



Clinical Evaluation of Hollow Viscous Perforation in Tertiary Care Hospital - A Prospective Study

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ABSTRACT

Background: A common abdominal emergency with a high morbidity and fatality rate is a gastric perforation. A significant aspect of the management of perforations is surgery. Early diagnosis, prompt surgical intervention and appropriate post-operative care are vital for favorable outcomes. **Objective:** To study the clinical profile, etiological factors and outcomes of patients with hollow viscus perforation, and to analyse the association of Mannheim Peritonitis Index (MPI) scores, socioeconomic status and place of residence with clinical presentation and hospital stay. **Methods:** A prospective, in-depth study of 50 cases of abdominal hollow viscus perforations was conducted from admissions at the Government Cuddalore Medical College Hospital, Chidambaram, Tamil Nadu, India. **Results:** The mean MPI (Mean Mannheim Peritonitis) score was found to be 6.76, indicating a relatively low predicted risk of morbidity and mortality. The mean hospital stay is approximately 11 days. The average presentation time is 34 hours. Majority of patients are from rural areas and belongs to low socioeconomic status. **Conclusion:** In our study, there was no statistically significant relation between place of residence and the length of hospital stay or presentation time, despite the fact that a greater proportion of patients were from rural regions and had lower socioeconomic status.

Keywords: Hollow viscus perforation, Duodenum perforation, ruptured bowel, abdominal emergency, appendicular perforation.

1. INTRODUCTION

A serious medical emergency known as the hollow viscus perforation or ruptured bowel of abdomen occurs when the walls of hollow organs in the abdominal cavity including small intestine, stomach, large intestine and other related tissues are compromised. The causes of hollow viscus perforation are multifaceted. It can arise from a variety of clinical conditions including obstruction of bowel from volvulus, ischemic bowel, gastrointestinal ulcers, colon cancer, diverticulitis and infections including C.difficile., trauma such as ingesting a sharp object, a knife wound, or undergoing a medical procedure like colonoscopy and other iatrogenic injuries. The location and extent of the perforation may affect the clinical presentation but common symptoms include abdominal pain, tenderness, nausea, vomiting, discomfort, rigidity, guarding and signs of peritoneal irritation. The pain usually starts suddenly when there is a hole in the stomach or early part of small intestine, but it may start more gradually when there is a hole in the large intestine. The nature of the pain is typically consistent. Sepsis with elevated heart rate, rapid breathing, fever and confusion may occur too.(1)

The absence of specific clinical signs and symptoms overlap with other intra-abdominal illnesses which make it more difficult to diagnose hollow viscus perforation in an appropriate time frame, increasing the risk of morbidity and mortality. Since the hollow viscera's structure is more delicate than that of parenchymatous organ, even small trauma might result in substantial damage.(2)

Diagnostic modalities are essential in the assessment of hollow viscus perforation. This may include imaging tests such as computed tomography (CT), ultrasound, abdominal X-ray and diagnostic peritoneal lavage (DPL) which facilitate the localization



and evaluation of perforations. There are laboratory tests that indicate associated systemic responses of tissue injury and infection such as complete blood counts, serum electrolytes, and inflammatory markers further add to the diagnosis procedure.

After diagnosis, management of hollow viscous perforation usually entails surgical exploration to identify and repair the perforated organ, removal of contaminated intra-abdominal fluid, and treatment of any related complications including sepsis, peritonitis, and Systemic inflammatory response syndrome (SIRS).(3) The patient's hemodynamic stability, the degree of intra-abdominal contamination and the surgeon's experience all play a role in the choice of surgical procedure that is to be employed whether open laparotomy or less invasive procedures like laparoscopy.

With a high morbidity and mortality rate, gastrointestinal perforations are a common abdominal emergency. The well-being of the patient is severely jeopardized by this condition which frequently calls for immediate medical attention to prevent potentially fatal complications. Increased mortality and morbidity are frequently caused by comorbidities, advanced age, delayed diagnosis, complications such as multi-organ dysfunction syndrome (MODS), septic shock and late intervention particularly in patients who survived the initial phase of insult.(4)

The management for hollow viscous perforation is still challenging despite advancements in medical imaging, surgery and perioperative care especially in tertiary care hospital settings wherein complex cases are common. The objective of this study is establishing a comprehensive model for clinical evaluation and management by analyzing cases of hollow viscous perforation in a tertiary care hospital setting. It evaluates the common type of perforations and their manifestations, postoperative complications, and investigate the prognosis based on the current research. By identifying patterns in clinical presentation, diagnostic strategies, surgical interventions, and outcomes, this study aims to develop evidence-based protocols to guide healthcare professionals in the timely recognition and efficient management of this critical condition ultimately improving patient survival and quality of life.

2. Materials and Method

The patient's and their families' histories were obtained. Demographic information, clinical features, clinical examination, investigations, intraoperative results, intervention type and post-operative management were all noted.

Study Design :	A prospective observational study.
Study Duration :	6 months.
Study Site :	This study is a single centered study which was conducted at the Departement of Surgery at Cuddalore Government Medical College and Hospital, Chidambaram, Tamil Nadu. The hospital is a 1200 bedded multi-speciality tertiary care teaching hospital.
Study Population :	A total of 50 patients who were diagnosed with hollow viscous perforation were studied. The enrolment of the patients was based on the inclusion and exclusion criteria.

2.1. Inclusion Criteria

1. Patients belonging to any age groups and genders diagnosed with gastro-intestinal hollow viscous perforation.
2. Patients who underwent surgical intervention for hollow viscous perforation.
3. Patients who gave informed consent for the study.

2.2. Exclusion Criteria

1. Patients with non-gastrointestinal perforations.
2. Patients who were referred after surgery performed elsewhere.

2.3. Study Procedure

Radiological Investigations: Chest x-ray, x-ray plain picture abdomen in erect posture to check for any free air under diaphragm. USG whole abdomen was done to check for any intra-abdominal mass, pancreatitis, free fluid or other pathology associated.

Biochemical Investigation: Culture and sensitivity of peritoneal exudate were done to check for the bacterial contamination and to guide the antibiotic therapy.



Complications: Patients were closely observed during the recovery period. Regular examinations were performed on the chest and abdomen to check for fistula, lower respiratory tract infection, acute respiratory distress syndrome, wound infection and intra-abdominal abscess. If any abnormalities were found, they were noted and treated appropriately. The input-output chart was meticulously kept up to date.

Assessment of Patients at Discharge: Prior to discharge, every patient underwent a comprehensive examination during which the following details were recorded: General health, wound status, abdominal examination for fistulas, hernias, and other conditions.

Statistical Analysis: Tables, graphs and percentages were used to present the data. A Microsoft Excel spreadsheet was used to compile and analyze the study's entire data.

3. Results

Hollow viscous perforation was found to be more common in males when compared to females. Males outnumbered females with a ratio of 4.5:1. In this study, most of the patients with hollow viscous perforation belong to the age-group of 50 years with the percentage of 38%. They were followed by the age-group of 21-30 years with the percentage of 26%. The oldest patient in this study was 78 years and was diagnosed with ileal perforation. The youngest patient enrolled for perforated appendix was 19 years.

Majority of the patients presented with hollow-viscous perforation come from rural areas (56%). Majority (64%) of the patients belonged to low SES group. 14% belonged to middle SES group and 8% belonged to high SES category.

The most common site of perforation was duodenal perforation which was presented in 26 patients with 52%. This was followed by appendicular perforation with 24%. In this study, ileal perforation constituted 12%. This was followed by stomach perforation which constituted 8%. Jejunum and ileum both constituted 2%. 28 patients (56%) reported diffuse pain over abdomen. 12 patients (24%) reported epigastric pain. Pain in right iliac fossa was present in 8 patients (16%).

The most common signs observed were guarding and rigidity (20%) and obliterated liver dullness (20%) which is followed by dehydration (16%) and free fluid in abdomen (16%). Vomiting (34%) is the most frequent symptom observed which is followed by fever (23%). Vomiting (34%) is the most frequent symptom observed which is followed by fever (23%). Alcohol contributed 40.3% and smoking contributed 28.4% of hollow viscous perforation. Alcohol and smoking alone contributed 68.7% of hollow viscous perforation. Inflammation contributed 17.9% and infection contributed 7.4% of hollow viscous perforation. 4.5% developed hollow viscous perforation due to trauma.

Pneumoperitoneum or air under diaphragm in X-ray abdomen was seen in 37 cases which accounted for 74% of the patients. Most of the patients were presented within 25-48 hours (38%). 16 patients were presented within 12 hours (32%). 10 patients were presented within 13-24 hours (20%).

Among the patients admitted, 32.6% had type-2 diabetes mellitus. 25.6% patients had appendicitis which was followed by hypertension that constituted 20.9%. Hernia contributed 16.3%.

Omental patch repair is the most common type of operation performed. It was performed in 28 patients which constituted for 56%. This is followed by appendicectomy (24%). 6 patients (12%) had simple closure.

The most common type of antibiotics prescribed for prophylaxis is third generation cephalosporins. Cefotaxime was prescribed in 24.9% cases. Metronidazole was administered in 20.4% patients admitted followed by piperacillin+tazobactam (15.9%), Ciprofloxacin (13.9%). Amoxicillin+clavulonic acid, Gentamicin and azithromycin were used in 9%, 8.4% and 7.5% cases respectively.

Majority of the patients had a hospital stay of 8-14 days (46%) which is followed by 1-7 days (38%). Among the 50 patients admitted, about 96% responded well to the treatment and got discharged. 2 patients were expired due to post-operative complications like septicemia and acute respiratory distress syndrome.

Most common complication recorded in this study was lower respiratory tract infection which constituted 22%. This was followed by wound infection (12%). The most common organism isolated was staphylococcus aureus (31.6%). E. coli and Klebsiella constituted 26.3% and 21.1% respectively. Proteus mirabilis and MRSA (methicillin resistant staphylococcus aureus) each contributed 10.5% wound infection equally. No post operative complications were observed in about 29 patients (58%).



Majority of patients (96%) had MPI scores below 21, indicating a low predicted risk of mortality. Only two patients (a score of 28 and 32) had higher scores suggesting a moderate to high risk of mortality and morbidity according to the MPI classification.

Table 1. General Characteristics of Patients			
Attributes		No of Patients	Percentage
Sex	Male	41	82
	Female	09	18
Age (Years)	< 20	7	14
	21 – 30	13	26
	31 – 40	3	6
	41 – 50	8	16
	> 50	19	38
Residence	Urban	22	44
	Rural	28	56
Socioeconomic Status	Low	32	64
	Middle	14	28
	High	4	8

Table 2. Clinical Characteristics of Patients			
Attributes		No of Patients	Percentage
Site of Perforation	Stomach	4	8
	Duodenum	26	52
	Jejunum	1	2
	Ileum	6	12
	Colon	1	2
	Appendix	12	24
Site of Pain	Diffuse	28	56
	Epigastric region	12	24
	Right iliac fossa (RIF)	8	16
	Right iliac fossa and Right Lumbar (RIF, RL)	1	2
	Right Hypochondriac region (RH)	1	2
Signs	Abdominal distension	23	14
	Guarding and rigidity	33	20
	Absent bowel sounds	24	14
	Dehydration	27	16
	Obliterated Liver dullness	34	20
	Free fluid in abdomen	27	16
Symptoms	Abdominal pain	18	15
	Vomiting	41	34
	Fever	28	23
	Bloating	23	19
	Constipation	11	9
Etiology	Smoking	19	28.4
	Alcohol	27	40.3
	Infection	5	7.4
	Trauma	3	4.5
	Obstruction	1	1.5
	Inflammation	12	17.9
Pneumoperitoneum in x-ray	Present	37	74
	Absent	13	26
Presentation Time	0-12 hours	16	32
	13-24 hours	10	20
	25-48 hours	19	38



	49-72 hours	5	10
Comorbidities	Hernia	7	16.3
	Appendicitis	11	25.6
	Pancreatitis	1	2.3
	Type 2 diabetes mellitus	14	32.6
	Hypertension	9	20.9
	Tuberculosis	1	2.3

Table 3. Clinical Management of Patients			
Attributes		No of Patients	Percentage
Operation Procedure	Omental patch repair	28	56
	Appendectomy	12	24
	Simple closure	6	12
	Resection anastomosis	3	6
	Loop ileostomy	1	2
Organisms Isolated	Staphylococcus aureus	6	31.6
	Escherichia coli	5	26.3
	Klebsiella spp.	4	21.1
	Proteus mirabilis	2	10.5
	MRSA	2	10.5
Antibiotics Prescribed	Ciprofloxacin	28	13.9
	Cefotaxime	50	24.9
	Metronidazole	41	20.4
	Amoxicillin + Clavulanic acid	18	9
	Piperacillin+ Tazobactam	32	15.9
	Azithromycin	15	7.5
	Gentamycin	17	8.4
Hospital Stay	1-7 days	19	38
	8-14 days	23	46
	>14 days	8	16
Outcome	Discharged	48	96
	Expired	2	4
MPI Score	Good (≤ 21)	48	96
	Moderate (21 - 29)	1	2
	Poor (≥ 30)	1	2

Table 4. Clinical Complications of Patients			
Attributes		No of Patients	Percentage
Post Operative Complications	Absent	29	58
	Intra-abdominal abscess	1	2
	Wound infection	6	12
	Fistula	1	2
	Lower respiratory tract infection	11	22
	Acute respiratory distress syndrome	1	2
	Septicemia	1	2

3.1 Relationship between Age, Sex and Site of Perforation:

Over 10 patients above the age of 50, 4 patients within the age group of 41-50 years and 7 patients within the age group of 21-30 years had perforation in the duodenum. Duodenum is the most common site of perforation in males followed by appendix, ileum and stomach.

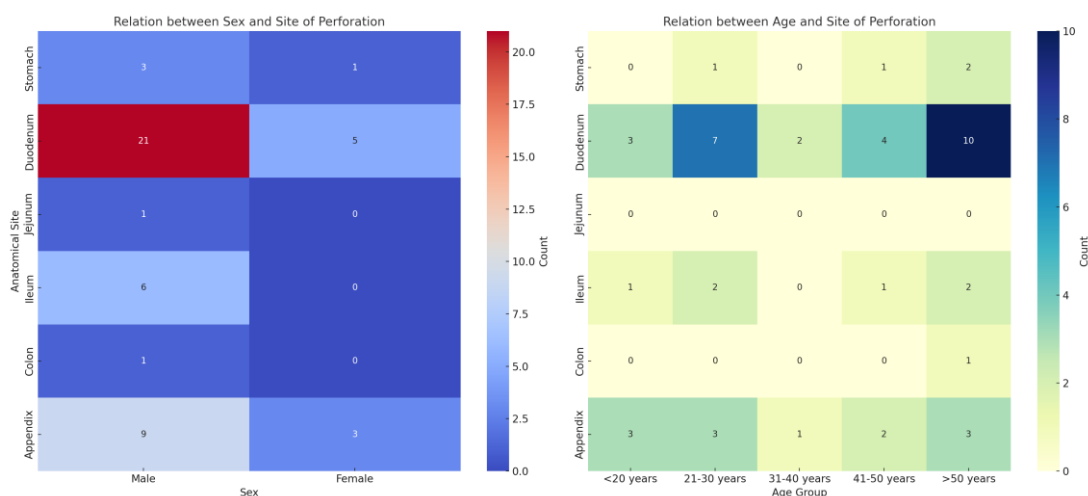


Fig 1: Relationship between Age, Sex and Site of Perforation

3.2. Statistical Analysis

3.2.1. Impact of gender on hospital stay:

The two-tailed P value equals 0.1327. By conventional criteria, this difference is considered to be not statistically significant. There is no impact of gender on hospital stay.

3.2.2. Impact of socioeconomic status on presentation time:

The Welch's ANOVA results indicate statistically significant differences among the Low, Middle, and High groups ($F(2,16.5)=5.67$, $p=0.013$), with a moderate-to-large effect size ($\eta^2=0.25$), suggesting that at least one group's mean differs meaningfully from the others. Post-hoc Games-Howell tests revealed a marginally significant difference between the Low and Middle groups (mean difference=10.68, $p=0.067$, Cohen's $d=0.65$), where the Low group tended to have higher values, while comparisons involving the High group were inconclusive due to its extremely small sample size ($n=4$), despite showing a large effect size against the Low group ($d=1.02$, $p=0.112$). These findings suggest meaningful differences between the Low and Middle groups, but the results for the High group should be interpreted with caution and require additional data to draw reliable conclusions. Visualizing these results with boxplots would help illustrate the group distributions and observed differences.

3.2.3. Impact of residence on presentation time:

The two-tailed P value equals 0.1500. By conventional criteria, this difference is considered to be not statistically significant. There is no impact of residence on presentation time.

Table 5. Descriptive statistical analysis				
Parameters	MPI	Hospital Stay (Days)	Presentation Time	Age
Mean	6.76	10.8	34.08	44.6
Median	5	11	24	47.5
Mode	0	7	48	20
Std. Deviation	7.2	3.46	20.04	18.2
Minimum	0	7	12	19
Maximum	32	18	72	78
Range	32	11	60	59
Skew	1.5	0.22	0.37	0.13
95% Confidence Interval of Mean	4.71 - 8.81	9.81 - 11.79	28.38 - 39.78	39.42 - 49.78



4. Discussion

This study was conducted in Cuddalore government medical college and hospital. A total of 50 patients with hollow viscous perforation admitted in the surgery unit that met the inclusion criteria were selected. The findings of this investigation were compared with the previously conducted studies. In the present study, the ratio of males to females for all types of perforation regardless of the site or pathological condition was 4.5:1. This is comparable to the study done by *Bhupender et al* which found that the sex ratio was 5:1. However, various authors reported varying sex ratios in their studies. *Bali RS et al.*, found the male to female ratio to be 2.1:1.(5)

The age group over 50 years old had the highest number of patients encountered in this study followed by the age group of 21-30 years old. The mean age of presentation is found to be 44.6, which is comparable to the mean age of 49 years as found by *Singh G et al.*(6).

Rao DCM et al found that the perforation of the duodenum was the most common site and males are more likely than females to have a duodenal ulcer perforation in the very first part of the duodenum(7) this is comparable to studies done by *Afridi et al*(8) and *Gupta S et al*(9). This current study too found that the duodenum was the most common site of perforation regardless of the underlying ailments, the majority of the patients belonged to the age group of over 50 years. A high incidence of duodenal ulcer perforation is due to smoking, alcoholism, and incomplete *H. pylori* treatment(10). Duodenal ulcer perforation is also significantly influenced by the NSAIDs abuse. In India, proximal region perforations are more common than distal region perforations which happen to be more common in western countries(11).

The most prevalent symptom that is experienced by all patients was abdominal pain which was followed by abdominal distension. In their investigation, *Bali et al.* discovered that 28% of patients had abdominal distension, 41.5% of patients had vomiting, and 98% of patients had abdominal pain(5). In their investigation of 53 cases, *Mishra SB et al.* (1991) found that 30 (60%) of the patients had a history of ulcers. In *Ramesh C. Bharati et al.*'s (1996) review, 20 cases (78%) had a prior history of pain.

The most common surgical procedure for managing perforations is laparotomy with closure using an omental patch repair. This is comparable to the study done by *Afridi et al*(8). Prior to surgery, every patient received nasogastric suction, broad spectrum antibiotic treatment, management of fluid and electrolyte imbalance and oxygen supplementation when required.

According to the research done by *Budhரா et al*(12), the most common complication is wound infection. Research by *Jhobta et al*(13), and *Afridi et al*(8), revealed that respiratory infections occurred in 28% and 20% of the patients respectively. The most frequent complications following hollow viscous perforation were respiratory (36%), wound infections (24%), dyselectrolyte (14%), sepsis 8%), and burst abdomen (25%), according to a study by *Pandian P et al.* that aimed to assess patterns, common age and sex and evaluate different treatment modalities to reduce mortality and morbidity of hollow viscous perforation(14). This study too suggests that lower respiratory tract infection is the most common complication observed. Elderly patients, delayed presentation, poor general condition (shock) and other co-morbid conditions were the risk factors. Patients with one or more risk factors experienced more post-operative complications. Mortality was influenced by the patient's overall health, intestinal health, level of peritoneal contamination, and related pre-operative co-morbid risk factors.

Our study shows that there is no significant difference between gender & hospital stay, Socioeconomic status & Presentation Time (Small significant difference is seen between low & middle) and Residence & Presentation Time.

In our study, Patients with MPI scores above 21 (28 and 32) succumbed during the postoperative period, suggesting a correlation between higher MPI scores and increased mortality risk. The mean Mannheim Peritonitis Index (MPI) score among patients with hollow viscus perforation was 6.76, indicating a relatively low predicted risk of morbidity and mortality. An MPI score of <21 is generally associated with a favorable prognosis, whereas scores above 29 correlate with higher mortality risk. The predominance low average score in our study supports the overall satisfactory outcomes.

5. Conclusion

Hollow viscous perforation continues to be a significant surgical emergency with considerable morbidity and mortality, particularly among individuals from lower socio-economic backgrounds and rural areas. In our study, there was no statistically significant relation between place of residence and the length of hospital stay or presentation time, despite the fact that a greater proportion of patients were from rural regions and had lower socioeconomic status.

This implies that although people living in remote areas can have an impact on health access, the clinical parameters of the patients were not significantly impacted. Improving outcomes for hollow viscus perforation requires sustained efforts to improve



community-level health education and emergency surgical care. Our study's sample size and single-center design limit its ability to provide insights on clinical and demographic features. Future studies should focus on multi-center, population-based studies to have a better understanding about the clinical outcomes and management of the cases.

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