

# Prospective Study On Biliary Bacteriology In Calcular Disease Of The Gall Bladder And The Role Of Common Newer Antibiotics

A Suri, M Yasir, M Kapoor, A Aiman, A Kumar

## Citation

A Suri, M Yasir, M Kapoor, A Aiman, A Kumar. *Prospective Study On Biliary Bacteriology In Calcular Disease Of The Gall Bladder And The Role Of Common Newer Antibiotics*. The Internet Journal of Surgery. 2009 Volume 22 Number 2.

## Abstract

**Objective:** To study:• The various bacterial pathogens isolated from bile obtained during surgery. • The difference in the bacterial profile of organisms grown from bile collected during surgery for acute cholecystitis and comparison with those undergoing elective cholecystectomy for chronic cholecystitis. • The antibacterial sensitivity of newer antibiotics on the organisms isolated from the bile of patients with gallbladder stone disease undergoing cholecystectomy. **Method:** This prospective study which was conducted in the Acharya Shri Chander College of Medical Sciences and Hospital, Sidhra, Jammu, comprised 150 consecutive patients and included both open as well as laparoscopic cholecystectomy. Samples, about 3-5 ml of bile, were collected and transported to the microbiology laboratory for further studies. Gram staining, aerobic and anaerobic cultures were done and antimicrobial sensitivity was tested. **Results:** *Escherichia coli* (53.84%) was one of the most common isolated bacteria followed by *Pseudomonas aeruginosa* (26.92%) and *Staphylococcus aureus* (19.23%). The resistance to second generation cephalosporins has increased with time, while the bile showed sensitivity to third- and fourth-generation cephalosporins,

**Conclusion:** Positive bile culture was a common finding in patients with acute cholecystitis in this study. *Escherichia coli* was one of the most common isolated bacteria followed by *Pseudomonas aeruginosa* and *Staphylococcus aureus*. The resistance to second-generation cephalosporins has increased while third- and fourth-generation cephalosporins show better promise and may be used as the first line of preoperative prophylaxis in operations for gallbladder stone disease.

## INTRODUCTION

In this part of India, gallbladder disease is the commonest surgical problem and cholecystectomy is the most frequently performed operation. In spite of modern standards of pre-operative preparation and refinements in anesthetic and operative techniques, post-operative wound infections occur in quite a number of patients. With introduction of newer and costlier antibiotics for preventing post-operative wound infection, the incidence of wound infection (post-operatively) has decreased, but the problem of controlling infection still persists and even suppuration, septicemia, or pyemia occurs at times after surgery. Despite high standards of sterilization of surgical instruments, dressings and ligatures, improved operation theatre design and strict aseptic techniques, many patients whose wounds were expected to heal by first intention suffer the discomfort, inconvenience and sometimes actual danger of wound infection.<sup>1</sup>

Acute and chronic inflammation of the gallbladder is the most common complication of gallbladder disease. A bacterial cause of cholecystitis has been proposed and bacteria are cultured in up to 46% of patients with acute cholecystitis.<sup>2</sup> The incidence of positive bile culture in patients with chronic cholecystitis who undergo elective operations is lower, at about 11- 43%.<sup>3</sup>

The pathogenesis of bactibilia is incompletely understood. The theories which have been proposed include; enterohepatic route, ascending biliary tract route from duodenum and haematogenous route. Unfortunately, none of these theories explains all observations; *Escherichia*, *Klebsiella*, *Streptococcus viridans* and *Staphylococci* are isolated.<sup>4</sup>

Aspiration and culture of bile at the time of surgery for biliary tract diseases has provided a unique opportunity to study the bacterial flora, as this may have diagnostic,

prognostic or therapeutic implications.<sup>5</sup>

The microorganisms predominantly found are gram-negative aerobes like *E. coli*, *Klebsiella*, *Proteus* and *Pseudomonas*; gram-positive cocci are also present in substantial numbers like the *Streptococci*, *Enterococci* and *Staphylococci*.

Anaerobes found in the bile are anaerobic *Streptococci*, *Clostridium welchii* and *Bacteroids fragilis*.<sup>6</sup>

The choice of antibiotics in patients with biliary sepsis will depend upon two important considerations; the sensitivity of the organisms to various agents and the concentration of the antibiotics in bile. However, in patients undergoing elective surgery, the role of a prophylactic antibiotic is to achieve adequate serum levels above the minimal inhibitory concentration (MIC) of the most likely suspected organisms.<sup>4</sup>

Timing of antibiotic administration is crucial to prevent post-operative wound sepsis. Prior to bacterial contamination, adequate tissue concentration of an antibiotic is necessary to achieve the maximum benefit. Most organisms recovered from bile at the time of surgery were sensitive to chloramphenicol and tetracycline.<sup>7</sup> Evens and Pollock (1973) confirmed the utility of cephaloridine as prophylactic antibiotic in gastrointestinal and biliary tract surgeries.<sup>1</sup>

Keighley et al. (1975) confirmed the prophylactic role or gentamycin therapy in biliary tract surgery. They observed a reduction in the incidence of bacteria in bile from 42% to 25% and in wound sepsis from 21% to 6% in the group receiving gentamycin prophylactically (as compared to the control group).<sup>6</sup>

Polk and Lepez Mayor (1969), who studied 172 gastrointestinal surgery cases, reported a marked reduction in wound infection rate with 1.0g cephaloridine given parentally one hour prior to surgery.<sup>8</sup>

## **METHOD AND MATERIAL**

This prospective study was conducted in the Post-Graduate Department of Surgery, Acharya Shri Chander College of Medical Sciences and Hospital Sidhra, Jammu, on 150 consecutive patients (113 females and 37 males) and included both open as well as laparoscopic cholecystectomy. Adult patients undergoing elective or emergency cholecystectomy were taken for the study. All patients were evaluated by history, clinical examination and underwent various investigations including complete blood counts, liver

function tests, renal function tests, ECG, X-ray and ultrasonography. Patients with deranged liver function tests, in form of raised alkaline phosphatase and bilirubin, and those with clinically documented associated pathology of the biliary tree were excluded from the study.

Patients received a single preoperative dose of cephalosporin at the time of induction of anaesthesia. Postoperatively, all patients were continued on the same antibiotic for two doses.

At surgery, bile was aspirated from the gallbladder. About 3-5 ml of bile was drawn with air flushed out of the syringe and the needle immediately capped or pushed in a sterile rubber bung. Samples were transported to the microbiology laboratory for further studies. A direct smear of the sample was examined microscopically after gram staining for various organisms. For aerobic culture, the sample was inoculated on blood agar and McConkey agar medium, and incubated at 37°C for 24 hours. For anaerobic culture, the sample was inoculated on blood agar medium with a metronidazole disc between primary and secondary streak lines. The plate was then placed in an anaerobic jar (gas pack method) and incubated at 37°C for 48 hours.

All collected culture plates were analyzed to determine various organisms isolated. Furthermore, the sensitivity of the organisms to newer cephalosporins was ascertained. Finally, all the integrated results were analyzed using standard statistical methods.

## **OBSERVATIONS**

The following observations were drawn:

Our series of 150 patients consisted of 113 (75.33%) females and 37 (24.67%) males with a female-to-male ratio of 3:1.

The age pattern for patients presenting for cholecystectomy showed that most of the patients (79; 52.67%) were belonging to the 3<sup>rd</sup> and 4<sup>th</sup> decades of life. (Table 1)

**Figure 1**

Table 1: Age Distribution (n = 150)

Age Groups (Years)	No. of Patients	Percentage
15-24	4	2.9%
25-34	26	17.3%
35-44	38	25.3%
45-54	41	27%
55-64	21	14%
65-74	17	11.3%
More than 75 years	3	2%

The patients presented with varied signs and symptoms; abdominal pain was the commonest symptom (97.3%), followed by fatty-food intolerance (61.3%), nausea (30%), vomiting (23.3%) and dyspepsia (20.6%). Most of the patients had an overlap of presenting symptoms. (Table 2)

**Figure 2**

Table 2: Signs and Symptoms (n = 150)

Clinical Presentation	No. of Patients	Percentage
1. Pain	146	97%
2. Fatty-Food Intolerance	92	61%
3. Nausea	45	30%
4. Vomiting	35	23%
5. Dyspepsia	31	20%

Diverse varieties of microorganisms were isolated from the bile in 26 (17.3%) out of 150 patients undergoing cholecystectomy. Aerobes were identified in all the culture-positive patients, whereas anaerobes were not identified in any patient.

Among culture-positive patients (26), *Escherichia coli* was the most common aerobe identified in 14 patients (53.84%). The other frequently encountered aerobes were *Pseudomonas aeruginosa* (26.92%) and *Staphylococcus aureus* (19.23%). (Table 3)

**Figure 3**

Table 3: Organisms Grown in Bile-Culture Positive Patients (n = 26)

Organism	No. of patients	Percentage
<i>Escherichia coli</i>	14	53.84%
<i>Pseudomonas aeruginosa</i>	7	26.92%
<i>Staphylococcus aureus</i>	5	19.23%

The highest incidence of positive cultures was noted in patients with acute cholecystitis (40%). (Table 4)

**Figure 4**

Table 4: Incidence of Bactibilia

Clinical Group	No. of Patients	Positive Bile Culture	Percentage
Acute cholecystitis	10	4	40%
Chronic cholecystitis	140	22	15.7%

Sensitivity to third- and fourth-generation cephalosporins was higher as compared to second-generation cephalosporins in acute as well as chronic cholecystitis. The antibiotics to which most of the organisms were found sensitive were cefoperazone (73.0%) and cefepime (69.23%), and almost all the organisms were resistant to cefuroxime (96.15%). (Table 5)

**Figure 5**

Table 5: Sensitivity Patterns of Cephalosporins

Cephalosporins	Sensitivity Pattern					
	Resistance (Total)	Sensitivity (Total)	Acute		Chronic	
			R	S	R	S
Cefuroxime	25	1	4	0	21	1
Cefoperazone	7	19	1	3	6	16
Cefepime	8	18	1	3	7	15

R - Resistant, S - Sensitivity

**DISCUSSION**

Most of the patients undergoing cholecystectomy were in the mean age group of 45-54 years, with ages ranging between 15 to 77 years, and this is consistent with the observations made by Ferzli (1991).<sup>9</sup> In our series, females (113) outnumbered the males (37). This indicates a higher incidence of the gallbladder stone in females as compared to males in the respective age groups.<sup>10</sup>

Pain in the gallbladder region was the most common symptom in the patients included in this study (97.3%). The second commonest symptom was fatty-food intolerance, which was present in 61.3% of patients. Reporting of the symptoms in both sexes was almost identical.

On gram staining, no organism was found microscopically in the bile of 24 (82.6%) patients in the present study. Later on, it was confirmed that such bile was sterile because no growth appeared on culture plates, both aerobic and anaerobic. In the present study only aerobes were cultivated. *Escherichia coli* (53.84%) was one of the most common isolated bacteria followed by *Pseudomonas aeruginosa* (26.92%) and *Staphylococcus aureus* (19.23%). In none of the cultures *Streptococcus*, *Clostridium* or *Klebsiella* was present.

Positive bile culture was a more common finding in patients with acute cholecystitis in this study. In the vast majority of patients with chronic cholecystitis, the bile was sterile.

The sensitivity of the organisms grown in our analysis of 26 out of 150 patients was tested against cefuroxime, cefoperazone and cefepime, and it was found that sensitivity to third- and fourth-generation cephalosporins was higher as compared to second-generation cephalosporins in acute as well as chronic cholecystitis. The resistance to second-generation cephalosporins has increased while third- and fourth-generation cephalosporins show better promise and may be used as the first line of preoperative prophylaxis in operations for gallbladder stone disease.

## **ACKNOWLEDGEMENTS**

The authors would like to thank Dr. Anil Sharma and Dr. Fayaz Khan (Dept. of Surgery, ASCOMS) for their valuable advice and support.

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**Author Information**

**Abhineet Suri, (M.S., ASCOMS)**

Department of Surgery, ASCOMS (Acharya Shri Chander College of Medical Sciences) & Hospital

**Mir Yasir, (P.G. Surgery, ASCOMS)**

Department of Surgery, ASCOMS (Acharya Shri Chander College of Medical Sciences) & Hospital

**Maria Kapoor, (M.S., ASCOMS)**

Department of Surgery, ASCOMS (Acharya Shri Chander College of Medical Sciences) & Hospital

**Aiffa Aiman, (P.G. Pathology, GMC Jammu)**

Department of Surgery, ASCOMS (Acharya Shri Chander College of Medical Sciences) & Hospital

**Ashutosh Kumar, (M.S., ASCOMS)**

Department of Surgery, ASCOMS (Acharya Shri Chander College of Medical Sciences) & Hospital