

## “Types of Bile Duct Injury and their Management Outcome- A Cross-Sectional Descriptive Study”

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### Abstract

### Original Research Article

**Background:** Bile duct injury is severe and potentially life threatening complication of cholecystectomy. It ruins the patient physically, mentally, socially and financially. The incidence of bile duct injury is alarming in our country. Management of such patients needs to be explained. **Aims:** To identify the types of bile duct injury and their subsequent management plan in our perspective. **Methods:** The study was carried out at Department of Hepatobiliary and Pancreatic surgery, BSMMU, BIRDEM, DMCH & other specialized hospital in Dhaka, Bangladesh. Patient with bile duct injury that occurred in local hospitals following cholecystectomy and subsequent admission in the department of Hepatobiliary and pancreatic surgery; BSMMU, BIRDEM and DMCH, Dhaka, Bangladesh during the period January 2014 to July 2018. A total of 70 patients diagnosed as bile duct injury were included in the study. Bile duct injury that occurs during liver or pancreas surgery or accident was excluded. Data were collected using a predesigned data collection sheet and analyzed using computer software SPSS (Statistical Package for Social Sciences) version 22. **Results:** Young and female patients suffer more 44(62.9%) than male. Occurrence was common during laparoscopic cholecystectomy 42(60%). Most of bile duct injury occur when cholecystectomy done on acute condition of gall bladder 59(84.3%). Most of bile duct injury patient came to specialized center after several week of injury with biliary stricture 54 (77.14%) with jaundice, some patients presented with abdominal pain 48(68.6%), abdominal distension 18(25.7), biliary peritonitis 16(22.9) and biliary fistula 14(20%). Patients with bile duct injury were evaluated by USG, liver function test, ERCP and MRCP. Maximum BDI patients were Bismath Type II 32(45.7%) and Bismath Type III 18(25.7%). Most of these patients were managed by Roux-en-y hepaticojejunostomy 41(59%) alone, some patients were managed by ERCP stenting 4(5.7%) but when patients came on early postoperative period were managed by biloma drainage 2(2.9%), peritoneal toileting 2(2.9%) or T-Tube within CBD 3(4.2%) and laparotomy and drainage 12(17.1%). Bile duct injury with stricture at different level presented more than the acute condition 20(35.5%). Post-operative complication after biliary surgery was 22(31.4%) but most of them managed by conservative treatment. **Conclusion:** The present study showed that bile duct injury occurs mostly in young female with acute cholecystitis. Common presentation was obstructive jaundice and biliary sepsis. Bismuth Type II and III were most common form of stricture. Biliary reconstruction (Roux-en-Y hepaticojejunostomy) was the treatment for biliary stricture. Peritoneal toileting, controlled fistula and later on biliary reconstruction was the treatment of biliary sepsis.

**Keywords:** Laparoscopic Cholecystectomy, USG, Liver Function Test, ERCP and MRCP, Gall Bladder.

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## INTRODUCTION

Bile duct injuries (BDI) take place in a wide spectrum of clinical settings. The mechanisms of injury, previous attempts of repair, surgical risk and general

health status importantly influence the diagnostic and therapeutic decision-making pathway of every single case. A multidisciplinary approach including internal medicine, surgery, endoscopy and interventional radiology specialists is required to properly manage this

complex disease. BDI may occur after gallbladder, pancreas and gastric surgery, with laparoscopic cholecystectomy responsible for 80%-85% of them [1-3]. Although not statistically significant, BDI during laparoscopic cholecystectomy is twice as frequent compared to injuries during an open procedure (0.3% open vs 0.6% laparoscopic)[4]. The bile duct is prone to be damaged by use of diathermy and the excessive dissection, required to delineate the anatomy of Calot's triangle, results in ischemic injury to the biliary tract. Other risk factors include difficulty in dissection due to acute or severe chronic inflammation, morbid obesity, unexpected bleeding, and presence of anomalous duct or vessel. These biliary injuries include leaks, strictures, transactions, or ligation of major bile duct. But various authors have advocated a distinction in bile leaks and bile injuries [10]. BDIs are a complex health problem and, although they usually occur in healthy young people, the effect on the patient's quality of life and overall survival is substantial [5]. The two most frequent scenarios are bile leak and bile duct obstruction. Most of BDIs after cholecystectomy are recognized transoperatively or in the immediate postoperative period [6,7]. Bile leak scenario is easily recognized during the first postoperative week. Constant bile effusion is documented through surgical drains, surgical wounds or laparoscopic ports. Patients usually complain of diffuse abdominal pain, nausea, fever and impaired intestinal motility. In addition, bile collections, peritonitis, leukocytosis and mixed hyperbilirubinaemia may be part of the clinical setting [8,9]. An obstructive pattern in liver function tests accompanied by jaundice is frequent in the biliary obstruction scenario. Most of these patients have a complex Strasberg E injury recognized in the transoperative period. However, if not identified during the first postoperative week, patients have an insidious evolution with relapsing abdominal pain and cholangitis as well as bile collections. Jaundice is not always present immediately after bile duct injury. Some partial stenosis and isolated sectorial right duct lesions (Strasberg B and C) present with abdominal pain, pruritus, general weakness, fever and intermittent alteration of liver function tests.

## OBJECTIVES

### General

- a) To identify the types of bile duct injury and subsequent management plan.

### Specific

- a) To identify the types of bile duct injury.
- b) To record clinical presentation of bile duct injured patients.
- c) To record surgical procedure required.
- d) To record the outcome.
- e)

## MATERIALS AND METHODS

### Study design

The study was a cross-sectional descriptive study.

### Place of study

The study was carried out at Department of Hepatobiliary and Pancreatic surgery, BSMMU, BIRDEM, DMCH & other specialized hospital in Dhaka, Bangladesh.

Study period: January, 2014 to July, 2018.

### Sample size

As the study was conducted over a limited period of time also unavailability of the patients finally the sample adjusted to 70.

### Study population

All the patients who were diagnosed as bile duct injury in hepatobiliary and pancreatic Surgery Department of Bangabandhu Sheikh Mujib Medical University, BIRDEM, DMCH & other specialized hospital in Dhaka, Bangladesh.

## SELECTION CRITERIA

### Inclusion criteria

- a) Clinico-pathologically & radiologically diagnosed as a case of bile duct injury following cholecystectomy.
- b) Those who will give informed consent to participate.

### Exclusion criteria

- a) Bile duct injury due to accidental injury followed RTA.
- b) Bile duct injury followed resection of liver lobe.
- c) Bile duct injury due to pancreas surgery, stomach surgery.

### Sampling technique

Each participant were selected according to inclusion and exclusion criteria and then included in this study by convenience sampling technique.

### Variables

To understand the different types of bile duct injury and management pattern of such patients in our country.

### Bile Duct Injury

The definition of Bile duct injury is injury of any part of biliary tree.

Classification: (The Bismuth classification for bile duct injury)

Type I – CHD stump > 2cm:

Type II – CHD stump < 2cm:

Type III- Hilar Rt. and Lt. Duct injury with confluence intact:

Type IV- Hilar separation of Rt. and Lt. Duct:

Type V- Injury to aberrant Rt. Duct ± CBD injury:

**Data collection instrument**

Data were collected by using semi-structured questionnaire and check list. According to the specific objective of the study, first the variables were identified, then questionnaire and checklist were developed, adequate correction and thorough checking was done. Questionnaire was finalized following pre-testing.

**Data collection technique**

Data were collected by face to face interview of patients and reviewing of medical records.

**Procedure followed**

After taking informed written consent from each respondent, face to face interview and review of medical records were performed and individual information was recorded on a separate questionnaire and checklist.

**Method of data processing**

After collection of every day, the data were checked; followed by editing and cleaning to detect errors or omissions and to maintain consistency and validity of the data. Then the data were entered into the computer using Statistical Package for Social Sciences (SPSS-22 version) software (SPSS Inc, Chicago, IL,

USA) and quality control of data maintained strictly, categorizing and coding done.

**Data analysis**

Data were analyzed according to the objectives and variables. The results were presented in tables and figures. The statistical terms include in the study were frequency and percentage.

**Ethical implication**

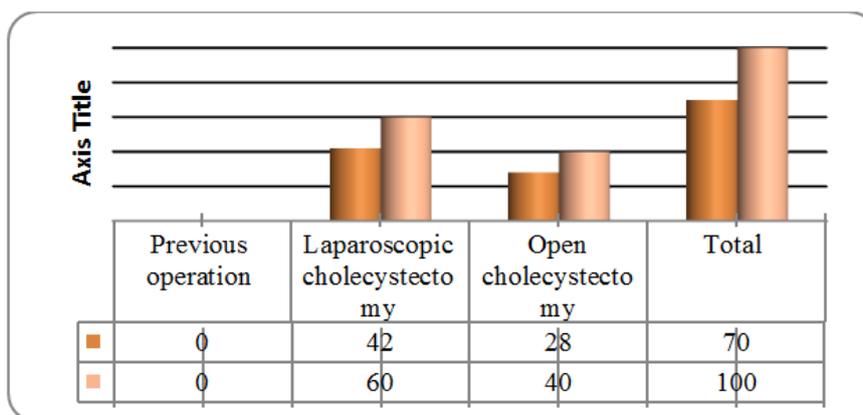
Keeping compliance with Helsinki Declaration for Medical Research Involving Human Subjects, 1964, the study subjects were informed verbally about the study design, the purpose of the study and their right to withdraw themselves from the project at any time, for any reason, what so ever. Subjects who gave informed written consent to participate in the study were included. In this study there was no chance of mental and physical harm and damage to personal reputation of any respondent. Privacy and confidentiality about the information of each respondent was maintained strictly.

**RESULTS**

In this study patients were selected irrespective of age. Result showed that bile duct injury more common in 30-49 years of age. Regarding age, majority i.e. 28(40%) of patients were in the age group 30-39 years followed 24(34.3%) in the age group of 40-49 years. Female 44(62.9%) were more sufferer than male 26(37.1%) shown in [Table-1].

**Table-1: Age distribution of bile duct injured patients according to sex (n=70)**

Sex	Age group (years)					Total
	<30	30-39	40-49	50-60	>60	
Male	0(0.0%)	9(12.9%)	14(20.0%)	3(4.3%)	0(0.0%)	26(37.1%)
Female	10(14.3%)	19(27.1%)	10(14.3%)	3(4.3%)	2(2.9%)	44(62.9%)
Total	10(14.3%)	28(40.0%)	24(34.3%)	6(8.6%)	2(2.9%)	70(100.%)



**Fig-1: Previous operation history of bile duct injured patients (n=70).**

Maximum patients i.e 42 (60%) had previous history of laparoscopic cholecystectomy followed by 28 (40%) had open cholecystectomy shown in [Figure-1].

**Table-2: Status of the disease condition at the time of primary surgery (n=70)**

Indications	Frequency	Percentage (%)
Acute attack	59	84.3
Acute cholecystitis	32	45.7
Empyema gallbladder	16	22.9
Acute cholecystitis with jaundice	6	8.6
Mucocele gallbladder	3	4.3
Acute cholecystitis with pancreatitis	2	2.9
Chronic attack	11	15.7
Chronic cholecystitis (Contacted/fibrosed gallbladder)	7	10.0
Large impacted stone in neck	3	4.3
Asymptomatic gallbladder/incidental findings – cholelithiasis	1	1.4

Status of the disease at the time of primary surgery shown in [Table 2]. Out of the 70 patients, 59(84.3%) were done cholecystectomy in acute condition and 11(15.7%) were done cholecystectomy in chronic or asymptomatic condition. During

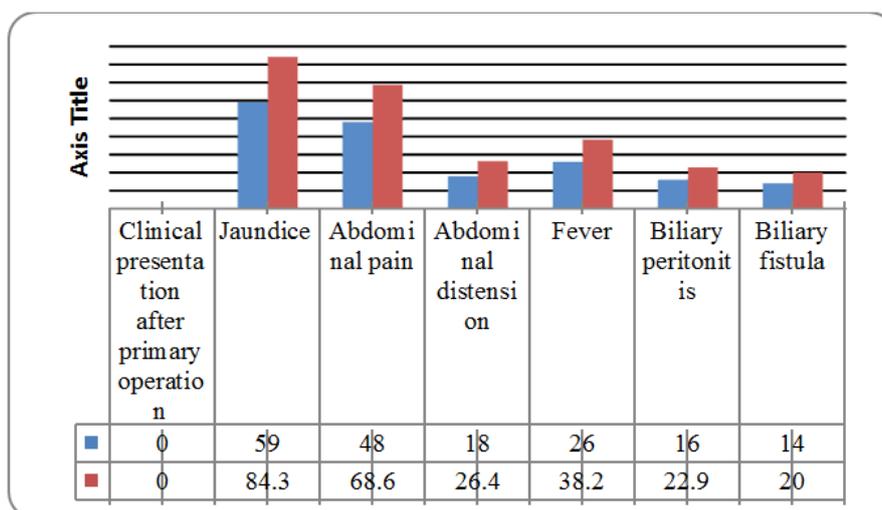
cholecystectomy with acute attack, 32(45.7%) patients had acute cholecystitis and 16(22.9%) patients had empyema gallbladder. During cholecystectomy with acute cholecystitis with jaundice, 6(8.6%) patients developed bile duct injury.

**Table-3: Time of identification as BDI after primary surgery (n=70)**

Time of presentation	Frequency	Percentage (%)
At the time of surgery	2	2.9
First week	18	25.7
2 <sup>nd</sup> week	4	5.7
3 <sup>rd</sup> week	8	11.4
4 <sup>th</sup> week	12	17.1
4 <sup>th</sup> week to 1 year	24	34.3
> 1 year	2	2.9

In this series only two (2.9%) patients bile duct injury were detected at the time of primary surgery. Majority of the patients were undetected at the time of

injury and presented variable period of time after primary surgery shown in [Table 3].

**Fig-2: Clinical presentation of BDI patients when admitted in hospital (n=68)**

All patients who presented after their primary operation were assessed by complete history taking and physical examination. In this study jaundice is the most common presentation 59(84%). Patients are also

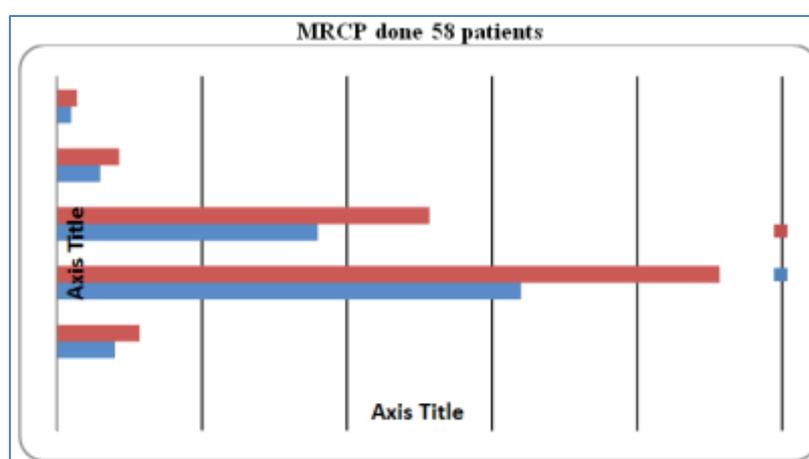
presented with abdominal pain 48(68.6%), fever 26(38.2%), abdominal distention 18(26.4%), biliary peritonitis 16(22.9%) and biliary fistula 14(20%) shown in [Figure-2].

**Table-4: Investigation findings of bile duct injured patients (n=70)**

Investigations	Frequency	Percentage (%)
USG findings	68	
Dilated biliary tree	53	75.1
Localized abdominal collection (Hepatorenal pouch)	6	8.5
Generalized abdominal collection	18	25.7
Hepatomegaly	08	11.4
ERCP	14	20.6
Biliary stricture	10	14.3
Bile leakage	4	5.7

[Table 4] shown investigations performed. Out of 70 cases USG performed 68 cases (2 patients repair at the time of surgery) and these investigations provided valuable information about condition of biliary tree, hepatic parenchyma and ductal system also intra

abdominal collection. 14 patients were done ERCP. Billiary stricture in different level seen among most of the patients (10). Bile leakage seen among 4 patients and all were underwent ERCP stenting.

**Fig-3: MRCP findings of BDI patients (n=70)**

[Figure-3] showed that most of the bile duct injury patient came to BSMMU with billiary stricture in different level. Within those highest number of patients with Bismuth Type II 32(45.7%) patients followed

Bismuth Type III 18(25.7%) patients then Bismuth Type I 4(5.7%) patients and Bismuth Type IV 3(4.3%) patients. Only one patient found Bismuth Type V injury.

**Table-5: Emergency surgery/intervention done which patients presented with bile duct injury post operatively (n=20)**

Findings	Diagnosed by	Surgery/Intervention	Frequency	Percentage (%)
Collection in hepatorenal pouch	Ultrasonogram	Percutaneous USG guided Biloma drainage	2	2.9
Intraperitoneal collection	Ultrasonogram	Peritonal toileting with drainage	2	2.9
Intraperitoneal collection	Ultrasonogram Liver function test	Laparotomy and drainage with insertion of T-tube in CBD	3	4.2
Billiary peritonitis	USG, Liver function test, MRCP	Laparotomy and drainage	13	18.5

[Table-5] shown out of 70 patients 20 patients were need emergency drainage of abdominal collection. Laparotomy and drainage needed 13 patients followed

by laparotomy with T-Tube insertion in CBD 3 patients. USG guided drainage was done 2 patients.

**Table-6: Definitive surgery/Intervention done of BDI patients (n=70)**

Procedure	Frequency	Percentage (%)
Roux-en-y hepaticojejunostomy	41	58.6
USG guided drainage followed Roux-en-y hepaticojejunostomy	6	8.6
Laparotomy and drainage followed Roux-en-y hepaticojejunostomy	12	17.1
ERCP stenting	4	5.7
Drainage of biloma and peritoneal toileting	4	5.7
Laparotomy, peritoneal toileting and insertion of t-tube in CBD	3	4.3
Total	70	100.0

[Tables-6] shown most of the patients (59%) were managed by Roux-en-y hepaticojejunostomy alone, secondly drainage of abdominal collection followed by Roux-en-y hepaticojejunostomy (25.7%).

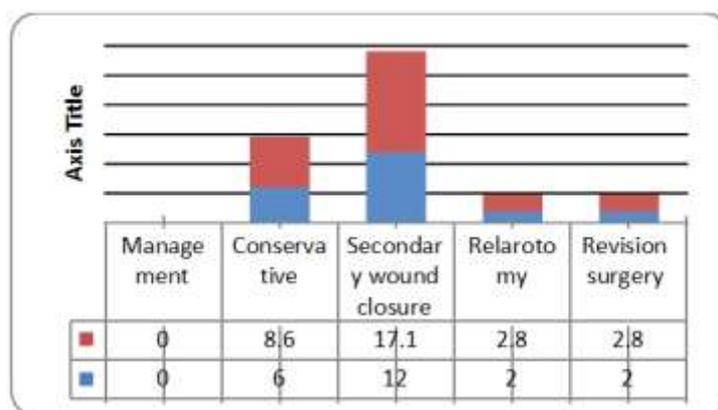
Some patients were managed by ERCP stenting (5.7%), drainage of biloma (5.7%) and insertion of T-Tube (4.3%).

**Table-7: Postoperative complications (n=70)**

Complications	Frequency	Percentage (%)
Anastomatic leakage	02	2.9
Wound infection	18	25.7
Anastomotic stricture	02	2.9
Total	22	31.4

[Table-7] shown post operative complications of bile duct injury patients (31.4%). Wound infection (25.7%) was the main complication after biliary

surgery, also occur anastomotic leakage (2.9%) and anastomotic stricture (2.9%).

**Fig-4: Management of complications (n=70)**

[Figure-4] shown most of the post operative complication was managed by conservative treatment (6) or secondary closure (12). But 4 patients need revision surgery, 2 patients for anastomotic leakage and 2 patients for anastomotic stricture.

## DISCUSSION

This cross sectional descriptive study was conducted in Bangabandhu Sheikh Mujib Medical University, Dhaka Bangladesh during the period from January 2014 to July 2018 with a view to find out which type of bile duct injury occur in our perspective, pattern of presentation, nature of intervention and outcome of treatment of that patients with iatrogenic bile duct injury. For this purpose 70 cases of bile duct injury were selected by convenience sampling. In this study 28(40%) of patients were in the age group 30-39 years

followed 24(34.3%) in the age group of 40-49 years. This indicate higher occurrence of bile duct injury in young adult group. 44(62.9%) patients with bile duct injury were female and 26(37.1%) were male. This higher occurrence of iatrogenic bile duct injury in female was provably due to the fact of gallstone disease is more common in female. In a study it was found that females were predominantly affected by iatrogenic bile duct injury than male [4]. In this study it was found that most of iatrogenic bile duct injury occurred during laparoscopic cholecystectomy 42(60.0%). This study result was consistent with the study conducted by Mercado *et al.*[4], that out of 30 bile duct injured 28(93.3%) were injured during laparoscopic cholecystectomy [10] This may be due to increased the number of laparoscopic cholecystectomy performed now a days, number of report mentioned that chronic

inflammation with tense scaring, peroperative bleeding, misidentification of cystic duct, large stone in Hartman's pouch or tethering of the infundibulum to the common bile duct by acute or chronic inflammation. In present study, it was found that iatrogenic bile duct injury occur highest number 59(84.3%) when cholecystectomy done on acute condition. Most of injury noted acute cholecystitis patients 32(45.7%) followed empyema gall bladder patients 16(22.9%), than acute cholecystitis with jaundice patients 6(8.6%). In chronic attack where higher occurrence occur cholecystectomy during chronic cholecystitis patient (contracted/ fibrosed gall bladder) 7(10%). This study result consist with the study Toruquist *et al.* [11], that risk of bile duct injury was doubled among patients with acute cholecystitis, whereas mild acute cholecystitis did not attack the risk of bile duct injury, a moderate attack more than doubled the risk, severe attack of cholecystitis had a close to significant eight fold increase in risk [12]. In this study, 2 patients (2.9%), with iatrogenic bile duct injury were diagnosed during the primary operation, one patient reconstructive surgery was performed at the same time and another patient primary repair of bile duct with T-tube insertion in situ was performed at the same setting. 68(97.1%) patients were presented as bile duct injury in postoperative period of their primary operation but most of the patients of bile duct injury usually presented after 2 weeks of primary surgery. In a study, it was found that more than 50% of bile duct injuries were undetected at the time of operation [13]. In the present study, out of 70, 68 patients with bile duct injury presented in postoperative period, most of the patients 59(84.3%) presented with obstructive jaundice, 48(68.6%) patients presented with abdominal pain 18(25.7%) of patients exhibited abdominal distensions, 16(22.9%) patients presented billiary peritonitis and 14(20%) patients were presented with billiary fistula. In a study found that out of 32 patients 22(68.7%) patients were presented postoperatively with pain jaundice and fever as the symptoms heralding the injury [14]. In another study, it was observed that bile duct injuries were detected in 44 patients post-operatively and mode of presentation was jaundice, biliary fistula with or without jaundice and biliary peritonitis [15]. Study carried out by Sikora et al 2001 showed that out of 34 patients, 18(53.0%) patients presented in post-operative period and 3(8.8%) had external biliary fistula, 5(14.7%) had biliary peritonitis and 10(29.5%) had biliary stricture[16]. The results of these studies were consistent with that of the present study. Patients of bile duct injury need some extra investigations, all the patients (68) presented with bile duct injury postoperatively underwent ultrasonography of whole abdomen and 53(77.9%) had dilated billiary tree, 6(8.5%) patients had localized abdominal collection and 18(25.7%) patients had generalized abdominal collection. ERCP was done in 14(20.6%) patients, 10 patients showed biliary stricture at different level and 4 patients had billiary leakage and stening was done all

of 4 patients at that time. MRCP done 58 patients, most of the cases lesion seen Bismuth type II 32(45.7%) patients followed type III 18(25.7%) patients and 4(5.7%) patients were Bismath type I, 3(4.3%) patients were type IV, only one patient was Bismath type V. Management strategy of bile duct injury is a complex one, it varies from cases to case. In this study out of 70 patients, 2(2.9%) patients injury was recognized at the time of primary surgery. Roux-en-y hepatico Jejunostomy was done in one patient at same setting and another patient was managed by primary repair with T-tube insertion. Rest of 68 patients in whom injury was recognized in postoperative period, required emergency drainage of abdominal collection, percutaneous ultrasound guided drainage was done in 6(8.6%) patients. Laparotomy, perotomial toileting, drainage and establishment of controlled billiary fistula were done 12(17.1%) patients. These patients were presented with either localized collection of bile (biloma) in association with leakage or fistula or presented with billary peritonitis. Definitive surgery was not done at that time. Definitive surgery was done when patient's condition improved and local inflammation was subsided. All these patients underwent Roux-en-Y hepaticojejunostomy in the same admission or some days later after discharge and following admission. Some patients 4(5.7%) were managed by USG guidance drainage of biloma and 3(4.3%) patients were managed by laparotomy and T-tube insertion in CBD. Out of 70 patients only biliary reconstruction by Roux-en-Y hepaticojejunostomy was done in 41(58.6%) patients, most of those patients presented with biliary stricture. This result was supported by a study that included 49 patients of bile duct injury and 33(67.3%) were recognized postoperatively and were treated surgically by biliary reconstructive surgery, 21(42.9%) hepaticojejunostomy and 12(24.4%) hepaticoduonostomy [17] In this study 4(5.7%) patients were managed by ERCP and stenting. These patients had either minor biliary leakage or short segment stricture. This study result was correlated with the study that included 27 patients of bile duct injury, with surgical reconstruction in 19(70.4%) patient's, endoscopic cholangiography and stent insertion in 2(7.4%) patient's, laparotomy and drainage in 1(3.7%) patient, percutaneous drainage in 2(7.4%) patients, PTC and stenting in 3(11.1%) patients and conservative management in 2(7.4%) patients [18]. In the current study 2 (2.9%) patients were managed by ultrasonogram guided drainage of biloma, 2(2.9%) patients were managed by peritoneal toileting and drainage these patients were presented with abdominal pain or bile collection in drain tube. 3(4.2%) patients were presented with abdominal collection in early postoperative period were managed by laparotomy, peritoneal toileting and insertion of a T-Tube in common bile duct. In a study in Pakistan institute of medical science found that out of 20 cases of bile duct injury 10(50%) were treated by roux-en-y hepaticojejunostomy, 2(10%) were treated by T-Tube

repair and 2(10%) patient's by simple drainage [15]. Result of this study was consistent with that of the present study. In this study 20 patients (28.6%) developed postoperative complications. 18(25.7%) patients developed surgical site infection. 17 patients were managed by regular dressing, 12 patients needed secondary closure. 2 patients need relaparotomy, and 2 (2.9%) patients developed anastomotic stricture after six months. Both were needed revision surgery. In a study total of 175 patients underwent definitive biliary reconstruction, including 172 hepaticojejunostomies (98%) and 3 end-to-end repairs. Seventy-five patients (42.9%) sustained at least 1 postoperative complication. The most common complications were wound infection (8%), cholangitis (5.7%), and intraabdominal abscess/biloma (2.9%). Minor biliary stent complications occurred in 5.7% of patients [19].

## CONCLUSION

The present study showed that bile duct injury occurs mostly in young female with acute cholecystitis. Common presentation was obstructive jaundice and biliary sepsis. Bismuth Type II and III were most common form of stricture. Biliary reconstruction (Roux-en-Y hepaticojejunostomy) was the treatment for biliary stricture. Peritoneal toileting, controlled fistula and later on biliary reconstruction was the treatment of biliary sepsis.

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