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THE ANATOMICAL SITE OF PERFORATION PERITONITIS AND THEIR MICROBIOLOGICAL PROFILE: A CROSS- SECTIONAL STUDY

General Surgery

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ABSTRACT

Aim: This study aims to analyze the microbiological distribution, antimicrobial sensitivity, and resistance profiles of pathogens in patients with perforation peritonitis, alongside the role of fungal infections. **Material & Methods:** A prospective, cross-sectional study was conducted at Chhatrapati Shivaji Subharti Hospital, Meerut, from September 2022 to 2024, involving 150 patients who underwent surgical intervention for perforation peritonitis. Peritoneal fluid samples were collected intraoperatively for microbiological culture, including aerobic, anaerobic, and fungal organisms. Microbial identification and antibiotic sensitivity testing were performed to assess resistance patterns. Patients' demographics, clinical presentation, and intraoperative findings were systematically recorded and analyzed. **Results:** Our study showed that E Coli was the most common organism. There was no growth in 56% (n=85) samples out of 150 patients. Polymicrobial infection were seen in 36% (n=54) organisms showed multidrug resistance. Fungal isolates were found in 21% (n= 32) samples however, its clinical significance remains unclear. Similarly Anaerobic isolates were found in 13% cases (n=19). The maximum percentage of microbial isolates was seen in cecal (n=3) and Appendicular (n=5) perforations 100% and 80% respectively whereas the minimum microbial isolates were seen in Rectal (n=3) and Duodenal (n=17) perforations 33% and 36% respectively. The class of antibiotics showing maximum sensitivity profile 100% (n=65) was of cationic polypeptides i.e Colistin, while routinely used class of cephalosporins used as empirical antibiotics matched carbapenems in sensitivity spectrum 75.4% (n=49), lowest sensitivity lied with tetracyclins 47.69% (n=31). It was seen that upper GI organs were having a higher percentage of fungal positivity 69% (n=9), as compared to lower GI tract isolates. **Conclusions:** This study provides an in-depth analysis of perforation peritonitis, highlighting significant gender disparities, chief complaints, and microbial profiles. The higher incidence in males is associated with risk factors such as smoking and alcohol use. Symptoms like abdominal pain and non-passage of stools underscore the need for timely diagnosis. Blunt abdominal trauma is a notable cause, warranting prompt imaging. The study advocates for customized antibiotic regimens due to resistant organisms like E. coli and Klebsiella pneumoniae, alongside comprehensive diagnostics for better patient outcomes.

KEYWORDS

Perforation peritonitis, microbiological profile, antimicrobial sensitivity, drug resistance, gastrointestinal perforation, fungal infection, anaerobic bacteria, India

INTRODUCTION

Perforation peritonitis remains one of the most frequently encountered and challenging surgical emergencies in developing countries like India. Despite advancements in surgical techniques, antimicrobial therapies, and intensive care, the management of this condition continues to pose significant challenges. Peritonitis, resulting from gastrointestinal perforation, is associated with high morbidity and mortality rates, particularly in resource-limited settings. The condition requires rapid diagnosis and intervention to prevent life-threatening complications such as sepsis and multiple organ failure.

Peritonitis refers to the inflammation of the serosal membrane that lines the abdominal cavity and its organs, typically caused by the introduction of infection through bowel perforation or the leakage of chemically irritating substances like gastric acid from a perforated ulcer. Although peritonitis is often recognized clinically due to typical signs and symptoms such as abdominal pain, tenderness, rigidity, and systemic manifestations like fever and tachycardia, its diagnosis can sometimes be misleading due to varied modes of presentation. This variability complicates the identification of the perforation's origin, making management even more complex. Diagnostic tools such as X-rays, ultrasound, and CT scans play a critical role in confirming the diagnosis.

The spectrum of gastrointestinal perforation varies geographically, with developed nations reporting a predominance of lower gastrointestinal perforations, while upper gastrointestinal perforations are more common in developing countries. In India, the majority of patients present late, often in the secondary stage of generalized peritonitis characterized by severe abdominal pain, distension, and sepsis due to purulent or fecal contamination. This delay in seeking medical care exacerbates the complexity of treatment, often requiring urgent surgical intervention combined with intensive care.

Peritonitis progresses through three stages: primary, secondary, and tertiary. In the primary stage, patients typically experience mild abdominal discomfort and tenderness. The secondary stage is marked by intense, localized or diffuse pain, rigidity, and tenderness, signaling a more advanced and severe infection. The tertiary stage is characterized by persistent symptoms and recurrent infections despite initial treatment, necessitating continued medical attention. If left untreated, peritonitis can rapidly escalate into sepsis and lead to multi-organ failure, underscoring the importance of early recognition and intervention.

The treatment of perforation peritonitis centers around three key principles: antimicrobial therapy, surgical intervention, and supportive care. Empirical antibiotic therapy is initiated promptly to cover a broad spectrum of pathogens, with adjustments made based on culture results and local antimicrobial resistance patterns. Surgical intervention is essential for source control, with the choice of technique (open or laparoscopic) depending on the patient's condition and the surgeon's expertise. Delays in surgical intervention can significantly increase the risk of morbidity and mortality. In addition, supportive care, including aggressive resuscitation, correction of electrolyte imbalances, and hemodynamic monitoring, is critical in stabilizing patients, especially those in septic shock.

This study focuses on understanding the microbiological profile in patients with perforation peritonitis, evaluating the impact of changing gastrointestinal flora due to factors such as antibiotic misuse and evolving dietary habits. By identifying organism-specific patterns and resistance trends, this research aims to guide the development of an updated antimicrobial protocol tailored to local conditions, potentially improving postoperative outcomes and reducing the incidence of recurrent infections. Through this comprehensive approach, the study seeks to contribute valuable insights into the management of perforation peritonitis in resource-limited settings.

Aims and Objectives

Aim :

1. To find the microbiological distribution according to Anatomical site of perforation in patients of perforation peritonitis
2. To assess the antimicrobial sensitivity profile in the isolated organisms of microorganisms of perforation peritonitis.
3. To assess the percentage of resistance seen in the isolated organisms against the commonly used antimicrobials
4. To assess the role of Fungi in perforation peritonitis

Methodology

This study was a prospective observational cross-sectional investigation conducted in the Department of General Surgery at Chhatrapati Shivaji Subharti Hospital, under N.S.C.B Subharti Medical College, Meerut. It was carried out over a period of two years, from September 2022 to 2024, and included 150 patients diagnosed with perforation peritonitis who were admitted and surgically treated at the hospital. The primary objective was to analyze the microbiological profiles of patients presenting with perforation peritonitis, with a specific focus on bacterial patterns and antibiotic sensitivity, to optimize postoperative management strategies.

Inclusion and Exclusion Criteria

Inclusion Criteria

1. All patients operated for perforation peritonitis by exploratory laparotomy, either open or laparoscopic
2. Patients who are being re-operated for perforation peritonitis

Exclusion Criteria

1. Cases where more than 2 gastrointestinal organs have perforations. In case of small bowel perforation separated by a distance of 3 feet will be excluded.
2. If a non-gastrointestinal organ like the gallbladder or the uterus has a perforation also.
3. Perforation peritonitis that are not operated including those managed only by intra-abdominal drain insertion
4. Perforation peritonitis operated after having preoperative drain placement

Patient Recruitment and Consent

Eligible patients were recruited after meeting the inclusion and exclusion criteria. Informed consent was obtained from all participants, with a detailed information sheet provided explaining the study's objectives, procedures, and potential risks. For patients unable to provide consent independently, caregivers provided consent on their behalf. Strict confidentiality measures were adhered to, ensuring patient anonymity throughout the study.

Data Collection

A structured proforma was used to document comprehensive patient data, including demographic details (age, sex, occupation), clinical history (onset and nature of symptoms, prior antibiotic use, timing of pain escalation), and immunocompromised status (e.g., HIV, diabetes, hepatitis). Physical examinations were conducted to assess vital signs, abdominal findings, and systemic health.

Diagnostic Investigations Included:

- Laboratory tests: Complete Blood Count (CBC), Liver Function Tests (LFT), Kidney Function Tests (KFT), coagulation profile (PT/INR), and viral markers.
- Imaging: Erect abdominal X-ray, focused abdominal ultrasound scan (FAST), and CT scans when additional diagnostic clarity was needed.

Microbiological Analysis

During surgery, peritoneal fluid was collected in sterile conditions:

- A 10 ml syringe was used to collect the initial peritoneal fluid encountered upon opening the peritoneum. Additional samples were obtained from localized pus, if present.
- A portion (5 ml) of the fluid was placed in Robertson's Cooked Meat (RCM) broth for anaerobic culture and transported at room temperature.
- The remaining 5 ml was transported in the syringe for aerobic and fungal cultures.

Gram staining was performed for preliminary microbial identification. Fluid in RCM broth was cultured to isolate anaerobic bacteria, while other samples were used for aerobic and fungal cultures. Antibiotic sensitivity testing was conducted to determine resistance patterns and refine postoperative antibiotic protocols.

Postoperative Monitoring and Management

Patients were monitored for infection, sepsis, abscess formation, and wound infections. Empirical broad-spectrum antibiotics (e.g., third-generation cephalosporins and metronidazole) were initiated and adjusted based on culture and sensitivity results. Supportive care included:

- Aggressive intravenous fluid therapy for dehydration and electrolyte imbalance correction.
- Hemodynamic monitoring, with vasopressor support for septic shock.
- Early postoperative nutritional support to counteract malnutrition.

Data Analysis

Patient data were recorded in Microsoft Excel, with analysis focusing on demographic variables, clinical presentations, laboratory findings, and microbiological profiles. Percentages and distributions were calculated to identify key patterns in peritonitis presentation, microbial characteristics, and patient outcomes.

Ethical Considerations

The study received approval from the institutional ethics committee. Informed consent was obtained from all participants, and confidentiality was strictly maintained, with only anonymized aggregate data used for analysis and reporting.

This methodological approach provided critical insights into the local microbial patterns associated with perforation peritonitis. By identifying resistance trends, the study aimed to establish a hospital-specific antimicrobial protocol, improving treatment efficacy, reducing complications, and enhancing patient outcomes.

Results and Observations

Chief Complaints	Count of Chief Complaints
Non passage of stools	104 (69.3%)
Blunt trauma abdomen	21 (14%)
Abdominal pain	21 (14%)
Abdominal distention	4 (2.6%)

C/S AEROBIC BACTERIA	Count of C/S AEROBIC BACTERIA
Escherichia coli	36 (24%)
Klebsiella pneumoniae	8 (5.3%)
Enterobacter cloacae	7 (4.6%)
Acinetobacter baumannii	4 (2.6%)
Pseudomonas aeruginosa	4 (2.6%)
Enterococcus faecium	2 (1.3%)
Morganella morganii	2 (1.3%)
Staphylococcus aureus	2 (1.3%)
no growth	85 (56.6%)
Grand Total	150

C/S ANAEROBIC BACTERIA	Count of C/S ANAEROBIC BACTERIA
Peptostreptococcus species	5 (5.3%)
Anaerococcus prevotii	4 (2.6%)
Bacteroides fragilis	3 (2%)
Peptostreptococcus anaerobius	3 (2%)
Clostridium perfringens	2 (2%)
Lactobacillus plantarum	2 (2%)
no growth	131 (87.3%)
Grand Total	150

C/S FUNGAL	Count of C/S FUNGAL
Candida Albicans	11 (7.3%)
Candida Glabrata	8 (5.3%)

Candida Tropicalis	7 (4.6%)
Candida Parapsilosis	4 (2.6%)
Candida Krusei	1 (0.6%)
no growth	118 (79.3%)
Grand Total	150

INTRA-OP FINDINGS	Count of INTRA-OP FINDINGS
Gastric perforation	32 (21.3%)
Duodenal perforation	17 (11.3%)
Jejunal perforation	9 (6%)
Ileal perforation	70 (46.6%)
Caecal perforation	3 (3.3%)
Appendicular perforation	5 (3.3%)
Transverse Colon perforation	4 (2.6%)
Sigmoid perforation	7 (4.6%)
Rectal perforation	3 (2%)
Grand Total	150

CLASS OF ANTIBIOTICS	SENSITIVITY (n) OUT OF TOTAL (n=65) ISOLATES
PENICILLINS (bLACTAMASES)	32(49.23%)
TETRACYCLINES	31(47.69%)
SULPHONAMIDES	46(70.76%)
CEPHALOSPORINS	49(75.4%)
OXAZOLIDINOONE	51(78.4%)
CARBAPENEMS	49(75.4%)
CATIONIC POLYPEPTIDES (COLISTIN)	65(100%)

Intraop findings	Aerobic + anaerobic bacteria	Aerobic bacteria	Aerobic bacteria + fungus	Anaerobic bacteria	Anaerobic bacteria + fungus	Fungus	None (%)	Grand total
Gastric perforation	4	7	1	2	0	5	13(40.6)	32
Duodenal perforation	0	0	2	0	0	4	11(64.7)	17
Ileal perforation	3	25	10	2	1	2	27(38.6)	70
Jejunal perforation	0	4	0	2	0	0	3(33.3)	9
Caecal perforation	1	0	0	2	0	0	0(0)	3
Appendicular perforation	0	1	1	0	0	2	1(20)	5
Transverse colon perforation	0	1	1	1	0	0	1(25)	4
Sigmoid perforation	0	3	0	1	0	0	3(42.85)	7
Rectal perforation	0	1	0	0	0	0	2(66.67)	3

DISCUSSION

This study presents an in-depth analysis of perforation peritonitis, shedding light on key aspects such as gender disparities, clinical symptoms, microbiological findings, and antibiotic resistance patterns. The observations contribute to a nuanced understanding of this critical surgical emergency and its management.

Gender Disparities

A significant predominance of male patients with perforation peritonitis was observed in this study. This gender disparity is likely influenced by factors such as higher rates of smoking, alcohol consumption, and NSAID use among men, which are known to increase the risk of gastrointestinal ulceration and subsequent perforation. Additionally, occupational exposures, such as physical strain and exposure to hazardous environments, may also contribute to this trend. These findings emphasize the importance of preventive strategies tailored to male populations, including community education on modifiable risk factors and workplace safety. Awareness campaigns targeting smoking cessation and cautious NSAID use could help reduce the incidence of perforation peritonitis, particularly in high-risk groups.

Clinical Presentations

The most common symptoms reported by patients were non-passage of stools and abdominal pain, both of which are hallmark features of perforation peritonitis. These symptoms underline the urgency of timely clinical recognition to prevent complications like sepsis, organ failure, and mortality. Blunt abdominal trauma emerged as a significant cause, particularly in younger patients and those involved in physical labor or vehicular accidents. The findings emphasize the critical role of diagnostic imaging, such as X-rays and CT scans, in trauma cases where early identification of perforation is vital for reducing morbidity and mortality. Prompt intervention through surgery is essential, as delays can lead to the progression of peritonitis and systemic infection.

Microbiological Profiles

Microbiological analysis provided key insights into the bacterial and fungal landscape of perforation peritonitis:

1. Aerobic Bacteria:

The most frequently isolated organisms were Escherichia coli and Klebsiella pneumoniae, consistent with their role as common pathogens in gastrointestinal perforations.

The presence of multidrug-resistant organisms, including Enterobacter cloacae and Acinetobacter baumannii, highlights the growing challenge of antimicrobial resistance in treating these infections.

2. Anaerobic Bacteria:

Found in 13% of cases, anaerobic organisms were more common in cecal and appendicular perforations, whereas they were notably absent in duodenal perforations.

This variability underscores the importance of culture-guided therapy, as broad-spectrum antibiotics with anaerobic coverage may not always be necessary.

3. Fungal Pathogens:

Fungal isolates, predominantly Candida species such as Candida albicans and Candida glabrata, were detected in 21% of cases. These were primarily associated with upper gastrointestinal perforations.

This finding suggests that antifungal therapy should be considered in select cases, especially when patients present with severe sepsis or immunosuppression. Broad-spectrum antifungal agents like echinocandins are recommended until susceptibility results are available.

Antibiotic Sensitivity Patterns

Antibiotic sensitivity testing revealed critical trends:

- Colistin demonstrated 100% sensitivity, positioning it as a last-resort option for multidrug-resistant infections.
- Commonly used empirical antibiotics such as cephalosporins and carbapenems showed comparable sensitivity rates, validating their role in initial treatment regimens.
- Tetracyclines exhibited lower sensitivity (47.69%), underscoring the importance of tailoring therapy based on local resistance patterns.

Polymicrobial Infections and Site-Specific Variations

Polymicrobial infections were identified in 36% of cases, particularly in gastrointestinal perforations. These included combinations of aerobic, anaerobic, and fungal pathogens, necessitating comprehensive antibiotic coverage. The study also found that anaerobic bacteria were more prevalent in lower gastrointestinal perforations, while fungal infections were more common in upper gastrointestinal sites. These site-specific variations highlight the importance of individualized treatment plans, guided by culture results and clinical presentation.

CONCLUSION

Microbiological Profile

- Aerobic bacteria were predominant, with Escherichia coli and Klebsiella pneumoniae being the most frequently isolated pathogens.
- Multidrug-resistant organisms, such as Enterobacter cloacae and Acinetobacter baumannii, present significant challenges in treatment.
- Anaerobic bacteria were detected in site-specific cases, particularly in lower gastrointestinal perforations, necessitating

selective anaerobic coverage.
- Fungal pathogens, including Candida albicans and Candida glabrata, were identified, highlighting the need for antifungal therapy in select cases.

Antimicrobial Resistance and Sensitivity
- Colistin showed 100% sensitivity and remains a critical option for treating multidrug-resistant infections.
- Broad-spectrum antibiotics such as third-generation cephalosporins, carbapenems, and beta-lactam/beta-lactamase inhibitor combinations were effective against most pathogens.
- Variability in sensitivity rates among tetracyclines and sulphonamides reinforces the importance of regular susceptibility testing to guide therapy.
- Tailored antimicrobial regimens, based on local resistance patterns, are essential for optimizing outcomes.

Polymicrobial and Site-Specific Infections
- Polymicrobial infections were observed in 36% of cases, emphasizing the need for comprehensive antimicrobial coverage.
- Site-specific microbial variations, such as anaerobic organisms in lower gastrointestinal perforations, underscore the importance of individualized treatment approaches.

Antifungal Therapy
- The presence of fungal pathogens in certain cases highlights the necessity of empirical antifungal therapy, especially with echinocandins, until susceptibility results are available.
- Antifungal treatment should be considered in patients with risk factors for fungal infections or severe disease.

Recommendations for Management
- Early diagnosis, timely surgical intervention, and tailored empirical antimicrobial therapies are crucial for managing perforation peritonitis effectively.
- Empirical therapies should account for local microbial profiles, focusing on common pathogens like E. coli and multidrug-resistant bacteria.
- Culture-guided therapy is essential to reduce unnecessary antibiotic use and mitigate resistance development.

Future Directions
- Further research is needed to explore the underlying mechanisms driving gender disparities in perforation peritonitis.
- Larger studies incorporating advanced diagnostic techniques and broader patient cohorts are necessary to refine treatment protocols.
- Standardized, site-specific treatment guidelines based on microbial profiles and local resistance patterns should be developed.

Clinical Implications
- This study highlights the complexity of managing perforation peritonitis, requiring a multidisciplinary approach that includes prevention, timely intervention, and individualized care.
- By addressing antimicrobial resistance and optimizing treatment strategies, these findings provide a foundation for improving patient outcomes and reducing complications.

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