Identification of Risk Factors for Post Operative Bile Leaks Following Hepaticojejunostomy

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Abstract

Background: Hepaticojejunostomy has become an important component of many surgical procedures, including the pancreaticoduodenectomy for benign and malignant neoplasms, liver transplantation, local bile duct resection for choledochal cyst and cancer, surgical palliation of unresectable malignant biliary obstruction, drainage for chronic pancreatitis, repair after bile duct injury and other procedure for miscellaneous disease like stone disease.

Objective: To identify the pre and per operative risk factors for the development of postoperative bile leaks in patients following Hepaticojejunostomy.

Methods: This comparative cross-sectional study was conducted in the Department of Hepatobiliary, Pancreatic & Liver Transplant Surgery, BSMMU, Shahbagh, Dhaka. from September 2022 to August 2023. Before starting this study, ethical clearance was taken from the IRB of BSMMU. After considering inclusion exclusion criteria, total of 35 patients undergoing HJ in many surgical procedures were enrolled in this study**.**

Results: In this study mean BMI of the patients having bile leak were 28.01±1.41 kg/m2 and patients without bile leak were 23.82±3.62 kg/m2 respectively which was statistically significant (p = 0.002). In our study 51.4% of the patients were classified as ASA I where as 48.6% as ASA II. In bile leaks group I, 7 patients were under ASA II.

Conclusion: Patients with poor general condition like over weight (BMI 25-29.9KG/M2), ASA II who underwent PBD, develop polymicrobial growth with commonly used antibiotic resistant organism in bile and disrupted biliary epithelium. These patients are prone to develop postoperative bile leaks following hepaticojejunostomy.

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Introduction

Hepaticojejunostomy has become an important component of many surgical procedures, including the pancreaticoduodenectomy for benign and malignant neoplasms, liver transplantation,

local bile duct resection for choledochal cyst and cancer, surgical palliation of unresectable malignant biliary obstruction, drainage for chronic pancreatitis, repair after bile duct injury and other procedure for miscellaneous disease like stone disease. Biliary leakage after Hepaticojejunostomy occurs in 0.4 to 8% of the patients depending on the type of procedure. Hepaticojejunostomy leak is the second common anastomotic failure following pancreaticoduodenectomy. Often biliary leakage is associated with various complications including intraabdominal abscess formation, pancreatic leakage after pancreaticoduodenectomy, bleeding and wound infection.[1] Although Hepaticojejunostomy leaks seldom occur, the outcome can be disastrous carrying a high risk for prolonged hospital stay, biliary peritonitis even mortality. The median length of stay is significantly greater for Hepaticojejunostomy leaks or combined Hepaticojejunostomy/pancreaticojejunostomy leaks when compared to pancreaticojejunostomy leaks. Hepaticojejunostomy leaks and combined leaks significantly increased 90-day mortality rate. Despite the frequent use of hepaticojejunostomy, a precise analysis of the risk factors associated with postoperative bile leaks is currently lacking in the literatures. The aim of this study is to describe the incidence of bile leaks after Hepaticojejunostomy and to define the predictive factors associated with the risk.

Objective

To identify the pre and per operative risk factors for the development of postoperative bile leaks in patients following hepaticojejunostomy.

Methods

This comparative cross-sectional study was conducted in the Department of Hepatobiliary, Pancreatic & Liver Transplant Surgery, BSMMU, Shahbagh, Dhaka. from September 2022 to August 2023. Before starting this study, ethical clearance was taken from the IRB of BSMMU. After considering inclusion exclusion criteria, total of 35 patients undergoing HJ in many surgical procedures were enrolled in this study. Following taking informed written consent, detailed clinical history, physical examination and relevant investigations were done in each patient after admission. After making the patients medically fit for surgery, hepaticojejunostomy(HJ) operation was done. In each patient peroperatively bile sample was collected aseptically for culture and antibiogram. Also resected bile duct was sampled for histopathology. According to ISGLS, bile leak was defined. This was determined from the intraabdominal drains placed routinely at the time of surgery and drain fluid was assayed for bilirubin on 3rd, 5th and 7th POD following HJ and also clinical parameters like abdominal distension (paralytic ileus) and radiological evidence of any intraabdominal collection. Patients were divided into two groups. Group 1 considered as patients with bile leaks and group 2 with no bile leaks following HJ.Preoperative and peroperative risk factors were evaluated in both groups of patients to identify its effect on the development of postoperative bile leak following HJ.Highest level of confidentiality and ethical standard was maintained during data storage and analysis. Data analysis was done by Statistical Package for Social Science (SPSS) version 25.

After compilation, the data were presented in the forms of tables, figures as necessary. Statistical analyses was carried out by using the Statistical Package for Social Sciences (SPSS) version 25 by SPSS Inc. (IBM), New York, USA.Mean ± standard deviation, percentage frequencies were determined as indicated .All statistical analysis will be conducted within 95% confidence interval

(CI) and p value <0.05 will be considered as statistically significant. Unpaired t test and chi square test were done to calculate the p value. Prior to the commencement of this study, the research protocol wwas approved from the Institutional Review Board (IRB) of BSMMU, Dhaka.

Results

Table I shows the demography of 35 patients undergoing hepaticojejunostomy. It was observed that the mean age was 49.1±13.0 years with ranged from 22 to 70 years. Almost two thirds (65.7%) patients were male and one third 12(34.3%) patients were female. More than one third (37.1%) patients had DM and 28.6% had HTN. About half of the participants were categorized as ASA Type I and other half were Type II. More than one third (37.1%) patients underwent PBD.

Table I: Demography of 35 Patients Undergoing Hepaticojejunostomy

Variable	Number	%
Age		
Mean±SD	49.1±13.0	
Range(min-max)	22-70	
Sex		
Male	23	65.7
Female	22	62.9
Comorbidity		
DM	13	37.1
HTN	10	28.6
ASA		
I	18	51.4
II	17	48.6
PBD	13	37.1

*PBD: Preoperative Biliary Decompression

Table II: Indication for Hepaticojejunostomy of 35 Patients

Variable	Number	Percentage
Benign	10	28.6
Hepaticolithiasis	2	5.7
Liver Cirrhosis	1	2.9
Choledochal Cyst	2	5.7
Choledocholithiasis	2	5.7
Benign biliary Stricture	2	5.7
Chronic Pancreatitis	1	2.9
Malignant	25	71.4
CA GB involving CBD	4	11.4
Cholangio CA	4	11.4
CA Head of Pancreas	10	28.6
Periampullary CA	7	20.0

Table II shows the indication for hepaticojejunostomy. It demonstrates that 28.6% patients belonged to benign case. Among them 2 (5.7%) cases were hepaticolithiasis, 2 (5.7%) cases of choledochal cyst, 2 (5.7%) cases of choledocholithiasis, 2 (5.7%) cases of benign biliary stricture and 1 (2.9%) patient had liver cirrhosis and 1 (2.9%) patient of chronic pancreatitis. Almost three fourth (71.4%)

patients were diagnosed as malignant case of which 10(28.60%) patients of CA Head of Pancreas, 7(20.0%) patients of Periampullary CA, 4(11.4%) patients of CA GB involving CBD and another 4(11.4%) patients of Cholangio CA.

Table III: Peroperative Bile Culture of 35 Patients Undergoing HJ

Variable	Number	%
Growth Positive	24	68.6
Monomicrobial	6	17.1
Polymicrobial	18	51.4
Kelbsiella spp.	10	28.6
E.coli	5	14.3
Pseudomonas spp.	4	11.4
Proteus spp.	4	11.4
Growth Negative	11	31.4

Table III shows the peroperative bile culture of 35 patients undergoing hepaticojejunostomy. It was observed that growth was found more than 60% of patients. Of which 18(51.4%) cases were Polymicrobial and 6(17.1%) cases were Monomicrobial. Among Polymicrobial 6(17.1%) cases were Klebsiella spp., 8(22.9%) cases were E. coli, 5(14.3%) cases were Pseudomonas spp. and Proteus spp. On the contrary 40% patients had no growth of bile culture.

Table IV: Table IV: Histopathology of Resected Bile Duct of 35 Patients Undergoing HJ

Variable	Number	%
Intact biliary epithelium	19	54.29
Disrupted biliary epithelium	16	45.71

Table IV shows the histopathology status of resected bile duct of 35 patients undergoing hepaticojejunostomy. More than half (54.29%) of patients had Intact biliary epithelium and 16(45.71%) patients had disrupted biliary epithelium.

Table V: Bile Leaks after HJ in 35 Patients

Variable	Number	%
Bile Leaks	9	25.7
Grade A	4	11.4
Grade B	2	5.7
Grade C	3	8.6
No Bile Leaks	26	74.3

Grade A bile leaks: bile leaks with no change in patients clinical management
Grade B bile leaks: bile leaks with active therapeutic intervention but is manageable without relaparotomy.

Grade C bile leaks: requires relaparotomy.

Table V shows the bile leaks status of 35 patients undergoing hepaticojejunostomy. It was observed that one fourth (25.7%) patients developed bile leaks postoperatively. Among them 4(11.4%)

patients were Grade A, 2(5.7%) were grade B, and 3(8.6%) patients were Grade C. Almost three fourth (74.3%) patients did not have bile Leakage.

Table VI: Univariate Analysis of Preoperative Factors for Bile Leaks following HJ

Variable	Group I n=9		Group II n=26		p Value
	n	%	n	%	
Age					
Mean±SD	42±11.74		51.54±12.73		[a]0.056[ns]
Range(min,max)	22-59		32-70		
Sex					
Male	5	55.6	18	69.2	
Female	4	44.4	8	30.8	[b]0.456[ns]
BMI					
Mean±SD	28.01±1.41		23.82±3.62		[a]0.002[s]
Range(min,max)	26-31		18.5-31		
Disease					
Benign	4	44.4	6	23.1	
Malignant	5	55.6	20	76.9	[b]0.221[ns]
Procedure					
HJ only	4	44.4	4	15.4	
HJ with other	5	55.6	22	84.6	[b]0.073[ns]
Comorbidity					
DM	5	55.6	14	53.8	
HTN	3	33.3	7	26.9	[b]0.832[ns]
ASA					
I	2	22.2	16	61.5	
II	7	77.8	10	38.5	[b]0.042[s]
PBD	6	66.6	7	26.9	[b]0.026[s]

apVaue Un-paired t test
bp Value Chi-Square test

Table VI shows the univariate analysis of preoperative risk factors for bile leak following hepaticojejunostomy. Majority 8(88.8%) patients had BMI 21-30 kg m^{-2} in group I and 17(65.4%) patients in group II. BMI, ASA II and PBD were significantly associated with bile leaks.

Table VII: Univariate Analysis of Peroperative Risk Factors for Bile Leaks Following Hepaticojejunostomy (n=35)

	Group I Bile Leaks n=9		Group II No Bile Leaks n=26		p Value
Variable	n	%	n	%	
Culture Positive	9	100.0	12	57.60	0.004[s]
Culture Negative	0	0	14	42.3	
Isolated Organism					
Monomicrobial	1	11.1	5	19.2	0.102[ns]
Polymicrobial	8	88.9	1	3.8	0.042[s]
Klebsiellaspp	5	55.6	1	3.8	0.102[ns]
E. Coli	3	33.3	5	19.2	0.479[ns]
Pseudomonas spp	2	22.2	3	11.5	0.325[ns]
Proteus spp	2	22.2	3	11.5	0.325[ns]

s=significant
ns=not significant
p Value reached from Chi-Square test

Table VII univariate analysis of peroperative risk factors for bile leaks following hepaticojejunostomy. It was observed that all (100.0%) patients had Culture Positive in group I and 12(57.60%) in group II. Majority (88.9%) patients Polymicrobial in group I and 3(11.5%) in group II. The difference was statistically significant ($p<0.05$) between two group.

Table VIII: Antibiotic Sensitivity of Bile culture among Two Groups of Patients

Antibiotic Group	Antibiotic	Group I N=9				Group II N=26				P Vale
		Sensitivity		Resistance		Sensitivity		Resistance		
		n	%	n	%	n	%	n	%	
Penicillin	Amoxycillin	3	33.3	6	66.7	4	15.4	8	30.8	0.676[ns]
	Tazobactam	7	77.8	2	22.2	10	38.5	2	7.7	0.586[ns]
Cephalosporin	Cefuroxime	1	11.1	8	88.9	2	7.7	10	38.5	0.612[ns]
	Ceftriaxone	1	11.1	8	88.9	2	7.7	10	38.5	0.612[ns]
	Cefepime	2	22.2	7	77.8	3	11.5	9	34.6	0.647[ns]
Aminoglycosides	Amikacin	5	55.6	4	44.4	4	15.4	8	30.8	0.283[ns]
Carbapenem	Imipenem	6	66.7	3	33.3	7	26.9	5	19.2	0.528[ns]
	Meropenam	7	77.8	2	22.2	8	30.8	4	15.4	0.476[ns]

Fluoroquinolones	Ciprofloxacin	2	22.2	7	77.8	1	3.8	11	42.3	0.387[ns]
Others	Cotrimoxazole	1	11.1	8	88.9	2	7.7	10	38.5	0.612[ns]
	Colistin	9	100.0	0	0.0	11	42.3	1	3.8	0.571[ns]

ns=not significant
p Value reached from Chi-Square test

Table IX: Univariate Analysis of Histopathology of Resected Bile Leak

Resected Bile Duct	Group I Bile Leak n=9		Group II No Bile Leaks n=26		p Value
	N	%	n	%	
Intact biliary epithelium	1	11.11	18	69.23	0.002[s]
Disrupted biliary epithelium	8	88.89	8	30.77	

Table X: Multivariate Analysis of Factors Associated with Postoperative Bile Leaks.

Variable	Odds Ratio	95% CI	p Value
BMI	0.715	0.48 - 1.08	0.108
ASA II	0.18	0.02-1.27	0.059
PBD	14.36	1.27 -100.0	0.031
Bile Growth	1.48	0.30 - 7.19	0.637
Disrupted Biliary Epithelium	40.36	2.47 - 100.0	0.010

Table X Multivariate Analysis of Factors Associated with Postoperative Bile Leaks. PBD had 14.36 times significantly ($p<0.05$) increased to develop Postoperative Bile Leaks with (95.0% C.I. 1.27 to 100.0). But Disrupted Biliary Epithelium, Bile Growth and BMI were not significantly associated with development of Postoperative Bile Leaks.

Table XI: Characteristics of 9 Patients of Bile Leaks Following Hepaticojejunostomy

Patients	Age (Years)	Sex	BMI (kg/m^2)	ASA	PBD	Bile Culture	Histopathology of Resected CBD
1	48	M	27	II	Yes	Growth	Disrupted
2	56	M	26.5	II	Yes	Growth	Disrupted
3	47	M	29	II	Yes	Growth	Disrupted
4	59	F	32.4	II	Yes	Growth	Disrupted
5	33	M	26.8	I	Yes	Growth	Disrupted
6	35	F	28.5	II	Yes	Growth	Disrupted
7	41	F	27.5	II	No	Growth	Disrupted
8	22	F	26.5	I	No	Growth	Disrupted
9	37	M	28.5	II	No	Growth	Intact

Discussion

A hepaticojejunostomy (HJ) is part of the reconstruction of the biliary tract in many surgical procedures. Although biliary leakage occurs relatively seldom the outcome can be disastrous resulting in biliary peritonitis, prolonged hospital stays and even mortality.This study aimed to identify the risk factors for prediction of postoperative bile leaks in patients undergoing HJ for different diagnosis.[3] In Our study total 35 patients who underwent HJ from July 2022 to June 2023 in BSMMU had been evaluated. Biliary leakage after a HJ occurs in 0.4% -0.8% of the patients depending on the type of procedure. In present study,the incidence of bile leak was 25.7% which is very high. This study was done in a tertiary level hospital and most of the critical cases are like hilar cholangio carcinoma, high bile duct injury (bismuth type ≥ III) referred to this hospital operated and resulted high incidence of bile leak. On the other hand shorter study period and smaller sample size also play contributary factor for higher incidence of bile leak.[4] In this study mean BMI of the patients having bile leak were 28.01±1.41 kg/m2 and patients without bile leak were 23.82±3.62 kg/m2 respectively which was statistically significant (p = 0.002).[5]

In our study 51.4% of the patients were classified as ASA I where as 48.6% as ASA II. In bile leaks group I, 7 patients were under ASA II. Which is statistically significant (p = 0.042). Similar findings not found in any other study.[6-9] Many studies found preoperative endoscopic biliary decompression (PBD) to be associated with bile leak. In our study PBD was significantly (p=0.026) associated with bile leak. Some study stated that PBD associated with bactibilia with polymicrobial organism showing resistance to commonly used antibiotics. In our study we found 100% of patients with bile leak had significantly (p=0.004) positive bile culture of them 88.9% was polymicrobial growth. Uncommon organisms (klebsiella spp., proteus spp pseudomonas observed in stent group. We also observed those organisms in stent group having higher resistant pattern to Cephalosporin and Carbapenem than no stent group. The important findings of this study was Colistin showing 100% sensitivity. Miah et at., 2020 also showed similar findings in their study. This polymicrobial growth in bile and resistant antibiogram profile of stent group may responsible for increased bile leaks[10-12]

Conclusion

Patients with poor general condition like over weight (BMI 25-29.9KG/M2), ASA II who underwent PBD, develop polymicrobial growth with commonly used antibiotic resistant organism in bile and disrupted biliary epithelium. These patients are prone to develop postoperative bile leaks following hepaticojejunostomy.

References

1. Browning JD, Szczepaniak LS, Dobbins R, Prevalence of hepatic steatosis in an urban population in the United States: impact of ethnicity. Hepatol. 2004; 40 (6):1387-1395.
2. Dowman JK, Tomlinson JW, Newsome PN, Pathogenesis of non-alcoholic fatty liver disease. QJM .2010; 103 (1): 71–83.
3. Adams LA, Sanderson S, Lindor KD, Angulo P, The histological course of nonalcoholic fatty liver disease: a longitudinal study of 103 patients with sequential liver biopsies. J Hepatol. 2005; 42(1):132–138.
4. Dyson J, Jaques B, Chattopadyhay D, Lochan R, Graham J, Das D, Hepatocellular cancer: the impact of obesity, type 2 diabetes and multidisciplinary team. J Hepatol.2014; 60 (5):110–117.
5. Lee JY, Kim KM, Lee SG, Prevalence and risk factors of nonalcoholic fatty liver disease in potential living liver donors in Korea: a review of 589 consecutive liver biopsies in a single center. J Hepatol. 2007; 47 (2): 239–44.

6. Oni ET, Agatston AS, Blaha MJ, Fialkow J, Cury R, Sposito A, A systematic review: burden and severity of subclinical cardiovascular disease among those with nonalcoholic fatty liver; should we care? Atherosclerosis. 2013; 230 (56): 258–267.
7. Promrat K, Kleiner DE, Niemeier HM, Jackvony E, Kearns M, Wands JR, Randomized controlled trial testing the effects of weight loss on nonalcoholic steatohepatitis. Hepatology. 2015; 51(8): 121–129.
8. Rodriguez B, Torres DM, Harrison SA, Physical activity: an essential component of lifestyle modification in NAFLD. Nat Rev Gastroenterol Hepatol. 2012; 9 (7): 726–731.
9. Saadeh S, Younossi ZM, Remer EM, Gramlich T, Ong JP, Hurley M, The utility of radiological imaging in nonalcoholic fatty liver disease. Gastroenterology. 2002; 123 (6): 745-750.
10. Targher G, Day CP, Bonora E, Risk of cardiovascular disease in patients with nonalcoholic fatty liver disease. N Engl J Med. 2010; 363 (43): 1341–1350.
11. Ueno T, Sugawara H, Sujaku K, Therapeutic effects of restricted diet and exercise in obese patients with fatty liver. J Hepatol. 1997; 27 (4): 103–107.
12. Zelber-Sagi S, Ratziu V, Oren R, Nutrition and physical activity in NAFLD: an overview of the epidemiological evidence. World J Gastroenterol. 2011; 17 (9): 3377–3389.