(International Print/Online Journal)

SJIF IMPACT FACTOR: 6.829
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 9, Issue 3, Page No: 62-73
May-June 2026

IJMSCR

Correlation of Clinical and Biochemical Findings on the Outcomes in Patients with Perforation Peritonitis: A Prospective Observational Study

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Type of Publication: Original Research Paper
Conflicts of Interest: Nil

Abstract

Introduction

Perforation peritonitis remains one of the most common surgical emergencies worldwide and is associated with high morbidity and mortality despite advances in surgical techniques, antibiotics, and intensive care. Delayed presentation and systemic derangements significantly influence outcomes. Identification of reliable clinical and biochemical predictors can help stratify risk and optimize perioperative management.

Materials And Methods

A prospective observational study was conducted on 90 adult patients diagnosed with perforation peritonitis who underwent emergency laparotomy at a tertiary care teaching hospital. Clinical parameters, laboratory investigations, intra-operative findings, and postoperative outcomes were recorded. Outcomes were analyzed in terms of morbidity and mortality, and correlations were assessed using appropriate statistical tests.

Results

The majority of patients were young males, with ileal and duodenal perforations being the most common sites. Delayed presentation (>72 hours), respiratory distress, hypoalbuminemia, hypoproteinemia, metabolic acidosis, elevated urea, and deranged lactate levels were significantly associated with increased mortality. Postoperative complications occurred in over half of the patients, with surgical site infection and prolonged ICU stay being the most frequent. Mortality was observed in 13.3% of cases.

Conclusion

Delayed hospital presentation and deranged preoperative biochemical parameters significantly worsen outcomes in perforation peritonitis. Early diagnosis, prompt surgical intervention, and aggressive correction of physiological and biochemical abnormalities are essential to reduce morbidity and mortality.

Keywords: Perforation peritonitis, biochemical markers, mortality, morbidity, emergency laparotomy

Introduction

Peritonitis is defined as inflammation of the peritoneal cavity and is most commonly caused by perforation of a hollow viscus, resulting in contamination by gastrointestinal contents. It is traditionally classified into primary, secondary, and tertiary peritonitis based on etiology and microbial origin[1]. Secondary peritonitis due to gastrointestinal perforation accounts for the majority of cases encountered in surgical practice and represents a life-threatening emergency[2].

In India and other developing countries, perforation peritonitis continues to pose a significant clinical challenge due to delayed presentation, limited access to healthcare, and high prevalence of infective etiologies such as typhoid and tuberculosis[3]. Upper gastrointestinal perforations, particularly duodenal ulcers, are more common in Asian populations, whereas lower gastrointestinal perforations predominate in Western countries[4]. Regardless of etiology, perforation leads to rapid fluid shifts, bacterial translocation, systemic inflammatory response syndrome, and sepsis[5].

The clinical presentation typically includes acute abdominal pain, guarding, rigidity, abdominal distension, and absent bowel sounds, often accompanied by systemic manifestations such as fever, tachycardia, hypotension, and altered sensorium[6]. If untreated or treated late, the condition may progress to septic shock, multiple organ dysfunction syndrome (MODS), and death[7].

Despite improvements in diagnostic imaging, antimicrobial therapy, surgical techniques, and postoperative critical care, the mortality associated with perforation peritonitis remains high, ranging from 6–20% in various series[8]. Several factors influence outcome, including age, comorbidities, duration of symptoms before surgery, extent of peritoneal contamination, and physiological reserve of the patient[9].

Biochemical parameters such as serum albumin, total protein, renal function tests, arterial blood gas values, and serum lactate reflect the severity of systemic illness and organ dysfunction. Hypoalbuminemia has consistently been shown to correlate with poor wound healing, increased infections, prolonged hospital stay, and mortality[10]. Similarly, metabolic acidosis, elevated lactate, and renal dysfunction indicate inadequate tissue perfusion and severe sepsis[11].

Risk stratification tools such as POSSUM and P-POSSUM integrate physiological and operative variables to predict surgical outcomes, but their applicability varies across populations[12]. There is a need to evaluate the role of readily available clinical and biochemical markers in predicting outcomes in perforation peritonitis, especially in resource-limited settings.

This study aims to correlate clinical presentation and initial biochemical parameters with postoperative outcomes in patients undergoing surgery for perforation peritonitis.

Materials And Methods

This prospective observational study was conducted in the Department of General Surgery at a tertiary care teaching hospital over a period of 22 months to assess the effectiveness of the P-POSSUM score for the prediction of morbidity and mortality after surgery for intestinal perforation.

Study Population

A total of 90 consecutive patients diagnosed clinically and radiologically with perforation peritonitis and undergoing emergency laparotomy were included after obtaining informed written consent.

Inclusion Criteria

1. Age ≥18 years and < 60 years
2. Clinical diagnosis of perforation peritonitis
3. Undergoing emergency surgical intervention

Exclusion Criteria

1. Patients discharged against medical advice
2. Polytrauma patients
3. Patients refusing consent

Data Collection

Detailed clinical history including duration of symptoms, prior treatment, comorbidities, and presenting complaints was recorded. Physical examination findings such as respiratory distress, hypotension, fever, and abdominal signs were documented.

Laboratory investigations included hemoglobin, total leukocyte count, serum electrolytes, renal function tests, serum protein, serum albumin, arterial blood gas analysis, and serum lactate. Radiological

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investigations included erect chest X-ray and abdominal imaging like CT abdomen when required.

Surgical Management

All patients underwent emergency exploratory laparotomy. Surgical procedures included primary repair, resection and anastomosis, or stoma formation based on intra-operative findings. Peritoneal lavage and drainage were performed in all cases.

Outcome Measures

Primary outcomes were postoperative morbidity and mortality. Secondary outcomes included ICU stay, postoperative complications, and length of hospital stay.

Statistical Analysis

Patients were scored by integration of clinical and laboratory findings (P-POSSUM) into 4 grades.

The scores were calculated using the equation below

ln[R/(1-R)] = -9.37+0.19 x physiological score +0.15 x operative score

Where the constituent variables of the physiological score operative variables are orderly graded as 1, 2, 4 or 8 based on their magnitude then summated to form a physiological score and operative severity score.

The patients were followed up through the course of their hospital stay to assess the final outcome in terms of length of ICU stay and total duration of hospital stay till 30th post-operative day.

The data obtained was entered into MS Excel. The data were represented both in frequencies as well as descriptive mode, with mean, median, and standard deviation. For statistical analysis, independent t-test or Mann-Whitney test were used to find the association of continuous variables. The P value of 0.05 was considered significant. All statistical analysis was performed using SPSS (Statistical Packages for Social Sciences, version 21.0. Armonk, NY: IBM corp.)

Sample Size

The sample was calculated to be n=75, with 26% being the proportion for perforated appendix most common cause of peritonitis in patients by using the formula n = Z α/2 2 p*(1-p) / d 2, where Z α/2 is the critical value of the Normal distribution at α/2 (For our study the confidence level of 95%, α is 0.05 and the critical value is 1.96), p=26% is the proportion of perforated appendix and d=10% is margin of error. During this study period, we were able to recruit 90 subjects for the same so as to reduce the margin of error in evaluating our results.

Results

Table 1 depicts that out of total 90 patients, 41 patients (45.5%) had ileal perforation followed by duodenal perforation seen in 17 (patients (18.8%). Rectum and gall bladder were least commonly involved sites seen in 1 (1.1%) patient.

Table 2 illustrates that out of the total alive patients, 38 patients (52.80%) had presented in less than 24 hours of the onset of the symptoms. Out of total 90 patients recruited, 12 patients (13.33%) expired. And out of 12 expired patients, 6 patients (50.0%) had presented after 72 hours of the onset of symptoms. Patients who presented within 24 hours of symptom onset had better chances of survival as compared to those who had delayed presentation to the hospital and thus resulting in higher chances of mortality.

Table 3 shows that 10 out of 12 (83.33%) patients who expired were found to have low serum protein levels. However low serum protein levels were also found in 36 (46.15%) of the total 78 alive patients. Further, 53.85% of the patients who were alive had normal protein levels, compared with only 16.67% of the patients who expired, who had normal protein levels.

Table 4 shows that majority i.e 65 out of 90 patients (72.2%) had prolonged ICU stay post operatively and 42 patients (46%) of the study cohort had signs of surgical site infections.

Figure 1 illustrates the range of physiological p-possum score which integrates clinical and laboratory findings in the study cohort. The maximum number of patients, 26 (28.9%), had a P-score in the range 19.3-25.6; while the minimum number of patients, 3 (3.3%), have a P-score range of 44.5-50.8. The mean P-score for the total study population was 26.16, with a standard deviation of 8.017.

Figure 2 illustrates range of operative score of p-possum which integrates clinical, laboratory findings along with intra operative findings. The majority of the patients, 55 (61.1%) had O-score range of 21.5-23.4. The mean O-score for the whole study population is 22.86, with standard deviation of 2.457.

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Table 5 compares the sign and symptoms with the outcome. Out of the total patients who were alive, 48.7% had presented to the hospital within 24 hours of onset of symptoms. Further, 50% of the patients who expired had delayed presentation to hospital of more than 72 hours after the onset of symptoms. Although, there was no significant relationship of the duration of symptoms with the outcome (p value 0.191). Cardiac history was found in 2 patients (16.7%) who expired. It was also seen in 1 patient (1.3%) out of the total alive patients. There was found to be a significant relationship between the outcome and presence or absence of cardiac history(p =.005)

4 patients (33.3%) out of those who expired received medical treatment elsewhere before presenting to the hospital as compared to only 9 patients (11.5%) out of total alive patients. The p-value of 0.46 suggests a significant relationship between treatment taken elsewhere before presenting to the hospital and their outcome in terms of morbidity and mortality.

41.7% of the patients who expired had breathing difficulty on clinical examination while only 7.7% of those who were alive had respiratory distress. The p-value <.001 suggest a significant relationship between pre-operative respiratory distress in the patient and their outcome.

Table 6 depicts the multivariant analysis of various factors in the cohort of study population. Median serum protein level for the total study population was 6g/dL, with a minimum value of 2.7g/dL and maximum value of 8.9g/dL. For the patients who were alive and those who expired, the same values were 6.10g/dL (3.7 - 8.9) & 4.70g/dL (2.7 - 6.7). A statistically significant relationship between the protein levels and the outcome (p<.001) was found.

The median albumin levels in the patients who were alive were 3.30 (1.4 – 5.2), and in those who expired were 2.3 (1.9 – 3.4). The p-value of <.001, indicated a significant relationship between albumin levels and the outcome. Metabolic and respiratory acidosis were significant factors in determining the outcome of the patients. The pH and pCO2 values showed a significant relationship with the outcome (p < .001, for both).

Similarly, respiratory distress as seen in the study population in the pre- operative period was significant factor in determining the outcome of the patient which showed a statistical significant relationship with the outcome (p < .001)

Table 7 illustrates the relationship between the delayed presentation to the hospital and the predicted outcome of the patients in terms of mortality and morbidity. Significant relationship with outcome was seen with hospital stay duration and P-POSSUM score, p-values <.001, <.001, respectively. P-possum score was found to be on higher side in patients who did not survive after the surgery.

Figure 3 illustrates A Boxplot between the mortality scores and the outcome show that the mean value of mortality scores for patients who were alive, was 43.5, while mean value for those who expired was 85.71, further proving the reliability in predicting the mortality in the study population by integrating clinical and laboratory findings in a score system (P-POSSUM).

Discussion

Perforation peritonitis remains a common and potentially fatal surgical emergency, particularly in developing countries, where delayed presentation and limited physiological reserve often contribute to poor outcomes. The present study evaluates demographic characteristics, clinical and biochemical predictors, operative factors, postoperative complications, and the utility of the P-POSSUM scoring system in predicting morbidity and mortality among patients undergoing emergency surgery for perforation peritonitis.

The study population demonstrated a clear male predominance, which is consistent with previous reports from the Indian subcontinent. This trend has been attributed to greater exposure to risk factors, differences in healthcare access, and delayed health-seeking behavior. Ileal perforation was the most common site observed, followed by duodenal perforation. This pattern differs from Western literature, where colonic perforations are more frequently encountered, highlighting the regional variation in etiology and disease presentation.

Delayed presentation continues to play an important role in disease severity and outcome. Although the association between duration of symptoms and mortality did not reach statistical significance, a higher proportion of expired patients presented more than 72 hours after symptom onset. Delayed presentation is often associated with advanced peritoneal

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contamination, established sepsis, and metabolic derangements, all of which adversely affect postoperative recovery and survival.

Among preoperative clinical parameters, respiratory distress and hypotension at presentation were strongly associated with mortality. Respiratory distress likely reflects severe systemic inflammatory response, metabolic acidosis, and early respiratory compromise, whereas hypotension indicates septic shock and impaired tissue perfusion. The presence of cardiac comorbidities was also significantly associated with adverse outcomes, suggesting that reduced physiological reserve contributes to higher mortality in emergency abdominal surgery. In contrast, common presenting symptoms such as abdominal pain, vomiting, distension, and fever did not show a significant association with outcome, as these symptoms are nearly universal in perforation peritonitis.

Biochemical parameters provided valuable prognostic information. Hypoproteinemia and hypoalbuminemia were significantly associated with mortality. Low serum albumin levels reflect poor nutritional status, systemic inflammation, and capillary leak, all of which impair immune function and wound healing. Additionally, metabolic and respiratory acidosis, elevated serum lactate levels, and raised serum urea were significant predictors of mortality, indicating the presence of severe sepsis and early organ dysfunction at presentation.

All patients in the study underwent emergency major surgery with gross peritoneal contamination, reflecting the advanced stage of disease at the time of intervention. Longer operative duration was significantly associated with mortality, possibly due to increased physiological stress and greater disease severity. Postoperative morbidity was considerable, with prolonged intensive care unit stay and surgical site infection being the most common complications. Sepsis, pulmonary complications, acute kidney injury, and multiple organ dysfunction syndrome contributed significantly to postoperative morbidity and mortality.

The P-POSSUM scoring system demonstrated strong predictive value in the present study. Both physiological and operative scores were significantly higher among patients who expired. Receiver operating characteristic curve analysis showed excellent discrimination between survivors and non-survivors, and the close agreement between observed and predicted mortality supports the reliability of P-POSSUM in this patient population. These findings suggest that P-POSSUM may be a useful adjunct for preoperative risk stratification, prognostication, and clinical decision-making in patients with perforation peritonitis.

This study has certain limitations. It was conducted at a single center with a relatively small sample size, which may limit generalizability. Etiological factors of perforation were not analyzed separately, and long-term outcomes were not assessed. Despite these limitations, the study highlights important clinical and biochemical predictors of outcome and supports the use of objective scoring systems in emergency surgical practice.

Conclusion

Our study suggests that delayed clinical presentation and deranged laboratory parameters are associated with increased postoperative complications and, consequently, higher mortality in patients with perforation peritonitis. These findings underscore the importance of early recognition, timely intervention, and prompt initiation of treatment, along with preoperative optimization of organ dysfunction by the surgical team, to improve patient outcomes.

Furthermore, integration of clinical features and laboratory parameters into a validated scoring system such as P-POSSUM can aid in predicting morbidity and mortality in patients with perforation peritonitis. The routine use of such objective risk assessment tools in surgical practice may assist in early risk stratification, informed decision-making, and improved perioperative management. Larger, multicentric studies with longer follow-up are warranted to further validate these findings.

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Table 1 Frequency distribution of site of perforation

PERFORATION SITE	Frequency	Percentage
Appendicular	5	5.5%
Ileal	41	45.5%
Gall Bladder	1	1.1%
Jejunal	12	13.3%
Duodenal	17	18.8%
Colonic	8	8.8%
Gastric	5	5.5%
Diverticular	3	3.3%
Small & Large Bowel	5	5.5%
Rectum	1	1.1%

Table 2 Frequency distribution of outcome based on duration of symptoms

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DURATION OF SYMPTOMS	OUTCOME			
	ALIVE		EXPIRED	
	Frequency	Percentage	Frequency	Percentage
< 24 Hours	38	52.80%	4	33.33%
24-72 Hours	17	21.80%	2	13.67%
> 72 Hours	23	29.50%	6	50.00%
Total	78	86.67%	12	13.33%

Table 3 Frequency distribution of outcome based on serum protein levels

SERUM PROTEIN LEVELS	OUTCOME			
	ALIVE		EXPIRED	
	Frequency	Percentage	Frequency	Percentage
Hypo-proteinemia (<6.6g/dl)	36	46.15%	10	83.33%
Normal Protein levels (6.6-8.7 g/dl)	42	53.85%	2	16.67%

Table 4 Frequency of types of post-operative complications in the study population

POST OP COMPLICATIONS	Frequency	Percentage
SSI	42	46%
ICU STAY	65	72.2%
PULMONARY EMBOLISM	9	19%
VAP	1	2%

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SUBACUTE INTESTINAL OBSTRUCTION	3	6%
SEPSIS	9	19%
HYPOVOLEMIC SHOCK	2	4%
DIC	4	8%
MODS	3	6%
ACUTE INTESTINAL OBSTRUCTION	1	2%
PNEUMONIA	1	2%
RE-PERFORATION	1	2%
PULMONARY EDEMA	1	2%
AKI	6	13%

Figure 1Histogram showing physiological p-possum score in study population

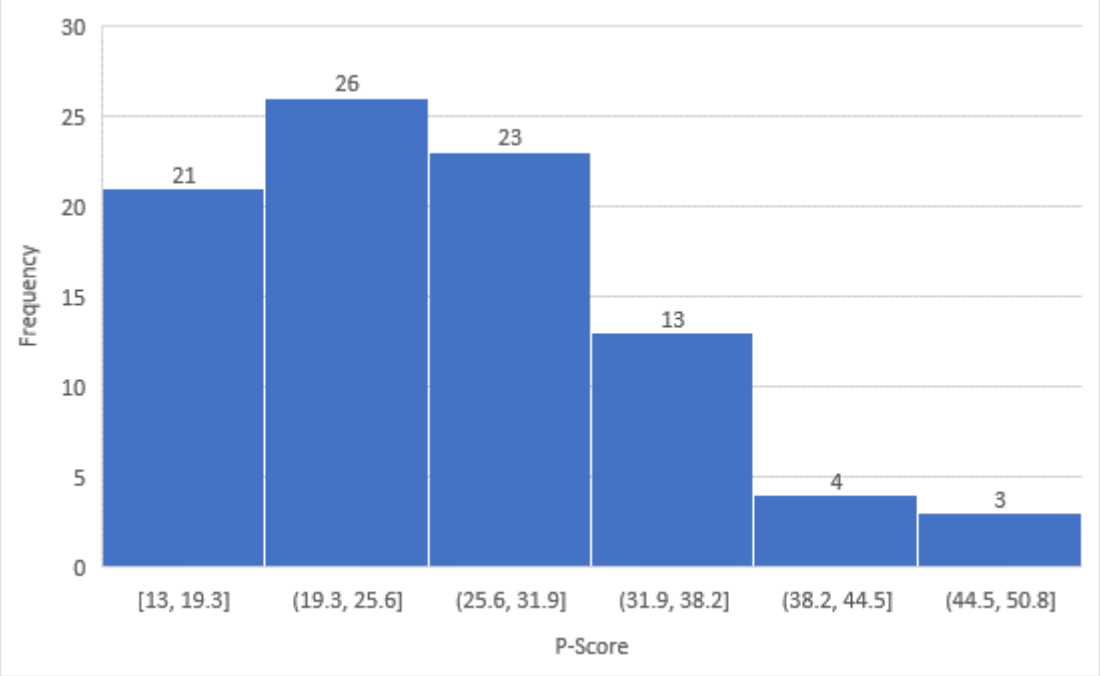

Figure 2 Histogram showing operative p-possum-score in study population

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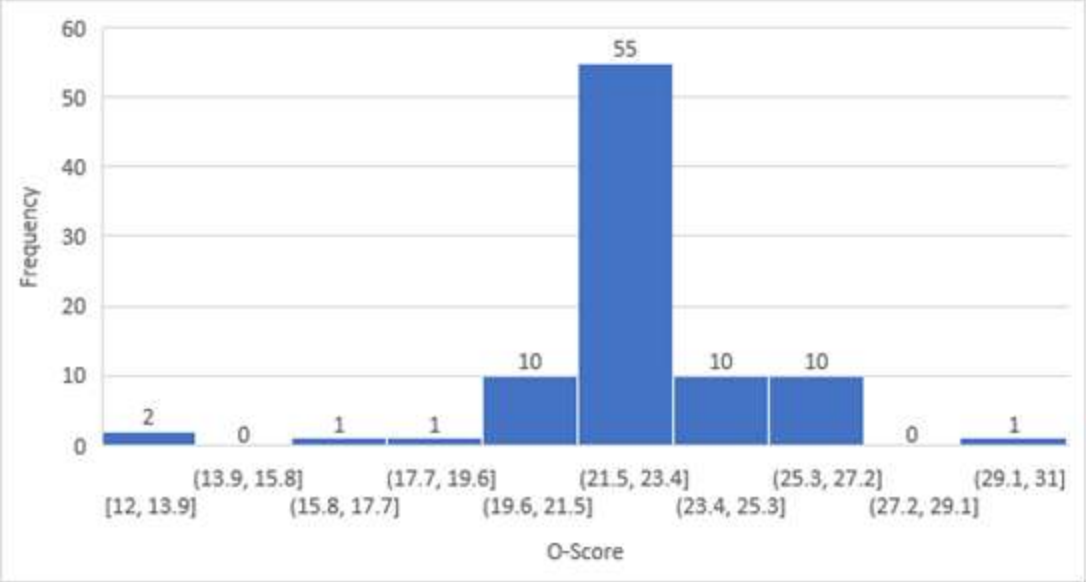

Table 5 Pre-operative findings

		ALIVE (n=78)	EXPIRED (n=12)	TOTAL (n=90)	p- value
SYMPTOM DURATION	< 24 Hours	38 (48.7%)	4 (33.3%)	42 (45.6%)	.191
	24-72 Hours	17 (21.8%)	2 (16.7%)	19 (21.1%)	
	> 72 Hours	23 (29.5%)	6 (50%)	29 (32.2%)	
Vomiting	Yes	55 (70.5%)	9 (75.0%)	64 (71.1%)	.753
	No	23 (29.5%)	3 (25.0%)	26 (28.9%)	
Pain Abdomen	Yes	77 (98.7%)	12 (100%)	89 (98.9%)	.697
	No	1 (1.3%)	0 (0%)	1 (1.1%)	
Obstipation	Yes	55 (70.5%)	9 (75.0%)	64 (71.1%)	.753
	Yes	23 (29.5%)	3 (25.0%)	26 (28.9%)	
Distension	Yes	62 (79.5%)	11 (91.7%)	73 (81.1%)	.321
	No	16 (20.5%)	1 (8.3%)	17 (18.9%)	
GCS	15/15	78 (100%)	12 (100%)	90 (100.0%)	NA
	Yes	1 (1.3%)	2 (16.7%)	3 (3.3%)	

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Cardiac History	No	77 (98.7%)	10 (83.3%)	87 (96.7%)	**.005**
Treatment taken elsewhere	Yes	9 (11.5%)	4 (33.3%)	13 (14.4%)	**.046**
	No	69 (88.5%)	8 (66.7%)	77 (85.6%)	
Breathing Difficulty	Yes	6 (7.7%)	5 (41.7%)	11 (12.2%)	**<.001**
	No	72 (92.3%)	7(58.3%)	79 (87.8%)	
Oliguria Anuria	Yes	3 (3.8%)	2 (16.7%)	5 (5.6%)	.072
	No	75 (96.2%)	10 (83.3%)	85 (94.4%)	
Fever	Yes	24 (30.8%)	5 (41.7%)	29 (32.2%)	.458
	No	54 (69.2%)	7 (58.3%)	61 (67.8%)	

Table 6 Correlation of laboratory parameters with the outcome of the study

	ALIVE (n=78)	**EXPIRED (n=12)**	**TOTAL (n=90)**	**p- value**
Haemoglobin, mean (±SD)	12.468 (2.5472)	11.742 (±2.5819)	12.371 (±2.549)	0.361
TLC, Median (min - max)	11955 (1200-23700)	6250 (1000-23000)	11755 (1000-23700)	0.610
Protein, Median (min - max)	6.10 (3.7-8.9)	4.70 (2.7-6.7)	6 (2.7-8.9)	**<.001**
Albumin, Median (min - max)	3.30 (1.4-5.2)	2.30 (1.9-3.4)	3.150 (1.4-5.2)	**<.001**
Urea, Median (min - max)	36.5 (0.6-136.0)	99.50 (24-140)	40.5 (0.6-140)	**<.001**
Creatinine, Median (min - max)	0.90 (0.30-17.00)	1.450 (0.48-3.36)	0.9150 (0.30-17.0)	0.586
Sodium, mean (±SD)	135.64 (±5.073)	137.67 (±10.594)	135.91 (±6.052)	0.283
Potassium, mean (±SD)	4.695 (±4.6801)	3.683 (±1.2328)	4.560 (±4.3883)	0.460
Ph, Median (min - max)	7.35 (7.10-7.90)	7.150 (6.80-7.36)	7.32 (6.80-7.90)	**<.001**

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pCO2, Median (min - max)	36.0 (20.0-55.0)	47.00 (30-60)	37.0 (20-60)	**<.001**
Lactate, Median (min - max)	7.50 (3.2-15.1)	8.80 (4.3-23.1)	7.8 (3.2-23.1)	**0.009**
HCO3, Median (min - max)	15.0 (8.0-24.0)	13.60 (8-22)	15.0 (8.0-24.0)	**0.030**
Heart Rate >100 n (%)	66 (84.6%)	12 (100%)	78 (86.7%)	0.148
<100 n (%)	12 (15.4%)	0 (0%)	12 (13.3%)	
Respiratory Rate >30 n (%)	8 (10.3%)	4 (33.3%)	12 (13.3%)	**<.001**
<30 n (%)	70 (89.7%)	8 (66.7%)	78 (86.7%)	
Systolic BP >90 n (%)	53 (67.9%)	0 (0%)	53 (58.9%)	**0.029**
<90 n (%)	25 (32.1%)	12 (100%)	37 (41.1%)	

Table 7Corrrelation of the delay in presentation with the outcome of the study

	ALIVE, n (%)	EXPIRED, n (%)	TOTAL, n (%)	p- value
Delay in presentation (>72 hours)	23 (29.50%)	6 (50.00%)	29 (32.2%)	0.191
ICU Stay, Median (min-max)	2.00 (0-11)	2.00 (1-12)	2.00 (0-12)	0.179
Hospital Stay, Median (min-max)	10 (3-34)	2 (1-16)	10 (1-34)	<.001
PRE-OPERATIVE RISK				
P-POSSUM, Median (min-max)	37.3 (10.2-84.0)	88.95 (60.1-96.3)	44.0 (10.2-96.3)	<.001

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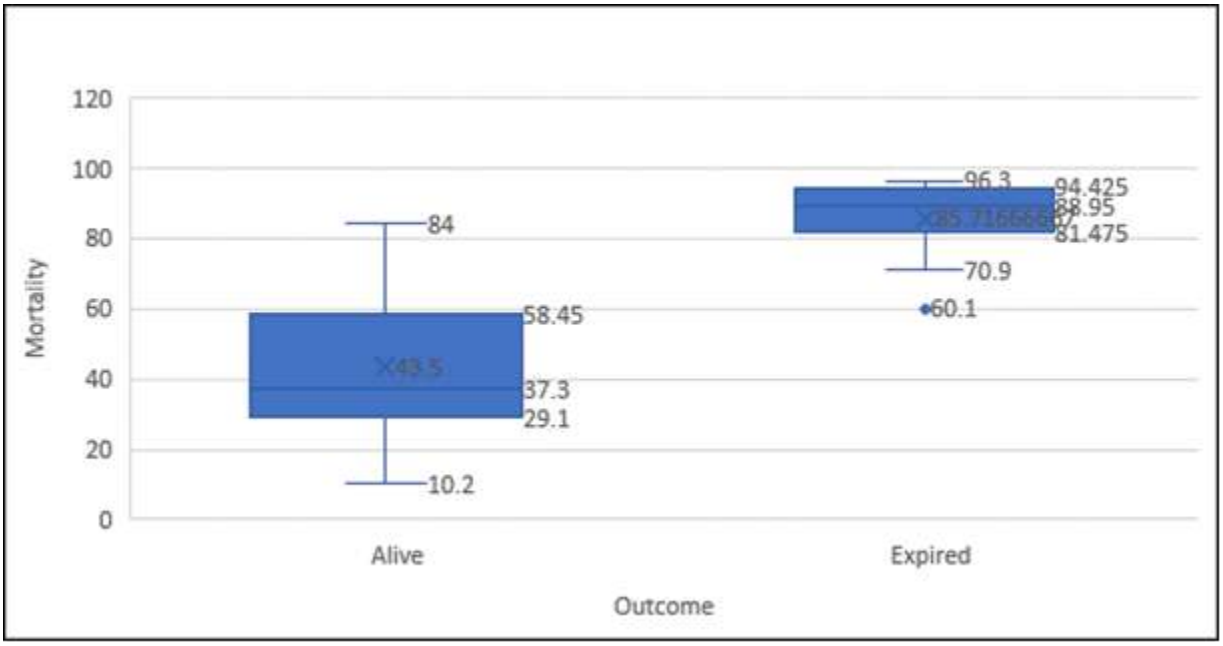
Figure 3 Boxplot showing relationship of mortality score with the outcome (mortality



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