery may indicate inadequate resuscitation, ongoing sepsis, significant blood loss, or limited cardiovascular reserve. Persistent intraoperative hypoperfusion may contribute to postoperative renal, respiratory, and other organ dysfunction. Thus, the present findings reinforce the importance of maintaining adequate perfusion and close haemodynamic monitoring throughout emergency surgery.

The overall postoperative complication rate in the present study was 46.7%. Surgical-site infection was the most common individual complication, followed by postoperative sepsis, acute kidney injury, and respiratory complications. These complications are consistent with the complex physiological and infectious environment associated with emergency abdominal surgery. Emergency operations frequently involve contaminated or dirty surgical fields, prolonged procedures, systemic inflammation, and patients who are physiologically compromised at the time of surgery. Tengberg et al. demonstrated that complications after emergency laparotomy can extend beyond the immediate postoperative period and contribute substantially to overall morbidity.[3]

ICU admission was required in 40% of patients, while 20% required mechanical ventilation. Both ICU admission and mechanical ventilation were significantly more frequent among patients who died. Although these variables are postoperative rather than preoperative predictors, they serve as important markers of the severity of postoperative physiological deterioration. Patients requiring ventilatory or vasopressor support often have significant respiratory, circulatory, or multiorgan dysfunction and therefore require close monitoring and aggressive organ-supportive therapy.

The mortality rate in the present study was 16.7%. Although interpretation should be cautious because of the small sample size, the mortality observed emphasises the substantial risk associated with emergency abdominal surgery. Preoperative shock, preoperative sepsis, tachycardia, elevated lactate, and intraoperative hypotension were significantly associated with mortality. These findings are consistent with the broader literature demonstrating that physiological status at presentation is a major determinant of emergency surgical outcome.[1,2,7,9]

Risk prediction has an important role in emergency surgery because identification of high-risk patients can facilitate early resuscitation, appropriate ICU referral, senior surgical involvement, optimisation of antimicrobial therapy, and timely source control. The POSSUM system developed by Copeland et al. incorporated physiological and operative variables to estimate postoperative morbidity and mortality and demonstrated the value of combining patient physiology with operative severity in surgical risk assessment.[11]

Subsequent modifications such as Portsmouth-POSSUM were developed to improve mortality prediction. 12 Although the present study did not formally apply a risk-prediction score, several of the variables identified—particularly physiological instability, renal dysfunction, and operative severity—overlap with the domains incorporated into established surgical risk assessment systems.

An important finding of the present study is that several predictors were available at or soon after presentation and could therefore potentially be used for early risk stratification. Hypotension, tachycardia, sepsis, leukocytosis, renal dysfunction, and elevated lactate can be assessed rapidly in most emergency surgical settings. Their identification may allow clinicians to distinguish patients requiring routine postoperative care from those who require aggressive resuscitation, early critical-care involvement, and closer postoperative surveillance.

The present study has several limitations. The sample size was relatively small, with only 30 patients and five deaths, which limits statistical power and increases the possibility of type II error. The study was conducted at a single institution over a six-month period, which may limit generalisability to other hospitals and patient populations. Serum lactate was not available for all patients, reducing the number of observations available for analysis of this variable. Furthermore, because of the small sample size, multivariable predictive modelling could not be reliably performed. Consequently, the identified associations should be interpreted as potential predictors rather than definitive independent risk factors. Larger multicentric prospective studies with longer follow-up and formal validation of predictive models are required to establish the independent prognostic value of these parameters.

Despite these limitations, the prospective nature of the study allowed systematic recording of clinical, laboratory, operative, and postoperative variables. The findings suggest that simple early markers of physiological deterioration and disease severity can identify patients at increased risk following emergency abdominal surgery. Particular attention should be given to patients presenting with shock or sepsis and those demonstrating tachycardia, elevated lactate, renal dysfunction, or significant intra-abdominal contamination.

Overall, the findings support an approach to emergency abdominal surgery in which early physiological assessment, prompt resuscitation, timely source control, and early postoperative risk stratification are integrated into perioperative management. Identification of high-risk patients at the earliest possible stage may facilitate appropriate allocation of critical-care resources and potentially improve postoperative outcomes.

CONCLUSION

This prospective cohort study demonstrates that emergency abdominal surgery is associated with substantial postoperative morbidity and mortality. **Preoperative shock, sepsis, tachycardia, hypotension, elevated total leukocyte count, renal dysfunction, and elevated serum lactate** were important early indicators of adverse outcomes. Among intraoperative factors, **generalised peritonitis, bowel resection, prolonged operative duration, and intraoperative hypotension** were associated with increased postoperative morbidity. Preoperative shock, sepsis, elevated lactate, and intraoperative hypotension were particularly associated with mortality.

These findings suggest that **early identification of physiological instability and disease severity at presentation, combined with timely resuscitation, appropriate source control, and close postoperative monitoring, may help identify high-risk patients following emergency abdominal surgery**. Larger prospective multicentric studies are required to validate these predictors and develop reliable risk-stratification models for emergency surgical practice.

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