

Bile Duct Injuries after Cholecystectomy- Problems in Management

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ABSTRACT OBJECTIVE

Cholecystectomy remains the most common cause of postoperative biliary injuries. Most common cause for these injuries is technical error or misinterpretation of the biliary anatomy. The mode of management, operative risks and outcomes vary considerably depending on the type of injury and its location. This study was done to analyse the different modes of presentation, the management techniques and outcomes following treatment of bile duct injury following laparoscopic or open cholecystectomy.

METHODS: *This is a retrospective analysis of 58 patients who presented with post-cholecystectomy biliary injuries at the Institute of Surgical Gastroenterology, Madras Medical College & Rajiv Gandhi Government General hospital, Chennai from August 2012 and January 2018. The study population was divided into two groups: those presenting early with bile leak and biloma, and those presenting late with biliary stricture and obstructive jaundice. Analysis was made based on data obtained regarding the type of injury, time of referral, various treatment modalities used, complications and mortality. Statistical analysis was performed using SPSS software and p value of <0.05 was considered to be statistically significant.*

RESULTS: *Majority of bile duct injuries (63.8%) occurred following laparoscopic cholecystectomy. Most were recognised postoperatively. Most common types of biliary injury were Strasberg types A and E2 (26% each). Sepsis was more common following delayed presentation (> 3 weeks). In the management of bile leak or biloma, Endoscopic retrograde cholangiopancreatography (ERCP) and biliary stenting had higher success rate (32%) compared to percutaneous drainage (17%), though it did not reach statistical significance. Surgery had significantly higher success rate (94.7%) compared to ERCP (22.2%) in the management of biliary stricture, though successful ERCP resulted in shorter hospital stay. Cholangitis and failed drainage were associated with increased risk of mortality.*

CONCLUSION: *Bile duct injury is more common following laparoscopic than open cholecystectomy. Those presenting with biloma and bile leak can be managed with either percutaneous drainage or ERCP or both. Bile duct injury presenting with jaundice secondary to stricture is best managed with definitive surgery. Cholangitis or sepsis is a major risk factor associated with mortality.*

KEYWORDS: *Bile duct injury, Percutaneous catheter drainage, ERCP Stenting, Hepaticojejunostomy*

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I. Background

Bile duct injury (BDI) is one of the dreaded major complications after cholecystectomy causing significant morbidity and mortality to the patient. Its incidence following open cholecystectomy is 0.2% to 0.3% whereas that following laparoscopic cholecystectomy is 0.6%.1-3

Bile duct anomalies, nature of gall bladder disease and surgeon's experience all contribute to bile duct injury. Injuries often occur due to misperceptions of normal anatomy than lack of knowledge, skill, or judgment. Other causes include a short cystic duct, significant inflammation, previous scar or adhesions and bleeding obscuring the field of vision4-5.

Often, a bile duct injury may not be identified until postoperatively. One must have a high index of suspicion and every effort should be made to avoid a delay in diagnosis. Symptoms of worsening abdominal

pain, fever, and abdominal distention that persist for several days warrant further investigation in the form of USG or CT to look for any collections³.

Evaluation of the extent of injury is done with MRCP or rarely ERCP. Majority of simple bile leaks can be managed with drainage alone or with drainage and ERCP biliary stenting but more complex injuries require multidisciplinary management and may require operative management⁶.

This study was conducted to evaluate the various modes of presentation of bile duct injury following lap/open cholecystectomy, their evaluation and management techniques and to analyse the outcomes.

II. Aim And Objectives

To identify the problems associated with management of patients with post cholecystectomy bile duct injuries; to categorize the type of bile duct injuries and analyse management options; and analysis of outcome.

III. Materials And Methods

This study is a retrospective analysis of a prospectively maintained database conducted in the Institute of Surgical Gastroenterology, Rajiv Gandhi Government General Hospital, Chennai, a tertiary care referral hospital in south India. All patients referred to the institute between August 2012 and January 2018 with post-cholecystectomy BDI were considered for the study.

The patients who presented with transections or partial lacerations, or strictures, of the common hepatic duct, common bile duct, or major segmental ducts were included in the study.

Patients with bile duct strictures due to other causes like chronic pancreatitis, gallstones, biliary tract infections, primary sclerosing cholangitis, or cholangiocarcinoma were excluded.

Operative details

At presentation, information regarding the cholecystectomy (preoperative symptoms, indication for surgery, preoperative evaluation, operative details, intraoperative complications, and postoperative events) was obtained by reviewing the medical records, interviewing the patient, and by discussing with the surgeon who operated whenever deemed necessary.

Mode of presentation

The patients were divided into two groups: those who presented with bile leak / biloma and those with biliary stricture with obstructive jaundice.

Evaluation and management

Routine blood investigations like complete blood count, liver function test, renal function tests were done in all patients to look for evidence of sepsis, biliary obstruction or metabolic derangements.

All patients in the study had an ultrasonography (USG) of abdomen, which is a simple bed side investigation to identify biloma and intrahepatic biliary radical dilatation. It is also used to perform guided drainage of collection. All patients presenting with biloma underwent percutaneous pigtail catheter drainage (PCD) in this study. ERCP was done in whom USG guided PCD failed to relieve the symptoms due to collection. In patients presenting with biliary peritonitis, laparotomy and lavage was done if PCD insertion failed.

MRCP was done for all patients to know the type of bile duct injury as per Strasberg classification⁷, usually after biloma/bile leak has reduced to minimal or after USG in patients presenting with obstructive jaundice. It serves a road map for diagnosis as well as to plan management.

Patients who responded to PCD / ERCP stenting were observed. During follow up period, those who developed biliary stricture were managed with surgical repair by hepaticojejunostomy or Choledochoduodenostomy. Patients were followed up postoperatively with clinical examination, USG abdomen and Liver function tests.

The management of biliary injury was done according to the institution protocol given below.

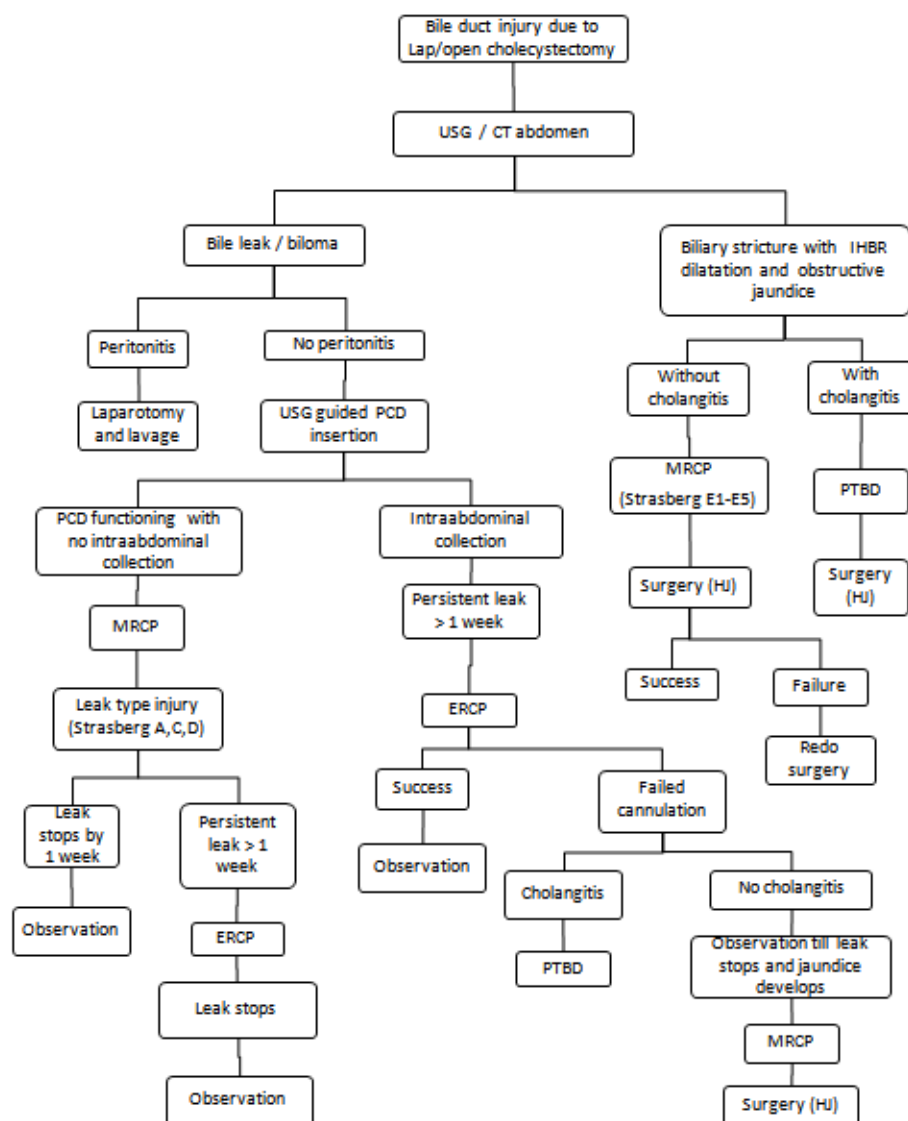


Chart 1: Management Algorithm for Bile Duct Injury

Statistical analysis

Collected data were analysed using SPSS software and p value<0.05 was considered to be statistically significant.

IV. Observations And Results

A total of 58 patients were included in the study. 56 patients were referred from elsewhere and 2 had undergone cholecystectomy in our institution.

	Open cholecystectomy	Laparoscopic cholecystectomy	p value
No of patients (58)	21 (36.2%)	37 (63.8%)	NA
Presentation			0.671
Biloma /bile leak	9	18	
Jaundice	12	19	
Type of injury (Strasberg)			0.074
Type A	3	12	
Type D	1	-	
Type E1	7	7	0.452
Type E2	6	9	
Type E3	4	5	
Type E4	-	3	
Type E5	-	1	

Table 1: Lap vs. open cholecystectomy bile duct injury

Table 1 shows that bile duct injury is more common after laparoscopic than after open cholecystectomy but it was not statistically significant.

Majority were females (39; compared to 19 males). The study population belonged to the age group of 20-79 years with majority of cases between 30-40 years of age.

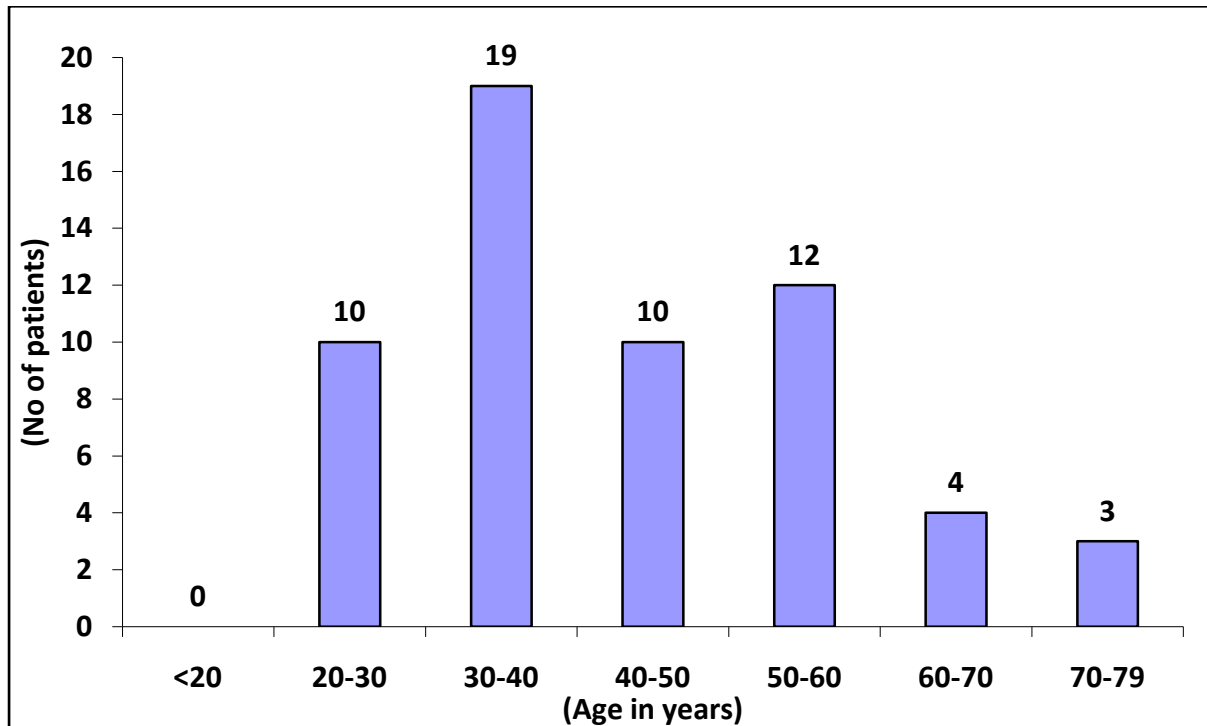


Chart-2: Age distribution of patients with bile-duct injury

Time of referral

Patients were categorized into 2 groups based on time of referral: < 3 weeks or ≥ 3 weeks.

Thirty-four patients were referred to our institute within 3 weeks of cholecystectomy. Three patients presented with jaundice and biliary peritonitis; 31 presented with biloma and bile leak via drain tube. One patient presented with intraoperative bile duct injury and was managed by Hepaticojejunostomy.

Twenty three patients were referred after 3 weeks following cholecystectomy-induced bile duct injury. All patients presented with jaundice. Seventeen of these patients presented with fever, loss of appetite, leucocytosis. Table 2 shows that sepsis was more common in delayed referral patients.

	Referred < 21 days	Referred ≥ 21 days	P value
No of patients	35	23	< 0.001
with sepsis	3	17	
Jaundice	10	23	
Biloma	31	0	
Mean Hospital stay	19 days	24 days	0.236

Table 2: Time of referral

Types of biliary injury

Most common types of biliary injury were Strasberg type A & E2 injury (15 patients each), followed by Strasberg type E1 injury (14 patients).

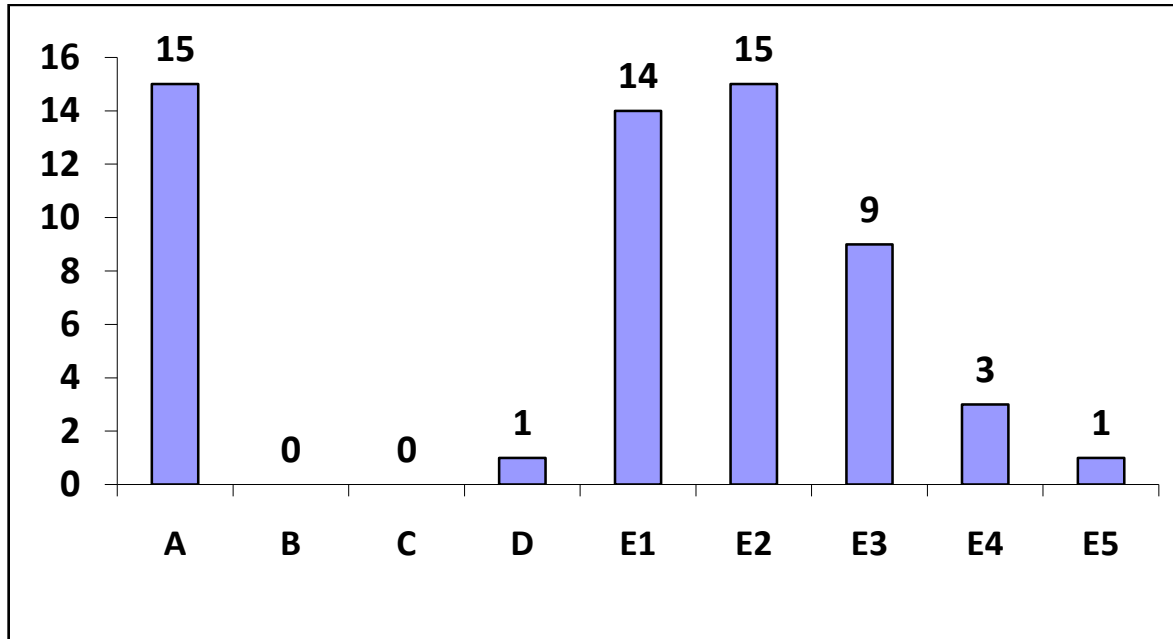


Chart 3: Types of bile-duct injury as per Strasberg classification

Group-1: Bile leak with biloma

Patients presenting with bile leak/biloma(n=34) were examined for signs of peritonitis. USG abdomen and/or CECT abdomen were done to look for site of biloma and whether it is localised or generalised in the peritoneal cavity.

All patients were managed initially with USG guided percutaneous catheter drainage (PCD). Only 6 patients (17%) improved with PCD alone with bile leak stopping in 10 - 15 days. Patients were evaluated with MRCP showing Strasberg type A injury.

Three patients who presented with biliary peritonitis underwent PCD first and next day taken up for laparotomy and lavage. During follow up they developed biliary stricture and managed with hepaticojejunostomy later.

Three patients presented with cholangitis and were treated with i.v. antibiotics and i.v. fluids and they improved with conservative management. Three patients developed malnutrition due to poor intake and were treated with i.v. albumin and blood products. No bleeding complication was encountered.



Figure 1: USG guided percutaneous catheter drainage for biloma

ERCP was performed in 28 patients in whom PCD failed. Nine patients (32%) improved with stenting alone; these patients had cystic duct stump leak that improved symptomatically and were discharged at 10-12 days. In 19 cases (68%), ERCP attempt failed due to inability to cannulate the ampulla and CBD.

One patient in whom ERCP failed, developed cholangitis and was treated with i.v. antibiotics and i.v. fluids. MRCP done showed type E1 biliary stricture and he was subjected to definitive surgery 6 weeks later.

One patient developed pancreatitis following ERCP and was managed conservatively. One patient developed malnutrition due to persistent bile leak.

Mean hospital stay of patients successfully treated with USG guided percutaneous drainage and ERCP was 11 days and 11.1 days, respectively.

When both interventions failed, resulting in persistent biliary fistula, length of hospital stay increased to 27 days. These 19 patients were further evaluated with MRCP and found to have stricture type of injury. In most of these patients, bile leak stopped spontaneously and they developed jaundice due to biliary stricture later.

Group-2: Jaundice with biliary stricture

Nineteen patients who presented with bile leak and initially managed with PCD and ERCP and did not improve following both procedures and later developed jaundice with biliary stricture were enrolled along with 23 patients who directly presented with jaundice with biliary stricture. Thus, 42 patients were totally included in group B.

These patients were investigated with MRCP to determine the type of injury and plan management accordingly. Eighteen of the 42 patients were subjected to ERCP for dilatation and stenting. It was successful in 4 patients (22%) only. In the rest, ERCP was deferred based on MRCP report.

One patient developed cholangitis following ERCP and was managed with PTBD but succumbed to septicemia eventually. One patient developed pancreatitis and 3 developed malnutrition which was managed accordingly.

Thirty-eight patients in this group were taken up for surgical management in the form of bilioenteric anastomosis. Hepaticojejunostomy was performed in 36 patients and Choledochoduodenostomy in 2 patients.

Most common complication encountered in post op period was wound infection (10 patients). One patient with type E4 type of biliary stricture, who underwent hepaticojejunostomy for both right and left ducts, developed cholangitis in post op period which was managed by PTBD but ultimately died due to cholangitis & septicemia. One patient developed anastomotic leak with drainage of about 200ml of bile per day in the drain. She was conservatively managed and leak stopped spontaneously.

One patient with type E4 biliary stricture, who underwent hepaticojejunostomy, developed melena in the post op period. CT angiogram could not locate the source of bleed. He was managed conservatively but developed progressive jaundice. USG abdomen shows dilated right system and hence PTBD was done. Patient improved and redo HJ was done later.

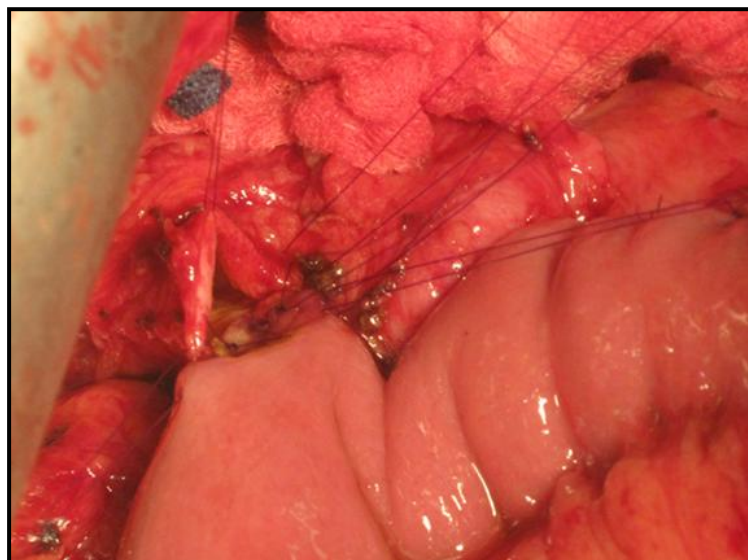


Figure 2: Hepaticojejunostomy

Table 3: BILE LEAK WITH BILOMA (N-34)

Factors	Management options		P value
	PCD	ERCP	
No of patients	34	28	0.414
Female	24	17	
Male	10	11	
Type of injury			0.368
Type A,D	16	10	
E1-5	18	18	
Success	6(17%)	9(32%)	0.185
Failure	28(83%)	19(68%)	
Mean Hospital stay			0.842
Success cases	11 days	11.1 days	
Failed cases	27.1 days	27.3 days	
Complications			0.713
Bleeding	-	-	
Cholangitis	3(12.5%)	1(5.3%)	
Pancreatitis	-	1(5.3%)	
Malnutrition	3(12.5%)	1(5.3%)	
Mortality	nil	nil	

Table 3 shows that management of bile leak with biloma by ERCP has higher success rate than PCD alone, though it was not statistically significant.

Table 4: BILIARY STRICTURE WITH JAUNDICE (N-42)

Factors	Management options		P value
	ERCP	Surgery	
Total	Attempted : 18	38	0.080
Female	9	28	
Male	9	10	
Type of injury			0.016
E1	11	12	
E2	3	14	
E3	3	8	
E4	0	3	
E5	1	1	
Success	4 (22.2%)	36 (94.7%)	< 0.001
Failure	14 (77.8%)	2 (5.3%)	
Mean Hospital stay (success case only)	10 days	27 days	< 0.001
Complications			0.679
Bleeding	-	-	
Cholangitis	1	1	
Pancreatitis	1	1	
Malnutrition	3	1	
Anastomotic leak	-	1	
Post op PTBD	-	2	
Redo HJ	-	1	
Mortality	1	1	

Table 4 shows that Surgery has better success rate than ERCP intervention for cases of post-cholecystectomy biliary stricture with obstructive jaundice.

Factors related to mortality

Factors causing mortality in post cholecystectomy bile duct injury include cholangitis and failed drainage by ERCP or surgery or PTBD.

Table 5: Factors causing mortality

Factors	Mortality		P value
	Yes	No	
Cholangitis	2	4	0.102
Failed ERCP	1	13	
Failed surgery	1	1	
Failed PTBD	2	1	

Cholangitis and failed drainage by surgery or PTBD were associated with increased risk of mortality in this study but it was not statistically significant.

V. Discussion

In this retrospective study, 58 patients presented with post cholecystectomy bile duct injuries which were more common following laparoscopic cholecystectomy (n=37) than open cholecystectomy (n=21)². Both young and elderly patients were affected with the median age group affected being 40±9 years. Females were more commonly affected (F: M = 2:1)³.

Patients were mostly referred from peripheral hospitals and only two patients were operated in our institution. On table identification of bile duct injury is rare as seen in our data - only one patient was diagnosed to have suffered bile duct injury during lap cholecystectomy in this study⁸.

Bile duct injury can be diagnosed by clinical history and examination and must be confirmed by imaging for planning further management. Blood investigations like complete blood count, renal function test and liver function test indicate presence of sepsis, organ failure and malnutrition.

USG abdomen is the initial imaging modality of choice. It has good sensitivity in detecting biloma and dilated biliary radicals. It also helps in the management of biloma with image guided percutaneous catheter drainage⁹. MRCP gives better road map of biliary tree for definitive surgical management as it delineates the type of bile duct injury.

In this study, 34 patients were referred within 3 weeks of bile duct injury. Most of them presented with bile leak and biloma. Only 3 patients presented with biliary peritonitis and were managed by emergency laparotomy and lavage following failed PCD. Others were managed with image guided percutaneous catheter drainage or ERCP stenting.

One patient presented with intraoperative bile duct injury and was managed by Hepaticojejunostomy.

Twenty patients were referred after a delay of 3 weeks. All of them presented with obstructive jaundice due to biliary stricture. Average no of hospital stay of these patients' ranged from 50-90 days. Seventeen patients had elevated WBC count and fever suggesting sepsis. Most of them presented with grade 1 cholangitis and were initially managed with antibiotics and elective bilioenteric bypass was done later. Only 2 patients presented with grade 3 cholangitis and were managed with emergency biliary decompression with PTBD. One of them died of cholangitis/septicemia. Thus, severe cholangitis was found to be a high risk factor for mortality following bile duct injury.

Most common types of injuries in early presentation was Strasberg type A, seen in 15 cases and that in delayed presentation group was Strasberg type E2 injury which was seen in 15 patients.

The patients were divided into two groups based on the type of presentation: Bile leak/biloma and jaundice due to stricture, for the purpose of analysis of success and outcomes of management modalities.

Thirty-four patients were included in Bile leak/biloma group (group 1). All cases underwent USG guided PCD initially. Only 6 were successfully managed with PCD alone. On evaluation with MRCP, all of them showed Strasberg Type-A bile duct injury. Success rate of PCD was 17%. Three patients who presented with biliary peritonitis were treated with emergency laparotomy and lavage following failure of PCD and ultimately needed definitive surgical drainage at a later date. In 28 patients in whom PCD failed, ERCP was attempted. ERCP stenting was successful in 9 patients, all with Strasberg type A injury. In the remaining 19 patients, ERCP stenting was not successful due to failure of cannulation. Success of ERCP in this group was 32%. There was no statistical significant difference in success rate, hospital stay and complications following these two procedures. There was no mortality¹⁰⁻¹¹.

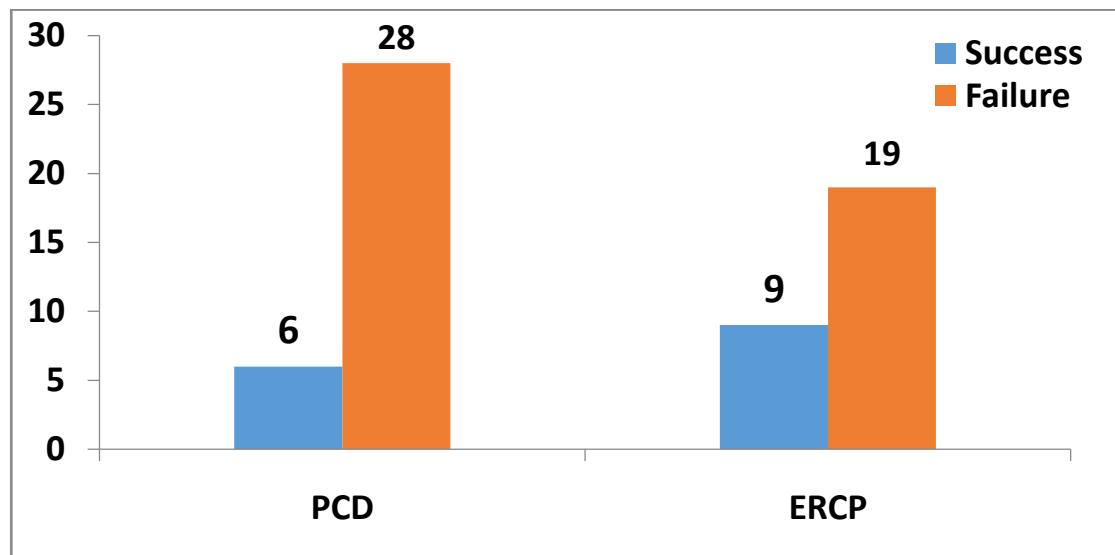


Chart 4: Management of bile leak / biloma (Group 1)

All the patients belonging to group 1 were followed up due to possibility of development of biliary stricture in the future. During the follow up of 3-6 months, 19 patients developed biliary stricture with obstructive jaundice. They underwent elective biliary drainage surgery later.

Patients belonging to group 2 (Jaundice with biliary stricture) presented late, usually after 3 weeks following cholecystectomy. It included 19 patients belonging to group 1 who failed to respond to PCD / ERCP and 23 patients who presented primarily with jaundice. They were evaluated with USG / MRCP, which showed biliary stricture, the most common being Strasberg type-E1 injury in 15 patients. ERCP was attempted in 18 patients but was successful in only 4 cases. One patient developed cholangitis following failed ERCP and emergency PTBD was done but he died due to septicemia.

Thirty-eight patients were treated with elective surgery. This includes 14 patients in whom ERCP failed. Thirty-six patients underwent hepaticojejunostomy and 2 underwent choledochoduodenostomy. Two patients in the postoperative period developed cholangitis and emergency PTBD was done. One patient died because of septicemia and organ failure while the other recovered. Success rate for surgery was 95%¹²⁻¹³.

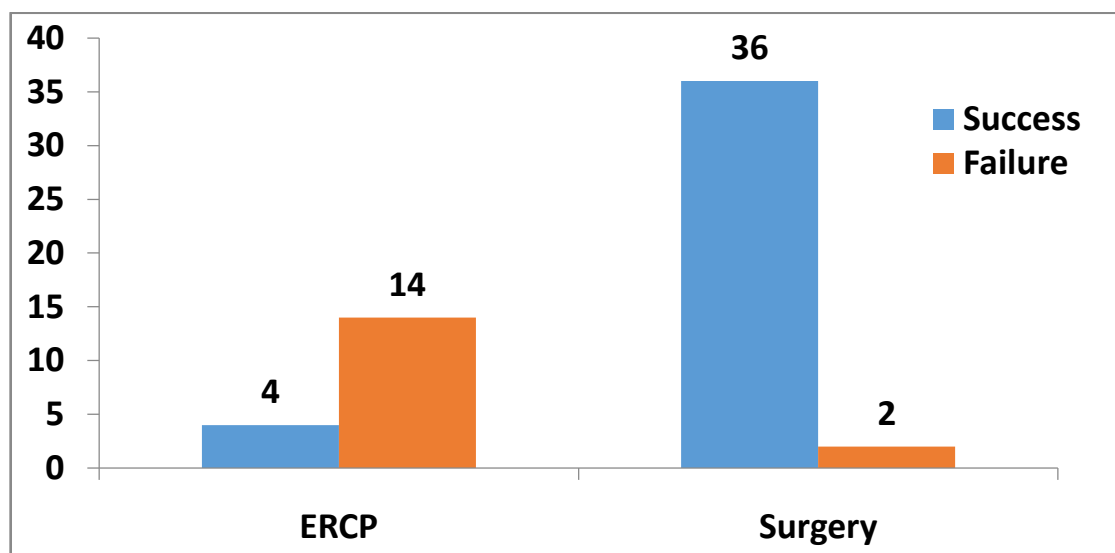


Chart 5: Management of Jaundice with biliary stricture (Group 2)

The overall mortality rate in this study was 3.4% (n=2). Cholangitis and failed drainage by surgery or PTBD were associated with increased risk of mortality.

VI. Conclusion

Bile duct injury is more common following laparoscopic than open cholecystectomy. In early cases, biloma/bile leak is the most common presentation and Strasberg type A is most common type of injury. In delayed cases, jaundice is the most common presentation and Strasberg type E2 is the most common type of injury.

Bile duct injury presenting with biloma and leak can be managed with either PCD or ERCP or both. These patients need to be followed up since they are prone to develop biliary stricture which needs definitive surgical management.

Bile duct injury presenting with jaundice secondary to stricture is best managed with definitive surgery rather than ERCP due to high success rate. Hepaticojejunostomy is the definitive surgery of choice in post cholecystectomy biliary stricture.

Cholangitis is a significant risk factor causing mortality following bile duct injury.

LIST OF ABBREVIATIONS

BDI	–	Bile duct injury
CBD	–	Common Bile Duct
IHBR	–	Intrahepatic biliary radicle
USG	–	Ultrasonogram
CT	–	Computed Tomography
CECT	–	Contrast Enhanced Computed Tomography
ERCP	–	Endoscopic Retrograde Cholangiopancreatography
MRCP	–	Magnetic Resonance Cholangiopancreatography
PCD	–	Percutaneous Catheter Drainage
PTBD	–	Percutaneous Transhepatic Biliary Drainage
HJ	–	Hepaticojejunostomy

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