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Research Article

A STUDY ON CLINICOPATHOLOGICAL PROFILE AND OUTCOME OF GASTROINTESTINAL PERFORATIONS: A PROSPECTIVE OBSERVATIONAL STUDY

SANJAY D DAKHORE[1]*, SAHAN M S[2], VIDHEY TIRPUDE[1], SHILPA PANDE[3], SUNIL B WANKHADE[1]

[1]Department of General Surgery, Government Medical College, Gondia, Maharashtra, India. [2]Department of Surgical Gastroenterology, SG PGI, Lucknow, Uttar Pradesh, India. [3]Department of Radiodiagnosis, AIIMS, Nagpur, Maharashtra, India.
*Corresponding author: Sanjay D Dakhore; Email: Sanjaydakhore14@gmail.com

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ABSTRACT

Objective: The objectives of the study are as follows:

(1) To study the clinicopathological profile and outcome of gastrointestinal (GI) perforations. (2) To study the incidence, demographics, etiology, clinical features, management techniques, and factors influencing outcomes in cases of GI perforations.

Methods: This was a prospective cohort study conducted in the Department of General Surgery in a tertiary care center in central India. One hundred and twenty cases of GI perforation were included in this study. Demographic data, detailed medical history, and present complaints were recorded for each patient. Clinical features were assessed by thorough physical and systemic examinations. Relevant laboratory tests, imaging, and operative findings were investigated. Management included operative interventions and postoperative analysis with documentation of complications. For statistical purpose, $p<0.05$ was taken as statistically significant.

Results: The study observed a significant male preponderance in cases of GI perforations (M: F ratio 1:0.27). Patients' age ranged from 18 to 86 years, with the highest incidence in those over 50 years (33.6%). Most patients were from Class IV and V socioeconomic status. Abdominal pain (100%) and vomiting (76.2%) were common symptoms. Hypertension (17.2%) and diabetes (14.7%) were prevalent comorbidities, with alcohol consumption (40.16%) as a notable risk factor. Gastroduodenal perforations were most frequent (63.93%). Common surgical interventions included modified Graham's patch (62.3%) and appendicectomy (12.3%). Surgical site infections (20.4%) were common complications. Mortality was 11.4%, primarily due to sepsis.

Conclusion: Early diagnosis and proper interventions are the cornerstone of management in cases of GI perforation. Prognosis depends on symptom duration, perforation site, peritoneal contamination, preoperative hypotension, and need for preoperative abdominal drainage. Chances of mortality increase in patients who present late after perforation.

Keywords: Gastrointestinal perforation, Abdominal pain, Operative interventions, Outcome.

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INTRODUCTION

Gastrointestinal (GI) perforation is a critical and often life-threatening surgical emergency which is characterized by a tear in the wall of the GI tract. This breach allows the contents to leak into the peritoneal cavity, leading to peritonitis and sepsis [1]. Perforation anywhere in the GI tract necessitates prompt medical and surgical intervention. The common causes of GI perforation include peptic ulcer disease, appendicitis, diverticulitis, malignancies, inflammatory bowel diseases such as Crohn's disease and ulcerative colitis, and traumatic injuries. Other predisposing factors in adults may include the use of nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroids, and anticoagulants. In addition to these diseases, lifestyle factors such as smoking, alcohol consumption, and stress can exacerbate the underlying conditions leading to perforation [2].

Risk factors for GI perforation include advanced age, as the GI tract becomes more susceptible to damage and disease with age. Chronic diseases such as diabetes and vasculitis syndromes can impair blood flow and healing, increasing the risk of perforation. Immunocompromised individuals, including those with HIV/AIDS or on immunosuppressive therapy, are also at higher risk due to their decreased ability to combat infections [3]. The pathophysiology of GI perforation involves the disruption of the integrity of the GI wall which can be caused by a variety of mechanisms. In the case of peptic ulcer disease, chronic inflammation and erosion of the mucosal lining by acidic contents of the stomach can lead to perforation. In diverticulitis, inflamed or infected diverticula can rupture resulting in perforation. Malignancies may cause perforation by direct invasion and destruction of the bowel wall or secondary to treatment-related complications. In addition, penetrating as well as blunt trauma can directly cause tears in the GI tract [4].

The clinical presentation of GI perforation is often acute and severe with symptoms including sudden onset of severe abdominal pain depending on the site of perforation. Patients may also experience nausea, vomiting, fever, tachycardia, and signs of peritonitis in the form of abdominal rigidity and rebound tenderness [5]. In some cases, there may be a preceding history of GI symptoms related to the underlying cause, such as peptic ulcer disease or diverticulitis. Complications of GI perforation can be severe and include generalized peritonitis, sepsis, abscess formation, and multiorgan failure. Early diagnosis and prompt management are essential to prevent these complications and improve patient outcomes [6].

Evaluation of a suspected GI perforation consists mainly of imaging studies which play a crucial role in the diagnosis. Plain abdominal radiographs may show free air under the diaphragm indicating the presence of pneumoperitoneum. However, computed tomography (CT) is the gold standard for diagnosis since it provides detailed information

about the location and extent of the perforation. Moreover, CT is also effective in the assessment of complications such as abscess formation or fluid collections. Ultrasonography may be useful in certain cases, particularly in pediatric patients or when CT is not readily available [7].

The management of GI perforation involves a combination of surgical and medical interventions. Initial management includes stabilizing the patient with intravenous fluids, broad-spectrum antibiotics to cover both aerobic and anaerobic organisms, and nasogastric decompression. Hemodynamic monitoring and support may be necessary in patients with sepsis or shock [8].

Surgical intervention is typically required to repair the perforation and address any underlying pathology. The choice of surgical approach depends on the location and cause of the perforation, as well as the patient's overall condition. Options include primary repair, resection of the affected bowel segment with primary anastomosis, or the creation of a stoma in cases where primary repair is not feasible. Laparoscopic surgery may be an option in selected cases, offering the benefits of reduced postoperative pain and shorter recovery time. In addition to surgical repair, the management of GI perforation includes addressing any underlying conditions that may have contributed to the perforation. This may involve discontinuing NSAIDs or corticosteroids, treating helicobacter pylori infection in cases of peptic ulcer disease, or providing long-term management for inflammatory bowel disease or malignancy [9].

METHODS

This was a prospective cohort study conducted in the Department of General Surgery in a tertiary care center in central India. One hundred and twenty cases of GI perforation were included in this study. The institutional ethics committee approved the study and written and informed consent was obtained from all the participants. The sample size was determined on the basis of pilot studies done on the subject of GI perforations. Assuming 90% power and a 95% confidence interval and based on the central limit theorem, the sample size was calculated to be sufficient if it was more than 110 so we included 122 consecutive patients having GI perforation in our study.

The demographic data pertaining to age, gender, residence, and occupation were recorded. Detailed history of present illness and treatment received was noted along with past, family, and personal history. Present complaints included reference to abdominal pain, vomiting, fever, trauma, abdominal distension, constipation, dyspepsia, loss of weight, jaundice, and any other symptoms. Attempt was made to determine the etiology of perforation and the time interval between the event and presentation to the hospital. History of smoking, alcohol intake, drug intake, and food habits were noted. History of diabetes, hypertension, tuberculosis, jaundice, and previous surgeries was also noted.

Detailed physical examination was duly recorded. General physical examination pertained to the clinical condition of the patient with special reference to dehydration and shock. Note was made of build, nourishment, pallor, icterus, lymphadenopathy, edema, clubbing, cyanosis, respiratory rate, temperature, pulse, and blood pressure. In systemic examination, particular note was made of abdominal findings related to clinical signs of peritonitis and perforation. Examination details included distension, scars, visible mass, and pulsations on inspection; tenderness, guarding, rigidity, palpable mass, organomegaly, distention and fluid thrill on palpation, shifting dullness and obliteration of liver dullness on percussion and bowel sounds on auscultation. Hernial sites, genitalia, and rectal examination findings were included in the study. Note was made of the examination of the respiratory, cardiovascular, and central nervous systems.

Enrolled patients were investigated as indicated for evaluation of the clinical status, confirmation of perforation, etiology thereof, and complications suspected or observed. Laboratory investigations were carried out as per clinical relevance, including complete blood count, blood sugar, electrolytes, renal function tests, liver function tests, blood culture, widal, fluid for adenosine deaminase, erect and supine abdominal X-ray, ultrasonography, contrast-enhanced CT scan, and other investigations as required. The number, size, and location of perforation were noted and operative management was noted. Postoperative analysis was done. Any complication if present was noted.

Chi-square and Fisher exact tests were used to determine the significance of the proportion of symptoms and signs between benign and malignant cases. The Student t-test was employed to assess the significance of the mean difference in laboratory parameters between benign and malignant cases. The odds ratio was used to evaluate the strength of the relationship between symptoms and signs of benign and malignant cases. If the $p<0.05$, the probability was considered statistically significant.

Inclusion criteria

1. All patients presenting with GI perforations
2. Age above 18 years
3. Those who gave written consent to be part of the study.

Exclusion criteria

1. Those who refused consent
2. Age <18 years
3. Cases of perforation of hepatobiliary system, traumatic perforations, and cases of iatrogenic perforation during laparotomy and gynecological procedures
4. Cases of delayed presentation with shock and septicemia whose general condition did not warrant any operative management even after all resuscitative measures.

RESULTS

Among the 122 studied cases, there were 96 (78.6%) males and 26 (21.4%) females. There was a significant male preponderance in cases of GI perforations with a M: F ratio of 1:0.27. Age of patients varied from 18 years to 86 years. Maximum incidence of perforations was seen in age groups >50 years (33.6%), followed by age group of 41–50 years. The least number of incidence was seen in the age group <20 years (4.9%). The youngest patient encountered in this study was 18 years and the oldest 86 years. The mean age of presentation was 44 years. Most of the patients belonged to Class IV and Class V according to modified Kuppuswamy's classification of socioeconomic status and hailing from rural areas. Per capita income was calculated and was classified among different classes (Table 1).

The analysis of clinical features showed that the most common presentation was abdominal pain which was seen in all patients (100%), followed by vomiting (76.2%). Abdominal distension was seen in 40.9% of the patients. Fever was seen in 43% of patients and 100% of patients with appendicular perforation had a history of fever. Mass per rectum (2.5%) and bleeding per rectum (2.5%) were seen in patients with carcinoma rectum leading to rectal perforation. Patients diagnosed with abdominal tuberculosis and malignancy had a history of weight loss (12.3%) (Fig. 1).

The most common comorbidities among patients with GI perforation were hypertension (17.2%) and diabetes (14.7%), with a significant portion having no comorbidity (64.75%). Among risk factors, alcohol consumption was prevalent in 40.16% of patients, followed by smoking (31.15%) and NSAID use (28.69%). The most frequent site of perforation was the gastroduodenal region (63.93%), followed by the small intestine (18.03%), appendix (12.30%), large intestine (4.10%), and rectum (1.64%). The primary etiology of perforation was peptic ulcer disease, accounting for 62.30% of cases, with other notable causes including enteric fever (13.11%) and appendicitis (12.30%) (Table 2).

Patients with perforation peritonitis on admission had tachycardia to an extent of 83.6% due to dehydration and as a result of systemic

Table 1: Demographic details of studied cases

Demographic details	No. of patients	Percentage
Gender distribution		
Males	96	78.6
Females	26	21.4
Age groups		
<20	6	4.9
21–30	19	15.5
31–40	21	17.3
41–50	35	28.7
>51	41	33.6
Socio economic status		
Class III	25	20.4
Class IV	5	46.7
Class V	40	32.9

Table 2: Summary of comorbidities, risk factors, sites of perforation, and etiology in patients with gastrointestinal perforation

Comorbidities, risk factors, sites of perforation, and etiology	Number of patients (%)
Comorbidities	
Hypertension	21 (17.2)
Diabetes	18 (14.7)
Previous surgery for peptic ulcer disease	2 (1.6)
History of tuberculosis	2 (1.6)
No comorbidity	79 (64.75)
Total	122 (100)
Risk factors	
Smoking	38 (31.15)
Alcohol	49 (40.16)
NSAID's	35 (28.69)
Total	122 (100.00)
Site of perforation	
Gastro duodenal	78 (63.93)
Small intestine	22 (18.03)
Large intestine	5 (4.10)
Appendix	15 (12.30)
Rectum	2 (1.64)
Total	122 (100.00)
Etiology of perforation	
Peptic ulcer	76 (62.30)
Appendicitis	15 (12.30)
Enteric fever	16 (13.11)
Tuberculosis	8 (6.56)
Diverticular disease	2 (1.64)
Malignancy	4 (3.28)
Volvulus	1 (0.82)
Total	122 (100.00)

NSAIDs: Nonsteroidal anti-inflammatory drugs

inflammatory response. Patients presenting after 3–4 days with established sepsis, there was more pronounced tachycardia with a feeble pulse indicating signs of sepsis.

Hypotension was seen in 31.1% of patients. These patients presented to casualty with a history more than 3 days. Along with hypotension, patients had guarding and rigidity. Out of 38 patients who had hypotension on admission, 23 patients, that is, 60.5% of patients were required to be started on vasopressors after adequate fluid resuscitation. Furthermore, patients in whom mortality was seen had a shock on admission and were not responding to fluid resuscitation. Dehydration was seen in 91.8% of patients which is worthy to note in this study. Patients with dehydration had less urine output during the procedure and postoperative period. Tenderness was noted in 100% of patients. Guarding was seen in 76.2% of patients. Localized guarding in the right iliac fossa was noted in all patients with appendicular perforation. Patients with peptic perforations had localized guarding

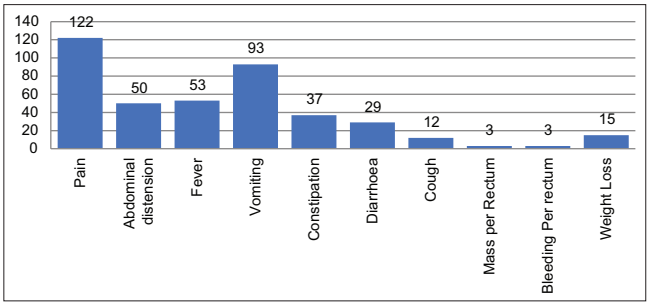

Fig. 1: Clinical features in the studied cases

in the epigastric region and these patients presented within 2 days duration. Patients presenting after 2 days either had guarding all over the abdomen or rigidity (Fig. 2).

The analysis of preoperative laboratory parameters revealed that 18.03% of patients had anemia, 72.13% had leukocytosis, 11.48% had leukopenia, and 20.49% presented with features suggestive of acute kidney injury (AKI). Imaging studies showed that pneumoperitoneum was detected on X-ray in 80.33% of patients, while 19.67% did not show gas under the diaphragm on X-ray, necessitating further evaluation with CT (Table 3).

Patients with prepyloric perforation underwent modified Graham's patch repair. That is perforation was primarily closed and a vascular omental patch was placed over the perforation and secured. Two patients who had duodenal perforation, one underwent modified Graham's patch and the other patient underwent T-tube placement in duodenal perforation and gastrojejunostomy. Two patients who were diagnosed with carcinoma stomach underwent primary closure of perforation and gastrojejunostomy. Patients with ileal perforation underwent resection and anastomosis in 50% of patients and in 40.90% of patients ileostomy was done. Due to peritoneal contamination and intra-abdominal sepsis, perforations near ileocecal junction were factors which decided the decision of making ileostomy. Mostly patients with large intestinal perforations underwent colostomy. Patients with appendicular perforation underwent open appendicectomy. Out of 15 patients, five patients were explored with lower midline laparotomy incision and the remaining 10 with gridiron incision. Patients with rectal perforation underwent transverse colostomy and definitive procedure later (Table 4).

Surgical site infections (SSI) occurred in 20.40% of patients. Most infections involved serous discharge, while some required the opening of sutures for purulent discharge management. Wound dehiscence was noted in 6.5% of patients. Respiratory complications were seen in around 20 patients which were managed by administration of broad-spectrum intravenous antibiotics. Postoperative fever was observed in 12.20% of patients, mainly due to SSIs, respiratory complications, urinary tract infections, and thrombophlebitis, with respiratory issues being the most common cause. AKI was noted in 12 patients, with most recovering after treatment for dehydration and sepsis, though two required hemodialysis. Paralytic ileus was seen in 12.20% of patients which was managed with potassium supplementation, nil per oral status, and regular nasogastric aspiration. Postoperative leaks were seen in 2.4% of patients. One patient with a modified Graham's patch repair experienced a bile leak managed conservatively leading to a controlled enterocutaneous fistula. Two patients with ileal resection and anastomosis had anastomotic leaks managed similarly, resulting in controlled enterocutaneous fistulas and subsequent discharge. These complications collectively increased morbidity and extended hospital stays for affected patients (Table 5).

The analysis of mortality in studied cases showed that out of 122 cases with GI perforation, majority of the patients could be treated successfully and were eventually discharged. However, 14 (11.4%) patients expired.

Table 3: Laboratory parameters and imaging features in studied cases

Lab parameters (preoperative) and imaging findings	Number of patients (%)
Lab parameters	
Anemia	22 (18.03)
Leukocytosis	88 (72.13)
Leukopenia	14 (11.48)
AKI	25 (20.49)
Imaging	
Pneumoperitoneum on X-ray	98 (80.33)
No gas under diaphragm on X-ray (indication for CT)	24 (19.67)

AKI: Acute kidney injury, CT: Computed tomography

Table 4: Operative procedures in studied cases

Operative procedure	Number of patients (%)
Modified Grahm's patch	76 (62.3)
Appendicectomy	15 (12.3)
Resection and anastomosis	11 (9.1)
Primary closure of small bowel	2 (1.6)
Ileostomy	10 (8.2)
Gastrojejunostomy	2 (1.6)
Colostomy	6 (4.9)
Total	122 (100)

Table 5: Incidence of complications in studied cases

Complications	Number of patients (%)
SSI	25 (20.4)
Wound dehiscence	8 (6.5)
LRTI	14 (11.4)
Postoperative atelectasis	17 (13.9)
Postoperative fever	15 (12.2)
AKI	12 (9.8)
ARDS	4 (3.2)
Septicemia	10 (8.1)
Paralytic ileus	15 (12.2)
Postoperative leak	3 (2.4)

AKI: Acute kidney injury, SSI: Surgical site infections

Mortality was seen in patients who presented with duration more than 3 days. All these patients had tachycardia and hypotension who were started on vasopressors. The most common cause of mortality was septicemia with multiorgan dysfunction which was seen in 7 (5.74%) patients and septicemia with acute respiratory distress syndrome (3.28%) and septic shock (2.46%) (Fig. 3).

DISCUSSION

In this study, out of 122 patients with GI perforations, there was a significant male preponderance with 96 males (78.6%) and 26 females (21.4%), resulting in a male-to-female ratio of 3.7:1. This gender distribution is comparable to the findings of Bali *et al.* who reported a male-to-female ratio of 2.1:1 in their study on perforation peritonitis [10]. The age distribution in our study showed that the maximum incidence of perforations occurred in patients aged over 50 years (33.6%), followed by those aged 41–50 years (28.7%). The mean age of presentation was 44.4 years, which aligns closely with the study by Fakhry *et al.* where the mean age was 44 years [11]. This suggests a consistent trend of higher GI perforation incidence among older adults across different studies.

Abdominal pain was the most common presenting symptom, observed in 100% of the patients, followed by vomiting (76.2%), and fever (43%). These findings are similar to those reported by Potey *et al.*, who

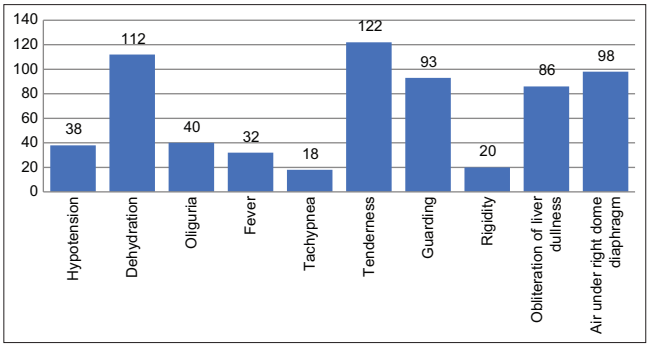

Fig. 2: Clinical presentation of the studied cases

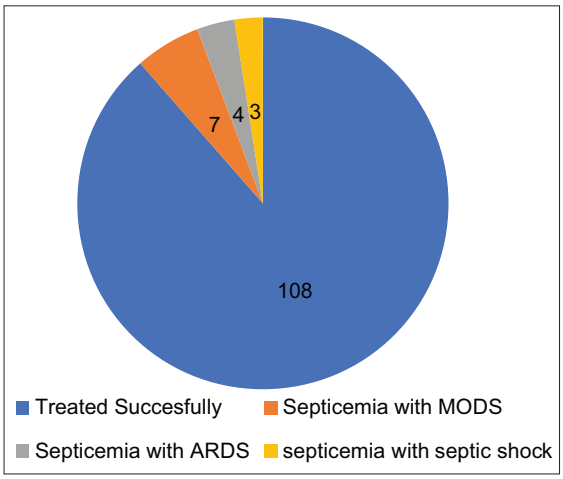

Fig. 3: Mortality and it's in studied cases

noted that abdominal pain was the universal symptom in their patient cohort [12]. In addition, in our study, 40.9% of the patients presented with abdominal distension, and 12.3% had a history of weight loss, indicating a significant burden of associated symptoms. This symptomatic profile underscores the importance of early diagnosis and intervention to mitigate severe outcomes in GI perforation cases.

Hypertension and diabetes were the most common comorbidities among our patients, present in 17.2% and 14.7% of cases, respectively. A significant portion (64.75%) had no comorbidity. In terms of risk factors, alcohol consumption was prevalent in 40.16% of patients, followed by smoking (31.15%) and NSAID use (28.69%). These findings are in line with those of Andersen IB who also highlighted the prominence of alcohol consumption and smoking as major risk factors in their study [13]. This reinforces the need for targeted public health interventions to address modifiable risk factors associated with GI perforations. Similar risk factors for GI perforation were also reported by Yuan *et al.* [14] and Lanas A *et al.* [15].

The gastroduodenal region was the most frequent site of perforation (63.93%), followed by the small intestine (18.03%), appendix (12.30%), and large intestine (4.10%). This distribution is consistent with the study by Kim *et al.* who also identified the gastroduodenal region as the most common site of perforation [16]. Peptic ulcer disease emerged as the primary etiology in our study, responsible for 62.30% of the cases, which aligns with the findings of Sarkar *et al.* who reported peptic ulcer disease as the leading cause (seen in 64%) of GI perforations in their cohort [17].

The most common surgical procedure performed was the modified Graham's patch repair (62.3%), followed by appendicectomy (12.3%), resection and anastomosis (9.1%), and ileostomy (8.2%). Similar surgical intervention patterns were observed in the study by Meena *et al.* where

the Omental patch closure was the predominant procedure, reflecting the standard surgical practice for peptic ulcer perforations [18].

In our study, SSIs were the most common postoperative complication, occurring in 20.4% of patients. The incidence of AKI and its management in our study closely mirrors the findings of Utaal *et al*. who reported renal complications in 12.5% of their patients [19]. These complications underscore the need for vigilant postoperative care to reduce morbidity and mortality in GI perforation patients.

The overall mortality rate in our study was 11.4%. Patients who presented with a duration of more than 3 days and had tachycardia and hypotension requiring vasopressors were at a higher risk of mortality. This mortality rate is comparable to the findings of Ramakrishnaiah *et al*. who reported a mortality rate of 16.5% [20]. The primary cause of death in our cohort was septicemia with multiorgan dysfunction syndrome, observed in 5.74% of patients. This highlights the critical importance of early intervention and aggressive management of sepsis in improving patient outcomes.

CONCLUSION

Perforation peritonitis remains a common surgical emergency, with peptic ulcer disease as the leading cause despite reduced incidence due to proton pump inhibitors. Other significant causes include abdominal tuberculosis and enteric fever. Timely resuscitation and surgical intervention can reduce morbidity and mortality. However, patients presenting after 48 h are at increased risk of complications, including paralytic ileus, respiratory issues, and SSIs, with the highest mortality seen in those presenting after 3–4 days. The prognosis depends on symptom duration, perforation site, peritoneal contamination, preoperative hypotension, and need for preoperative abdominal drainage.

CONFLICTS OF INTEREST

None.

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