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Original Research Article

A study on various risk factors involved in benign gastrointestinal perforations in rural population of tri-state border

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ABSTRACT

Background: Gastrointestinal perforation is a common surgical emergency encountered by surgeons worldwide. Benign gastrointestinal perforations are especially prevalent in rural populations, leading to significant mortality and often requiring emergency surgery. This study was aimed to investigate the association of various risk factors of benign gastrointestinal perforations in the Tristate border of Tamil Nadu, Andhra Pradesh and Karnataka, thereby assessing the prognosis and surgical outcome.
Methods: A prospective observational study was conducted from March 2023 to March 2024 at the Department of General Surgery, PESIMSR, KUPPAM. The study included a total of 50 patients with perforation features, selected using purposive sampling technique. A detailed medical history was taken, physical examination and relevant investigations were conducted, and the findings were correlated with intraoperative and histopathology reports. The patients were followed up for complications. The data was analysed with appropriate statistical methods.
Results: Out of 50 patients, 72% were males and 28% were females. The most common age range of presentation was 41-50 years. The leading cause of perforation was peptic ulcer, accounting for 46% of cases, followed by appendicitis in 22% of cases, typhoid in 18% of cases, trauma in 12% of cases, and tuberculosis in 2% of cases. Mortality was observed in 7 cases (14%). It's important to note that multiple organ dysfunction syndrome (MODS) and mortality were linked to a higher Mannheim peritonitis prognostic index, indicating a poor prognosis.
Conclusion: Early diagnosis with risk factors assessment, immediate fluid resuscitation, and timely surgical intervention are crucial in significantly lowering the mortality rate associated with perforated peritonitis

Keywords: Gastrointestinal perforation, Risk factors, Mortality, Laparotomy, Peritonitis, Prognosis

INTRODUCTION

Gastrointestinal perforation causing peritonitis is a common surgical emergency in India. Despite advances in perioperative care, antimicrobial therapy, and intensive care support, perforation peritonitis still leads to high morbidity and mortality.[1] Perforation is defined as an abnormal opening in a hollow organ or viscus. It is derived from the Latin word "perforatus," meaning "to bore through." Known since the days of Hippocrates, transmigration of bacteria from the gut causes peritonitis, which may be fatal or cause profound morbidity. Hippocrates first reported the Hippocratic facies, which is still seen as a critical predictive factor today when he first identified the condition of peritonitis.[2] Perforation peritonitis can have serious consequences if left untreated, including bacteremia, generalized sepsis, multiorgan failure, and shock. The gastrointestinal system can be perforated anywhere from the esophagus to the rectum. In many cases, the diagnosis is clinically obvious, but radiological confirmation is typically sought before surgical intervention. Additionally, factors such as delayed treatment, poor clinical condition upon

admission, the type of perforation, and complicating features can significantly impact morbidity and mortality.[3] Various risk factors including infectious diseases like typhoid, tuberculosis, *Helicobacter pylori*), HIV infection, appendicitis, peptic ulcer, abuse of non-steroidal anti-inflammatory drugs (NSAIDs), trauma, iatrogenic factors, foreign bodies, malignancy, diverticulitis, chronic alcohol use, and smoking, are responsible for gastrointestinal perforation.[4]

In India, delayed hospital arrival is common, and patients often arrive with well-established generalized peritonitis, purulent and fecal contamination, and varied degrees of septicemia after receiving over-the-counter medication and treatment from a local practitioner. Perforated duodenal ulcer, ileal typhoid perforation, small bowel tuberculosis, stomach perforation, and perforation due to acute appendicitis were the most common causes of perforation peritonitis. The ileum, duodenum, stomach, appendix, jejunum, and colon are the structures in the gastrointestinal system that are potentially prone to perforations.[5]

The mannheim peritonitis index (MPI) is a powerful scoring system that accurately predicts the outcome of patients suffering from diffuse peritonitis. As the MPI score increases, so does the risk of mortality.[6]

Understanding the importance of early diagnosis, assessing risk factors, determining prognosis, and providing immediate treatment is crucial in reducing the impact of perforation peritonitis in low-income rural areas of South India. This approach is essential for preventing the morbidity and mortality associated with peritonitis due to the spillage of intestinal contents. The primary objective of this study was to explore the link between various risk factors and potential outcomes in gastrointestinal perforations, and to establish correlations with the existing Mannheim Peritonitis Index.

METHODS

Study design

This was prospective observational study

Study place

Department of General Surgery, PES Institute of Medical Sciences and Research, Kuppam, Andhra Pradesh, India

Study period

The study duration was of 1 year from March 2023 to March 2024.

Sample size

For study the sample size taken was 50.

Sampling method

Purposive sampling method.

Patient selection

Patients admitted with diagnosis of gastrointestinal perforation who underwent surgery in PESIMSR, KUPPAM during the study period.

Inclusion criteria

All patients with signs and symptoms of peritonitis with suspected gastrointestinal perforation. Perforations of esophagus, stomach, small intestine, colon, rectum and appendix were included.

Exclusion criteria

Perforations due to malignancy were excluded from the study.

Method of data collection

The data collection was conducted with proper informed consent using a standardized questionnaire. It included a detailed history, physical examination, relevant blood and radiological tests. Patients underwent surgery, and preoperative findings were compared with intraoperative and histopathology reports when possible.

Descriptive statistics were used for analysis. For each participant, the following information was obtained: demographic statistics (age, gender, occupation, and residential area), clinical presentation (symptoms and signs such as abdominal pain, nausea/vomiting, fever, guarding, and rigidity), vital signs, and laboratory investigations (complete blood count, serum electrolytes, liver function tests, renal function tests, arterial blood gas analysis, and serology). Radiological investigations included chest X-ray, ultrasonography, and, in some cases, computed tomography of the abdomen.

After initial resuscitation, patients underwent surgery, and peritoneal fluid was sent for culture. Depending on the site of perforation, patients underwent closure with Graham's omentoplasty, minimal resection and end-to-end anastomosis, or appendicectomy. The Mannheim peritonitis prognostic index was calculated for all patients. Patients were followed up daily until discharge or death and were treated with broad-spectrum antibiotics for 5 days postoperatively.

Statistical analysis

The data was entered into MS Excel 2019 and further analyzed using SPSS (version 26.0; SPSS Inc., Chicago, IL, USA). For descriptive analysis, categorical variables were analyzed using frequency and percentages, and continuous variables were analyzed by calculating

mean±standard deviation. For inferential analysis, numerical data were analyzed using the 't'-test and categorical data were analyzed using the Chi-square test. A 'p' value of <0.05 was considered statistically significant.

RESULTS

A total of 50 patients were studied, and the recorded findings were analyzed. Upon analyzing the distribution, it is evident that the majority of occurrences are concentrated within the age range of 41 to 50 years old. There is a notable spike in the 41-50 age group, which accounts for 30% of the overall instances. Next, the age group 31-40 accounted for 26% of the cases. Furthermore, a significant percentage of instances were detected among those aged 21-30 (24%) and 51-60 (18%). Individuals aged 10-20 had the lowest occurrence, representing only 2% of the overall cases.

Out of 50 patients, 36 (72%) were male and 14 (28%) were female. The data presented in table 2 offers valuable insights into the symptomatology of perforated peritonitis within rural populations. It is evident that all 50 patients reported experiencing abdominal pain, highlighting the universal nature of this symptom. Additionally, a significant majority, 74%, experienced vomiting, while 72% had abdominal distension. Fever was observed in 66% of cases, and constipation affected 56% of the population. These findings underscore the urgent need for effective interventions in rural healthcare settings.

The highest number of perforations, 15 instances, was found in the stomach, accounting for 30% of the total cases. Appendicular perforation was identified in 11 cases, making up 22% of the total perforation cases in the rural population. Perforations in the ileum were found in 10 cases, accounting for 20% of the total cases. There were 7 reported cases of perforations in the duodenum, which accounted for 14% of the total cases. Perforations in the jejunum were found in 6 cases, accounting for 12% of the total cases. The incidence of colon perforations was quite low, with just 1 case, accounting for 2% of the total cases. The leading cause of perforation was peptic ulcer, accounting for 46% of cases, followed by appendicitis at 22%, typhoid at 18%, trauma at 12%, and tuberculosis at 2%. The postoperative period presents various challenges, with surgical site infection being the most prevalent complication, affecting 29 (58%) cases.

Additionally, dyselectrolytemia was observed in 26 (52%) cases, while 24 (48%) cases experienced septicaemia/shock. Furthermore, wound dehiscence affected 9 (18%) cases. Respiratory complications were present in 14% of cases, acute renal failure in 6%, cardiac complications in 4%, and delirium in 8%. Unfortunately, mortality was observed in 7 cases, accounting for 14% of the total cases. The Mannheim peritonitis index (MPI) score was calculated, revealing that patients with an MPI score exceeding 21 had a significantly higher incidence of multiple organ dysfunction syndrome (MODS) and mortality.

Table 1: Age and gender distribution.

Variables	N	%
Age (in years)		
10-20	1	2
21-30	12	24
31-40	13	26
41-50	15	30
51-60	9	18
Gender	N	%
Male	36	72
Female	14	28

Table 2: Symptoms.

Presentation	N	%
Pain abdomen	50	100
Vomiting	37	74
Abdominal distension	36	72
Fever	33	66
Constipation	28	56

Table 3: Site of perforation.

Site	N	%
Stomach	15	30
Appendix	11	22
Ileum	10	20
Duodenum	7	14
Jejunum	6	12
Colon	1	2

Table 4: Etiology of perforation.

Etiology	N	%
Peptic ulcer	23	46
Appendicitis	11	22
Typhoid	9	18
Trauma	6	12
Tuberculosis	1	2

Table 5: Rate of complications.

Complications	N	%
Surgical site infection	29	58
Dyselectrolytemia	26	52
Septicemia/Shock	24	48
Wound dehiscence	9	18
Respiratory complications	7	14
Renal complications	3	6
Cardiac complications	2	4
Confusion/delirium	4	8
Death	7	14

Table 6: Association of mannheim peritonitis index with MODS and death.

MPI	N	MODS	Death
<13	11	6	0
14-21	9	7	1
22-29	12	12	1
>29	18	18	5

DISCUSSION

The diagnosis of peritonitis is usually based on clinical symptoms. Initially, patients may experience dull, poorly localized abdominal pain (visceral peritoneum) which then progresses to steady, severe and more localized pain (parietal peritoneum). Subsequently, the pain may become diffuse. Other common symptoms include anorexia, nausea, and vomiting. Patients may also experience fever or hypothermia, as well as tachycardia due to the release of inflammatory mediators. Hypovolemia can occur due to vomiting and third space loss into the peritoneal cavity. As dehydration progresses, patients may become hypotensive and may have reduced urine output. On abdominal examination, patients typically demonstrate diffuse tenderness on palpation. In most cases, the point of maximum tenderness or rebound tenderness overlies the pathological process. Abdominal wall rigidity is commonly observed. In severe cases of peritonitis, patients often avoid motion and keep their hips flexed to relieve abdominal wall tension. Additionally, the abdomen may be distended with hypoactive or absent bowel sounds.[7]

Table 7: Comparison of mean age among the literature.

Similar studies	Mean age	Males %	Females %
Yadav et al[10]	33.9	83.1	16.9
Bali et al[11]	37.8	68.5	31.5
Nabi et al[12]	34.42	77.6	22.4
Hameed et al[13]	39.6	76.6	23.4
This study	44	72	28

Table 8: Symptomatology of different studies.

Similar studies	Pain abdomen	Fever	Vomiting	Abdominal distention/ constipation	NSAID history
Yadav et al[10]	96.6	34.1	52.3	73.9	6.8
Bali et al[11]	98	-	41.5	28	15
Nabi et al[12]	97.3	34	52.6	75	6.8
This study	100	66	74	72	-

Table 9: Etiology of perforation.

Similar studies	Peptic ulcer	Typhoid	Trauma	TB
Yadav et al[10]	26.4	26.4	-	10.3
Bali et al[11]	45	22	9	10
Hameed et al[13]	50	24	14.5	20
This study	46	18	12	2

Table 10: Site of perforation.

Similar studies	Stomach	Appendix	Duodenum	Ileum	Jejunum	Colorectal
Yadav et al10	11.5	3.5	26.4	39	4.6	6.1
Nabi et al[12]	11.8	-	30.2	43.4	-	-
This study	30	22	14	20	12	2

Gastrointestinal perforations are common in males under 50 years old, especially in developing countries. They can occur anywhere from the esophagus to the rectum, with the stomach and appendix being the most common sites. The main cause of gastrointestinal perforation is acid peptic disorders, with other important causes including typhoid, trauma, and tuberculosis. Around 80% of perforated gastric ulcers are *H. pylori* positive, and 4-10% of patients on daily therapeutic-dose NSAIDs develop a prepyloric perforation within 3 months of starting the therapy. Typhoid is the most common cause of small bowel perforation, especially in regions with contaminated water supplies and inadequate waste disposal. The most serious complications of typhoid are

intestinal bleeding and ileal perforations, both resulting from necrosis of Peyer's patches in the terminal ileum. Most patients with typhoid who develop perforation do so within the first 2 weeks of the illness. In India, tuberculosis accounts for 9% of small intestinal perforations.[8]

Both penetrating and blunt injuries can lead to perforations in the gastrointestinal tract (GIT). It is important to note that injuries to the GIT may not always display obvious symptoms and are more frequently associated with penetrating trauma. GIT injuries occur in approximately 30% of stab wounds and a striking 80% of gunshot wounds to the abdomen. In cases of blunt trauma, the presence of an abdominal wall bruise or a seat-belt sign should be taken seriously as these signs are indicative of potential GIT injuries. However, it is crucial to recognize that perforation of the gastrointestinal tract is a relatively rare consequence of blunt abdominal trauma.[9] The Mannheim prognostic index is a powerful tool with high accuracy in predicting individual prognosis for patients with peritonitis. By considering factors such as age over 50, female sex, organ failure, malignancy, peritonitis duration over 24 hours, non-colonic origin of sepsis, diffuse peritonitis, and type of exudates, this index categorizes patients into different risk levels. In patients with score of 0-5, the expected mortality is zero, 6-13 expected mortality is 2%, 14-21 expected mortality is 13%, 22-29 expected mortality is 26% and in score of 30-39 expected mortality is 64%. This index provides valuable insights that can significantly impact patient care and outcomes.[6]

This study aimed to identify various factors contributing to gastrointestinal perforation in a tertiary setting. Perforation peritonitis is a common surgical emergency in tropical countries like India, with a higher incidence in men aged between 41 and 50 years. Proximal gastrointestinal perforations, particularly gastric perforations, were more prevalent in this study. The study revealed that acid peptic disease (46%) was the most common cause of perforation, similar to findings in other Indian studies.

A significant number of patients had a history of taking non-steroidal anti-inflammatory drugs (NSAIDs), which may have contributed to the perforations. The study also identified 11 cases (22%) of appendicular perforation and only one case (2%) of tubercular perforation. Surgical Site Infections (SSI) were the major post-operative complication, occurring in 58% of cases. The study reported a 14% mortality rate. Peritonitis is a common surgical emergency, and there is a substantial amount of literature that explores various aspects of perforation peritonitis in Asia and s.

The results of this study were compared to four other similar investigations conducted at different times between 2006 and 2023. The authors of these studies are Yadav D.K et al, Bali et al, Nabi et al, and Hameed et al. The parameters of this study were compared to the findings and outcomes of the previously mentioned investigations to draw relevant conclusions about the group of patients in the local geographic area. Because of limited sample size of our study, we were unable to identify a definitive common cause of mortality associated with gastrointestinal perforations. This limitation highlights the need for larger-scale research to better understand the factors contributing to these serious outcomes.

CONCLUSION

Multi organ dysfunction syndrome and mortality were associated with higher mannheim peritonitis prognostic index. Early diagnosis of at-risk patients and prompt surgical intervention, combined with broad-spectrum antibiotics, proper resuscitation, correction of electrolyte imbalances, and definitive treatment, are crucial for achieving good outcomes and minimizing morbidity and mortality

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