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A Study of Clinical Evaluation and Management of Gastro-Intestinal Perforations

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ABSTRACT

Background: Despite advances in diagnostic modalities, antibiotics, anesthesia, and surgical techniques, perforated peritonitis continues to be associated with significant morbidity and mortality. The present study examines the clinical profile, etiology, operative management, postoperative complications, and outcomes in patients presenting with gastrointestinal perforation.

Methods: This prospective observational study was conducted in the Department of General Surgery at a tertiary care hospital. A total of 78 patients diagnosed with gastrointestinal perforation who underwent emergency surgical intervention were included in the study. Detailed clinical history, physical examination findings, laboratory investigations, intra-operative findings, surgical procedures performed, postoperative complications, and outcomes were recorded and analyzed.

Results: In the present study, gastrointestinal perforation was more commonly observed in middle-aged individuals with male predominance. The most common etiology was peptic ulcer disease (43.6%), followed by appendicitis (28.2%), typhoid fever (15.4%), malignancy (7.7%), and tuberculosis (5.1%). With respect to the anatomical site, appendicular (28.2%) was the most common, followed by gastric perforation (prepyloric) (25.6%), ileal (24.4%), and duodenal perforations (14.1%). Emergency exploratory laparotomy was performed in all patients. The most frequently performed procedure was Graham's omental patch repair (39.7 %), followed by appendicectomy (28.2%). Surgical site infection was the most common complication (34.6%), followed by sepsis (17.9%) and respiratory complications. Mortality occurred in 12.8% of patients, mainly among those presenting with shock, severe sepsis, and delayed presentation.

Conclusion: Early diagnosis, aggressive resuscitation, prompt surgical intervention, and meticulous postoperative care are essential to improve outcomes in patients with perforated peritonitis.

Keywords: Peptic ulcer, Gastrointestinal perforation, Peritonitis, Mortality

INTRODUCTION

Gastrointestinal perforation is a surgical emergency that is defined by the transgression of the complete thickness of a viscus wall, which in turn causes the escape of GI contents into the peritoneal cavity and leads to peritonitis.[1] Also, it is the main reason for emergency laparotomy in developing countries and still is related to high rates of morbidity and mortality,

although we have seen improvements in surgical procedures, critical care, and antimicrobial therapy. [2]

GI perforations can be seen due to many intestinal diseases like peptic ulcer disease, inflammatory bowel diseases, diverticulitis, secondary to typhoid or tuberculosis, ischaemic bowel disease, and malignancies. Additionally, it can also be due to traumatic injuries (both blunt and penetrating) or iatrogenic injuries during endoscopic procedures. [3,4]

Peritoneal contamination after gastrointestinal perforation is a major consequence, occurring due to the spillage of gastric and intestinal contents and bacteria into the peritoneum.[5,6]

Bacterial infection and systemic inflammatory response syndrome (SIRS) develop after chemical peritonitis initially.[7] This may progress to sepsis, septic shock, and multiorgan failure if left untreated.[8] The length of time between perforation and surgical intervention, host immunological response, bacterial load, and degree of contamination are important factors that affect the outcome.[9] Initial care must include early detection and timely resuscitation with intravenous fluids, electrolyte correction, and broad-spectrum antibiotics.[10]

It is crucial to assess the clinical profile, operational care, and postoperative results in specific institutions due to the ongoing burden of gastrointestinal perforations and the regional variations in etiological patterns. Such information aids in the identification of risk factors for complications, the comprehension of regional illness trends, and the improvement of management tactics. The study's conclusions are intended to add to the body of knowledge already in existence and help enhance the prognosis and treatment of this potentially fatal illness.

Objectives: To study the clinical profile, etiological factors, surgical management, and postoperative outcomes of patients presenting with gastrointestinal perforations at a tertiary care hospital.

MATERIALS AND METHODS

The study was a hospital-based prospective observational study, conducted in the Department of General Surgery at Gulbarga Institute of Medical Sciences (GIMS), Kalaburagi, a tertiary care teaching hospital that caters to both urban and rural populations. The study was carried out over a period of 18 months, from May 2024 to October 2025. All patients admitted to the surgical wards and emergency department with a diagnosis of gastrointestinal perforation during the study period were included in the study. A total of 78 patients who fulfilled the inclusion criteria were included in the study.

Sample size was calculated with 95% confidence interval estimation, 15% anticipated range and 10% absolute error of margin by using formula:

Sample Size Calculation

The sample size for the present study was calculated using the following formula:

$$n = \frac{Z^2 \times p \times q}{d^2}$$

Where:

n = Required sample size

Z = Standard normal deviate at 95% confidence level (1.96)

p = Expected prevalence/proportion

$q = 1 - p$

d = Allowable error (precision)

In the present study:

Expected prevalence (p) = 20% = 0.20

Therefore, $q = 1 - 0.20 = 0.80$

Allowable error (d) = 11% = 0.11

Substituting these values in the formula:

$$n = \frac{(1.96)^2 \times 0.20 \times 0.80}{(0.11)^2}$$

$$n = \frac{3.84 \times 0.20 \times 0.80}{0.0121}$$

$$n = \frac{0.6144}{0.0121}$$

$$n = 50.7$$

Thus, the required sample size for the study is 50 participants**.** Previous prospective studies evaluating the clinical profile and management of gastrointestinal perforations have utilized sample sizes of approximately

50 patients; hence, a sample size of 50 was considered adequate and feasible for the present study. [11,12]

Patients aged 18 to 80 years, diagnosed with gastrointestinal perforation based on clinical, radiological, and intraoperative findings, who underwent surgical management for gastrointestinal perforation and who provided informed consent to participate in the study were included in the study. Patients with traumatic and esophageal perforations, who were managed conservatively without surgery and who did not give consent for participation were excluded from the study.

Ethical clearance was obtained from the Institutional Ethics Committee of Gulbarga Institute of Medical Sciences before commencement of the study (GIMS/KLB/PHARMA/IEC/262/2024-25). Written informed consent was obtained from all patients or their attendants. Confidentiality of patient data was strictly maintained throughout the study.

Data were collected using a structured and predesigned proforma. Demographic details, Clinical history, Radiological Investigations such as Plain erect chest and abdominal radiograph to detect free air under the diaphragm, Ultrasonography of abdomen to identify free fluid and bowel pathology, Contrast-enhanced CT scan was performed in selected cases where diagnosis was uncertain or for localization of perforation.

All patients preoperatively underwent initial resuscitation which included, Intravenous fluid administration, Correction of electrolyte imbalance and Nasogastric decompression. The various surgical procedures were performed based on patients' factors and site of perforation. The primary outcome measures such as postoperative morbidity, need for intensive care unit admission, duration of hospital stay and mortality were measured. Patients were followed until discharge or death.

Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Descriptive statistics, such as frequencies and percentages for categorical variables and mean and standard deviation for continuous variables, were used. Significance was assessed using a t-test. The chi-square test was used to express categorical variables as proportions.

RESULTS

All 78 patients who fulfilled the inclusion criteria and underwent surgical management were analyzed. The demographic profile, clinical presentation, etiological factors, intraoperative findings, surgical procedures performed, postoperative complications, and outcomes were recorded using a structured proforma.

The Mean age was 44.6 ± 15.2 years. The majority of patients belonged to the 31–40 years age group (23.1%). A considerable proportion (21.8%) were elderly (>60 years), indicating that gastrointestinal perforation affects both middle-aged and older populations. There was a statistically significant ($p<0.001$) male predominance in the study population with a male-to-female ratio of 2.9: 1, suggesting higher exposure of males to risk factors such as smoking, alcohol consumption, and NSAID use. Although males predominated across all age groups, the difference was not statistically significant ($p=0.77$), indicating a similar age distribution pattern among both sexes **(Table 1)**.

Table 1: Age and Sex Distribution of study populations.

Age Group	Male	Female	Total
18–30	11	3	14
31–40	14	4	18
41–50	12	4	16
51–60	9	4	13
>60	12	5	17
Total	**58**	**20**	**78**

All the 78 patients presented with pain abdomen. Sixty-two patients also had complained of abdominal distension and 49 patients had vomiting, 36 patients had constipation and 28 of them presented with fever, reflecting generalized peritonitis at presentation **(Figure 1)**.

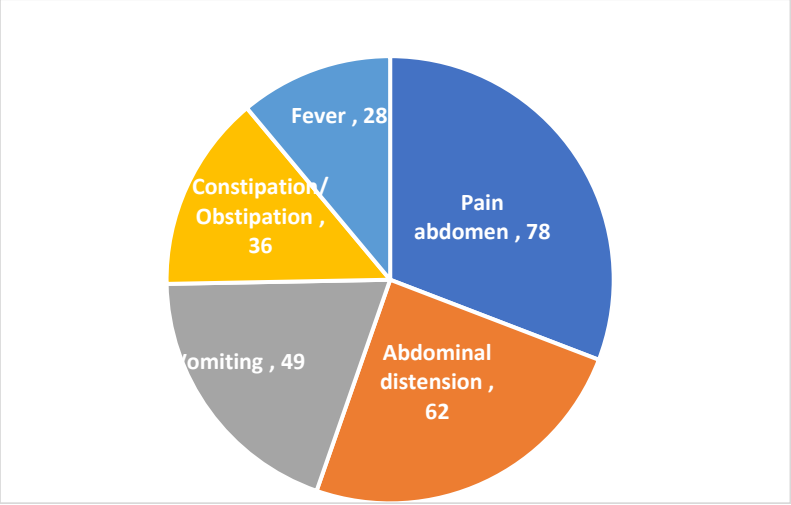

Figure 1: Clinical Presentation of Patients.

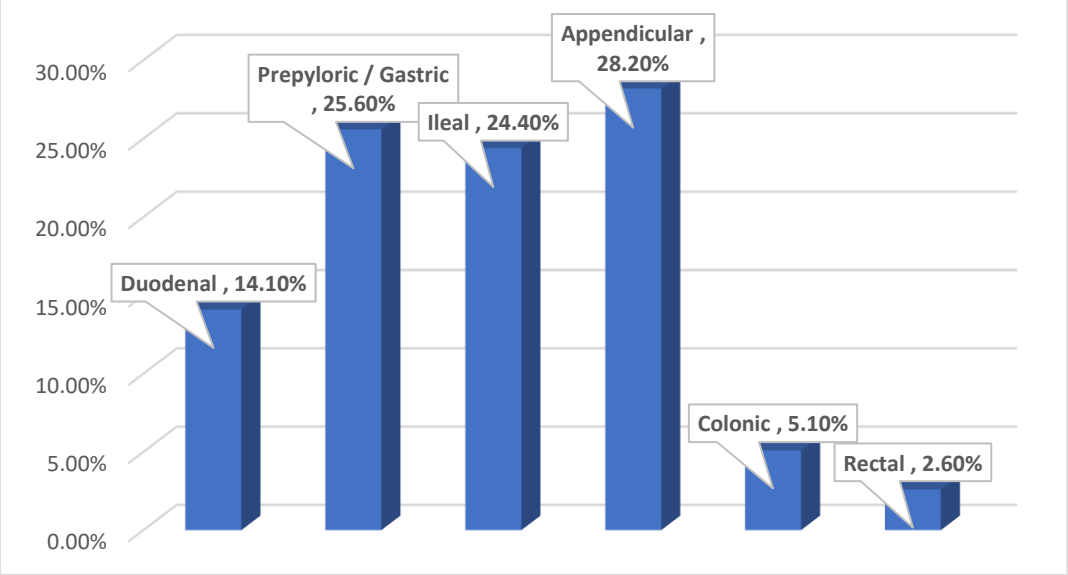

Figure 2: Anatomical Site of Perforation.

Concerned to anatomical site of perforation, appendicular perforation was the most common site of perforation, accounting for 28.2% of cases, followed by prepyloric/gastric perforation (25.6%) and ileal perforation (24.4%). Duodenal perforation constituted 14.1% of cases. Overall, lower gastrointestinal perforations were more common than upper gastrointestinal perforations in the present study **(Figure 2)**.

Table 2: Surgical management details of study populations.

S. No	Surgical management details	Number of Patients (%)
1.	**Surgical Procedure**	
	Graham's omental patch repair	31 (39.7)
	Primary closure of perforation	14 (17.9)
	Appendicectomy	22 (28.2)

	Resection and anastomosis	4 (5.1)
	Diversion stoma	7 (9)
2.	**Postoperative Complication**	
	No complication	23(29.5)
	Surgical site infection	27(34.6)
	Sepsis	14(17.9)
	Respiratory complications	6 (7.7)
	Bile leak	4 (5.1)
	Drain site abscess	2 (2.6)
	Burst abdomen	2 (2.6)
3.	**ICU Requirement**	
	No ICU admission	26 (33.3)
	ICU admission without mechanical ventilation	41 (52.6)
	ICU admission with mechanical ventilation	11 (14.1)
4.	**Duration of Stay (days)**	
	≤ 7 days	20(25.6)
	8–14 days	42 (53.8)
	>14 days	16 (20.5)
5.	**Outcome**	
	Discharged	68 (87.2)
	Death	10 (12.8)

Peptic ulcer disease was the most common etiological factor, accounting for 43.6% of cases, followed by appendicitis (28.2%) and typhoid fever (15.4%). Malignancy and tuberculosis contributed to 7.7% and 5.1% of cases respectively. Graham's omental patch repair was the most commonly performed surgical procedure (39.7%), reflecting the predominance of upper gastrointestinal perforations. This was followed by appendicectomy (28.2%) and primary closure of perforation (17.9%). Diversion stoma (9.0%) and resection with anastomosis (5.1%) were performed in complicated cases requiring more extensive surgical management. In the present study, surgical site infection was the most common postoperative complication, observed in 34.6% of patients, followed by sepsis (17.9%) and respiratory complications (7.7%). Approximately 29.5% of patients had an uneventful postoperative course without complications. Other complications such as bile leak, drain site abscess, and burst abdomen were observed in a smaller proportion of patients. In the present study, 66.7% of patients required ICU admission following surgery for gastrointestinal perforation. Among them, 14.1% required mechanical ventilation, indicating severe systemic illness and respiratory compromise. Approximately 33.3% of patients were managed without ICU admission, suggesting relatively stable postoperative recovery in this group. The majority of patients (53.8%) had a hospital stay between 8–14 days. Prolonged hospital stay (>14 days) was observed in patients with postoperative complications. The overall mortality rate was 12.8%, which is comparable to rates reported in similar studies on perforation peritonitis **(Table 2).**

Table 3: Association between site of perforation, surgical procedure, and complications.

S. No	Site of Perforation and Procedure Performed	Complication Present (n=55)	No Complication (n=23)	Total (78)
1.	**Site of Perforation**			
	• Duodenal	6	5	11
	• Gastric / Prepyloric	15	5	20
	• Ileal	14	5	19
	• Appendicular	14	8	22
	• Colonic	4	0	4
2.	**Procedure Performed**			
	• Graham's omental patch repair	19	12	31

	• Primary closure • Appendicectomy • Resection and anastomosis • Diversion stoma	11 12 4 9	3 10 0 0	14 22 4 7

Table 3 shows the association between site of perforation, surgical procedure and complications. Complications were more frequently seen in ileal (14/19) and gastric perforations (15/20), likely due to greater peritoneal contamination and delayed presentation. However, the distribution of complications across different perforation sites did not show a statistically significant association. Postoperative complications were more frequent after major procedures such as diversion stoma (9/9) and resection with anastomosis (4/4), whereas comparatively fewer complications were observed after appendicectomy (12/22) and Graham's omental patch repair (19/31).

Table 4: Comparison between the various parameters and outcome of patients.

S. No	Parameters	Discharged	Death	Total
1.	**Age Group (years)**			
	18–30	14	0	14
	31–40	17	1	18
	41–50	14	2	16
	51–60	10	3	13
	>60	13	4	17
2.	**Duration**			
	≤ 24 hours	39	1	40
	> 24 hours	29	9	38
3.	**ICU Requirement**			
	No ICU admission	26	0	26
	ICU admission without mechanical ventilation	38	3	41
	ICU admission with mechanical ventilation	4	7	11
4.	**Shock at Presentation**			
	Present	24	10	34
	Absent	44	0	44
5.	**Type of Perforation**			
	Upper gastrointestinal perforation	29	2	31
	Lower gastrointestinal perforation	39	8	47

There was a statistically significant association between increasing age and mortality, indicating poorer outcomes among elderly patients (4/10 patients). Mortality was higher among patients who underwent surgery after 24 hours of symptom onset (9/10 patients). This suggests that delay in diagnosis and intervention adversely affected survival. Mortality was markedly higher among patients requiring ICU admission with mechanical ventilation (7/10 patients). Patients managed without ICU admission had no mortality in the present study (0/10 patients). In the present study, 34 patients presented with shock at admission, and mortality was significantly higher in this group. All 10 deaths occurred among patients presenting with shock, indicating that shock at presentation was a strong predictor of poor outcome in patients with gastrointestinal perforation. Mortality was higher among lower gastrointestinal perforations (8/10 patients) compared to upper gastrointestinal perforations (2/10 patients), likely due to greater fecal contamination, delayed presentation, and higher incidence of sepsis **(Table 4)**.

DISCUSSION

In the present study, gastrointestinal perforation was most frequently observed among middle-aged individuals, with a clear male predominance. Similar observations have been reported in a study done by Syed O. Ilyas et al, evaluating perforation peritonitis.[13] The male predominance

observed in this study may be attributed to increased exposure to risk factors such as smoking, alcohol consumption, chronic NSAID use, and irregular dietary habits among males.

The current study reported that increasing age is associated with higher morbidity and mortality in patients with perforated peritonitis. Similar observation was seen in a study carried out by Sharma R et al, which indicates that elderly patients often have decreased physiological reserve, which makes them more vulnerable to septic shock and multi-organ dysfunction following perforation.[14]

In the present study, peptic ulcer disease was identified as the most common cause of gastrointestinal perforation, followed by appendicitis and typhoid ileal perforation. A study by Vishal Vaishnavi et al also showed that peptic ulcer is a common etiological factor for gastrointestinal perforation.[15] Despite the widespread use of proton pump inhibitors and H. pylori eradication therapy, perforated peptic ulcer remains a common surgical emergency.

In the present study, appendicular perforation was the most common site of gastrointestinal perforation, followed by gastric and ileal perforations. Lower gastrointestinal perforations accounted for a higher proportion of cases compared to upper gastrointestinal perforations.

Several earlier surgical studies have reported duodenal perforation as the most common site of perforation peritonitis. However, recent trends suggest a gradual shift in the pattern of perforation with increasing incidence of appendicular and ileal perforations, particularly in developing countries.[15,16]

From a surgical standpoint, the anatomical site of perforation plays a crucial role in determining the severity of peritoneal contamination and the operative strategy. Upper gastrointestinal perforations typically produce chemical peritonitis initially due to leakage of gastric contents. In contrast, lower gastrointestinal perforations often result in fecal peritonitis, which carries a significantly higher risk of septic complications.[17,18]

In the present study, patients with lower gastrointestinal perforations were found to have more severe peritoneal contamination compared to those with upper gastrointestinal perforations. Similar observations have been reported in a study by Xu X et al, in which fecal contamination was associated with an increased incidence of postoperative sepsis and wound infection.[19] Adequate peritoneal lavage and thorough exploration of the abdominal cavity are essential steps during surgery to reduce bacterial load and prevent postoperative complications.

In the present study, Graham's omental patch repair was the most commonly performed surgical procedure, reflecting the predominance of peptic ulcer perforation. Graham's patch repair is a simple and effective technique that involves closure of the perforation with an omental patch. This procedure has been widely accepted as the standard treatment for perforated peptic ulcers due to its technical simplicity and favourable outcomes.[20]

In the present study, surgical site infection was the most frequent complication observed. The high incidence of wound infection can be attributed to contamination of the operative field with gastrointestinal contents during surgery. Similar findings have been reported in a study by Vishal Vaishnavi et al, where wound infection was identified as the most common postoperative complication following emergency laparotomy. [15]

A significant proportion of patients in the present study required postoperative ICU care. Comparable findings were seen in a study by Olaussom M et al., which justify that the patients with severe sepsis, hemodynamic instability, or respiratory compromise often require intensive monitoring and organ support in the postoperative period.[21]

Mechanical ventilation was required in a smaller proportion of patients who developed respiratory failure or septic shock. Studies

have shown that the requirement for mechanical ventilation is associated with increased mortality in patients with perforated peritonitis.[15]

In the present study, patients presenting with shock had significantly higher mortality compared to those without shock. Studies done by Ogbuanya AU et al. and Ciftci F et al., also showed a positive association between shock and mortality in GI perforation. [22, 23]

Septic shock results from systemic inflammatory response due to bacterial contamination of the peritoneal cavity. Early aggressive resuscitation, including fluid therapy, vasopressor support, and prompt surgical intervention, is essential to improve survival in these patients.

In the present study, the majority of patients recovered following surgical intervention, while mortality occurred in a smaller proportion of cases. Mortality was mainly observed in patients with delayed presentation, septic shock, and severe postoperative complications. These findings were supported by study done by Sharma L et al. [24]

The findings of the present study highlight the importance of early diagnosis and timely surgical intervention in patients with gastrointestinal perforation. Improving public awareness, strengthening primary healthcare services, and ensuring early referral to tertiary care centers can significantly reduce complications associated with perforated peritonitis

Limitations of the study:

The present study was conducted at a single tertiary care center, limiting generalizability, and the sample size was relatively small (n = 78). Only short-term in-hospital outcomes were assessed; long-term follow-up was not done. Being an observational study, causal relationships could not be established.

CONCLUSION

The present study demonstrated that gastrointestinal perforations predominantly affect middle-aged males, with the highest incidence observed in the 31–50 years age group. Peptic ulcer disease was identified as the most common etiological factor, and duodenal perforation was the most frequent site. Upper gastrointestinal perforations constituted the majority of cases. Graham's omental patch repair was the most commonly performed and effective procedure for upper gastrointestinal perforations, while primary closure and resection procedures were appropriate for selected lower gastrointestinal perforations. Surgical site infection was the most common complication, while bile leak and drain site abscess were observed in a small proportion of cases and were successfully managed. Patients who developed complications had a significantly prolonged hospital stay. The findings of this study emphasize that early presentation, aggressive resuscitation, timely surgical management, and appropriate postoperative care are key factors in reducing morbidity and mortality in patients with gastrointestinal perforation.

Declaration by Authors

Ethical Approval: Approved by the Institutional Ethics Committee (GIMS/KLB/PHARMA/IEC/262/2024-25).

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Conflict of Interest: The authors declare that none of the authors have a conflict of interest.

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