

A PROSPECTIVE STUDY OF BACTERIOLOGIC PROFILE OF BILE IN PATIENTS UNDERGOING BILIARY SURGERIES AND ITS IMPLICATION ON PERIOPERATIVE ANTIBIOTIC REGIME AT A TERTIARY CARE CENTER***¹Dr. Sony Saju, ²Dr. D. K. Sharma, ³Dr. Jitendra Singh Chouhan and ⁴Dr. Alpesh Kothari**¹Postgraduate Resident, Department of General Surgery, R.N.T. Medical College, Udaipur.²Sr. Professor & HOD, Department of General Surgery, R.N.T. Medical College, Udaipur.³Postgraduate Resident, Department of General Surgery, R.N.T. Medical College, Udaipur.⁴Assistant Professor, RNT Medical College, Udaipur.***Corresponding Author: Dr. Sony Saju**

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ABSTRACT

Background: The biliary tree is a sterile system responsible for bile transport, but bacterial colonization can occur due to biliary obstruction or interventions. Bacteriobilia can lead to postoperative complications and impair hepatic function. Factors such as biliary obstruction, immunocompromised status, and prior instrumentation increase the risk of bacteriobilia. Surgical site infections in biliary surgeries result in prolonged hospital stays and higher morbidity and mortality rates. Prophylactic antibiotics are commonly used, but the variability in bile bacteriology necessitates periodic evaluation and guideline development. This study aims to determine the bacteriologic profile and sensitivity of organisms in patients undergoing biliary surgeries. **Methods:** The study obtained ethical committee approval and informed consent from patients. Data was collected from patients who underwent biliary surgeries at Rabindranath Tagore Medical College from June 2021 to December 2022. It was a prospective observational study using a standardized proforma to collect clinical history, investigations, operative details, and postoperative complications. Inclusion criteria included patients of any sex with biliary surgeries and intraoperative biliary sample collection, regardless of underlying pathology. Exclusion criteria included patients who refused consent, those managed conservatively, and those on prolonged preoperative antibiotic therapy. Statistical analysis was performed using Epi Info software, with $p < 0.05$ considered significant. **Results:** The manuscript presents important findings regarding bacteriobilia, biliary pathologies, and antibiotic sensitivity in a study population. The results indicate that bacteriobilia incidence varied among different age groups, with the highest prevalence in the 61-70 age group. The distribution of bacteriobilia among various biliary pathologies was also examined, with cholelithiasis being the most prevalent. Furthermore, the antibiotic sensitivity pattern for *E. coli* infections was investigated, highlighting the high sensitivity of amikacin. These findings contribute valuable information for understanding bacteriobilia, biliary pathologies, and guiding appropriate antibiotic treatment strategies.

INTRODUCTION

The biliary tree, comprising the liver, gall bladder, and bile ducts, is a sterile system through which bile flows into the alimentary canal. Bacteriobilia, the colonization of bacteria in the bile, can occur due to biliary obstruction or interventions.^[1] Under normal conditions, the biliary tract is considered to be devoid of bacterial flora, thanks to anatomical barriers, physical mechanisms, chemical factors, and immunological defenses. However, when these defense mechanisms fail, bacterial colonization and infections can occur, leading to postoperative complications and impairing hepatic functions.^[2]

Bacteriobilia is more common in patients with biliary obstruction, immunocompromised individuals, diabetics,

and the elderly, as well as those with prior biliary sepsis or instrumentation. In patients undergoing surgery for symptomatic biliary obstruction without prior instrumentation, bacteriobilia is usually monomicrobial, primarily caused by gram-negative enteric aerobes. Infections in the biliary tract can also contribute to the formation of gallstones.^[3]

Postoperative infective complications after biliary surgeries can lead to prolonged hospital stays, increased costs, additional procedures, and higher morbidity and mortality rates. The incidence of surgical site infections in complex biliary surgeries can be substantial. While numerous factors have been associated with these complications, the role of biliary colonization and its

interaction with other risk factors are not well understood.^[4]

Prophylactic antibiotics are commonly administered before biliary surgeries to prevent bacterial multiplication in the operative field. However, the bacteriologic profile and sensitivity of bile may vary, necessitating periodic review and development of guidelines for perioperative antibiotic regimes.^[5]

This study aims to detect the bacteriologic profile of bile and the sensitivity of isolated organisms in patients undergoing biliary surgeries. The findings will contribute to the understanding of bacteriobilia and help develop recommendations for perioperative antibiotic treatment.^[6]

MATERIALS AND METHODS

The study was carried out after getting approval from ethical committee and on obtaining informed consent from patients.

Source of Data: Those patients who had undergone biliary surgeries in department of General Surgery at Rabindranath Tagore Medical College (RNTMC) Udaipur for various biliary pathologies from June 2021 till December 2022.

Type of study: This is a hospital based Prospective Observational study.

Methods of Data collection: The data was collected in a specially designed standardized proforma containing details of relevant clinical history along with significant

previous illnesses, perioperative biochemical and hematological investigations like CBC, RFT, LFT, preoperative imaging studies, perioperative antibiotics used, bacteriology of bile obtained along with its sensitivity, type of operative procedure and postoperative complications.

Study Method

Inclusion criteria

1. Patients of either sex who had undergone biliary surgeries and whose intraop biliary samples were obtained, in surgical department of RNT Medical College Udaipur, irrespective of their underlying pathology.

Exclusion criteria

1. Patients not willing to give consent for participating in the study.
2. Patients presenting with biliary diseases and undergoing conservative management.
3. Patients on prolonged preoperative antibiotic therapy other than the standard single dose of intravenous antibiotic at the time of induction of anesthesia prior to surgical procedures.

Statistical Analysis: All the collected data were entered in Microsoft Excel 2021 and statistical analysis was performed using standard statistical software Epi Info by CDC. Qualitative data was analyzed using rates and percentages and quantitative data with mean and standard deviation. Categorical variables were compared using Chi-square test and continuous variables with students t-test. A p value < 0.05 was considered statistically significant.

RESULTS

Table 1: Bacteriobilia in different age groups.

Age Group	No: of Patients (N _a)	Percentage (N _a /T _a) *100	No: of patients with Bacteriobilia (N _b)	Percentage of Bacteriobilia within age group (N _b /N _a)
< 20	4	5.9	2	50.0
21 - 30	14	20.6	3	21.4
31 - 40	12	17.6	2	16.6
41 - 50	16	23.5	4	25.0
51 - 60	11	16.2	2	18.2
61 - 70	9	13.2	5	55.5
> 70	2	2.9	-	nil
Total	(T _a) = 68	100	T _b = 18	

Table 1 presents the incidence of bacteriobilia in different age groups among the patients undergoing biliary surgeries. Among the total study population of 68 patients, 26.50% were diagnosed with bacteriobilia. The highest incidence of bacteriobilia was observed in the age group of 61-70, with 55.5% of the patients in that group having bacteriobilia. The age group of <20 had the lowest incidence of bacteriobilia, with 50.0% of the patients affected. The data from Table 1 provide valuable

insights into the distribution of bacteriobilia across different age groups in the study population.

Table 2: Bacteriobilia observed among various biliary pathologies.

Diagnosis	Culture positive Bile (%)	Sterile Bile (%)	Total
Cholelithiasis	12(21.1%)	45(78.9%)	57
Gall Bladder Polyp	Nil (0%)	1(100%)	1
Empyema Gall Bladder	2(100%)	Nil (0%)	2
Cholelithiasis with Choledocholithiasis	2(66.7%)	1(33.3%)	3
Cholelithiasis with CBD Stricture	Nil (0%)	1(100%)	1
Choledocholithiasis	Nil (0%)	1(100%)	1
Choledochal Cyst	1(50%)	1(50%)	2
Hepatic hydatid cyst with cystobiliary communication	1(100%)	Nil (0%)	1
Total	18	50	68

Table 2 illustrates the distribution of bacteriobilia among various biliary pathologies in the study population. Out of the total 68 patients, 18 (26.5%) were found to have positive bile culture for bacteria. Among the different biliary pathologies, cholelithiasis accounted for the majority of cases (57 patients), with 12 (21.1%) having culture-positive bile and 45 (78.9%) having sterile bile. Gall bladder polyp, empyema gall bladder, cholelithiasis with choledocholithiasis, cholelithiasis with CBD stricture, choledocholithiasis, choledochal cyst, and hepatic hydatid cyst with cystobiliary communication were less prevalent, with varying percentages of culture-positive bile and sterile bile. These findings provide insights into the association between different biliary pathologies and the presence of bacteriobilia in the study population.

Table 3: Bacteriology of bile culture.

Organism	No: of Patients	Percentage
Acinetobacter	1	1.47
Staphylococcus	5	7.35
E. coli	7	10.29
Enterococcus	1	1.47
Klebsiella	2	2.94
Micrococcus	1	1.47
Streptococcus	1	1.47
Sterile	50	73.53

Table 3 reveal a diverse range of bacteria present among the tested patients. Staphylococcus and Escherichia coli (E. coli) were the most common organisms identified, with 5 cases (7.35%) and 7 cases (10.29%) and 50 patients (73.53%), showed no bacterial growth and were considered sterile.

Table 4: Antibiotic sensitivity pattern for E. coli.

Antibiotics	Sensitivity		Resistance	
	No: of Patients	Percentage	No: of Patients	Percentage
Amikacin	7	100	-	-
Gentamycin	5	71.4	-	-
Piperacillin+Tazobactam	4	57.1	1	14.3
Amoxicillin Clavulanic acid	1	14.3	4	57.1
Cotrimoxazole	2	28.5	1	14.3
Ampicillin	-	-	3	42.8
Meropenem	1	14.3	2	28.5

Table 4 provides the antibiotic sensitivity pattern for Escherichia coli (E. coli) infections. The results show the number and percentage of patients who exhibited sensitivity or resistance to different antibiotics. Amikacin demonstrated 100% sensitivity, with all 7 patients being susceptible to it. Gentamicin showed a sensitivity rate of 71.4% (5 patients). Piperacillin+Tazobactam exhibited a sensitivity rate of 57.1% (4 patients) and a resistance rate of 14.3% (1 patient). Amoxicillin Clavulanic acid had a sensitivity rate of 14.3% (1 patient) and a resistance rate of 57.1% (4 patients). Cotrimoxazole showed a sensitivity rate of 28.5% (2 patients) and a resistance rate of 14.3% (1 patient). Ampicillin had a resistance rate of 42.8% (3 patients). Meropenem exhibited a sensitivity

rate of 14.3% (1 patient) and a resistance rate of 28.5% (2 patients).

DISCUSSION

Our study provides a comprehensive analysis of the findings related to bacteriobilia among patients who underwent biliary surgeries. We included a total of 68 patients with an average age of 43.45 ± 15 years, and our data revealed a significant occurrence of bacteriobilia among the elderly population, consistent with previous studies.^[7]

We observed a peak prevalence of bacteriobilia (55%) in the age group of 61 to 70 years, highlighting the importance of age as a risk factor. This finding aligns

with a study conducted by Oliveira, which reported an average age of 56 years for patients with bacteriobilia. Our study also confirmed the female predominance in biliary pathologies, with a female-to-male ratio of 2.58:1 among our patients. This observation is in line with previous research, which attributes the increased risk of cholelithiasis and gallstone formation in females to hormonal changes during pregnancy, hormone replacement therapy, and oral contraceptive use. On the other hand, we found a higher occurrence of bacteriobilia among males undergoing biliary surgeries, which may explain the higher incidence of difficulties and complications in this group.^[8]

In terms of clinical symptomatology, we found that pain abdomen was universally present among all patients, followed by nausea, vomiting, icterus, and fever. Fever and icterus were associated with the highest occurrence of bacteriobilia, which is consistent with the historical association of these symptoms with biliary obstruction, a major risk factor for bacteriobilia. Our study revealed a higher prevalence of bacteriobilia among patients with common bile duct (CBD) pathologies compared to gallbladder pathologies, supporting previous research in this area. Biliary obstruction and increased biliary pressure in CBD pathologies create conditions favorable for bacterial proliferation and translocation, leading to serious infections such as hepatic abscess and sepsis.^[9]

We also observed a significant correlation between bacteriobilia and diabetes, with a higher bile culture positivity rate in diabetic patients compared to non-diabetics. This finding is consistent with previous studies and highlights the association of type 2 diabetes mellitus (T2DM) with higher rates of infections and gallstone formation. Poor glycemic control, altered immune response, and dyslipidemia in diabetes contribute to bacterial proliferation in the bile ducts.^[10]

Our study also explored the correlations between bacteriobilia and factors such as CBD instrumentation, previous history of similar illnesses, pre-operative and post-operative complete blood count (CBC) derangements, post-operative fever, and wound infections. We found that CBD instrumentation and a history of biliary pathology or ERCP procedures were associated with an increased risk of bacteriobilia. We suggest that the judicious use of antibiotics perioperatively can help achieve biliary sterility. In terms of bile culture bacteriology, our study identified *Escherichia coli* as the most common organism isolated, consistent with previous research. Monomicrobial infections were prevalent in positive bile samples.^[11]

While our study contributes valuable insights into the prevalence and risk factors associated with bacteriobilia among patients undergoing biliary surgeries, we acknowledge several limitations. The relatively small sample size may limit the generalizability of our findings to a larger population. Additionally, the study was

conducted at a single center, which could introduce bias and limit the external validity of the results. Furthermore, the lack of a control group in our study makes it challenging to establish a causal relationship between the identified risk factors and the occurrence of bacteriobilia. Including a control group of patients without biliary pathologies or surgeries would have facilitated a better comparison and assessment of the risk factors.^[12]

We also acknowledge the retrospective nature of our study, which relies on the analysis of existing medical records that may contain missing or incomplete data, potentially affecting the accuracy and reliability of the findings. Further studies are warranted to explore other potential risk factors and their impact on the development of bacteriobilia. Factors such as the duration of biliary obstruction, the type of biliary instrumentation, and the use of prophylactic antibiotics should be investigated in future studies to provide a more comprehensive understanding of this topic.^[13]

The study showed bacteriobilia in 26.47% patients, all of which turned out to be monomicrobial. The predominance of monomicrobial pattern was also observed by Ruan^[14] in his study where 351 out of 363 positive bile samples (96.77%) turned out to be monomicrobial.

E. coli was the most common organism isolated (38.9%) in the present study, followed by staphylococcus (27.8%), *Klebsiella* (11.1%) and *Enterococcus*, *Acinetobacter*, *Micrococcus* and *Streptococcus* all occurring in 5% patients each.

In a study by Capoor,^[15] a total of 104 bile samples were studied and bacteria were isolated in 37 samples (35.6%). The most common organism isolated was *Escherichia coli* (11, 29.7%), followed by *Klebsiella pneumoniae* (10, 27%), *Citrobacter* (3, 8.1%), *Salmonella enterica* serovar typhi (3, 8.1%), *Pseudomonas aeruginosa* (2, 5.4%), *Acinetobacter* spp. (1, 2.7%), *Candida krusei* (1, 2.7%), *Staphylococcus aureus* (1, 2.7%). Polymicrobial infection of *P. aeruginosa* with *K. pneumoniae* was observed in 4 patients (3.8%).

In another study by Ahmaad^[16], positive bile culture was found in only 25 out of 106 patients (23.6%) with cholecystectomy for symptomatic gallstones. *E. coli* was the most common cultured organism in 10 (40%) patients, followed by *Klebsiella* in five (20%) patients, *Pseudomonas* in five (20%) patients, *Proteus* in two (8%) patients, *Staphylococcus aureus* in two (8%) patients, and mixed organisms were cultured in one patient (4%).

All major isolates like *E. coli*, *Staphylococcus* and *Klebsiella* showed maximum sensitivity towards aminoglycosides.

CONCLUSION

In conclusion, our study emphasizes the importance of addressing bacteriobilia during biliary surgeries, particularly in patients with obstructive biliary pathologies. Age, diabetes, and biliary obstruction were identified as risk factors. To optimize patient outcomes, it is crucial to select prophylactic antibiotics based on local bacterial flora and resistance profiles. Routine bile culture and sensitivity testing should be performed, and perioperative antibiotic regimes should be regularly reviewed and revised accordingly. Implementing these measures will help effectively tackle bacteriobilia and enhance postoperative recovery.

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