

## Original Article

# Correlation between Positive Bile Culture and Subsequent Wound Infection after Elective Benign Biliary Surgery — A Prospective Study

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Though gall bladder bile is usually sterile, bactibilia has been found to be present in upto 15% of patients of benign biliary diseases. Most patients of bactibilia tend to be asymptomatic. But, postoperative surgical site infection is not uncommon in these patients. This study was conducted to find a correlation between bactibilia and postoperative wound culture in cases of surgical site infection in benign biliary diseases. To perform a bacteriological analysis from the infected surgical site and correlate it with the sample collected from the gall bladder during cholecystectomy. A prospective study was designed including 60 patients, between 18 to 65 years age, undergoing elective biliary surgery. A 5ml sample of bile, aspirated from the gall bladder at the time of cholecystectomy was cultured and the bacteria identified in positive cultures. If any patient developed surgical site infection, a sample from the infected wound was obtained and bacteriological analysis was performed. Positive Bile cultures were obtained in 14 cases (23.3%). *E Coli* was found to be the most frequent isolate from bile of which most were sensitive to piperacillin – tazobactam. Nine (9) cases (15%) developed post operative wound infection and *E coli* was the commonest isolated organism. A strong positive correlation was noted using Pearson Correlation coefficient. Incidence of asymptomatic bactibilia is around 15%. *E coli* is the commonest isolated organism from bile. The incidence of surgical site infection was 15% and *E coli* was again the commonest organism isolated with a statistically significant strong positive correlation.

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**Key words :** Bactibilia, Cholecystectomy, Surgical site infection.

Cholelithiasis is one of the most common pathologies encountered in day to day surgical practice. The incidence of cholelithiasis amongst healthy, young individuals varies between 11% to 36% in western population and in about 17% population in Asian countries<sup>1</sup>. Treatment of symptomatic gallstones is by cholecystectomy, either laparoscopic or open, thus making cholecystectomy one of the most commonly performed abdominal operations<sup>1</sup>.

Though bile in the gall bladder is commonly sterile in nature; bactibilia has been found to coexist in upto 30% of chronic cholelithiasis cases while in acute cholecystitis and elderly symptomatic patients, the prevalence can be as high as 46%<sup>1</sup>. In spite of bactibilia, patients can often be asymptomatic. Following any sort of intervention (open or endoscopic), these bacteria might get disseminated and cause infective complications.

Although bile culture and sensitivity is not routinely done during cholecystectomy, bile culture has shown pres-

ence of aerobic organisms<sup>2-5</sup>. Though many surgeons do not favour the use of prophylactic antibiotics in elective biliary surgeries, the high incidence of bactibilia warrants further deliberation on routine bile culture, prophylactic antibiotic usage in cholecystectomy and its effect on outcome of the procedure.

To associate the incidence of septic complications in biliary surgery to culturable bacteria in bile, it needs to be proven that same organisms are cultured from the infected source, in case a postoperative septic complication occurs.

The present study was undertaken to find a correlation between bactibilia and postoperative surgical site infection (SSI) after benign biliary surgery, and whether the organisms found in the infected wound are same as those found in the bile.

### *Aims and Objectives :*

- (1) To determine the incidence of bactibilia in the study population.
- (2) To identify the causative organisms and determine their antibiotic sensitivity in bactibilia.
- (3) To ascertain the incidence of surgical site infection

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(SSI) in elective cases of benign biliary surgeries.

(4) To identify the causative organisms and their antibiotic sensitivity in SSI following benign biliary surgeries.

(5) To assess the association between organisms found in bactibilia and those found in postoperative SSI in the same patients

**MATERIALS AND METHODS**

In 60 patients between 18-65 years age, who underwent surgery for benign biliary pathologies between May 2014 and April 2015 in a surgical unit of a Rural Government Medical College were prospectively recruited to the study. Written, informed consent was obtained from all patients participating in the study. Institutional board review and ethical clearance were obtained. Patients admitted for management of benign biliary pathology, mainly biliary stone disease were included in the study.

Patients suffering from malignant biliary pathologies, and patients with co-morbidities like diabetes mellitus, hypertension, asthma, COPD, immunodeficiency, coagulopathy, or those with clinical / biochemical features of pre-existing systemic infection were excluded from the study.

After a detailed history and thorough clinical examination, all patients underwent an ultrasonography of the abdomen for confirming the diagnosis. Antibiotic prophylaxis using a single dose of injection ceftriaxone (1gm) was administered during induction. During surgery, the following information was recorded: duration of operation, type of operation, interval between administration of the antibiotics and incision, spillage of bile and any intra-operative complications. Intra-operatively, a 5ml sample of bile was collected from the gall bladder with a syringe and sent for microbial analysis, culture and sensitivity. In the laboratory, the bile sample was inoculated into nutrient broth and subculture was done on blood agar, MacConkey agar media for aerobic culture testing. If there was growth after overnight incubation, an antibiogram test was performed using the Kirby Bauer disk diffusion method. The organism was identified using biochemical tests. The spectrum of microorganisms isolated from the bile culture and their sensitivity pattern was recorded.

Postoperatively, patients were clinically assessed daily, and the wound evaluated for any erythema, exudate, discharge or dehiscence. A note was also made of any systemic features of sepsis, if present. A postoperative total leukocyte count was repeated at 48 hrs. If features of incisional SSI were present, their incidence was documented. In cases which did develop SSI, samples were obtained for microbiological analysis (aerobic culture using same precautions and methods as intra op samples). The spectrum of microorganisms in wound discharge, their culture and sensitivity pattern were recorded. The antibiotic was changed depending on the sensitivity report. The

culture report of the intra-operatively collected bile was compared to that of the postoperative wound swab, to see whether there was any correlation of the organisms.

Standard statistical methods were used for data compilation & tabulation in the form of tables, charts and graphs. SPSS version 20 was used for statistical analysis.

**ANALYSIS AND RESULTS**

Compilation of data was done and the results analysed using standard statistical methods.

Most of the patients in our study population were females (87%).

The mean age was 38.25 years with a standard deviation of 9.543. The youngest patient was 21 years old, while the oldest patient was 65 years old. Around 66% of the study population was between 31-50 years old. Laparoscopic cholecystectomy was the most common procedure (34/60 = 65%) and cholecystectomy (laparoscopic + open) greatly outnumbered choledocholithotomy (85% versus 15%).

Most of the patients (46/60=76.7%) grew no organism when their intraoperatively collected bile was cultured. Only 14/60 = 23.3% patients showed a positive bile culture. Of the 60 patients, 36 (60%) had multiple gall bladder calculi on USG, while 24 had single calculous. When this data was corroborated with those having positive bile culture, it was seen that bile culture positivity is slightly higher in patients with multiple calculi.

Bile culture positivity clearly occurs more frequently in patients with a history of recent acute attack than in those where acute attack happened some time back indicating relation between positive bile culture and acute cholecystitis (Fig 1).

*E coli* was the commonest organism isolated from intra-operatively collected bile sample. Most of the organisms were sensitive to piperacillin + tazobactam or amikacin (Fig2).

Of the 60 patients who underwent surgery, 9 (15%) developed wound infection.

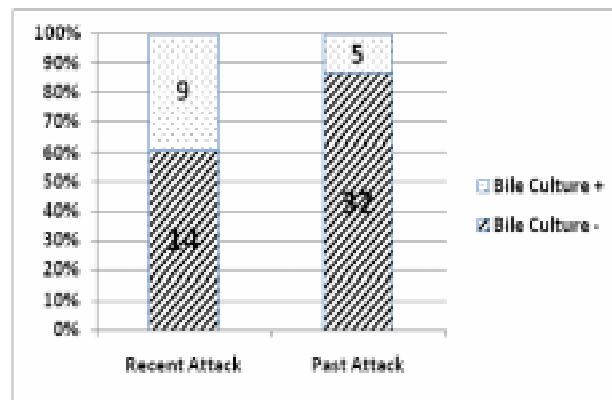


Fig. 1 — Distribution of bile culture positive patients with respect to recent & past attack of cholecystitis

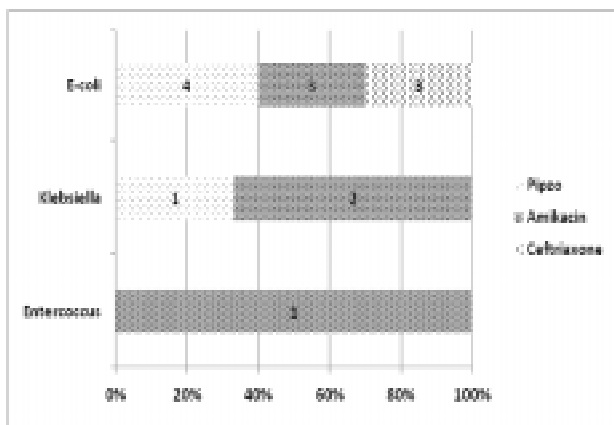


Fig.2 — Organisms present in culture positive bile and their drug sensitivity

*E coli* was the commonest organism isolated from post cholecystectomy wound swabs taken from patients with post-operative wound infection. The organism profile was similar to that found in intraoperative bile culture. It was seen that wound infection was much more common in intra-operative bile culture positive patients than in culture negative ones (Fig 3).

The relationship between intraoperative bile culture and postoperative wound infection was investigated using Pearson product-moment correlation coefficient. There was a strong, positive correlation between the two variables [ $r = 0.541, n = 60, p < 0.0005$ ], with higher chance of postoperative wound infection associated with positive intraoperative bile culture. The correlation as measured by the Chi – Square tests is depicted in Table 1 and the symmetric measures correlation in Table 2.

**DISCUSSION**

Gall bladder as an organ is sterile despite being functionally and anatomically attached to small intestine which harbours bacterial flora. The continuous flow of bile, action of sphincter of Oddi and bile itself acting as a selective antibacterial agent ensures sterility of gall bladder. Bile, both in conjugated and unconjugated form, prevents

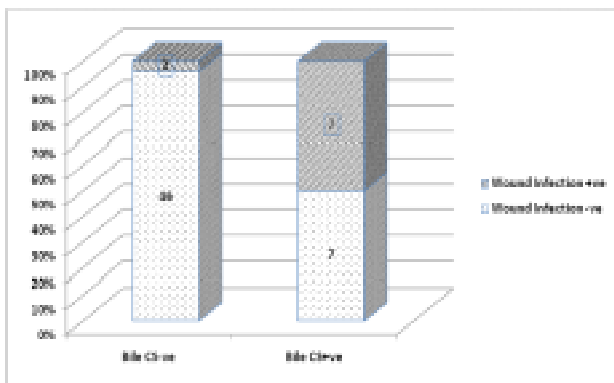


Fig. 3 — Prevalence of wound infection in patients with positive and negative bile culture

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	17.545 <sup>a</sup>	1	0		
Continuity Correction <sup>b</sup>	14.147	1	0		
Likelihood Ratio	14.863	1	0		
Fisher's Exact Test				0	0
Linear-by-Linear Association	17.252	1	0		
N of Valid Cases	60				

	Value	Asymp. Std. Error <sup>a</sup>	Approx. Tb	Approx. Sig.
Interval by Interval	Pearson's R 0.541	0.132	4.896	0.000 <sup>c</sup>
Ordinal by Ordinal	Spearman Correlation 0.541	0.132	4.896	0.000 <sup>c</sup>
N of Valid Cases	60			

growth of bacteria.

When there is inflammation of gall bladder, bile flow abnormality or stasis of bile, there is bacterial infiltration into gall bladder. Organisms isolated from gall bladder are mainly from enterobacteriaceae group, including *E Coli*, *Klebsiella* and *Enterobacter*<sup>2-5</sup>. Among these *E Coli* was the most commonly isolated organism. Significant numbers of patients (23.3% in our series) have positive bile culture, even though they may be asymptomatic and do not harbour features of sepsis.

Cholecystectomy is one of the most commonly performed general surgical procedures. Cholecystectomy (both open and laparoscopy) and choledocholithotomy most of the times are clean operations and are done in elective setting. Thus, they rarely have wound infection.

The common causes of wound infection in such cases may be patient related factors (DM, immunosuppression, long term use of steroids, other systemic disorders, poor hygiene), operation theatre environment and personnel related factors, and postoperative care related factors. Even if all the above are optimised, a segment of biliary surgery patients still develop wound infection. This study was aimed to find out any correlation between bactibilia and post-operative wound infection in such patients.

In our study bile culture was found to be positive in 14 out of 60 patients (23%). Khan *et al*<sup>6</sup> had found bactibilia in 33% patients in this subcontinent while Pokharel *et al*<sup>7</sup> found bactibilia in 8% patients in South India.

A study by Morris – Stiff *et al*<sup>8</sup> showed prevalence of bactibilia to be 15.6% in UK. Presence of risk factors like recent acute attack, advanced age, and choledocolithiasis have been associated with bactibilia in other studies. In the present study 11 out of 14 patients of bactibilia had one or more of these risk factors *vis-à-vis* 3 patients with-

out such risk factors, but with evidence of bactibilia. The cause of this bactibilia is not certain but ascension of bacteria from duodenum is presumed to be one of the causes<sup>9</sup>. Inflammation of gall bladder seems to facilitate the ascension of bacteria from duodenum. Bile is normally sterile. Sphincter of Oddi acts as a barrier and continuous flow of bile keeps the bile sterile. Disruption of the sphincteric function may also add to migration of organisms from duodenum to biliary tree. Inflammation in cholecystitis and obstruction due to cholelithiasis also alters this status, leading to intrusion of bacteria in gall bladder. Also inflamed gall bladder has been seen to develop markedly altered permeability, thereby contributing to the pathophysiological change<sup>4</sup>.

Hematogenous spread is also a contributing factor as shown by Sahu *et al*<sup>10</sup>. In our study *E coli* was the most commonly isolated organism in intra operative bile culture (70%) followed by *Klebsiella* and *Enterococcus*. Öztürk *et al* and Velázquez-Mendoza *et al* have also found *E coli* to be the most common organism but with a lesser prevalence (30%)<sup>2,3</sup>. Sattar *et al* also found *E coli* to be present in 50% of positive bile cultures<sup>4</sup>. *E coli* and *Klebsiella* were the predominant organisms in a study done by Nasreen Jan *et al*<sup>11</sup>. Coliforms constituted 61% of organisms in study by Ronald T Lewis *et al*<sup>5</sup>.

*E Coli* being most commonly occurring organism corroborates the assumption that ascension of bacteria from gut is a major cause of bactibilia.

Postoperative wound infection was seen in 15% of the population in the present study. Cainzo M *et al*<sup>12</sup> found postoperative wound infection in 7.5% of patients, while Povoski *et al*<sup>13</sup> reported a postoperative wound infection rate of 14% in their study involving complex biliary procedures. Surgical site infection was 11.25% in the study by José Dolores Velázquez-Mendoza *et al*<sup>3</sup>. R Ashok *et al*<sup>14</sup> found the wound infection to be 11.04%.

In our study, 71% patients with bile spillage developed wound infection while the remaining 29% did not indicating the contribution of bile spillage in pathogenesis of wound infection. Similar results have been obtained in studies by Sattar *et al*<sup>4</sup>, Adel F Ramzy *et al*<sup>15</sup> and Takehiro Fujii *et al*<sup>16</sup>.

In our study, *E Coli* was the commonest (67%) organism in swabs taken from patients with post-operative wound infection, followed by *Enterobacter*. The finding corroborates with a similar study done in India by Khan *et al*<sup>6</sup>. The study by R Ashok *et al*<sup>14</sup> also found *E coli* to be the commonest organism of wound infection (73%) followed by *Klebsiella* and *Enterobacter*, consistent with the present study.

In our study, wound infection occurred in 50% of bile culture positive patients whereas only 4% patients with

negative bile culture had wound infection. A B Khan *et al* reported wound infection in 30% patients with positive bile culture vis a vis only 3% in patients with sterile bile<sup>6</sup>. Similar findings have been reported in a study by Adel F Ramzy *et al*<sup>15</sup> and Lykkegaard Nielsen M *et al*<sup>17</sup>.

So, our study indicates that infected bile contributes to the pathogenesis of wound infection after biliary surgery. It may be presumed that postoperative wound infection may be prevented / controlled by giving postoperative antibiotics in concurrence with the culture-sensitivity of the intra-operatively collected bile, rather than any empirical antibiotic protocol. However, since the study population here is small, the above correlation has to be validated after studies with larger patient populations.

### Conclusion :

Though bile is normally considered sterile, incidence of bactibilia is to the tune of around 15% even in asymptomatic patients, with *E coli* being the commonest organism. Surgical site infection can occur in as many as 15% cases of surgery for benign biliary pathology, even though they are considered 'clean contaminated' surgeries. Here also, the commonest cultured organism is *E coli*.

In this study, it was seen that there was a strong, positive correlation between bactibilia and postoperative wound infection, with higher chance of postoperative wound infection associated with positive intraoperative bile culture.

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**Conflicting Interest : None**

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