Original Research Article

Correlation of intra-operative bile cultures with septic complications following biliary tract surgery

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ABSTRACT

Background: Routine intra-operative bile culture during biliary tract surgeries is a common practice among hepatobiliary surgeons. This is based on reports that bactibilia is a predictor of septic complications following these surgeries. This study was aimed at studying the microbiological profile of routine intraoperative bile cultures and correlate with the isolates from septic foci in those undergoing biliary tract surgeries.

Methods: A prospective database of all patients who underwent biliary tract surgeries between July 2014 to June 2016 was taken up for analysis. Charts were reviewed with special focus on microbiological culture data yielded from both routine bile culture and those from septic complications were recorded and analyzed. Strain typing screening was done by comparing the antibiotic susceptibility profiles of various isolates in each patient.

Results: Of the total one hundred and forty four patients undergoing biliary tract surgery, 46 patients (32%) had a positive bile culture. Of these cultures were positive in 30 out of 32 patients (94%) who had preoperative CBD stent in situ. Bile culture positivity rate was highest with CBD exploration cases and incidence of surgical site infections (SSI) was highest with pancreatoduodenectomy cases. There was no significant association between a positive bile culture and development of surgical site infection ($p = 0.09$).

Conclusions: There is no significant association of a positive bile culture with risk of surgical site infections in patients undergoing biliary tract surgery. Even in patients with positive bile culture who develop surgical site infections, two third of them are caused by different strains.

Keywords: CBD, Pancreatoduodenectomy, SSI

INTRODUCTION

Routine intra-operative bile culture during biliary tract surgeries is a common practice among hepatobiliary surgeons. This is based on reports that bactibilia is a predictor of septic complications following these surgeries.^{1,2} Most of these studies have focused on impact of pre-operative biliary drainage on the biliary microflora and its resulting infectious complications. Bile-contaminated operations are reported to have a higher incidence of septic complications than non-bile-contaminated operations.³

There is high correlation of bile culture results with those from post-operative septic foci with concordance rates as high as 80-89%.⁴⁻⁶ Intra operative bile culture result was thus purported to guide early institution of appropriate in patients at risk of developing infectious complications and guide selection of appropriate antibiotic prophylaxis. This study was aimed at studying the microbiological profile of routine intraoperative bile cultures and correlate with the isolates from septic foci in those undergoing biliary tract surgeries.

METHODS

A prospective database of all patients who underwent biliary tract surgeries between July 2014 to June 2016 was taken up for analysis. Laparoscopic cholecystectomies were excluded from this subset of patients. Remaining one hundred and forty four consecutive operations on the biliary tract were reviewed. As a standard protocol, cultures were routinely made of common duct bile intra-operatively. Antibiotics prophylaxis consisting of third generation cephalosporin was administered at induction of anesthesia.

Charts were reviewed to record patient characteristics including etiology and type of surgery, perioperative complications and hospital stay with special focus on microbiological culture data yielded from both routine bile culture and those from septic complications were recorded and analyzed. Strain typing screening was done

by comparing the antibiotic susceptibility profiles of various isolates in each patient. Continuous variables were expressed as mean and Categorical variables were expressed as percentages. To compare categorical variables, the Chi-square test was used using GraphPad Instat version 3.05. P value less than 0.05 was considered as significant.

RESULTS

Of the total one hundred and forty four patients undergoing biliary tract surgery, 46 patients (32%) had a positive bile culture. Of these cultures were positive in 30 out of 32 patients (94%) who had preoperative CBD stent in situ. Bile culture positivity rate was highest with CBD exploration cases and incidence of surgical site infections (SSI) was highest with pancreatoduodenectomy cases as depicted in Table1.

Table 1: Bile culture and SSI incidence among various biliary tract surgeries.

Surgeries	Bile culture		SSI incidence n (%)
	Positive n (%)	Negative n (%)	
Pancreatoduodenectomy* (n = 50)	13 (26)	37 (74)	17 (34)
Triple bypass (n = 20)	6 (30)	14 (70)	5 (25)
CBD explorations (n = 42)	24 (57)	18 (43)	7 (16)
Hepaticojejunostomy (n = 32)	3 (9)	29 (91)	7 (21)

*25 of these 50 patients (50%) had preoperative stenting done.

Table 2: Table depicting the various isolates and their common antibiotic susceptibility profile in patients undergoing biliary tract surgery.

Isolates	Organisms (%)	Antibiotic sensitivity (%)
Bile culture n = 70*	Escherichia coli (56%), Klebsiella sp. (14%)	Imipenem (100%), Amikacin/ Gentamicin (96%) Piperacillin-Tazobactam/ Cefaperazone-sulbactam (90%)
	Enterococcus sp. (17%), Streptococcus sp. (9%)	Vancomycin (100%), Linezolid/ Erythromycin (91%) Amoxycillin-clavulunate (85%)
	Staphylococcus sp. (3%)	Cefoxitin/Clindamycin (100%)
SSI n = 51#	Escherichia coli (63%), Klebsiella sp. (8%)	Amikacin/ Gentamicin (96%), Imipenem (94%) Piperacillin-Tazobactam/Cefaperazone-sulbactam (92%)
	Enterococcus sp. (8%), Streptococcus sp. (4%)	Vancomycin (90%), Linezolid/ Erythromycin (100%) Amoxycillin-clavulunate (70%)
	Staphylococcus sp. (17%)	Cefoxitin/Linezolid/Vancomycin (100%)
Blood n = 5	Escherichia coli (60%), Klebsiella sp. (20%)	Imipenem (75%), Amikacin/ Gentamicin (75%) Piperacillin-Tazobactam/Cefaperazone-sulbactam (75%)
Urine n = 5	Escherichia coli (60%), Klebsiella sp. (20%)	Imipenem (100%), Amikacin/ Gentamicin (100%) Piperacillin-Tazobactam (100%), Cefaperazone-sulbactam (100%)

*Bile culture: polymicrobial = 16, monomicrobial = 30; #SSI culture: polymicrobial = 9; monomicrobial = 30.

Table 2 depicts the various isolates and their common antibiotic susceptibility profile in these patients.

Apart from seventy organisms isolated from 46 patients with positive bile culture, fifty one isolates were obtained from 43 patients who developed surgical site infections and 5 isolates each from blood and urine cultures.

Table 3: Depicting the association between positive bile culture and development of surgical site infection.

	SSI present	SSI absent	p
Bile culture positive	16*	30	0.09
Bile culture negative	20	78	

* Strain typing screening showed only 37 % (6 cases) matching between stains from bile and SSI.

Escherichia coli and *Klebsiella* species were the most common gram negative organisms isolated. Irrespective of source of isolates, they showed high sensitivity to imipenem, amikacin, gentamicin, piperacillin-tazobactam and cefepime-sulbactam. *Enterococcus* species and non-hemolytic streptococcus were the common gram positive isolates with high sensitivity to vancomycin, linezolid and erythromycin.

There was no significant association between a positive bile culture and development of surgical site infection as shown in Table 3 ($p = 0.09$).

DISCUSSION

The incidence of SSI following hepatopancreatobiliary surgery are reported to vary from 8% to 45% depending on the series and complexity of surgeries involved.^{7,8} our series reported an overall incidence of 25% with highest incidence with pancreatoduodenectomy cases. This may be attributed to the fact that nearly half of these patients had undergone preoperative stenting which is an independent risk factor for developing SSI. Specific risk factors associated with high risk for the development of SSI following hepatopancreatobiliary surgery have been thoroughly studied in literature.⁸⁻¹⁰ One of the modifiable risk factors appears to be selection of appropriate antibiotic prophylaxis.¹¹

Our study was aimed at evaluating the impact of routine intra-operative bile culture on the post-operative management of these patients. *Escherichia coli* and *Klebsiella* species were the commonest gram negative isolates in both bile and septic foci.¹²⁻¹⁴ Antibiotic sensitivity profile of Gram negative SSI isolates revealed high sensitivity to amikacin/gentamicin (96%), imipenem (94%), piperacillin-tazobactam or cefepime-sulbactam (92%). *Staphylococcus* species were the common gram positive organism causing SSI with uniform sensitivity to ceftazidime, linezolid and vancomycin (100%).

Our study did not reveal a significant association between a positive bile culture and development of SSI. Moreover on antibiogram strain typing revealed that even in those with positive bile culture developing SSI, the infective strain causing SSI was matching the bile isolate strain in only one-third of cases. Multiple studies have demonstrated that the organism causing SSI matches the

isolate from bile but these studies have not specified if strain typing was done to confirm the same.^{4,15,16} Further genomic analysis is needed in future studies focusing on this aspect.

Up to five strains of *E. coli* are known to colonize single human flora.¹⁷ Findings from our study suggest that strain isolated from bile differs from the strain causing SSI in up to two third of cases. Routine bile culture may not be necessary unless the patient is already in cholangitis or a high risk surgical candidate. More often culture reports are not even referred to unless patient develops clinical signs of deterioration.

Thus a cumulative SSI surveillance data may be sufficient to guide adoption of appropriate antibiotic prophylaxis or empiric antibiotic regimen in the absence of bile culture of individual patients. This is similar to a previous study on pancreatoduodenectomy demonstrating that selection of prophylactic antibiotics on the basis of microorganisms isolated from SSIs in the early group contributed to the reduced incidence of SSIs in later group.¹⁸

CONCLUSION

There is no significant association of a positive bile culture with risk of surgical site infections in patients undergoing biliary tract surgery. Even in patients with positive bile culture who develop surgical site infections, two third of them are caused by different strains.

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