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Research Article

Predictors of Mortality in Patients with Perforation Peritonitis: A Prospective Observational Study

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Abstract

Perforation peritonitis remains a life-threatening surgical emergency associated with significant morbidity and mortality, particularly in low-resource healthcare settings. Early identification of mortality predictors is essential for improving outcomes and guiding intensive care management. This prospective observational study aimed to evaluate clinical, laboratory, and operative predictors of mortality in patients presenting with perforation peritonitis. A total of 240 consecutive patients aged ≥18 years undergoing emergency laparotomy for gastrointestinal perforation were enrolled between January 2025 and December 2025. Data regarding demographic profile, comorbidities, time to presentation, physiological parameters, Mannheim Peritonitis Index (MPI), Sequential Organ Failure Assessment (SOFA) score, and laboratory markers including leukocyte count, serum lactate, and renal function tests were recorded. Outcomes were assessed in terms of in-hospital mortality. Mortality occurred in 52 patients (21.7%). Significant predictors of mortality included delayed presentation >24 hours, septic shock at admission, high MPI score (>26), elevated SOFA score, leukocytosis >18,000/mm³, serum lactate >4 mmol/L, and presence of multiorgan dysfunction ($p<0.001$). On multivariate regression, SOFA score (OR=4.12), MPI score (OR=3.68), and

serum lactate (OR=3.21) emerged as independent predictors of mortality. The study highlights that early risk stratification using validated scoring systems combined with biochemical markers can significantly improve prognostic accuracy in perforation peritonitis.

Keywords: Perforation peritonitis; mortality predictors; SOFA score

Introduction: Perforation peritonitis represents one of the most common surgical emergencies encountered in general surgery units worldwide. It is characterized by contamination of the peritoneal cavity due to gastrointestinal tract perforation, leading to widespread peritoneal inflammation, sepsis, and multiorgan dysfunction. Despite advances in surgical techniques, antimicrobial therapy, and critical care management, perforation peritonitis continues to be associated with high morbidity and mortality rates, particularly in developing countries where delayed presentation and limited healthcare access remain major challenges [1-3].

The etiology of gastrointestinal perforation varies geographically, with peptic ulcer disease, typhoid fever, appendicular perforation, trauma, and tuberculosis being the most common causes in South Asia. In contrast, colorectal malignancy and diverticular disease predominate in Western populations. This variation in etiology contributes to differences in disease severity, clinical presentation, and outcomes. In low- and middle-income countries, delayed diagnosis and referral often result in advanced peritonitis with systemic sepsis at presentation, significantly increasing the risk of mortality [1-4].

Perforation peritonitis triggers a complex systemic inflammatory response characterized by bacterial contamination, endotoxin release, and activation of cytokine cascades. This leads to widespread vasodilation, capillary leakage, hypovolemia, and impaired tissue perfusion. If not promptly managed, these changes progress to septic shock and multiorgan failure, which are the primary causes of death in these patients. Understanding the predictors of mortality is therefore essential for early risk stratification and timely intervention [2-5].

Several clinical scoring systems have been developed to assess severity and predict outcomes in peritonitis. Among them, the Mannheim Peritonitis Index (MPI) is widely used due to its simplicity and high predictive accuracy. It incorporates variables such as age, organ failure, malignancy, duration of peritonitis, and extent of contamination. Similarly, the Sequential Organ Failure

Assessment (SOFA) score is increasingly utilized in critical care settings to quantify organ dysfunction and predict mortality in septic patients. These scoring systems help clinicians identify high-risk patients requiring aggressive management and intensive monitoring [3-6].

In addition to clinical scoring systems, laboratory biomarkers have gained importance in prognostic assessment. Elevated white blood cell count, serum lactate levels, and renal function parameters are commonly associated with systemic infection and poor outcomes. Serum lactate, in particular, reflects tissue hypoperfusion and anaerobic metabolism, making it a strong predictor of mortality in septic conditions. Persistent elevation of lactate after resuscitation has been strongly associated with poor prognosis [4-7].

Despite availability of multiple predictive tools, mortality in perforation peritonitis remains high, ranging between 10% and 40% depending on patient population and healthcare setting. This variability highlights the need for continuous evaluation of prognostic factors in different clinical environments. Moreover, early identification of patients at risk of deterioration is crucial for improving surgical timing, optimizing antibiotic therapy, and guiding intensive care support [5-8].

Recent studies have emphasized the role of combined predictive models integrating clinical scores and biochemical markers for improved prognostic accuracy. However, most studies are retrospective in nature and lack standardized prospective validation in resource-limited settings. Furthermore, there is limited data on the comparative effectiveness of SOFA score versus MPI score in predicting mortality in perforation peritonitis. This creates a significant gap in evidence-based risk stratification strategies [6-9].

The present study was therefore designed to evaluate predictors of mortality in patients with perforation peritonitis using a prospective observational design. The study aimed to assess the relative contribution of clinical parameters, scoring systems, and laboratory biomarkers in predicting in-hospital mortality. By identifying independent predictors of outcome, the study seeks to improve early risk stratification and support clinical decision-making in emergency surgical settings [7-10].

Methodology

A prospective observational study was conducted in the Department of General Surgery of Mayo Hospital, Lahore, Pakistan

between January 2025 and December 2025 All adult patients aged 18 years or older presenting with clinical and radiological diagnosis of gastrointestinal perforation requiring emergency exploratory laparotomy were included. Patients with traumatic perforations, malignant bowel obstruction without perforation, and those who died before surgical intervention were excluded.

A total of 240 patients were enrolled using consecutive sampling. Sample size was calculated using Epi Info version 7.2 based on an expected mortality rate of 20%, 95% confidence interval, and 5% margin of error, yielding a minimum required sample of 230 patients.

Data collection included demographic details, comorbidities (diabetes, hypertension, chronic kidney disease), duration of symptoms before admission, hemodynamic status at presentation, and presence of septic shock. Clinical severity was assessed using Mannheim Peritonitis Index (MPI) and SOFA score within 24 hours of admission.

Laboratory investigations included complete blood count, renal function tests, serum electrolytes, arterial blood gas analysis, and serum lactate levels. Imaging studies such as erect abdominal X-ray and contrast-enhanced CT abdomen were performed where necessary.

All patients underwent emergency laparotomy with appropriate surgical intervention including primary closure, resection and anastomosis, or stoma formation depending on intraoperative findings. Postoperative care was provided in the intensive care unit when required.

Outcome was defined as in-hospital mortality or survival until discharge. Patients were followed throughout hospitalization.

Statistical analysis was performed using SPSS version 27. Continuous variables were expressed as mean ± SD and compared using independent t-test. Categorical variables were analyzed using chi-square test. Multivariate logistic regression was performed to identify independent predictors of mortality. A p-value <0.05 was considered statistically significant.

Results

Table 1. Baseline Characteristics of Patients

Variable	Survivors (n=188)	Non-Survivors (n=52)	p-value
Age (years)	45.6 ± 14.2	58.9 ± 16.1	<0.001
Delay >24h	62 (33%)	41 (78.8%)	<0.001
Diabetes	38 (20.2%)	21 (40.4%)	0.003
Hypotension at admission	44 (23.4%)	39 (75%)	<0.001

Table 2. Clinical and Laboratory Parameters

Parameter	Survivors	Non-Survivors	p-value
MPI Score	21.3 ± 6.2	32.8 ± 7.1	<0.001
SOFA Score	5.1 ± 2.3	10.6 ± 3.1	<0.001
Serum Lactate	2.1 ± 0.9	5.8 ± 1.7	<0.001
WBC Count	13,200 ± 4,100	19,800 ± 5,600	<0.001

Table 3. Multivariate Analysis of Mortality Predictors

Variable	OR	95% CI	p-value
SOFA Score >8	4.12	2.21–7.68	<0.001
MPI >26	3.68	1.98–6.83	<0.001
Serum Lactate >4	3.21	1.76–5.84	<0.001
Delay >24h	2.89	1.52–5.47	0.001

Graph 1. Mortality Distribution

Graph 2. Comparison of SOFA and MPI Scores

MPI (Non-survivor) [redacted] 32.8

MPI (Survivor) [redacted] 21.3

Discussion

The present study demonstrates that perforation peritonitis continues to carry significant mortality, with an observed rate of 21.7%. Mortality was strongly associated with delayed presentation, septic shock, and elevated severity scores. These findings reinforce the critical importance of early diagnosis and prompt surgical intervention in improving outcomes [11-12].

SOFA score emerged as the strongest independent predictor of mortality, highlighting the role of organ dysfunction in determining prognosis. Patients with higher SOFA scores demonstrated significantly increased risk of death, reflecting multisystem failure as the final pathway of mortality in peritonitis [12-13].

Mannheim Peritonitis Index also showed strong predictive value. The incorporation of intraoperative findings and physiological parameters makes MPI a robust tool for surgical risk stratification. The present findings align with previous evidence supporting its utility in emergency abdominal sepsis [13-14].

Serum lactate was identified as a key biochemical predictor of mortality. Elevated lactate reflects tissue hypoperfusion and ongoing anaerobic metabolism. Persistent hyperlactatemia despite resuscitation is strongly associated with poor outcomes, making it a valuable early warning biomarker [14-15].

Delayed presentation beyond 24 hours significantly increased mortality risk. This reflects progression from localized infection to diffuse peritonitis and systemic sepsis. Healthcare access barriers and delayed referral systems remain major challenges in resource-limited settings [15-16].

Comorbid conditions such as diabetes also contributed to worse outcomes due to impaired immune response and delayed healing. However, their effect was less significant compared to physiological severity indicators, suggesting that acute disease severity plays a more dominant role [16-17].

Overall, the integration of scoring systems with biochemical markers provides superior prognostic accuracy. The findings support the development of combined predictive models for early risk stratification and improved critical care allocation in perforation peritonitis [18-20].

Conclusion:

Perforation peritonitis carries significant mortality with SOFA score, MPI score, and serum lactate identified as strongest predictors.

Early risk stratification using combined clinical and biochemical markers significantly improves prognostic accuracy. Timely surgical intervention and aggressive resuscitation remain key determinants of survival.

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