ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 7543-7546 (2026)
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BIOINFORMATION
Discovery at the interface of physical and biological sciences
BIOMEDICAL INFORMATICS
www.bioinformation.net
Volume 22(10)
Research Article

Received October 1, 2026; Revised October 31, 2026; Accepted October 31, 2026, Published October 31, 2026
DOI: 10.6026/973206300227543

SJIF 2026 (Scientific Journal Impact Factor for 2026) = 8.478
2022 Impact Factor (2023 Clarivate Inc. release) is 1.9

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Edited by Ruby Singh
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Citation: Kumar *et al.* Bioinformation 22(10): 7543-7546 (2026)

Etiology, management and outcome analysis of perforation peritonitis in a tertiary care centre, India

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ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 7543-7546 (2026)
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Abstract:
Perforation peritonitis is a serious abdominal emergency associated with substantial morbidity and mortality despite advances in perioperative care. This prospective observational study evaluated 124 patients undergoing emergency laparotomy at a tertiary care centre for etiology, clinical presentation, surgical management, complications and prognostic scores. Peptic ulcer disease was the most common cause, ileal perforation was the most frequent site and higher Mannheim Peritonitis Index (MPI) and Jabalpur Prognostic Index (JPI) scores were associated with increased post-operative complications and mortality. Early diagnosis, adequate resuscitation and timely surgical intervention remain essential for improving outcomes. MPI and JPI may aid in risk stratification and prognostic assessment of patients with perforation peritonitis.

Keywords: Perforation peritonitis, Mannheim peritonitis index (MPI), Jabalpur prognostic index (JPI), emergency laparotomy, post-operative complications

Background:
Perforation peritonitis is a common surgical emergency caused by perforation of a hollow viscus leading to contamination of the peritoneal cavity by gastrointestinal contents. If not treated in time, it can rapidly progress to sepsis, multiorgan dysfunction and death **[1, 2].** Even with improvements in antibiotics, anesthesia and intensive care support, perforation peritonitis continues to carry significant morbidity and mortality, especially in developing countries where delayed hospital presentation is frequently encountered **[3].** The causes of perforation peritonitis differ according to geographic region and socioeconomic conditions. In India, peptic ulcer disease, enteric perforation, abdominal tuberculosis, trauma and malignancy are among the common etiological factors **[4]**. Patients usually present with severe abdominal pain, abdominal distension, vomiting, fever, guarding and rigidity. Delay in diagnosis and treatment often worsens the clinical condition and increases the risk of post-operative complications **[5].** Emergency exploratory laparotomy remains the standard treatment for most patients. Depending on intraoperative findings, procedures such as primary repair, Graham's patch repair, bowel resection, or stoma formation may be performed **[6]**. In recent years, prognostic scoring systems like Mannheim Peritonitis Index (MPI) and Jabalpur Prognostic Index (JPI) have been increasingly used to predict morbidity and mortality and to identify patients requiring intensive management **[7].** Therefore it is interest to evaluate the etiological factors, surgical management, post-operative complications and overall outcomes of perforation peritonitis in a tertiary care centre and to assess the prognostic value of MPI and JPI scoring systems.

Materials and Methods:
Study design and setting:
This prospective observational study was conducted in the Department of General Surgery, Gandhi Medical College and Associated Hospitals, Bhopal, over a period of 18 months. A total of 124 adult patients presenting with clinical and radiological evidence of perforation peritonitis and undergoing emergency surgical intervention were included in the study.

Inclusion criteria:
[1] Patients with perforation peritonitis undergoing emergency laparotomy
[2] Patients of either gender who provided informed consent
[3] Patients with intraoperatively confirmed hollow viscus perforation

Exclusion criteria:
[1] Patients with primary peritonitis including spontaneous bacterial peritonitis
[2] Patients unfit for surgery or anesthesia
[3] Patients who expired before definitive surgical intervention
[4] Patients who not provided informed consent

Data collection:
Clinical data were collected prospectively using a structured proforma. Pre-operative details included demographic profile, presenting symptoms, co-morbidities, laboratory investigations, radiological findings and prognostic scores including Mannheim Peritonitis Index (MPI) and Jabalpur Prognostic Index (JPI). Intraoperative findings such as site and cause of perforation, degree of contamination and surgical procedure performed were recorded. Post-operative complications, ICU requirement, duration of hospital stay, morbidity and mortality were also documented.

Outcome measures:
The primary outcome was in-hospital mortality. Secondary outcomes included post-operative complications such as surgical site infection, respiratory complications, renal failure, paralytic ileus and duration of hospital stay. Correlation of post-operative outcomes with MPI and JPI scores was also assessed.

Statistical analysis:
Data were entered in Microsoft Excel and analyzed using Epi Info version 7.0. Quantitative variables were expressed as mean ± standard deviation, while qualitative variables were presented as frequency and percentage. Chi-square test or Fisher's exact test was used to assess association between prognostic scores

and post-operative outcomes. A p-value <0.05 was considered statistically significant.

Results:

The majority of patients belonged to the 21–40 years age group, accounting for 56.46% of the study population, a marked male predominance (83.87%) was observed and male-to-female ratio was 5.2:1. Diabetes mellitus was the most common associated co-morbidity **(Table 1).** Peptic ulcer disease was the most common cause of perforation peritonitis, accounting for 34.68% of cases, followed by enteric perforation (28.23%) **(Figure 1).** Ileum was the most common anatomical site of perforation (37.10%), followed by the pre-pyloric region (20.16%). Regarding surgical management, stoma formation was the most commonly performed procedure (45.16%), reflecting severe contamination and delayed presentation in many patients. Graham's patch repair and modified Graham's patch were frequently employed in gastroduodenal perforations **(Table 2).** Pyoperitoneum was the most common type of peritoneal contamination observed in 72.58% patients, followed by fecopyoperitoneum and haemoperitoneum, each accounting for 12.90% cases **(Table 3).** Post-operative complications and mortality increased with rising Mannheim Peritonitis Index (MPI) scores. Mortality was absent in the low-risk group (<21), increased to 16.7% in the moderate-risk group (21–29) and reached 52.6% in the high-risk group (>29). Surgical site infection was the most common complication across all groups, while renal failure, burst abdomen and post-operative bowel obstruction were more frequently observed in patients with higher MPI scores. Mean hospital stay also progressively increased with increasing MPI score **(Table 4).** A significant association was observed between higher MPI scores and adverse post-operative outcomes. Mortality, renal failure, post-operative bowel obstruction and paralytic ileus showed statistically significant correlation with increasing MPI scores ($p<0.05$) **(Table 5).** Higher Jabalpur Prognostic Index (JPI) scores were significantly associated with increased post-operative complications and mortality. Mortality increased from 0% in the low-risk group (0–6) to 45.0% in patients with scores >12. Anastomotic leak, paralytic ileus, surgical site infection, respiratory illness, renal failure and post-operative bowel obstruction demonstrated statistically significant association with rising JPI scores **(Table 6**). Out of 124 patients with perforation peritonitis, the majority survived following surgical management, while mortality was observed in 15.3% cases.

Table 1: Demographic profile of patients with perforation peritonitis

Variable Category		Number of Patients (N=124)	Percentage (%)
Age Group (Years)	11–20	13	10.48%
	21-30	35	28.23%
	31-40	35	28.23%
	41-50	18	14.52%
	51-60	9	7.26%
	61-70	10	8.06%
	71-80	4	3.23%
Gender	Male	104	83.87%
	Female	20	16.13%
Co-morbidities	No Significant Co-morbidity	103	83.06%
	Diabetes Mellitus	10	8.06%
	Hypertension	6	4.84%
	Diabetes + Hypertension	5	4.03%

Table 2: Distribution of anatomical sites of perforation and surgical procedures performed

Variable Category		Number of Patients (N=124)	Percentage (%)
Site of Perforation	Ileal	46	37.10%
	Pre-pyloric	25	20.16%
	Jejunal	15	12.10%
	Appendicular	10	8.06%
	Pyloric	9	7.26%
	Gastric Body	7	5.65%
	Others	12	9.67%
Surgical Procedure	Stoma Formation	56	45.16%
	Modified Graham's Patch	30	24.19%
	Graham's Patch	14	11.29%
	Primary Repair	12	9.68%
	Appendicectomy	7	5.65%
	Others	5	4.03%

Table 3: Distribution of patients according to degree of peritoneal contamination

Peritoneal Contamination	Frequency (N)	Percentage (%)
Pyoperitoneum	90	72.58%
Fecopyoperitoneum	16	12.90%
Haemoperitoneum	16	12.90%
Haemobilio-peritoneum	2	1.16%

Table 4: Distribution of post-operative complication across Mannheim peritonitis index groups

MPI Category	<21 (Low risk)	21–29 (Moderate risk)	>29 (High risk)
n (%)	77 (62.1%)	42 (33.9%)	19 (15.3%)
Mortality n (%)	0 (0.0%)	7 (16.7%)	10 (52.6%)
Anastomotic Leak n (%)	5 (6.5%)	4 (9.5%)	1 (5.3%)
Paralytic Ileus n (%)	20 (26.0%)	5 (11.9%)	6 (31.6%)
Surgical Site Infection n (%)	25 (32.5%)	22 (52.4%)	10 (52.6%)
Burst Abdomen n (%)	2 (2.6%)	5 (11.9%)	4 (21.1%)
Respiratory Illness n (%)	13 (16.9%)	4 (9.5%)	2 (10.5%)
Renal Failure n (%)	1 (1.3%)	6 (14.3%)	10 (52.6%)
Post-op Bowel Obstruction n (%)	2 (2.6%)	0 (0.0%)	3 (15.8%)
Intra-abdominal Abscess n (%)	12 (15.6%)	1 (2.4%)	0 (0.0%)
Stricture n (%)	4 (5.2%)	0 (0.0%)	1 (5.3%)
Incisional Hernia n (%)	1 (1.3%)	0 (0.0%)	0 (0.0%)
Mean Hospital Stay (days)	15.2	17.8	21.3

Table 5: Correlation between Mannheim peritonitis index scores and post-operative outcomes (complications and mortality)

Outcome	<21	21–29	>29	p-value
Mortality	0 (0.0%)	7 (16.7%)	10 (52.6%)	<0.0001
Anastomotic Leak	5 (6.5%)	4 (9.5%)	1 (5.3%)	0.384
Paralytic Ileus	20 (26.0%)	5 (11.9%)	6 (31.6%)	0.005
Surgical Site Infection	25 (32.5%)	22 (52.4%)	10 (52.6%)	0.360
Burst Abdomen	2 (2.6%)	5 (11.9%)	4 (21.1%)	0.594
Respiratory Illness	13 (16.9%)	4 (9.5%)	2 (10.5%)	0.316
Renal Failure	1 (1.3%)	6 (14.3%)	10 (52.6%)	<0.0001
Post-op Bowel Obstruction	2 (2.6%)	0 (0.0%)	3 (15.8%)	<0.001
Intra-abdominal Abscess	12 (15.6%)	1 (2.4%)	0 (0.0%)	0.546
Stricture	4 (5.2%)	0 (0.0%)	1 (5.3%)	0.320
Incisional Hernia	1 (1.3%)	0 (0.0%)	0 (0.0%)	0.611

Table 6: Association of Jabalpur prognostic index with post-operative outcomes

Outcome	0–6 (n=63)	7–12 (n=41)	>12 (n=20)	p-value
Mortality	0 (0.0%)	8 (19.5%)	9 (45.0%)	<0.0001
Anastomotic Leak	2 (3.2%)	5 (12.2%)	3 (15.0%)	0.0077
Paralytic Ileus	10 (15.9%)	13 (31.7%)	8 (40.0%)	<0.001
Surgical Site Infection	14 (22.2%)	16 (39.0%)	7 (35.0%)	0.0166
Burst Abdomen	1 (1.6%)	4 (9.8%)	2 (10.0%)	0.0640
Respiratory Illness	5 (7.9%)	9 (22.0%)	5 (25.0%)	0.0135
Renal Failure	2 (3.2%)	5 (12.2%)	4 (20.0%)	<0.0001
Post-op Bowel Obstruction	1 (1.6%)	2 (4.9%)	1 (5.0%)	<0.001
Intra-abdominal Abscess	4 (6.3%)	6 (14.6%)	3 (15.0%)	0.5422

Stricture	1 (1.6%)	2 (4.9%)	1 (5.0%)	0.7771
Incisional Hernia	0 (0.0%)	1 (2.4%)	0 (0.0%)	0.3604

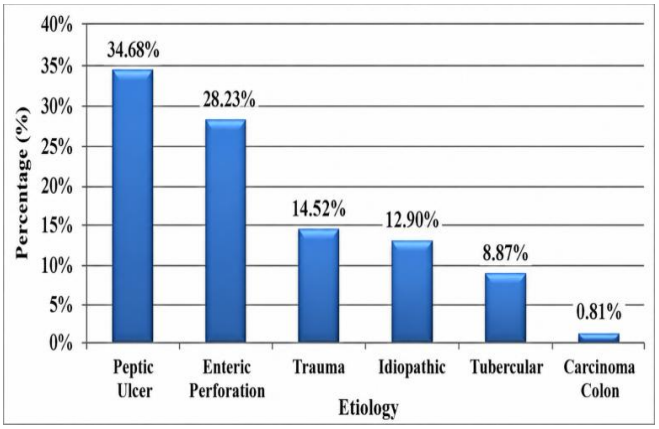


Figure 1: Etiological distribution of perforation peritonitis

Discussion:

Perforation peritonitis remains a major cause of surgical emergencies in developing countries and continues to contribute significantly to post-operative morbidity and mortality **[8].** In the present study, most patients belonged to the younger age group of 21–40 years, with a clear male predominance. Similar demographic trends have been observed in other Indian studies **[9].** Peptic ulcer disease was found to be the most common cause of perforation peritonitis, followed by enteric perforation. These findings are in agreement with previous studies conducted in tertiary care settings, where upper gastrointestinal and small bowel perforations formed the majority of cases **[10, 11].** Ileal perforation was the most commonly involved site in our study, possibly reflecting the persistent burden of enteric infections and delayed referral patterns in developing regions **[12].** Stoma formation was the most commonly performed surgical procedure. This may be related to severe contamination, friable bowel condition and unstable presentation in many patients. Similar observations have been reported in recent surgical studies where diversion procedures were preferred in high-risk cases to reduce post-operative leakage and sepsis **[13].** Post-operative complications such as surgical site infection, paralytic ileus, respiratory illness and renal failure were more frequently observed in patients with higher MPI and JPI scores. Mortality also increased significantly with rising prognostic scores, suggesting that both scoring systems are useful indicators of disease severity and post-operative outcome **[14].** Comparable findings have been documented in recent studies evaluating the prognostic role of MPI and JPI in perforation peritonitis **[15].** The findings of the present study highlight the importance of early diagnosis, prompt resuscitation, timely surgical intervention and proper post-operative monitoring in reducing complications and improving survival in patients with perforation peritonitis.

Conclusion:

Perforation peritonitis remains a major surgical emergency, with peptic ulcer disease and enteric perforation as leading causes. Higher MPI and JPI scores were significantly associated with post-operative complications and mortality. Early diagnosis, prompt surgery, and adequate resuscitation are essential to improve patient outcomes.

Ethical approval: Institutional Ethics Committee approval was obtained before commencement of the study.

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