

A Prospective Study of the Etiology, Clinical Characteristics, and Surgical Outcomes of Hollow Viscus Perforation PeritonitisAsif¹, Syed Shahid Irfan²^{1,2}Assistant Professor, Dept. of General Surgery RIMS, Raichur, Karnataka, India

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Conflict of interest: Nil

Abstract

Introduction: Generalized peritonitis due to hollow viscus perforation (HVP) is still one of the common surgical emergencies seen worldwide. Morbidity and mortality remain high, despite major advances in imaging, intensive care, antimicrobial therapy, and operative techniques, especially in the developing world where patients often present late. Early diagnosis, prompt resuscitation, timely surgery and adequate postoperative intensive care are the important determinants of patient's survival. Understanding the changing spectrum of etiology and factors influencing outcomes is important for better clinical management.

Objectives: To study the spectrum of etiology, clinical presentation, operative findings, postoperative complications and short term surgical outcome of patients presenting with hollow viscus perforation peritonitis.

Materials & Methods: The prospective observational study was conducted in the Department of General Surgery for a duration of 18 months. We included consecutive adult patients diagnosed as hollow viscus perforation who needed emergency laparotomy. Demographic profile, clinical presentation, laboratory investigations, radiological findings, intraoperative observations, operative procedures, post-operative complications, duration of hospital stay and mortality were analyzed.

Result: Included were a total of 120 patients. Mean age was 44.8±16.5 years and 81.7% of cases were males. The commonest etiology was peptic ulcer perforation (41.7%) followed by ileal perforation (26.7%), appendicular perforation (13.3%), traumatic perforation (10.0%), colonic perforation (5.0%) and jejunal perforation (3.3%). The most common findings were diffuse abdominal pain (100%), abdominal tenderness (100%), guarding (95%) and pneumoperitoneum on erect chest radiograph (88.3%). The commonest procedure performed was Graham's omental patch repair. Surgical site infection was the most common postoperative complication (25.0%). Overall mortality was 8.3%, and delayed presentation >24 hours, septic shock, older age, and multiple comorbidities were significant predictors of adverse outcomes.

Conclusion: Peptic ulcer disease is the most common cause of perforation of a hollow viscus. Early diagnosis, early resuscitation, timely surgical intervention and aggressive postoperative management have significant impact on clinical outcomes and mortality.

Keywords: Hollow viscus perforation; Peritonitis; Emergency laparotomy; Peptic ulcer perforation; Surgical outcomes; Prospective study.

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Introduction

Hollow viscus perforation (HVP) is among the most serious abdominal emergencies requiring immediate surgical intervention. Without early surgical intervention, leakage of gastrointestinal contents into the peritoneal cavity results in generalized peritonitis, septic shock and multiple organ dysfunction [1,2].

The spectrum of etiology of hollow viscus perforation varies geographically. Colorectal malignancy, diverticular disease and NSAID induced perforations are common in the western countries while perforated peptic ulcer, enteric

fever, abdominal tuberculosis and traumatic perforations continue to predominate in the developing countries [2–5]. Peptic ulcer perforation is the most common cause of emergency laparotomy globally. Risk factors include infection with *Helicobacter pylori*, chronic NSAID use, smoking, alcohol consumption, corticosteroid therapy, and physiologic stress [2,5,6].

Patients usually present with sudden severe abdominal pain, abdominal rigidity, vomiting, fever, abdominal distension and signs of generalized peritonitis. A delay in diagnosis [1,2,7]

increases morbidity and mortality greatly. Contrast-enhanced computed tomography is the most sensitive in locating gastrointestinal perforation [17], but an erect chest radiograph showing pneumoperitoneum is still a useful first-line diagnostic test. Management includes aggressive fluid resuscitation, correction of electrolyte imbalance, broad spectrum antibiotics, prompt exploratory laparotomy, adequate source control, peritoneal lavage, and postoperative intensive care [1,9,10]. The identified prognostic factors are advanced age, delayed presentation, septic shock, fecal contamination, renal dysfunction, diabetes mellitus and high ASA score [5, 7, 8, 10].

Though advances in surgical and critical care have contributed to better survival, perforation peritonitis carries a high burden of postoperative complications and mortality especially in resource-constrained settings [1,2,4]. Hence, the present prospective study was done to evaluate the etiology, clinical features, operative management and short term surgical outcome of patients presenting with hollow viscus perforation peritonitis.

Materials and Methods

Study Design and Setting : The present prospective observational study was carried out in the Department of General Surgery, tertiary care teaching hospital for a period of 18 months. All the eligible patients admitted with the diagnosis of hollow viscus perforation peritonitis needing emergency surgical intervention were included in the study.

Study Population: Informed written consent was obtained from a total of 120 consecutive patients.

Criteria for Inclusion

- Patients ≥ 18 years of age.
- Diagnosis of hollow viscus perforation (clinical & radiological)
- Patients admitted for emergency exploratory laparotomy.
- Patients willing to enter in the study.

Criteria for exclusion

- Primary peritonitis in the absence of gastrointestinal perforation.
- Leakage from an anastomosis after earlier GI surgery.
- Conservatively treated patients.
- Patients with missing clinical records or patients who refused to participate.

Procedure of the Study: All the patients were subjected to detailed history, thorough physical examination, routine laboratory investigations, erect chest radiography, abdominal ultrasonography and contrast enhanced CT scan when indicated and clinically feasible on admission. Initially she received aggressive IV fluid resuscitation, nasogastric decompression, urinary catheterization, broad-spectrum IV antibiotics, proton pump inhibitors, electrolyte correction and optimization prior to surgery.

After adequate resuscitation, an emergency exploratory laparotomy was performed. The intraoperative findings were recorded including site of perforation, size, degree of peritoneal contamination and operative procedure performed. Surgical procedures included Graham's omental patch repair, primary closure, bowel resection with primary anastomosis, ileostomy, appendectomy, Hartmann's procedure or any other appropriate procedure determined by operative findings.

Patients were followed until they were discharged or died. We recorded postoperative complications, length of hospital stay and in-hospital mortality.

Outcome Measures

Primary outcomes included:

- Etiology of perforation
- Clinical portrait
- Findings at operation
- Conducted surgeries
- Complications after surgery
- Length of stay in hospital
- Statistical Analysis of Mortality

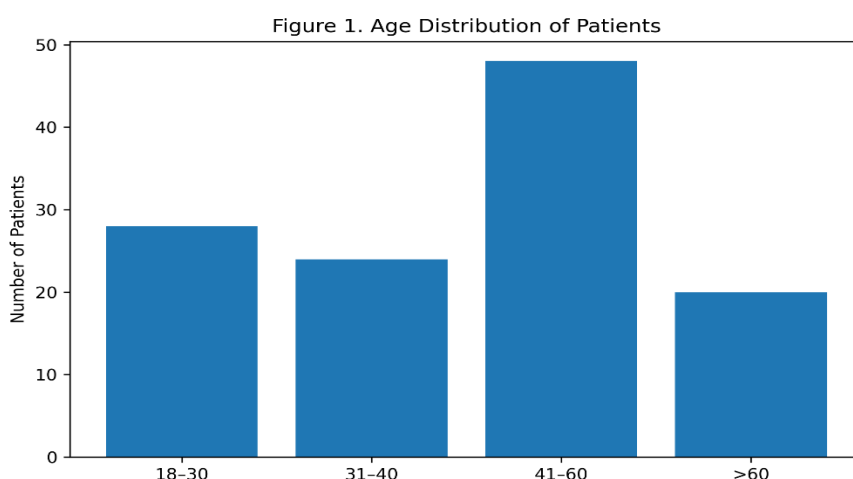
Data was entered in Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation (SD) and categorical variables as frequency and percentage. The association of categorical variables was tested by Chi-square or Fisher's exact test. A p-value of <0.05 was considered as statistically significant.

Results

Baseline Characteristics: A total of 120 patients were included in the study. The mean age was 44.8 ± 16.5 years (range: 18–82 years). The majority of patients belonged to the 41–60 years age group (40.0%). Males predominated, accounting for 81.7% of the study population, with a male-to-female ratio of 4.5:1.

Table 1: Demographic Characteristics of Study Participants (n = 120)

Variable	Number	Percentage (%)
Age Group (years)		
18–30	28	23.3
31–40	24	20.0
41–60	48	40.0
>60	20	16.7
Gender		
Male	98	81.7
Female	22	18.3
Mean age (years)	44.8 ±16.5	—

**Figure 1: Age Distribution of Patients with Hollow Viscus Perforation**

Etiology of Hollow Viscus Perforation: Peptic ulcer perforation was the most common etiology (41.7%), followed by ileal perforation (26.7%). Appendicular perforation accounted for 13.3%, traumatic perforation for 10.0%, colonic perforation for 5.0%, and jejunal perforation for 3.3%.

Table 2: Etiology of Hollow Viscus Perforation

Etiology	Number	Percentage (%)
Peptic ulcer perforation	50	41.7
Ileal perforation	32	26.7
Appendicular perforation	16	13.3
Traumatic perforation	12	10.0
Colonic perforation	6	5.0
Jejunal perforation	4	3.3
Total	120	100

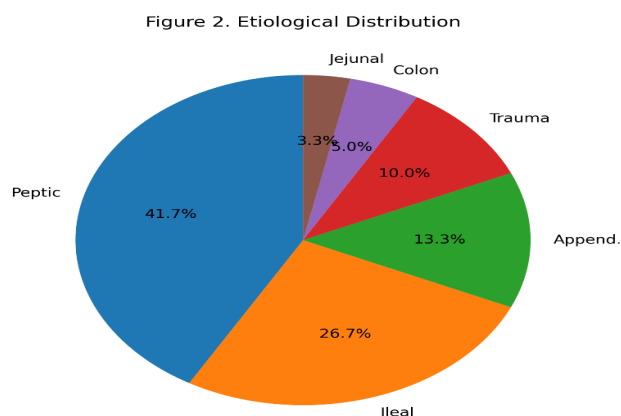
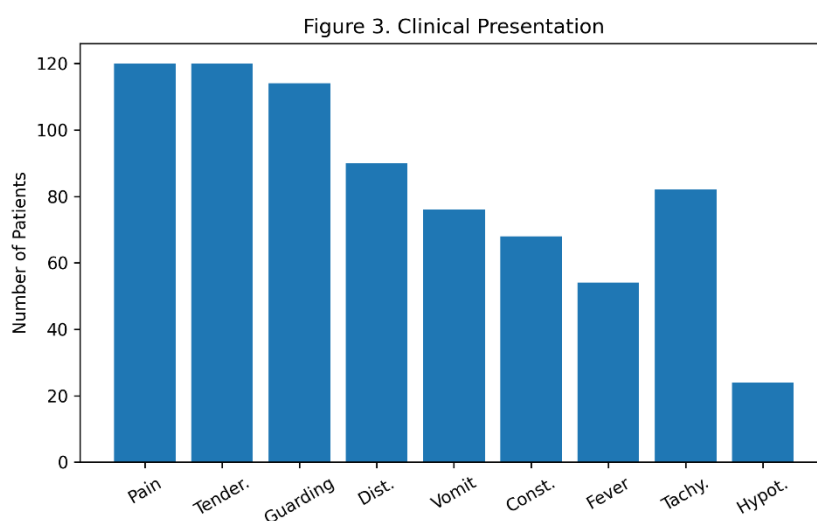


Figure 2: Etiological Distribution of Hollow Viscus Perforation

Clinical Presentation: Sudden onset abdominal pain was the universal presenting complaint. Guarding, rigidity, abdominal distension, vomiting, constipation, fever, tachycardia, and hypotension were frequently observed.

Table 3: Clinical Presentation

Clinical Feature	Number	Percentage (%)
Abdominal pain	120	100.0
Abdominal tenderness	120	100.0
Guarding/Rigidity	114	95.0
Abdominal distension	90	75.0
Vomiting	76	63.3
Constipation	68	56.7
Fever	54	45.0
Tachycardia (>100 bpm)	82	68.3
Hypotension	24	20.0

**Figure 3: Clinical Presentation of Patients**

Radiological and Laboratory Findings: Pneumoperitoneum on erect chest radiograph was observed in 88.3% of patients. Free intraperitoneal fluid on ultrasonography was present in 91.7%, while contrast-enhanced CT abdomen identified the perforation site in the majority of patients who underwent imaging.

Table 4: Laboratory and Radiological Findings

Investigation	Number	Percentage (%)
Pneumoperitoneum on erect chest X-ray	106	88.3
Free fluid on ultrasonography	110	91.7
CT abdomen performed	52	43.3
Leukocytosis (>11,000/mm ³)	92	76.7
Raised serum creatinine (>1.5 mg/dL)	18	15.0
Serum albumin <3.0 g/dL	36	30.0

Operative Findings: Exploratory laparotomy confirmed the diagnosis of hollow viscus perforation in all patients. Generalized purulent peritonitis was observed in 58 (48.3%) patients, while fecal peritonitis was present in 32 (26.7%). Localized contamination was noted in 30 (25.0%) patients. The perforation size ranged from 0.3 cm to 3.5 cm, with duodenal perforations generally measuring less than 1 cm and ileal perforations showing greater variability. Most peptic ulcer

perforations involved the anterior wall of the first part of the duodenum. Ileal perforations were predominantly located within 60 cm of the ileocecal junction.

Traumatic perforations commonly involved the jejunum and ileum, whereas colonic perforations were mainly secondary to sigmoid diverticulitis or malignancy.

Table 5: Intraoperative Findings (n = 120)

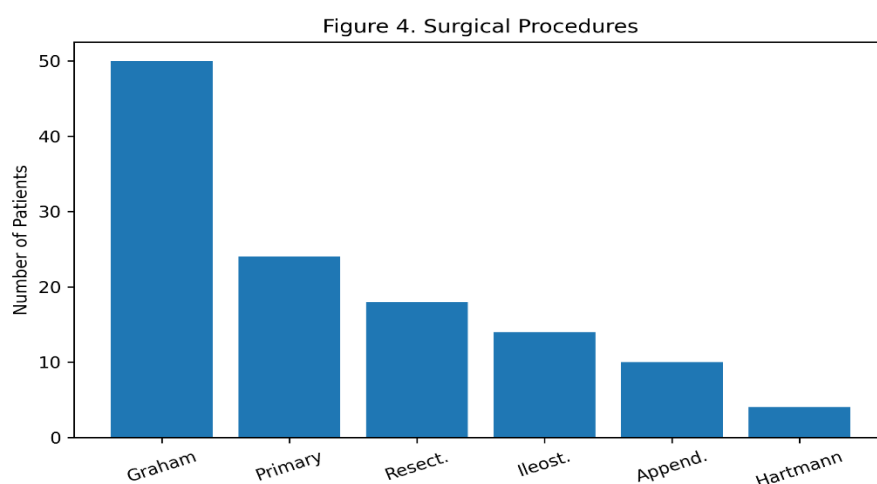
Variable	Number	Percentage (%)
Type of Peritoneal Contamination		
Purulent peritonitis	58	48.3
Fecal peritonitis	32	26.7
Localized contamination	30	25.0
Amount of Intraperitoneal Collection		
<500 mL	26	21.7
500–1000 mL	48	40.0
>1000 mL	46	38.3
Number of Perforations		
Single	114	95.0
Multiple	6	5.0

Surgical Procedures Performed: The choice of operative procedure depended upon the site and etiology of perforation, degree of contamination, bowel viability, and hemodynamic status of the patient. Graham's omental patch repair was the commonest surgical procedure, performed in

patients with peptic ulcer perforation. Primary repair was commonly undertaken for traumatic perforations and selected ileal perforations. Resection with primary anastomosis or ileostomy was performed in patients with extensive bowel involvement or unhealthy bowel margins.

Table 6: Surgical Procedures Performed (n = 120)

Surgical Procedure	Number	Percentage (%)
Graham's omental patch repair	50	41.7
Primary closure/repair	24	20.0
Resection with primary anastomosis	18	15.0
Ileostomy	14	11.7
Appendicectomy	10	8.3
Hartmann's procedure	4	3.3
Total	120	100

**Figure 4: Surgical Procedures Performed**

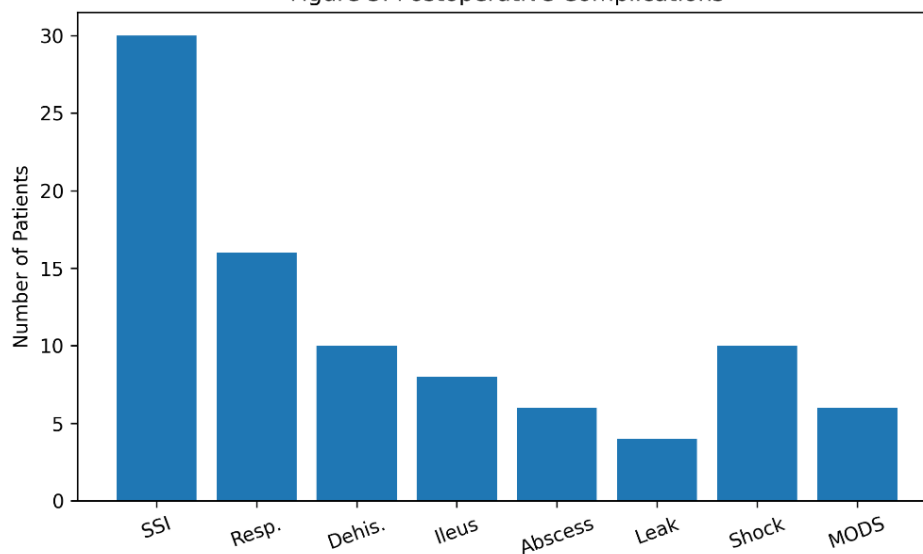
Postoperative Complications: Postoperative complications developed in 52 patients (43.3%). Surgical site infection was the most frequent complication, followed by respiratory complications, wound dehiscence, prolonged ileus,

intra-abdominal abscess, and anastomotic leak. Patients presenting after 24 hours of symptom onset experienced significantly higher postoperative morbidity compared to those presenting earlier ($p < 0.05$).

Table 7: Postoperative Complications

Complication	Number	Percentage (%)
Surgical site infection	30	25.0
Respiratory complications	16	13.3
Wound dehiscence	10	8.3
Prolonged ileus	8	6.7
Intra-abdominal abscess	6	5.0
Anastomotic leak	4	3.3
Septic shock	10	8.3
Multi-organ dysfunction syndrome	6	5.0

Some patients experienced more than one complication.

Figure 5. Postoperative Complications**Figure 5: Postoperative Complications**

Hospital Stay and Surgical Outcomes: The mean duration of hospital stay was 11.8 ± 4.9 days. Patients developing postoperative complications had a significantly longer hospital stay (16.4 ± 5.2 days) than those without complications (8.3 ± 2.6

days). Ten patients died during hospitalization, giving an overall mortality rate of 8.3%.

Delayed presentation (>24 hours), advanced age (>60 years), septic shock at admission, fecal peritonitis, and associated diabetes mellitus were significantly associated with mortality.

Table 8: Surgical Outcomes

Outcome	Number	Percentage (%)
Uneventful recovery	68	56.7
Recovery with complications	42	35.0
Mortality	10	8.3
Mean hospital stay	11.8 ± 4.9 days	—

Figure 6. Surgical Outcomes

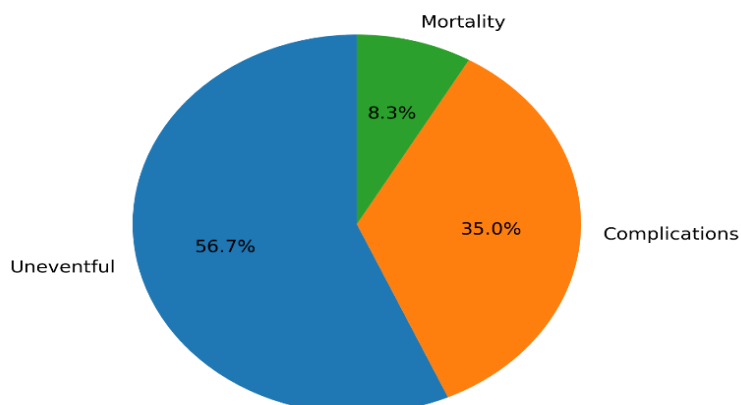


Figure 6: Surgical Outcomes of Patients

Factors Associated with Mortality: Comparison between survivors and non-survivors demonstrated several factors associated with poor outcomes.

Table 9: Factors Associated with Mortality

Variable	Survivors (n=110)	Deaths (n=10)	p-value
Age >60 years	16 (14.5%)	4 (40.0%)	0.031
Presentation >24 hours	38 (34.5%)	8 (80.0%)	0.004
Septic shock	14 (12.7%)	8 (80.0%)	<0.001
Diabetes mellitus	22 (20.0%)	5 (50.0%)	0.028
Fecal peritonitis	24 (21.8%)	8 (80.0%)	<0.001
Serum creatinine >1.5 mg/dL	12 (10.9%)	6 (60.0%)	<0.001

Discussion

The present study shows that hollow viscus perforation was mainly found in middle aged adults with the mean age of 44.8 years. These findings are consistent with other Indian studies which have reported the peak incidence in the fourth and fifth decades of life [3,4,13,14].

The male predominance (81.7%) observed in the present study is in agreement with earlier reports from India and other developing countries where smoking, alcohol intake, NSAID consumption and occupational exposure are more common among men [3,4,5].

The commonest etiology was peptic ulcer perforation constituting 41.7% of cases. Similar results have been reported by Søreide et al., Møller et al., and Jhobta et al., who found perforated peptic ulcer to be the most common cause of generalised peritonitis requiring emergency surgery [2,4,5]. Ileal perforation was the second most common cause (26.7%). This finding is consistent with the ongoing burden of enteric fever and infectious bowel diseases in developing countries

and similar to the studies by Gupta and Kaushik and Beniwal et al. [3,14].

The clinical picture of our patients resembled that reported in previous studies [2–4] and was characterized by acute abdominal pain, generalized tenderness, guarding, rigidity, abdominal distension, vomiting and fever.

Radiologic evidence of pneumoperitoneum was present in 88.3% of the patients. This finding is in line with the study of Kumar et al. who found erect chest radiography to be an effective initial diagnostic investigation, although computed tomography has increased sensitivity for detection of perforation [17].

The most common procedure was Graham's omental patch repair as the predominant pathology was peptic ulcer perforation. The method is still the operation of choice for small duodenal perforations because of its simplicity and good clinical results [1,2,16]. The most common post-operative complication was surgical site infection (25%). Similar postoperative wound infection rates have been reported in previous studies of perforation peritonitis which are still attributable to gross

bacterial contamination, delayed presentation, emergency surgery and prolonged operative duration [3,9,18].

Respiratory complications were the second most common morbidity. Early post-operative mobilisation, chest physiotherapy, adequate analgesia and intensive respiratory care have been shown to reduce the pulmonary complications following emergency laparotomy [10,11].

The overall mortality of 8.3% in the present study is comparable with previously published mortality rates of 5 to 20% [2,5,7].

Presentation > 24 h, septic shock, fecal peritonitis, old age, diabetes mellitus and renal dysfunction were significantly correlated with mortality. Buck et al., Testini et al., and Boey and Wong have consistently identified similar prognostic factors [7,8,16].

Strengths of this study include the prospective design, standardized perioperative management, and thorough evaluation of operative findings and postoperative outcomes. However, the study is limited by its single-center design and relatively small sample size. Further larger multi-center studies with longer follow-up are needed to validate these findings [1,2,5].

Conclusion

Peritonitis due to hollow viscus perforation is one of the most challenging surgical emergencies as it rapidly progresses to generalized peritonitis, sepsis and multiple organ dysfunction if timely intervention is delayed. The present prospective study showed that peptic ulcer perforation is the leading cause of the hollow viscus perforation followed by ileal perforation, appendicular perforation, traumatic bowel injury and colonic perforation. The disease was most prevalent in middle-aged men which is suggestive of the impact of lifestyle factors, NSAID use, smoking, alcohol intake and infectious etiologies which are more common in developing countries.

Patients presented with acute abdominal pain, abdominal tenderness, guarding and radiological evidence of pneumoperitoneum. Emergency exploratory laparotomy after aggressive resuscitation remained the mainstay of successful management.

Graham's omental patch repair was the commonest procedure done due to the preponderance of duodenal ulcer perforation. The most common postoperative complication was surgical site infection. Delayed presentation, septic shock, fecal peritonitis, advanced age, diabetes mellitus and renal dysfunction were the significant predictors of postoperative morbidity and mortality. The overall mortality rate of 8.3% in the present study is better

than that reported previously and reflects the benefits of early diagnosis, early resuscitation, appropriate antimicrobial therapy, timely surgery and comprehensive post-operative intensive care.

With public health measures to reduce the burden of enteric fever, rational use of NSAIDs, smoking cessation, improved sanitation and increased awareness about early medical consultation, the burden of perforation peritonitis is expected to further decrease.

Early diagnosis, early referral, proper perioperative optimization, careful operative technique and multidisciplinary postoperative management are still the key strategies to improve surgical outcome and reduce mortality in patients with hollow viscus perforation.

Strengths of the Study

The study is the first to use a large national sample to examine the effects of different types of childhood adversity on adult health outcomes.

- Observational study, prospective, standardized data collection.
- Consecutive patient recruitment minimized selection bias.
- Full evaluation of demographic, clinical, operative and postoperative variables.
- Assessment of morbidity and mortality outcomes.
- Findings are representative of the modern spectrum of hollow viscus perforation encountered in tertiary care surgical practice.

Limitations

- Single centre study with a relatively small sample size.
- No long term follow up post discharge.
- Quality-of-life and functional outcomes were not evaluated.
- No microbiological culture profile and antimicrobial resistance patterns were studied.

There was no multivariate regression analysis performed to identify independent predictors of mortality.

Recommendations to Clinicians

1. Develop early detection of generalized peritonitis at the peripheral health care centers.
2. Referral to tertiary surgical centres in a timely manner is critical to reduce delay in definitive care.
3. Immediate aggressive preoperative resuscitation should be instituted and broad spectrum antibiotic coverage started as soon as diagnosis is made.
4. Once adequate resuscitation has been achieved, emergency exploratory laparotomy should not be unnecessarily delayed.

5. Strict adherence to perioperative infection prevention protocols should be employed to reduce postoperative surgical site infections.
6. High risk patients, particularly the elderly, late presenters and those with septic shock should be monitored in the postoperative intensive care unit.
7. Public health measures for enteric fever prevention and rational use of NSAIDs may reduce the incidence of hollow viscus perforation.

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