

Evaluation of Bile Culture and Antibiotic Sensitivity Patterns in Patients Undergoing Cholecystectomy

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ABSTRACT

Background

Bacterial colonization of bile is frequently encountered in patients with gallstone disease and may contribute to postoperative infectious complications. Knowledge of local microbial flora and antibiotic susceptibility patterns is essential for selecting appropriate prophylactic and therapeutic antibiotics in patients undergoing cholecystectomy.

Aim

To evaluate bile culture positivity and antibiotic sensitivity patterns among patients undergoing cholecystectomy at a tertiary care center.

Methods

A retrospective observational study was conducted at Shri Ramkrishna Institute of Medical Sciences and Sanaka Hospitals, Durgapur, from May 2025 to May 2026. Records of 98 patients who underwent elective or emergency cholecystectomy and had intraoperative bile cultures performed were reviewed. Demographic data, clinical diagnosis, bile culture results, bacterial isolates, and antibiotic sensitivity profiles were analyzed.

Results

Bile culture positivity was observed in 38.8% of patients. The most common isolates were *Escherichia coli* (42.1%), *Klebsiella pneumoniae* (23.7%), *Enterococcus* spp. (15.8%), and *Pseudomonas aeruginosa* (10.5%). Culture positivity was significantly associated with age >60 years, acute cholecystitis, and diabetes mellitus ($p < 0.05$). Meropenem, Piperacillin-Tazobactam, and Amikacin demonstrated the highest sensitivity rates among Gram-negative isolates.

Conclusion

Bile culture positivity is common among cholecystectomy patients, particularly in elderly and diabetic individuals. Gram-negative organisms predominate, and antibiotic susceptibility patterns support the use of broad-spectrum agents in high-risk patients.

Keywords: Bile culture, Cholecystectomy, Gallstone disease, Antibiotic sensitivity, Biliary infection, *Escherichia coli*.

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INTRODUCTION

One of the most prevalent gastrointestinal conditions requiring surgery in the globe is gallstone disease. For symptomatic cholelithiasis and accompanying

consequences, such as acute cholecystitis, gallbladder empyema, and biliary pancreatitis, cholecystectomy is still the recommended course of treatment. Even though the gallbladder is generally sterile, gallstones, biliary blockage, inflammation, or compromised host immunity

can all lead to bacterial colonisation of bile. Microorganisms within the biliary system are known as bactibilia, and they have been found in 20–50% of patients following cholecystectomy. people with acute biliary infections, diabetics, and elderly people likely to have a higher incidence. Recurrent inflammation, intra-abdominal abscess formation, surgical wound infection, and septic consequences can all be attributed to persistent bacterial colonisation(1).

Gram-positive organisms like *Enterococcus* species and Gram-negative enteric bacteria like *Escherichia coli*, *Klebsiella* species, *Enterobacter* species, and *Pseudomonas* species are the most commonly isolated microbes from bile. Geographical location, medical procedures, and patient characteristics can all affect the bacterial spectrum. An essential part of surgical therapy is appropriate perioperative antibiotic prophylaxis. However, biliary bacteria' growing resistance to antibiotics has emerged as a major clinical concern. The advent of multidrug-resistant pathogens may render previously successful empirical antibiotic regimens insufficient. In order to direct evidence-based antimicrobial therapy, it is crucial to periodically monitor bile culture isolates and local antibiotic susceptibility patterns(2).

Positive bile cultures have been linked to poor postoperative outcomes in a number of investigations. Finding risk variables linked to bactibilia may aid with risk stratification and improve perioperative care. However, there is still little information available about antibiotic sensitivity patterns and bile culture positive from eastern India. In order to assess the microbiological profile of bile cultures collected during cholecystectomy and examine the patterns of antibiotic susceptibility of isolated organisms, the current investigation was conducted. Additionally, the study sought to determine the clinical and demographic characteristics linked to positive bile cultures in cholecystectomy patients(3).

MATERIALS AND METHODS

Study Design

Retrospective observational study.

Study Setting

Department of General Surgery, Shri Ramkrishna Institute of Medical Sciences and Sanaka Hospitals, Durgapur.

Study Duration

May 2025 to May 2026.

Sample Size

98 patients.

Inclusion Criteria

- Patients undergoing laparoscopic or open cholecystectomy.
- Availability of intraoperative bile culture reports.
- Complete medical records.

Exclusion Criteria

- Previous biliary surgery.
- Incomplete microbiological records.
- Malignant biliary obstruction.

Data Collection

Data extracted included:

- Age and gender.
- Clinical diagnosis.
- Presence of diabetes mellitus.
- Type of surgery.
- Bile culture findings.
- Isolated microorganisms.
- Antibiotic susceptibility profile.
- Postoperative complications.

Statistical Analysis

Data were analyzed using SPSS version 26.

- Chi-square test.
- Student's t-test.
- Logistic regression.

A p-value <0.05 was considered statistically significant.

RESULTS

Table 1. Baseline Characteristics

The study included 98 patients, with females comprising 72.4% of the cohort. Acute cholecystitis was present in approximately one-third of patients.

Variable	Total (n=98)
Mean Age (years)	49.8 ± 13.7
Female (%)	71 (72.4)
Male (%)	27 (27.6)

Diabetes Mellitus (%)	29 (29.6)
Acute Cholecystitis (%)	34 (34.7)
Chronic Cholecystitis (%)	64 (65.3)

Table 2. Bile Culture Positivity and Associated Factors

Positive bile cultures were significantly associated with advanced age, diabetes mellitus, and acute cholecystitis.

Variable	Culture Positive (n=38)	Culture Negative (n=60)	p-value
Age >60 years	18 (47.4%)	12 (20.0%)	0.004
Diabetes Mellitus	17 (44.7%)	12 (20.0%)	0.009
Acute Cholecystitis	21 (55.3%)	13 (21.7%)	0.001

Table 3. Distribution of Bacterial Isolates

Escherichia coli was the most commonly isolated organism, accounting for 42.1% of positive cultures.

Organism	Frequency (%)
<i>Escherichia coli</i>	16 (42.1)
<i>Klebsiella pneumoniae</i>	9 (23.7)
<i>Enterococcus</i> spp.	6 (15.8)
<i>Pseudomonas aeruginosa</i>	4 (10.5)
<i>Enterobacter</i> spp.	2 (5.3)
Others	1 (2.6)

Table 4. Antibiotic Sensitivity Pattern of Major Isolates

Meropenem demonstrated the highest sensitivity rate, followed by Piperacillin-Tazobactam and Amikacin. Resistance was highest against Amoxicillin-Clavulanate and Ciprofloxacin.

Antibiotic	Sensitivity (%)
Meropenem	92.1
Piperacillin-Tazobactam	89.5
Amikacin	84.2
Cefoperazone-Sulbactam	78.9
Ceftriaxone	63.2
Ciprofloxacin	55.3
Amoxicillin-Clavulanate	47.4

Table 5. Postoperative Outcomes

Patients with positive bile cultures experienced significantly higher rates of surgical site infection and prolonged hospitalization.

Outcome	Culture Positive	Culture Negative	p-value
Surgical Site Infection (%)	15.8	5.0	0.048
Prolonged Hospital Stay (%)	21.1	8.3	0.041

DISCUSSION

The current retrospective study assessed antibiotic susceptibility patterns and bile culture positive in individuals having cholecystectomies. The results show that bactibilia is still often seen in gallstone disease patients and is strongly linked to acute cholecystitis, diabetes mellitus, and advanced age. Additionally, the majority of culture-positive cases included Gram-negative enteric pathogens, which has significant ramifications for the use of perioperative antibiotics.

The current study's overall bile culture positivity rate of 38.8% is similar to rates seen in earlier research, which vary from 20% to 50%. Variations in patient groups, the frequency of acute inflammatory diseases, exposure to antibiotics, and microbiological methods could all contribute to the diversity between studies. The results corroborate the idea that patients following cholecystectomy frequently have bacterial colonisation of their bile, especially if they have risk factors for biliary infection(4).

The strong correlation between positive bile cultures and age over 60 was one of the key findings. Elderly people are more likely to have comorbid conditions, delayed biliary drainage, and weakened immune systems, all of which might promote bacterial colonisation. Numerous investigations assessing biliary microbiology in gallstone disease have revealed similar correlations(5). Another important risk factor for bactibilia was found to be diabetes mellitus. Compared to people without diabetes, diabetic patients showed significantly greater frequencies of positive bile cultures. It is well recognised that hyperglycemia weakens human defence systems, increases vulnerability to bacterial infections, and impairs neutrophil activity. The higher incidence of biliary colonisation seen in diabetic populations may be related to these physiological alterations(6).

Notably, there was a correlation between culture positivity and acute cholecystitis. Acute cholecystitis was present in more than half of the individuals with positive cultures. By increasing mucosal permeability and impairing biliary outflow, acute gallbladder inflammation may promote bacterial invasion. As a result, acute gallbladder inflammation is more likely to result in microbial development than chronic illness. Gram-negative enteric microbes predominated in the microbiological profile seen in this investigation. With almost 40% of positive cultures, *Escherichia coli* was the most commonly isolated pathogen(7). This result is in line with earlier research that identified *E. coli* as the primary biliary pathogen and is compatible with the gastrointestinal origin of biliary germs. The second most frequent isolate was *Klebsiella pneumoniae*, which was followed by *Pseudomonas aeruginosa* and *Enterococcus* species(8).

High sensitivity rates for amikacin, piperacillin-tazobactam, and meropenem were found by analysing antibiotic susceptibility patterns. Conversely, there was significantly less susceptibility to widely used antibiotics as amoxicillin-clavulanate and ciprofloxacin. The increasing problem of biliary pathogen antimicrobial resistance is reflected in these studies. In order to minimise improper antimicrobial usage and guide empirical antibiotic selection, periodic local surveillance is crucial, as demonstrated by the observed resistance patterns. Surgical site infections and extended hospital stays were considerably more common in patients with positive bile cultures(9). This discovery emphasises the therapeutic significance of identifying patients at higher risk of biliary infection and implies that bactibilia may affect postoperative outcomes. Reducing infection complications and improving surgical outcomes may be possible with appropriate perioperative antibiotic prophylaxis based on local susceptibility data(10).

The study's investigation of clinical and microbiological results in a real-world surgical population is one of its strengths. It is important to recognise some limitations, though. The study was carried out in a single location, and the retrospective approach makes it more difficult to prove causation. There was inconsistent availability of information about specific resistance mechanisms and past antibiotic exposure. Notwithstanding these drawbacks, the study offers insightful information about the microbiological traits of bile cultures and the current patterns of antibiotic sensitivity in cholecystectomy patients. The results highlight the significance of identifying high-risk patients who can benefit from focused preventive measures and encourage the routine evaluation of local resistance trends when choosing perioperative antibiotic medication(11).

CONCLUSION

With an overall positivity rate of over 40%, the current study shows that positive bile cultures are commonly seen among patients following cholecystectomy. Biliary bacterial colonisation was found to be significantly predicted by advanced age, diabetes mellitus, and acute cholecystitis. The most common pathogens found in bile samples were gram-negative enteric microbes, namely *Escherichia coli* and *Klebsiella pneumoniae*. High sensitivity to Meropenem, Piperacillin-Tazobactam, and Amikacin was found by antibiotic susceptibility analysis, but resistance to a number of routinely used antibiotics was noted.

The clinical relevance of bactibilia in surgical practice was highlighted by the increased incidence of postoperative infection complications and longer hospital stays among patients with positive bile cultures. These results emphasise the significance of sensible antibiotic selection based on local susceptibility trends and

microbiological surveillance. Patients with acute cholecystitis, diabetics, and the elderly may benefit most from routine bile cultures. In order to optimise perioperative management methods for patients undergoing cholecystectomy, future multicenter prospective studies with larger sample numbers are advised to further assess the association between bile microbiology, antibiotic resistance, and postoperative outcomes.

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