Section: General Surgery

Original Research Article

BACTERIOLOGICAL PROFILE OF PERITONEAL FLUID IN HOLLOW VISCUS PERFORATIVE PERITONITIS: A PROSPECTIVE STUDY

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ABSTRACT

Background: Hollow viscus perforative peritonitis is a surgical emergency that can lead to serious complications and death. Starting the right antibiotics quickly is crucial, but the first-choice antibiotics often do not match the patterns of bacterial sensitivity found in cultures. This study aims to look at the types of bacteria in peritoneal fluid from patients with hollow viscus perforative peritonitis and evaluate antibiotic sensitivity patterns to guide treatment.

Materials and Methods: This prospective observational study included 100 patients who were admitted with signs of hollow viscus perforative peritonitis at the Department of General Surgery, Raichur Institute Of Medical Sciences, India, over a period of 18 months. We collected peritoneal fluid during emergency laparotomy, cultured it for aerobic and anaerobic organisms, and performed antibiotic sensitivity tests.

Results: The most affected age group was 31 to 50 years (48%), with more males (67%) than females. Duodenal perforation was the leading cause (46%). We found that culture positivity was 72%. Escherichia coli (38%) was the most common isolate, followed by Klebsiella pneumoniae (24%), Pseudomonas aeruginosa (6%), Enterococcus faecalis (2%), and Candida albicans (2%). Among antibiotics, meropenem showed the highest sensitivity (81%), followed by amikacin (72%). We observed high resistance rates for ceftriaxone (63%) and piperacillin-tazobactam (47%), both of which are used as first-line treatments here.

Conclusion: First-choice antibiotic regimens often do not match the sensitivity patterns found in cultures. It is crucial to monitor local bacteria and manage antibiotic use to improve patient outcomes.

Keywords: perforative peritonitis, peritoneal fluid culture, bacteriological profile, antibiotic sensitivity, empirical antibiotics, hollow viscus perforation.

INTRODUCTION

Peritonitis caused by the perforation of a hollow organ is still one of the most common surgical emergencies around the world. When the stomach, small intestine, or large intestine perforates, contents like bacteria, bile, and food debris spill into the sterile peritoneal cavity. This leads to acute inflammation and sepsis. Despite improvements in critical care, broad-spectrum antibiotics, and surgical methods, perforative peritonitis still results in significant illness, longer hospital stays, and a mortality rate between 6 and 27% in various studies.[1–3]

The causes of this condition differ by region. In developing countries, duodenal ulcer perforation is the most common cause, while diverticulitis and cancer are more frequent in Western nations.[4] The microbial population in the peritoneum varies based on where the perforation occurs: upper gastrointestinal perforations usually involve Gram-positive bacteria, while bowel perforations often host a mix of Gram-negative bacilli and anaerobes.[5]

Key management steps include quick resuscitation, emergency surgery for source control, and the early start of antibiotic treatment. However, a significant challenge is that the antibiotics chosen empirically do not always match the actual sensitivity of the bacteria found in the peritoneum. This mismatch can lead to prolonged sepsis, more complications, longer hospital stays, and the growth of drug-resistant organisms.[6-8]

Treatment guided by cultures has shown better results than empirical treatments.[9] Still, many centers in low- and middle-income countries do not have standardized regional antibiograms. Therefore, it is essential to continuously assess the bacterial patterns in peritoneal fluid to improve empirical antibiotic guidelines.

This prospective study aimed to investigate the bacterial profile of peritoneal fluid in cases of hollow viscus perforative peritonitis and evaluate antibiotic sensitivity patterns to inform future empirical protocols.

MATERIALS AND METHODS

Study Design and Setting: A prospective observational study took place in the Department of General Surgery at Raichur Institute Of Medical Sciences in India over 18 months. The Institutional Ethical Committee approved the study, and all patients gave written informed consent.

Study Population: We included patients aged 18 years and older who showed signs of generalized peritonitis and had radiological evidence of pneumoperitoneum or bowel perforation and who underwent emergency laparotomy.

Exclusion criteria:

- Primary bacterial peritonitis
- Peritonitis related to peritoneal dialysis
- Postoperative peritonitis
- Patients already on culture-directed antibiotics before admission
- Immunocompromised patients receiving steroids or chemotherapy

Sample Size: We enrolled a total of 100 consecutive eligible patients.

Data Collection: We recorded demographic characteristics, clinical presentation, perforation site, and operative findings. During surgery, we collected peritoneal fluid samples for analysis before lavage using sterile aspiration. We submitted these samples immediately for:

- Gram staining
- Aerobic and anaerobic culture
- Antimicrobial susceptibility testing (Kirby-Bauer disc diffusion)

Empirical Antibiotics Used

Before the culture results were available, all patients received:

- Piperacillin-Tazobactam

We adjusted empirical therapy based on culture sensitivity reports.

Outcome Parameters

- Organisms isolated
- Sensitivity and resistance to commonly used antibiotics
- Need for antibiotic escalation
- Postoperative clinical outcomes

Statistical Analysis

We analyzed data using SPSS v.26. We expressed continuous variables as mean ± SD and categorical variables as proportions. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Demographic Profile: The highest proportion of cases occurred in the 31–50 year age group (48%), followed by >50 years (32%) and ≤30 years (20%). Males constituted 67% and females 33%.

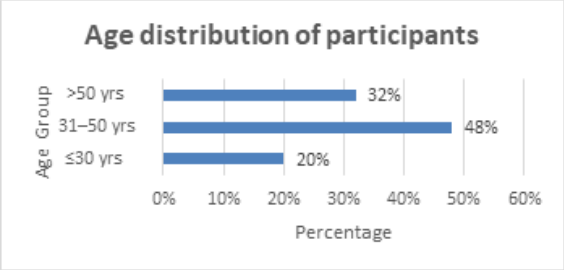

Figure 1: Age distribution of participants

Etiology and Anatomical Site of Perforation: Duodenal ulcer was the most common cause (46%), followed by ileal typhoid perforation (24%), appendicular perforation (10%), traumatic jejunal perforation (8%), gastric ulcer (6%), and colonic diverticulitis (6%).

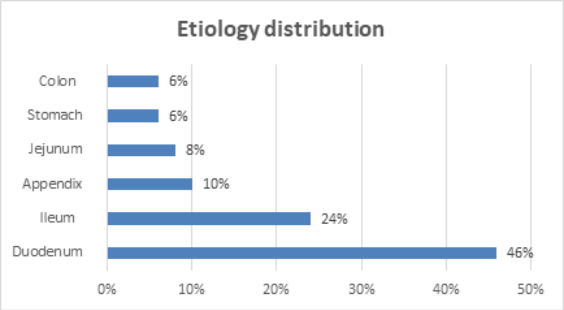

Figure 2: (text-based bar graph): Etiology distribution

Culture Outcomes: Culture positivity was 72% and no growth was observed in 28%.

Bacteriological Profile

Among culture-positive samples (n = 72):

Organism	n (%)
E. coli	38 (38%)
Klebsiella pneumoniae	24 (24%)
Pseudomonas aeruginosa	6 (6%)
Enterococcus faecalis	2 (2%)
Candida albicans	2 (2%)

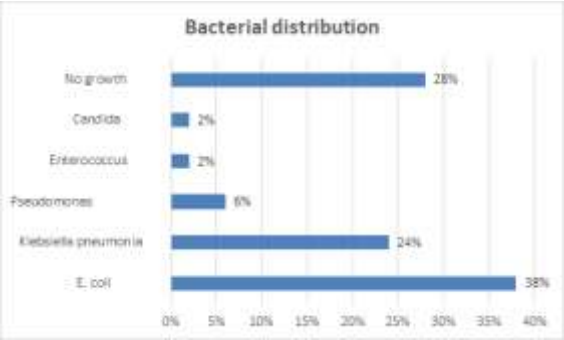

Figure 3: (pie-chart style layout): Bacterial distribution

Antibiotic Sensitivity Pattern

Antibiotic	Sensitivity (%)
Meropenem	81
Amikacin	72
Imipenem	69
Piperacillin-Tazobactam	53
Ciprofloxacin	47
Gentamicin	41
Ceftriaxone	37
Amoxiclav	32
Colistin (Pseudomonas only)	66

Empirical–Culture Concordance

Parameter	n (%)
Empirical antibiotics fully sensitive	22 (22%)
Partially sensitive	34 (34%)
Resistant	44 (44%)

Empirical resistance was notably high for E. coli and Klebsiella.

Postoperative Complications

- Surgical site infection – 18%
- Burst abdomen – 6%
- Septic shock – 10%
- Mortality rate – 8%

DISCUSSION

This study shows a significant difference between empirical therapy and culture-based sensitivity in cases of perforative peritonitis. The higher number of males and middle-aged adults matches earlier reports, which indicate that smoking, alcohol use, NSAID misuse, and Helicobacter pylori-related peptic ulcer disease are common risk factors.[10-12]

Duodenal perforation was the most common cause, in line with several Indian studies that point to acid-peptic disease as a major factor in perforative peritonitis in South Asia.[13-15] The culture positivity rate of 72% in our study was similar to the 65–80% reported in other literature.[16]

E. coli and Klebsiella pneumoniae were the most frequently isolated bacteria, confirming that Gram-negative bacilli are prevalent in secondary peritonitis.[5,17] The sensitivity profile showed that carbapenems and aminoglycosides were the most effective, while the empirical agents, ceftriaxone and piperacillin-tazobactam, provided less than ideal coverage. This difference highlights the increasing antimicrobial resistance due to the overuse of empirical antibiotics.[18-20]

The emergence of fungal and multidrug-resistant strains, even in small numbers, further stresses the need for specific antimicrobial strategies instead of one-size-fits-all drug protocols.

Clinical Significance

- Culture-based therapy should replace empirical methods wherever possible.
- Hospitals need to keep local antibiograms updated every year.
- Early care from a team of specialists can lessen complications.

Limitations

- The study was conducted at a single center and had a small sample size.
- It did not examine long-term recurrence or quality of life.

Recommendations

- Start broad-spectrum therapy that covers Gram-negative bacilli and anaerobes.
- Change to step-down therapy once sensitivity results are available.
- Strengthen antibiotic stewardship programs.

CONCLUSION

Hollow viscus perforative peritonitis remains a life-threatening condition that needs urgent surgery and the right antibiotic support. The bacteriological profile in this study identifies E. coli and Klebsiella pneumoniae as key contributors. The initial empirical antibiotics showed high resistance, highlighting the importance of peritoneal fluid culture for guiding antibiotic choice. Regular evaluation of local bacteriological patterns is essential to improve empirical therapy and patient outcomes.

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