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ORIGINAL RESEARCH

Predictors of Postoperative Outcome in Emergency Laparotomy for Perforation Peritonitis; a Retrospective Cross-sectional Study

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Abstract: **Introduction:** Hollow viscus perforation is a significant cause of surgical mortality. Various attempts have been made to identify high-risk patients preoperatively and optimize and manage such patients more aggressively. This study aimed to evaluate the predictors of outcome in patients undergoing emergency laparotomy for perforation peritonitis. **Methods:** This retrospective cross-sectional study was conducted on perforation peritonitis cases admitted to the Department of General Surgery, All India Institute of Medical Sciences, Rishikesh, India. The association between preoperative patient variables with postoperative complications, anastomotic leaks, need for intensive care unit (ICU) admission, and 30-day mortality were evaluated. **Results:** Tachycardia at the time of admission (t = 2.443, p = 0.020), hypotension ($\chi 2$ = 18.214, p = <0.001), lower haemoglobin (t = -4.134, p = <0.001), higher blood urea nitrogen levels (W = 1967.000, p = 0.012), International Normalised Ratio (INR) ≥ 1.5 ($\chi 2$ = 17.340, p = <0.001), the mean albumin level 2.89 ± 0.77 g/dL (t = -2.348, p = 0.027), and delay in surgery ($\chi 2$ = 28.423, p = 0.008) were significant associate factors of mortality. The association between need for ICU admission and higher pulse rate on admission (W = 2782.500, p = 0.011), lower systolic blood pressure (W = 1627.500, p = 0.029), higher blood urea nitrogen (W = 2299.000, p = 0.030) and serum creatinine levels (W = 2192.500, p = 0.045), preoperative coagulopathy ($\chi 2$ = 6.773, p = 0.017), hypoalbuminemia (t = -2.515, p = 0.016), and delay in surgery ($\chi 2$ = 17.780, p = 0.016) was significant. **Conclusion:** Based on the results of this study, hypotension, azotaemia, coagulopathy, and delay in surgery, increase the risk of postoperative mortality of patients undergoing emergency laparotomy for perforation peritonitis. Tachycardia, hypotension, azotaemia, hypoalbuminemia, and pre-operative coagulopathy were good predictors of need for ICU admission. Shock at presentation, deranged renal function and coagulopathy were associated with an increased risk of postoperative complications.

Keywords: Emergencies; intestinal perforation; mortality; peritonitis

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1. Introduction

Gastrointestinal tract perforation is one of the most common surgical emergencies worldwide. Peritonitis and the resultant sepsis and systemic complications due to the perforation are still responsible for significant mortality despite the advent of newer antibiotics, safer operative and anaesthetic techniques, and an improved understanding of pre- and postoperative management (1). Rapid source control through surgical exploration and prudent antimicrobial therapy is fundamental for treating intra-abdominal sepsis due to perforation (2).

Billing et al. proposed early prognostic assessment of patients with perforation peritonitis to allow triaging of patients for a more aggressive therapeutic approach (3). Several scoring systems have since been developed to enable general and

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prognostic evaluation of patients with perforation peritonitis (2, 4). Bohen et al. did an anatomical classification of intra-abdominal infections into three groups (group I- appendicitis and perforated duodenal ulcer; group II- peritonitis from all other intra-abdominal organs, not following surgery; and group III- postoperative peritonitis) and showed a difference in outcomes between them (4). The Acute Physiology and Chronic Health Evaluation (APACHE) system, on the other hand, is a non-specific physiologic scoring system that has been validated for risk stratification and has also been used in several studies for intra-abdominal infections (5). Meakins and associates proposed an approach for the study and clinical management of intra-abdominal infections that combined functional and anatomical components (6). Singh et al. did a prospective analysis of 84 patients with perforation peritonitis and identified laboratory indices, delay in presentation, and surgery as good predictors of postoperative mortality (7). Most of these scoring systems are exhaustive and challenging to use in emergency departments.

This study aimed to evaluate the predictive factors of postoperative outcome in patients undergoing emergency laparotomy for perforation peritonitis.

2. Methods

2.1. Study design and settings

A retrospective cross-sectional study was conducted in the Department of General Surgery at the All India Institute of Medical Sciences, Rishikesh, a government-run medical university and tertiary-care hospital in Northern India. The study period was from 01st July 2017 to 01st July 2020. The association between preoperative patient variables with postoperative complications, anastomotic leaks, need for intensive care unit (ICU) admission, and mortality were studied. Approval was obtained from the Institute's Ethics Committee before the study (AIIMS/IEC/20/741). The transparent reporting of a multivariable prediction model for individual prognosis or diagnosis (TRIPOD) statement was adhered to while reporting this study (8).

2.2. Participants

All adult patients admitted to General Surgery department with the diagnosis of peritonitis due to perforation of the gastrointestinal (GI) tract were included on the basis of clinical findings, pneumoperitoneum on chest X-ray, or Abdominal computed tomography (CT). All cases of primary peritonitis, perforations due to corrosive intake, trauma, postoperative peritonitis due to anastomosis leakage, pregnant patients, and patients whose records were not available were excluded.

2.3. Data collection

Patient data were retrospectively collected from the electronic health records (EHR) of the hospital database. Patient details such as demographic information (age, gender, co-morbidities/addictions), symptoms at the time of presentation (pain abdomen, vomiting, fever, ileus), vital signs at the time of presentation (heart rate, blood pressure), and preoperative blood parameters (haemoglobin, total leucocyte count, serum creatinine, blood urea, International Normalised Ratio (INR), serum albumin) were collected. The type of management (operative/non-operative), delay in surgery, and the anatomical site of perforation were also recorded.

2.4. Outcomes

Postoperatively, data regarding complications (using the Clavein-Dindo classification)(9), anastomotic leaks, need for ICU admission, and 30-day postoperative mortality were collected.

2.5. Statistical analysis

The sample size was based on a study by Jhobta et al., who reported 10% mortality in patients with perforation peritonitis (10). It was calculated according to the formula by Lemeshow et al., (11). With a precision (δ) of 0.05 (5%), and type I error (α) at 0.05 (5%), z was taken as 1.96. Based on the above formula, the required sample size was calculated as, N = [1.96^2 x 0.10 x (1-0.10)] / 0.05^2 = 138.29 ≈ 139. Thus, with a 95% confidence interval, the minimum sample size required for the study was 139.

Statistical analysis was done using the SPSS statistics package v23 (IBM Corp., USA)(12). We tried to explore the association between the preoperative patient variables with the postoperative outcomes, as mentioned above. Group comparisons for continuously distributed data were made using the independent sample t-test. For non-normally distributed data, an appropriate non-parametric test, such as the Wilcoxon test, was used. Chi-squared test was used for group comparisons of categorical data. In case the expected frequency in the contingency tables was found to be <5 for >25% of the cells, Fisher's exact test was used instead. Linear correlation between the variables was explored using Pearson's and Spearman's correlation for normally and non-normally distributed data, respectively. Statistical significance was kept at $p<0.05$.

3. Results

3.1. Baseline characteristics of studied cases

One hundred eighty-three consecutive cases of perforation peritonitis with the mean age of 42.61 ± 15.99 (Range: 18-85) years presenting during our study period were included in

the study (80.5% male). 13% of patients had some comorbidity such as diabetes mellitus, hypertension, tuberculosis, etc. Most of the patients also had some form of addiction, with smoking (52.4%), and alcohol intake (20.5%) being common.

3.2. Associated factors of outcomes

I. Postoperative anastomotic leaks

Participants in the age group 41-50 years had the highest proportion of leaks ($\chi2$ = 16.846, p = 0.026). Among the presenting symptoms, ileus was significantly associated with anastomotic leaks ($\chi2$ = 4.941, p = 0.043). The site of perforation was also associated with postoperative leaks ($\chi2$ = 41.051, p = 0.045), with duodenum, caecum or ascending colon perforations contributing to the majority of leaks. Table 1 shows the associated factors of postoperative anastomotic leak of studied cases.

II. Postoperative complications

Vomiting as a presenting complaint was a predictor of postoperative complications (p = 0.005). The duration of ileus at presentation also predicted delayed complications (p = 0.027). Shock (systolic blood pressure (SBP) < 100 mmHg) on admission correlated with poor prognosis (p = 0.013). Among the blood parameters, raised serum creatinine (p = 0.043) and coagulopathy (INR > 1.5) (p = 0.017) predicted postoperative complications. Table 2 shows the association between different grades of Clavien-Dindo postoperative complications (9) and preoperative variables.

III. ICU admission

Table 3 summarizes the association between need for ICU admission and preoperative parameters. Patients who required ICU admission had a higher pulse rate on admission (W = 2782.500, p = 0.011). The median (interquartile range; IQR) of systolic BP in the ICU admission group was 103 (90-120) mmHg. There was a significant difference in systolic BP (W = 1627.500, p = 0.029) between groups, with the median systolic BP being highest in the group that did not require ICU admission. Subgroup analysis revealed a significant difference between the groups, SBP < 100 and SBP ≥ 100 ($\chi2$ = 12.194, p = <0.001). Deranged renal function was significantly associated with ICU admission, with both blood urea (W = 2299.000, p = 0.030) and serum creatinine levels significantly elevated (W = 2192.500, p = 0.045). Preoperative coagulopathy also predicted ICU admission ($\chi2$ = 6.773, p = 0.017). Hypoalbuminemia was also a strong predictor of ICU admission (t = -2.515, p = 0.016), with 2.17 times higher chance of admission in those with albumin <2.5g/dL (95% CI= 0.79-5.94). The reason for delay in surgery was also a significant predictor of ICU admission ($\chi2$ = 17.780, p = 0.016).

IV. Postoperative mortality

Table 4 summarizes the association between 30-day mortality and preoperative parameters. Tachycardia at the time of admission was associated with higher postoperative mortality (t = 2.443, p = 0.020). However, on subgroup analysis, no difference was observed between the groups, pulse rate (PR) < 100 and PR ≥ 100 ($\chi2$ = 3.722, p = 0.054). Hypotension was also associated with increased postoperative mortality ($\chi2$ = 18.214, p = <0.001) with 4.55 times higher risk of mortality in the group with systolic BP ≤ 100 mmHg (95% CI = 2.19 - 9.22). Diastolic BP was also significantly associated with postoperative mortality (W = 988.500, p = <0.001). The haemoglobin (Hb) in the postoperative mortality group was significantly lower (t = -4.134, p = <0.001). However, no difference in the group Hb ≤ 8 g/dL and Hb > 8g/dL ($\chi2$ = 4.925, p = 0.061) was evident on subgroup analysis. On the other hand, blood urea levels influenced postoperative mortality (W = 1967.000, p = 0.012). INR ≥ 1.5 was also associated with higher mortality ($\chi2$ = 17.340, p = <0.001). The mean (standard deviation; SD) of albumin level in mortality group was 2.89 (0.77) g/dL and was significantly associated with postoperative mortality (t = -2.348, p = 0.027). No difference was evident on subgroup analysis between the groups, albumin ≤ 2.5 g/dL and > 2.5 g/dL ($\chi2$ = 3.685, p = 0.089).

There was a significant difference in mortality due to surgery delay ($\chi2$ = 28.423, p = 0.008). Delay due to initial resuscitation led to the highest rate of mortality.

4. Discussion

Based on the results of this study, hypotension, azotaemia, coagulopathy, and delay in surgery increase the risk of postoperative mortality of patients undergoing emergency laparotomy for perforation peritonitis. Tachycardia, hypotension, azotemia, hypoalbuminemia, and preoperative coagulopathy were good predictors of ICU admission. Shock at presentation, deranged renal function and coagulopathy were associated with an increased risk of postoperative complications.

Generalised peritonitis is a common surgical emergency. It is one of the leading causes of death in non-trauma surgical patients, with a mortality as high as 20% (2, 3). Even with the advancement in diagnostic and therapeutic aspects over the years, a significant number of lives are being lost to this illness.

Several modifiable and non-modifiable factors can influence the clinical outcome in patients with perforation peritonitis. Attempts must be made to identify and optimize the high-risk patient preoperatively, while simultaneously preparing for emergency surgery. Multiple studies have tried to identify the factors that can influence the clinical outcome in these patients. Certain factors and lab parameters can be used to predict the outcome, and several scoring systems have been devised using them, such as the Acute Physiology and Chronic Health Evaluation (APACHE) score, the Simplified Acute Physiology Score (SAPS), the Boey Score, the Multi-

Organ Failure (MOF) Score, and the Mannheim Peritonitis Index (MPI) (2, 7). These scores are not simple to use and are time-consuming. Preoperative functional status is also being used for predicting the postoperative outcome (13). It is, thus, more relevant to identify simple patient parameters that can predict postoperative complications and mortality.

Anastomotic leak is one of the major complications following bowel repair or anastomosis. The UK Surgical Infection Study Group defined an enteric leak as "leakage of luminal contents from a surgical join between two hollow viscera" (14). Several factors have been linked to anastomotic leaks such as, malnutrition, steroids, tobacco use, leukocytosis, cardiovascular disease, alcohol use, lower GI anastomoses, suboptimal anastomotic blood supply, operative time of more than 2 hours, bowel obstruction, perioperative blood transfusion, and intra-operative septic conditions not conducive to a primary anastomosis (15, 16). We report the highest rate of anastomotic leaks between 41-50 years of age ($\chi 2$ = 16.846, p = 0.026). Mcdermott et al. found that the mean age group was 60 years and that age did not correlate with postoperative leakage (17). We found preoperative ileus to be significantly associated with anastomotic leaks ($\chi 2$ = 4.941, p = 0.043). Peter et al. observed similar findings in patients undergoing colorectal resection (15). Multiple studies have shown that those with lower GI anastomoses are more prone to leaks than those having anastomoses in the upper GI tract, especially after emergency surgery (16, 18). We found the site of perforation to be associated with anastomotic leaks ($\chi 2$ = 41.051, p = 0.045). However, most leaks in our patients occurred following duodenal, caecal, and colonic perforations, in that order. In another study, Gupta et al. observed that the size of the duodenal perforation determines the risk of postoperative leak (19). We report hypotension at the time of admission as an important predictor of postoperative mortality ($\chi 2$ = 18.214, p = 0.001) with 4.55 times higher risk in those with systolic BP ≤ 100 mmHg (95% CI = 2.19 - 9.22). Diastolic BP was also significantly associated with postoperative mortality (W = 988.500, p =0.001). Singh et al. also found that shock could predict poor postoperative outcomes, which is in line with our findings (7). In a study by Wesselink et al., the authors observed that intraoperative mean arterial pressure (MAP) less than 60-65mm Hg was associated with poor surgical outcomes (20).

We conclude that deranged renal function and hypoalbuminemia are important predictors of postoperative complications. This is in concordance with studies conducted previously (3, 21). Presence of coagulopathy (INR >5) was also related to postoperative mortality (t = -2.348, p = 0.027). This could be a result of sepsis-induced disseminated intravascular coagulopathy (DIC). In a single-centre analysis, Nakamura et al. found that preoperative DIC score is a prognostic factor for colonic perforation associated with peritonitis (22). Moreover, patients with deranged kidney function, hypoalbuminemia, and deranged INR were more likely to require ICU admission post-surgery. However, the other important causes of raised creatinine in these patients, such as urinary tract obstruction (stones, neoplasms, prostatic hyperplasia), diabetes, and nephrotoxic drug intake, must also be kept in mind.

It seems that preoperative variables such as tachycardia, hypotension, deranged renal function, coagulopathy, and hypoalbuminemia are strong predictors of poor prognosis in patients with perforation peritonitis. Identifying one or more of these high-risk predictors calls for a more aggressive resuscitation with rapid source control for a favourable patient outcome.

5. Limitation

This study was a retrospective one, and data collection was record-based. A larger prospective study is, thus, required to generate more substantial evidence. This study was conducted at a tertiary-care referral centre, thus receiving the sickest patients from the state and outside. Moreover, there was a significant delay in the presentation of patients due to the arduous Himalayan terrain. All of these could potentially cause a systematic error in favour of the most critical patients, which may not be the case at other centres, and thus, result in an overestimation in our findings. Age, and pre-existing systemic illnesses, are specific confounders that must also be individually matched for to generate more decisive evidence. The role of inflammatory markers such as C-reactive protein and procalcitonin in severity assessment in patients with perforation peritonitis and abdominal sepsis is well known (23, 24). However, due to the high costs of these tests and non-affordability by the majority of our patients, they could not be included in the present study.

6. Conclusion

Based on the results of this study, hypotension, azotaemia, coagulopathy, and delay in surgery increase the risk of postoperative mortality of patients undergoing emergency laparotomy for perforation peritonitis. Tachycardia, hypotension, azotaemia, hypoalbuminemia, and pre-operative coagulopathy were good predictors of ICU admission. Shock at presentation, deranged renal function, and coagulopathy were associated with an increased risk of postoperative complications.

7. Declarations

7.1. Acknowledgments

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Sciences, Rishikesh (India).

7.2. Funding and support

Nil.

7.3. Conflict of interest

The authors declare that they have no conflict of interest.

7.4. Authors' contribution

Dr. Somprakas Basu, Dr. Farhanul Huda, Dr. Praveen Kumar conceptualised the study; Dr. Ankit Rai, Dr. Lena Elizabath David, Dr. Chezhian S did the data collection; Dr. Ankit Rai, and Dr. Lena Elizabath David did the data analysis; Dr. Ankit Rai, Dr. Lena Elizabath David, Dr. Chezhian S prepared the first manuscript; Dr. Somprakas Basu, Dr. Farhanul Huda, Dr. Sudhir Singh, Dr. Praveen Kumar, Dr. Ankit Rai, Dr. Lena Elizabath David, Dr. Chezhian S reviewed the manuscript; Dr. Somprakas Basu, Dr. Farhanul Huda, Dr. Praveen Kumar supervised the study at all stages.

7.5. Data availability

The data used and/or analyzed in the study are available with the corresponding author and can be provided on request.

7.6. Ethical considerations

This study was approved by the Institute Ethics Committee of the All India Institute of Medical Sciences, Rishikesh (AIIMS/IEC/20/741). The committee waived patient consent for this study as medical records were used for data collection and a statement on patient data confidentiality and compliance with the Declaration of Helsinki was provided.

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Table 1: Associated factors of postoperative anastomotic leak in the studied patients

Parameters	Anastomotic Leak		P
	Present (n = 7)	Absent (n = 178)	
Age (Years)			
Mean ± SD	50.14 ± 6.31	42.31 ± 16.19	0.133
41-50 Years	5 (14.7)	29 (85.3)	0.026
51-60 Years	2 (7.1)	26 (92.9)	
Gender			
Male	7 (4.7)	142 (95.3)	0.349
Female	0 (0.0)	36 (100.0)	
Co-Morbidities			
Addiction	6 (4.9)	116 (95.1)	0.426
Symptoms			
Pain	7 (3.8)	176 (96.2)	1.000
Vomiting	3 (3.4)	85 (96.6)	1.000
Fever	4 (8.5)	43 (91.5)	0.073
Ileus	7 (6.4)	102 (93.6)	0.043
Duration of symptoms (days)			
Pain	4.43 ± 2.82	7.35 ± 18.24	0.591
Vomiting	4.00 ± 2.00	3.66 ± 3.69	0.329
Fever	3.75 ± 2.06	9.84 ± 17.45	0.589
Ileus	2.71 ± 1.60	2.74 ± 1.85	0.924
Vital signs			
Systolic BP (mmHg)	113.57 ± 21.63	109.76 ± 18.31	0.635
Pulse Rate (bpm)	111.57 ± 19.23	104.74 ± 17.30	0.342
Investigations			
Haemoglobin (g/dL)	11.38 ± 2.23	12.66 ± 3.17	0.403
TLC (/cu.mm)	9663.3 ± 3447.4	12408.4 ± 9243.02	0.727
Platelet Count (/cu.mm)	187.67 ± 56.89	1471.42 ± 9188.72	0.384
Blood Urea (mg/dL)	80.60 ± 64.35	59.33 ± 45.46	0.269
Serum Creatinine (mg/dL)	1.63 ± 1.82	1.29 ± 0.90	0.604
INR	1.21 ± 0.11	1.41 ± 0.55	0.492
Serum Albumin (g/dL)	3.00 ± 0.43	3.29 ± 0.84	0.334
Delay in surgery			
Yes	6 (5.7)	99 (94.3)	0.251
Site of perforation			
Gastric (Type I)	1 (20.0)	4 (80.0)	0.045
Gastric (Type III)	4 (5.9)	64 (94.1)	
Duodenum*	1 (100.0)	0 (0.0)	
Jejunum	1 (33.3)	2 (66.7)	
Management			
Operative	7 (4.7)	141 (95.3)	1.000
Non-operative	0 (0.0)	18 (100.0)	

Data are presented as mean ± standard deviation (SD) or frequency (%). BP: Blood Pressure;
INR: International Normalised Ratio; TLC: Total Leucocyte Count. *: duodenum, caecum, and ascending colon.

Table 2: Association between different grades of Clavien-Dindo postoperative complications and preoperative variables

Parameters	Post-operative complications based on Clavien-Dindo Grade							P
	I (n =1)	II (n = 21)	IIIa (n=15)	IIIb (n=7)	IVa (n=23)	IVb (n = 4)	V (n = 15)	
Age (Years)								
Mean ± SD	42.00 ± 0	35.81 ± 10.97	39.93 ± 15.81	43.57 ± 14.66	44.04 ± 16.83	51.75 ± 11.00	50.07 ± 18.80	0.199
Gender								
Male	1 (1.4)	14 (20.3)	12 (17.4)	7 (10.1)	20 (29.0)	4 (5.8)	11 (15.9)	0.448
Female	0 (0.0)	7 (41.2)	3 (17.6)	0 (0.0)	3 (17.6)	0 (0.0)	4 (23.5)	
Co-Morbidity								
Addiction	1 (1.9)	14 (25.9)	8 (14.8)	2 (3.7)	15 (27.8)	2 (3.7)	12 (22.2)	0.307
Symptom								
Pain	1 (1.2)	21 (24.7)	15 (17.6)	6 (7.1)	23 (27.1)	4 (4.7)	15 (17.6)	1.000
Vomiting	1 (2.6)	16 (42.1)	6 (15.8)	1 (2.6)	7 (18.4)	3 (7.9)	4 (10.5)	0.005
Fever	1 (3.6)	6 (21.4)	8 (28.6)	3 (10.7)	4 (14.3)	1 (3.6)	5 (17.9)	0.177
Ileus	1 (1.8)	11 (19.3)	8 (14.0)	5 (8.8)	18 (31.6)	3 (5.3)	11 (19.3)	0.422
Duration of symptoms (Days)								
Pain	2.00 ± 0	3.38 ± 1.75	16.40 ± 37.16	3.83 ± 3.25	4.22 ± 2.68	4.50 ± 1.29	13.87 ± 30.92	0.054
Vomiting	2.00 ± 0	2.69 ± 1.40	5.67 ± 3.50	1.00 ± 0	4.43 ± 3.87	4.33 ± 1.53	4.50 ± 3.79	0.186
Fever	2.00 ± 0	7.33 ± 6.25	5.62 ± 4.96	4.00 ± 1.73	4.25 ± 3.86	6.00 ± 0	10.00 ± 9.90	0.950
Ileus	2.00 ± 0	2.27 ± 1.42	4.50 ± 2.98	1.20 ± 0.45	3.28 ± 1.96	3.67 ± 2.08	2.36 ± 1.29	0.027
Vital signs								
Pulse Rate (BPM)								
Mean ± SD	128.0 ± 0	107.6± 19.12	106.00 ± 11.50	115.5 ± 25.7	106.3 ± 16.1	110.2 ± 16.8	112.07 ± 17.1	0.758
Systolic BP (mmHg)								
Mean ± SD	128.0 ±0	109.50 ± 16.4	114.20 ± 20.8	118.4 ± 11.7	114.78 ± 10.43	110.5 ± 30.44	100.5 ± 23.06	0.167
<100	0 (0.0)	5 (29.4)	2 (11.8)	0 (0.0)	1 (5.9)	2 (11.8)	7 (41.2)	0.013
≥100	1 (1.5)	15 (22.1)	13 (19.1)	7 (10.3)	22 (32.4)	2 (2.9)	8 (11.8)	
Diastolic BP (mmHg)								
Mean ± SD	70.00 ± 0	75.95 ± 11.27	76.27 ± 23.89	78.43 ± 8.83	69.30 ± 9.45	70.00 ± 14.14	61.87 ± 13.45	0.051
Investigations								
Haemoglobin (g/dL)	-	12.64 ± 3.15	11.65 ± 2.76	11.55 ± 3.66	12.36 ± 3.17	12.95 ± 2.52	9.34 ± 2.83	0.059
TLC (/cu.mm)	-	12395.1±7774.4	18355.6±11001.3	8580.0±6869.9	10847.4±7975.3	7480.6±5304.0	13102.5±15258.4	0.089
Platelet Count (/cu.mm)	-	282.05 ± 155.89	263.85 ± 244.21	280.29 ± 232.78	231.32 ± 105.79	202.67 ± 160.75	5508.55 ± 17409.69	0.597
Blood Urea (mg/dL)	-	51.38 ± 27.00	61.41 ± 51.76	48.57 ± 20.75	80.47 ± 62.90	170.82 ± 97.71	76.00 ± 47.52	0.103
Cr (mg/dL)								
Mean ± SD	-	1.21 ± 0.65	1.10 ± 0.53	0.78 ± 0.29	1.54 ± 1.37	3.09 ± 1.39	1.66 ± 1.20	0.058
≤2 mg/dL	0 (0.0)	16 (26.2)	14 (23.0)	7 (11.5)	15 (24.6)	1 (1.6)	8 (13.1)	0.043
>2 mg/dL	0 (0.0)	3 (20.0)	1 (6.7)	0 (0.0)	4 (26.7)	3 (20.0)	4 (26.7)	
INR								
Mean ± SD	-	1.40 ± 0.35	1.38 ± 0.20	1.23 ± 0.09	1.55 ± 0.81	1.25 ± 0.22	1.80 ± 0.50	0.154
≤1.5	0 (0.0)	10 (25.0)	10 (25.0)	5 (12.5)	11 (27.5)	2 (5.0)	2 (5.0)	0.017
>1.5	0 (0.0)	6 (28.6)	3 (14.3)	0 (0.0)	4 (19.0)	0 (0.0)	8 (38.1)	
Serum Albumin (g/dL)	-	3.38 ± 0.89	3.18 ± 0.73	2.61 ± 0.38	2.95 ± 0.83	3.10 ± 0.46	2.86 ± 0.84	0.081
Imaging								0.761
Delay in Surgery	1 (1.8)	15 (27.3)	9 (16.4)	3 (5.5)	14 (25.5)	3 (5.5)	10 (18.2)	0.879
Site of Perforation								0.367
Management								
Operative	1 (1.2)	21 (25.6)	13 (15.9)	7 (8.5)	21 (25.6)	4 (4.9)	15 (18.3)	0.682
Non-operative	0 (0.0)	0 (0.0)	1 (50.0)	0 (0.0)	1 (50.0)	0 (0.0)	0 (0.0)	

Data are presented as mean ± standard deviation (SD) or frequency (%). BP: Blood Pressure; Cr: Creatinine; INR: International Normalised Ratio; TLC: Total Leucocyte Count; BPM: Beat Per Minute.

Table 3: Association between need for ICU admission and preoperative parameters

Parameters	Need for ICU admission		P
	Yes (n = 32)	No (n = 138)	
Age (Years)			
Mean ± SD	46.59 ± 17.33	41.62 ± 15.51	0.141
Gender			
Male	28 (20.0)	112 (80.0)	
Female	4 (13.3)	26 (86.7)	
Co-Morbidity			
Addiction	23 (20.4)	90 (79.6)	0.472
Symptom			
Pain	32 (18.9)	137 (81.1)	1.000
Vomiting	12 (15.4)	66 (84.6)	0.275
Fever	9 (20.5)	35 (79.5)	0.765
Ileus	21 (21.0)	79 (79.0)	0.409
Duration of symptoms (days)			
Pain	9.81 ± 24.18	6.91 ± 17.08	0.575
Vomiting	2.83 ± 1.40	3.70 ± 3.85	0.723
Fever	5.00 ± 6.00	10.86 ± 19.03	0.317
Ileus	2.67 ± 1.32	2.77 ± 2.00	0.693
Pulse Rate (BPM)			
Mean ± SD	111.41 ± 15.69	102.87 ± 16.72	0.011
<100	6 (9.8)	55 (90.2)	0.020
≥100	26 (24.5)	80 (75.5)	
Systolic BP (mmHg)			
Mean ± SD	105.09 ± 22.42	112.01 ± 16.00	0.029
<100	12 (42.9)	16 (57.1)	<0.001
≥100	20 (14.4)	119 (85.6)	
Diastolic BP (mmHg)			
Mean ± SD	64.53 ± 13.75	72.67 ± 12.23	0.001
Laboratory			
Haemoglobin (g/dL)	12.26 ± 2.96	12.69 ± 3.27	0.505
TLC (/cu.mm)	11794.44 ± 9330.32	12709.10 ± 9307.87	0.406
Platelet Count (/cu.mm)	2390.15 ± 11114.30	968.27 ± 8028.70	0.224
Blood Urea (mg/dL)	77.87 ± 61.75	54.17 ± 40.04	0.030
Serum Creatinine (mg/dL)			
Mean ± SD	1.70 ± 1.19	1.18 ± 0.84	0.045
≤2	20 (15.2)	112 (84.8)	0.032
>2	8 (36.4)	14 (63.6)	
INR			
Mean ± SD	1.69 ± 0.75	1.30 ± 0.31	0.018
≤1.5	10 (10.9)	82 (89.1)	0.017
>1.5	9 (31.0)	20 (69.0)	
Serum Albumin (g/dL)			
Mean ± SD	2.94 ± 0.79	3.37 ± 0.84	0.016
<2.5 g/dL	7 (30.4)	16 (69.6)	0.149
≥2.5 g/dL	20 (16.8)	99 (83.2)	
Delay in Surgery			
Yes	18 (17.1)	87 (82.9)	0.572
Hours	14.78 ± 12.12	12.67 ± 22.15	0.191
Reason for the delay			
Unavailability of OT slot	14 (14.7)	81 (85.3)	
Unavailability of ICU/ventilator	0 (0.0)	1 (100.0)	
Delay in diagnosis	0 (0.0)	3 (100.0)	
Initial Resuscitation	3 (100.0)	0 (0.0)	0.016
Left against medical advice	0 (0.0)	0 (0.0)	
Non-operative management	1 (50.0)	1 (50.0)	
Delay in CT scan	0 (0.0)	1 (100.0)	
Impending Perforation	0 (0.0)	1 (100.0)	

Table 3: Association between need for ICU admission and preoperative parameters

Parameters	Need for ICU admission		P
	Yes (n = 32)	No (n = 138)	
Management			
Operative	29 (19.6)	119 (80.4)	0.531
Non-operative	2 (11.1)	16 (88.9)	

Data are presented as mean ± standard deviation (SD) or frequency (%). BP: Blood Pressure; INR: International Normalised Ratio; TLC: Total Leukocyte Count; ICU: Intensive Care Unit; CT: Computed Tomography; OT: Operation Theatre; BPM: Beat Per Minute.

Table 4: Association between postoperative 30-day mortality and preoperative parameters

Parameters	Mortality		P
	Present (n = 23)	Absent (n=162)	
Age (Years)			
Mean ± SD	49.00 ± 18.51	41.70 ± 15.45	0.072
Gender			
Male	17 (11.4)	132 (88.6)	0.403
Female	6 (16.7)	30 (83.3)	
Co-Morbidity			
Addiction	14 (11.5)	108 (88.5)	0.583
Symptom			
Pain	23 (12.6)	160 (87.4)	1.000
Vomiting	9 (10.2)	79 (89.8)	0.358
Fever	7 (14.9)	40 (85.1)	0.577
Ileus	15 (13.8)	94 (86.2)	0.555
Duration of symptoms (Days)			
Pain	14.43 ± 29.99	6.21 ± 15.29	0.534
Vomiting	3.44 ± 2.65	3.70 ± 3.75	0.657
Fever	7.86 ± 8.88	9.57 ± 17.87	0.844
Ileus	2.40 ± 1.12	2.79 ± 1.91	0.706
Pulse Rate (BPM)			
Mean ± SD	112.43 ± 15.33	103.92 ± 17.42	0.020
<100	4 (6.2)	60 (93.8)	0.054
≥100	19 (16.2)	98 (83.8)	
Systolic BP (mmHg)			
Mean ± SD	98.26 ± 22.49	111.60 ± 17.15	0.002
<100	12 (34.3)	23 (65.7)	<0.001
≥100	11 (7.5)	135 (92.5)	
Diastolic BP (mmHg)			
Mean ± SD	61.70 ± 12.04	72.08 ± 12.96	<0.001
Laboratory data			
Haemoglobin (g/dL)			
Mean ± SD	10.17 ± 2.62	12.94 ± 3.09	<0.001
<8 g/dL	3 (33.3)	6 (66.7)	0.061
≥8 g/dL	15 (9.6)	141 (90.4)	
TLC (/cu.mm)	14282.7± 14684.3	12135.6 ± 8356.3	0.648
Platelet Count (/cu.mm)	3464.1 ± 13610.6	1197.4 ± 8415.4	0.165
Blood Urea nitrogen (mg/dL)	91.61 ± 68.97	55.63 ± 40.37	0.012
Serum Creatinine (mg/dL)			
Mean ± SD	1.78 ± 1.22	1.24 ± 0.87	0.063
≤2 mg/dL	14 (10.1)	125 (89.9)	0.094
>2 mg/dL	6 (23.1)	20 (76.9)	
INR			
Mean ± SD	1.91 ± 0.80	1.35 ± 0.47	0.002
≤1.5	4 (4.2)	92 (95.8)	<0.001
>1.5	10 (30.3)	23 (69.7)	
Serum Albumin (g/dL)	2.89 ± 0.77	3.34 ± 0.83	0.027
Mean ± SD			0.089
<2.5 g/d	L 6 (24.0)	19 (76.0)	
≥2.5 g/dL	13 (10.2)	115 (89.8)	
Reason for the delay			
Unavailability of OT slot	9 (9.5)	86 (90.5)	
Unavailability of ICU/ventilator	0 (0.0)	12 (100.0)	
Delay in diagnosis	1 (33.3)	2 (66.7)	0.008
Initial Resuscitation	3 (100.0)	0 (0.0)	
Left against medical advice	0 (0.0)	2 (100.0)	
Non-operative management	0 (0.0)	2 (100.0)	
Delay in investigations (CT)	0 (0.0)	1 (100.0)	
Impending Perforation	0 (0.0)	1 (100.0)	

Table 4: Association between postoperative 30-day mortality and preoperative parameters

Parameters	Mortality		P
	Present (n = 23)	Absent (n=162)	
Management			
Operative	20 (13.5)	128 (86.5)	1.000
Non-operative	2 (11.1)	16 (88.9)	

Data are presented as mean ± standard deviation (SD) or frequency (%). BP: Blood Pressure; INR: International Normalised Ratio; TLC: Total Leukocyte Count; ICU: Intensive Care Unit; CT: Computed Tomography; OT: Operation Theatre; BPM: Beat Per Minute.