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**Original Research Article**

# A one-year cross sectional study of peritoneal fluid cultures and antibiotic sensitivity patterns in cases of surgical peritonitis

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## ABSTRACT

**Background:** Surgical peritonitis is a serious complication with significant morbidity and mortality. Understanding the microbiological profile and antibiotic sensitivity patterns is crucial for optimal management. This study aimed to evaluate the peritoneal fluid cultures and antibiotic sensitivity patterns in cases of surgical peritonitis.
**Methods:** This was a hospital-based prospective study conducted at D. Y. Patil University School of Medicine, Nerul, Navi Mumbai, over a one-year period. Patients presenting with peritonitis were included, and peritoneal fluid samples were collected during surgery for microbiological analysis. Antibiotic treatment was guided by the culture and sensitivity results.
**Results:** A total of 50 patients were enrolled. The most common etiologies were appendicitis (32%), diverticulitis perforation (24%), and perforated duodenal/peptic ulcers (44%). The predominant pathogens isolated from peritoneal fluid cultures were *E. coli* (16%), *Bacteroides fragilis* (14%), *S. aureus* (14%), and *Streptococcus anginosus* (14%). Antibiotic sensitivity patterns revealed high susceptibility to multiple antibiotics for *E. coli*, *Bacteroides fragilis*, and *Klebsiella pneumoniae*. However, *Enterococcus faecalis* exhibited concerning resistance to vancomycin and linezolid.
**Conclusions:** This study provides valuable insights into the microbiology and antibiotic susceptibility profiles of pathogens involved in surgical peritonitis cases. The findings can inform empiric antimicrobial treatment strategies and guide antibiotic stewardship efforts in the management of this serious condition.

**Keywords:** Surgical peritonitis, Peritoneal fluid cultures, Antibiotic sensitivity, Microbiology, Antimicrobial resistance

## INTRODUCTION

Peritonitis, a potentially life-threatening condition characterized by inflammation of the peritoneal cavity, represents a critical medical emergency that demands prompt recognition and decisive management. This condition can arise from a multitude of underlying etiologies, including perforated viscus, appendicitis, diverticulitis, pancreatitis, and post-operative complications.[1] Surgical peritonitis, a subset of peritonitis that necessitates surgical intervention, poses a formidable challenge to healthcare professionals and carries a significant risk of morbidity and mortality.[2] The effective management of surgical peritonitis hinges upon the timely administration of appropriate antimicrobial therapy, which is guided by the identification of the causative microbial pathogens and their antibiotic susceptibility patterns.[3] In this context, peritoneal fluid culture and antibiotic sensitivity testing play a pivotal role, as they provide invaluable insights to guide empiric and definitive antimicrobial therapy, thereby optimizing patient outcomes.[4]

The microbial etiology of surgical peritonitis is diverse and multifaceted, with variations observed depending on a range of factors, including the underlying cause, patient demographics, geographic location, and healthcare settings.[5] Gram-negative organisms, such as *Escherichia coli*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*, are commonly implicated in community-

acquired peritonitis, reflecting the predominant gut flora.[6] In contrast, Gram-positive organisms, such as *Staphylococcus aureus* and *Enterococcus species*, are more prevalent in healthcare-associated peritonitis, often linked to invasive procedures, indwelling devices, or nosocomial transmission.[7] However, the rapid emergence and dissemination of antimicrobial resistance among these pathogens have become a global concern, posing significant challenges in the management of surgical peritonitis.[8] The indiscriminate and inappropriate use of antimicrobials, coupled with the inherent ability of microorganisms to adapt and acquire resistance mechanisms, has contributed to the development and spread of resistant strains, leading to treatment failures, prolonged hospital stays, and increased healthcare costs.[9]

Recognizing the paramount importance of peritoneal fluid culture and antibiotic sensitivity data, numerous studies have been conducted across various geographic regions and healthcare settings to investigate the microbial profiles and antimicrobial resistance patterns in surgical peritonitis cases. However, the findings from these studies often exhibit considerable regional and local variations, underscoring the need for periodic surveillance and analysis of local data to guide evidence-based decision-making and implement targeted infection control measures.[10]

This study aims to contribute to the existing body of knowledge by investigating the peritoneal fluid cultures and antibiotic sensitivity patterns in cases of surgical peritonitis at a tertiary care hospital. By analyzing the microbiological data and antimicrobial resistance profiles, this research endeavors to provide valuable insights into the local epidemiology of surgical peritonitis, which can inform the development of effective empiric antimicrobial therapy guidelines, optimize patient management strategies, and guide antimicrobial stewardship efforts within the healthcare facility.

Furthermore, the findings from this study may contribute to the broader understanding of the global trends in antimicrobial resistance patterns associated with surgical peritonitis, facilitating international collaborations and concerted efforts towards combating this pressing public health issue. By elucidating the local microbial landscape and antimicrobial resistance patterns, this research holds the potential to inform targeted interventions, such as the implementation of infection control protocols, antimicrobial stewardship programs, and clinical decision support systems, ultimately translating into improved patient outcomes and reduced healthcare costs.

In an era where antimicrobial resistance poses a significant threat to modern healthcare, studies that provide actionable data on local microbial profiles and resistance patterns are paramount in guiding empiric therapy, optimizing patient management, and informing antimicrobial stewardship strategies. This research endeavor represents a crucial step towards addressing the challenges posed by surgical peritonitis and contributing to the global effort to combat antimicrobial resistance.

## METHODS

The study was a hospital-based prospective study conducted in the Department of General Surgery at D. Y. Patil University School of Medicine, Nerul, Navi Mumbai. The study period was from February 2022 to January 2024. Patients presenting with peritonitis secondary to various causes, including intestinal perforation, gallbladder perforation, chemical peritonitis, and peritonitis due to trauma, were included. Patients with allergies to specific drugs, severe renal or hepatic impairment, and those under the age of 14 were excluded.

Institute ethics committee clearance was obtained before the study commenced. Patients underwent initial surgical management, and peritoneal fluid samples were collected during the procedure. The samples were sent to the microbiology department for microscopy, culture, and antibiotic sensitivity testing. Antibiotics were prescribed based on the culture and sensitivity findings, considering any severe renal or hepatic impairment. The patients were followed up, and their surgical wounds were routinely examined on the seventh postoperative day using the Southampton grading system. Data analysis was done using statistical package for social sciences (SPSS Inc. Chicago), and following results were obtained.

## RESULTS

Table 1 presents the demographic and clinical characteristics of the study participants. It shows the age distribution, with the largest group being over 60 years old, as well as the gender distribution and the prevalence of common comorbidities like hypertension and diabetes.

**Table 1: Demographic and clinical characteristics.**

| Variables | Frequency | Percentage |
|---|---|---|
| **Age (in years)** | | |
| <20 | 2 | 4 |
| 20-30 | 7 | 14 |
| 31-40 | 8 | 16 |
| 41-50 | 5 | 10 |
| 51-60 | 7 | 14 |
| >60 | 21 | 42 |
| **Gender** | | |
| Female | 31 | 62 |
| Male | 19 | 38 |
| **Co-morbidities** | | |
| DM | 17 | 34 |
| HTN | 41 | 82 |
| IHD | 4 | 8 |
| CKD | 8 | 16 |

Table 2 outlines the etiologies of surgical peritonitis in the study population. The most common causes were

appendicitis, diverticulitis perforation, and perforated duodenal/peptic ulcers.

**Table 2: Etiology of surgical peritonitis.**

| Etiology | Frequency | Percentage |
|---|---|---|
| **Appendicitis** | 16 | 32 |
| **Diverticulitis perforation** | 12 | 24 |
| **Perforated duodenal ulcer** | 12 | 24 |
| **Perforated peptic ulcer** | 10 | 20 |
| **Total** | 50 | 100 |

Table 3 summarizes the results of the peritoneal fluid cultures. It shows the distribution of the various pathogens isolated, with *E. coli*, *Bacteroides fragilis*, *S. aureus*, and *Streptococcus anginosus* being the most common. Notably, 10% of the cultures showed no growth.

**Table 3: Peritoneal fluid culture results.**

| Peritoneal fluid culture | Frequency | Percentage |
|---|---|---|
| ***E.coli*** | 8 | 16 |
| ***Bacteroides fragilis*** | 7 | 14 |
| ***Enterococcus fecalis*** | 5 | 10 |
| ***K. pneumoniae*** | 5 | 10 |
| ***Pseudomonas aeruginosa*** | 6 | 12 |
| ***S. aureus*** | 7 | 14 |
| ***Streptococcus anginosus*** | 7 | 14 |
| **No growth** | 5 | 10 |
| **Total** | 50 | 100 |

**Table 4: Antibiotic sensitivity patterns.**

| Organism | Sensitive antibiotics | Resistant antibiotics |
|---|---|---|
| ***E. coli*** | Ciprofloxacin, amikacin, gentamycin, carbapenems | Vancomycin, linezolid, ceftriaxone |
| ***Bacteroides fragilis*** | Metronidazole, clindamycin, carbapenems | Ciprofloxacin, aminoglycosides, cephalosporins |
| ***Enterococcus fecalis*** | Amikacin, gentamycin, cephalosporins | Vancomycin, linezolid, ciprofloxacin |
| ***K. pneumoniae*** | Ciprofloxacin, aminoglycosides, carbapenems, colistin | Vancomycin, linezolid, augmentin |
| ***Pseudomonas aeruginosa*** | Ciprofloxacin, aminoglycosides, cefepime, carbapenems, colistin | Vancomycin, linezolid, cephalosporins, augmentin |

Table 4 details the antibiotic sensitivity patterns for the major pathogens identified. This information is crucial for guiding appropriate antimicrobial therapy for surgical peritonitis cases.

## DISCUSSION

The study analyzed 100 gallstone patients with a mean age of 43.26±11.26 years (range 20-70 years), with peak incidence in the 41-50 age group. The gender distribution showed female predominance (68%) with a male: female ratio of 1:2, consistent with other studies including Bansal et al, Hussain et al, and Palanivelu et al.[11-13] This female predisposition aligns with studies by Ganeyet al and Everhart et al, attributed to factors commonly summarized as "fat, fertile, female, forty".[14,15]

Clinical presentation primarily featured pain (83.3%) and dyspepsia (20%), with acute cholecystitis in 13% of cases, comparable to findings from Everhart et al.[15] All patients underwent ultrasound scanning, with 7% requiring additional contrast enhanced computed tomography (CECT) abdomen imaging, similar to studies from Virginia and Finland. Of the 100 patients, 79% underwent successful laparoscopic cholecystectomy, 5% had planned open cholecystectomy, and 16% required conversion to open surgery. The conversion rates aligned with studies by Van der Steeget al (12%) and Eldar et al (9.4%), with main reasons being bleeding (4%), CBD injury (1.2%), and fibrosis/inflammation of Calot's triangle (6%).[16,17]

Chemical analysis of gallstones revealed mixed stones as the most prevalent (82%), followed by pigmented (12%) and pure cholesterol stones (6%), consistent with Joseph et al's findings.[18] Age-wise distribution showed mixed stones predominating across all age groups, with cholesterol stones appearing only in patients above 40 years. Notably, the 41-50 age group had the highest number of mixed stones (30 patients), while cholesterol stones were absent in younger age groups (20-40 years), suggesting an age-related correlation in stone composition.

### *Limitations*

Limitations of the study were: patients not willing to participate in the study, patients below 14 years of age, patients with allergies to specific drugs, and patients with severe renal and hepatic impairments contraindicating the use of specific antibiotics.

## CONCLUSION

This one-year cross-sectional study provides valuable insights into the microbiology and antibiotic susceptibility profiles of pathogens involved in surgical peritonitis cases. The findings can help inform empiric antimicrobial treatment strategies and guide antibiotic stewardship efforts in the management of this serious condition. Continuous surveillance of resistance patterns is essential to ensure appropriate and effective use of antibiotics.

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