



RESEARCH ARTICLE

MANAGEMENT OF POST SURGICAL BILIARY STRICTURES IN A TERTIARY LEVEL TEACHING HOSPITAL OF GUJARAT, A 09 YEARS EXPERIENCE OF A SINGLE GASTROSURGICAL TEAM

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Manuscript Info

Manuscript History

Received: 7 August 2025

Final Accepted: 9 September 2025

Published: October 2025

Key words:-

Iatrogenic Bile Duct Injury, Bile Duct Strictures, Hepaticojunostomy.

Abstract

Introduction: Bile duct injury (BDI) following cholecystectomy continues to be a serious iatrogenic complication that significantly affects patients' quality of life and results in high healthcare costs. Although the incidence of BDI during laparoscopic cholecystectomy has marginally increased { .4% to .6% } as compared to 1 to .2% during open cholecystectomy {18}, the overall number of cases remains substantial due to the high frequency of cholecystectomy procedures {1,13}. If bile duct injury (BDI) is not properly managed, it can lead to biliary stricture, which may result in serious complications such as recurrent strictures, cholangitis, or even liver function impairment leading to even cirrhosis. Open Roux-en-Y hepaticojunostomy {RY HJ}, when performed with precise surgical technique, continues to be the gold standard treatment, providing excellent long-term outcomes for most patients.

Methodology: This is a descriptive observational study with retrospective data analysis and prospective data collection with follow up which includes 60 patients, aged between 16 and 65 years, from a single gastrosurgery unit at SMT NHL Municipal Medical College in Ahmedabad, conducted over a 09-year period August 2015 and September 2024. Patients who underwent surgical management for definitive treatment of biliary injuries in the form of Roux en Y hepaticojunostomy (R-en-Y HJ), were included in the study. The study analysed demographic data, factors affecting surgical complications, long-term outcomes, and follow-up results.

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Results: Out of 60 patients, 34 were females, 26 were males. Mean age was 37.3 ± 14 Yrs. Out of 60 patients 2 were case of redo HJ. Patients were classified according to bismuth Strassberg type of injury and it was found that majority i.e. 47% had E2 type of injury, followed by 32% who had E3 type of injury. 13% had E1 injury, 7% had E4 injury and only 1 pt had E5 injury. USG and MRCP was performed in all patients. CT scan was performed in 83%

cases. liver biopsy was performed in 31 cases. Atrophy hypertrophy complex was observed in 4 out of 60 patients (6.7%). The mean duration between injury and repair was notably longer in patients with AHC, at 239 days, compared to 119 days for patients with biliary strictures undergoing hepaticojejunostomy (HJ) without AHC. Concurrent vascular injuries were identified in seven patients (11.6%). Common bile duct dilatation greater than 1.5 cm, type I Bismuth classification, total bilirubin levels, and albumin, were statistically correlated with favourable perioperative outcomes.

Conclusion: Optimizing preoperative nutrition, resolution of cholangitis if present, ensuring proper timing of the repair, and performing a tension-free mucosa to mucosa Roux-en-Y hepaticojejunostomy (R-en-Y HJ) that drains all ducts at an experienced hepatobiliary centre contribute to achieving the best outcomes.

Introduction:-

Cholecystectomy is among the most frequently performed abdominal surgeries. Iatrogenic injuries to the biliary tract leading to biliary strictures, that occur during upper abdominal surgeries and are mostly associated with cholecystectomy. These injuries not only heighten morbidity and mortality but also diminish patients' quality of life and survival, imposing a substantial financial burden on society and also are a leading cause of litigation. During the open cholecystectomy era, the bile duct injury rate was between 0.1% and 0.2%. However, with the rise of laparoscopic cholecystectomy, this rate has increased to between 0.4% and 0.6%{1,13,18}

The management of patients with iatrogenic bile duct strictures depends on several factors, including the timing of injury detection, the type of injury, patient-specific factors, and the availability of a skilled hepatobiliary surgeon. A tension-free, mucosa to mucosa, Roux-en-Y hepaticojejunostomy (R-en-Y HJ) is widely regarded as the most suitable treatment {2,3}. To understand the presence of postsurgical biliary strictures and identify the most effective treatment approach, and factors influencing the outcomes of repair, we analyzed the outcomes of surgical treatments in 60 patients, classified according to the Bismuth-Strasberg classification system. This study also assessed the clinicopathological factors affecting the results of hepaticojejunostomy performed for biliary strictures.

Materials and Methods:-

Between August 2015 and September 2024, 60 consecutive patients underwent Roux en Y HJ anastomosis for post-surgical bile duct stricture at the Smt. NHL Municipal Medical College, Ahmedabad, Gujarat. This mixed study spanned from August 2015 to September 2024 and included all patients referred to our department with bile duct strictures. Patients with bile duct strictures resulting from choledochal cysts, choledocholithiasis, sclerosing cholangitis, chronic pancreatitis, or ampullary disease were excluded from the study also patients treated solely with endoscopic or interventional radiological methods, and those lacking complete follow-up were excluded from the study.

We assessed several variables, including patient demographics, clinical and laboratory parameters, preoperative diagnosis, the type of bile duct injury based on the Bismuth-Strasberg classification, and the time between the injury and definitive treatment. Surgical factors analyzed were the duration of the procedure and the amount of blood loss, while postoperative factors included complications, length of follow-up, patient outcomes, and mortality rates. Preoperative blood tests and assessments to examine the biliary anatomy were performed on all patients. All patients were assessed by a multidisciplinary team consisting of gastrosurgeons, radiologists, and anaesthesiologists.

The standard surgical procedure performed was a tension-free mucosa-to-mucosa Roux-en-Y hepaticojejunostomy (HJ){4}, incorporating all ducts at the hilum. All surgeries were carried out using an open approach through a right subcostal incision extending to the midline. The extent of injury was confirmed using the Bismuth Strasberg classification. A side-to-side HJ was created with a 50 cm Roux loop in a retro colic manner. After the HJ, a stent was placed across the anastomosis in all patients, which was externalized and typically removed after 45 days after obtaining normal cholangiogram.

Patients were assessed through clinical examination and liver function tests were done between the 2nd and 5th postoperative days., we conduct follow-ups every two weeks for the first month, then at 6 weeks and 8 weeks, then at three months, and subsequently every six months for life, ensuring we capture any long-term complications to make sure we capture long-term complications earlier. Complications were categorized as early (occurring within 30 days) and late (occurring after 30 days). The analysis of overall postoperative morbidity, including anastomotic leakage,

anastomotic stricture, cholangitis, surgical-site infections (SSIs), pulmonary complications, deep vein thrombosis (DVT), incisional hernias, and reoperation, was correlated with preoperative factors such as included serum albumin levels, preoperative total bilirubin levels, intraoperative blood transfusions, age, body mass index (BMI), comorbid conditions, gender, type of biliary injury (E1-E5), and any associated vascular injuries.

Statistical analysis:-

Data collected for the study was initially entered into Microsoft Excel 2007 and subsequently transferred and analysed using SPSS version 21.

Descriptive Statistics:

Continuous variables were presented as means with standard deviations, while nominal or categorical variables were expressed as proportions and percentages. A p-value of less than 0.05 was considered statistically significant. MedCalc software version 12.2.1.0 was employed for all statistical calculations.

Bi-variate Analysis:

To examine the relationship between dependent and independent variables, appropriate statistical tests such as the chi-square test, fisher test and t-test were applied.

Results:-

During the study period, 60 patients underwent R-en-Y HJ anastomosis. Of these, 60,34 (56.7%) were female, and 26 (43.3%) were male. The mean age was 37.3 years and the mean body mass index (BMI) was 22.87. Comorbidities were identified in 8 patients (13.3%), with four having type 2 diabetes and 4 having both diabetes and hypertension. The demographic characteristics of our patients are summarized in Table 1.

TABLE 1

Variable	N=60	%	SD
Age (mean, SD)	37.3		13.77
Gender (female, %)	34	56.7	
Comorbidities, %	8	13.33	
Body Mass Index (mean, SD)	22.87		2.99
Type of Injury (Bismuth Classification)			
Bismuth I(%)	8	13.3	
Bismuth II(%)	28	46.7	
Bismuth III(%)	19	31.6	
Bismuth IV(%)	4	6.7	
Bismuth II (%)	1	1.7	

TABLE 2 Index Procedure Done

INDEX PROCEDURE	FREQUENCY	PERCENTAGE
LAP CHOLECYSTECTOMY	39	65%
OPEN CHOLECYSTECTOMY	11	18.3%
LAP TO OPEN CHOLECYSTECTOMY	9	15%
OPEN CHOLECYSTECTOMY WITH CBD EXPLORATION	1	1.7%
TOTAL	60	100%

Most common indication was symptomatic cholelithiasis n =40{66.7%}

General physical examination of patients in our study revealed that 71% patients had jaundice, 35% had itching, pale stool in 31.7% and other 32% patients had pain abdomen, which was similar to other study by Kapoor BS et al{14}. 12 patients in our study had fever and 8 patients had pedal oedema. During preoperative assessment mean hemoglobin and serum albumin values were 10.1 ± 1.8 gm/dl and 2.2 ± 0.23 gm/dl. Mean duration between injury and HJ is 99 days. The mean operative time duration for R-en-Y HJ was 189.9 ± 25 min and mean blood loss was 82 ± 20 ml.

During the surgical procedure, nodular liver was observed in two patients, while four patients exhibited the atrophy-hypertrophy complex (AHC). Additionally, three patients showed evidence of internal fistulisation with the duodenum. Hepaticojejunostomy was done after visualising, securing and including all 3 ducts in HJ anastomosis so as to drain all segments. Ductoplasty was done in 5 patients. Concurrent vascular injuries were identified in seven patients {11.6%}. There were no instances of postoperative mortality.

Postoperative complications occurred in 17 patients (28.3%) as shown in [Table 4]. The average preoperative total bilirubin level was 7.04 ± 3.4 mg/dL. At two weeks and three months post-surgery, the mean bilirubin levels were 1.72 ± 1.09 mg/dL and 0.9 ± 0.56 mg/dL, respectively. Two patients who experienced bile leaks responded positively to conservative treatment, with the leaks resolving on average eight days after the procedure. One patient developed an intra-abdominal bile collection, which was identified via ultrasound on postoperative day five and was managed with two pigtail catheters inserted percutaneously. The patient recovered well. Late postoperative complications included anastomotic stricture and incisional hernia. Anastomotic stricture was observed in two patients, occurring 12 and 16 months after the Roux-en-Y hepaticojejunostomy (HJ). Both patients required re-exploration and underwent redo HJ proximal to the original site. Incisional hernia developed in three patients.

Table 3-Outcomes Of HJ

	N	%	SD
PEROPERATIVE			
Time to repair	99 days		± 280 days
Duration of surgery	188.9 minutes		± 25 minutes
Blood loss	82ml		± 20 ml
Short-term complications <30 days			
Cholangitis	8	13%	
Transient bile leak	2	3.3%	
Sepsis	0	0	
Intraabdominal collection	1	1.17%	
SSI	7	11.7%	
Pulmonary complication	6	10%	
DVT	1	1.17%	
Long term complications > 30 days			
Stricture of HJ	2	3.3%	
Late reoperation	2	3.3%	
Incisional hernia	3	5%	

Table -4 Classification Of Complications According To Clavien Dindo Classification:

GRADE	NO. OF PATIENTS
Grade 1 SSI,	7
Grade 2 PULMONARY {Atelectasis} DEEP VEIN THROMBOSIS	6 1

Grade 3	
Incisional hernia	3
cholangitis	8
Transient bile leak	2
Intra-abdominal collection	1
Stricture at hj site	2
Grade 4	0
Grade 5	0

Total bilirubin value in our study was significantly decreased post operatively from 6.1 gm% to 0.98 gm% (3 months).ALP value in our study was also significantly decreased post operatively from 356 to 79.7 (3 months).

Table 5 - Factors Affecting Outcomes

LAB FINDINGS	DURATION BETWEEN INJURY AND HJ		P VALUE
	≤6 WEEKS	>6 WEEKS	
TBILURUBIN	1.83± 1.2	7±5.1	0.005
ALP	302.3±243	364.29±129	0.26
ALT	42.63±31	45±26	0.79
Hb	10.1±1.2	10±1.8	0.9
Platelet	3.18±1.5	3.2±3.4	0.89
Creatinine	1.27±0.97	0.95±0.6	0.07
TLC	9320±6500	8841± 6700	0.48
albumin	2.2±.23	3.1±.15	0.045

Table 6 - Dilatation Of The Bile Duct

Dilatation of the bile duct above stricture n (%)	
< 1.5 cm =1	29(48.33%) P=.047

1.5 to 3 cm =2	16(26.66%)
More than 3 cm =3	15(25.00%)

Table 7- Complications According To Early and Late Repair

Complication Type	Early (<8 weeks) Reconstruction (%) N=21	Late (>8 weeks) Reconstruction (%) N=39	Significance
Wound infection	3	4	.687
Transient Bile leak	1	1	.379
Overall immediate morbidity	6	11	1
Stricture	1	1	.38
Recurrent cholangitis	3	5	.875
Overall long-term morbidity	2	3	.807

We could not find any significant statistical difference between early, {less than 8 weeks} versus late repair {more than 8 weeks} which is similar to other studies{15,16,17}, however we now prefer to do it in >8 weeks duration, considering proper maturation of stricture, proper demarcation in cases of ischemic injury, settlement of inflammatory and infectious conditions and improvement of nutritional status.

Discussion:-

Biliary tract injuries are serious complications that significantly impact a patient's quality of life, with high morbidity rates{125,126}. Unfortunately, the incidence of these injuries has been rising due to the increasing number of cholecystectomies performed globally {1,13}. The indications for the initial surgeries in our study were symptomatic gallstones (76.7%), choledocholithiasis (11.1%), acute cholecystitis (5%), mucocele (2%), and gallbladder polyps (3.3%). Our study included 12 patients (20%) who underwent planned open cholecystectomy in outside hospitals, one of whom had a concomitant common bile duct (CBD) stone. Additionally, 39 patients (65%) had laparoscopic cholecystectomy, and 9 patients underwent laparoscopy that was later converted to open surgery. The primary clinical features in our patients included jaundice (71.7%), fever (20%), and pruritus (35%) clay stool [31.7%] which is similar to other studies[14]

The primary goal in treating a bile duct stricture is to ensure long-term symptom relief and to prevent the need for future hospitalizations. According to global literature, a tension-free mucosa to mucosa Roux-en-Y hepaticojejunostomy remains a safe and effective treatment option, associated with a lower incidence of stricture, making it the preferred choice for long-term management of these patients. Our experience aligns with this data, and we consider this surgical approach to be the optimal solution for this type of injury. The key surgical principle is to achieve a tension-free anastomosis by suturing healthy tissues {5,6,7}. One of the most commonly utilized systems for categorizing these injuries is the Bismuth classification, which we implement in our practice. According to this classification, the most prevalent lesions encountered were type II and type III. This is attributable to our status as a referral centre for hepatopancreatobiliary (HPB) surgery, where we handle more severe biliary tract injuries compared to other facilities.

In our series 11.6% of the patients who underwent HJ had concomitant vascular injuries, which were linked to the development of postoperative anastomotic strictures. The use of trans-anastomotic stents in Roux-en-Y hepaticojejunostomy is a subject of debate {8,9}. In our practice, we employed appropriately sized infant feeding tubes, which were exteriorized through the Roux limb. The stenting aimed to facilitate the anterior wall anastomoses, helpful in cases of anastomotic leaks, and primarily to obtain a postoperative tube cholangiogram that demonstrates adequate unobstructed drainage from all ducts, particularly in the context of a teaching hospital. Typically, the stent was clamped during the first postoperative week and removed after an average of 45 days following a normal cholangiogram.

Atrophy-hypertrophy complex (AHC) of the liver is a complication that can occur in patients with iatrogenic benign biliary strictures. In a study conducted in North India{10}, 36 out of 362 patients (9.9%) who underwent surgical repair were found to have AHC. In our study, AHC was observed in 4 out of 60 patients (6.7%). The mean duration between injury and repair was notably longer in patients with AHC, at 239 days, compared to 119 days for patients with biliary strictures undergoing hepaticojejunostomy (HJ) without AHC. This suggests that delayed repair may be associated with an increased likelihood of developing AHC.

Cirrhosis present at the time of bile duct injury repair is considered a poor sign and a major predictor of increased morbidity and mortality. Liver histology in patients with biliary strictures varies, showing changes from cholestasis, such as hepatocyte swelling, ballooning degeneration, periportal inflammation, and fibrosis, to advanced secondary biliary cirrhosis with regenerating nodules{11}. Intraoperative biopsies were performed on 31 out of 60 patients who underwent Roux-en-Y hepaticojejunostomy (HJ). Among them, four had clear evidence of secondary biliary cirrhosis, nine had mild to moderate fibrosis classified as early cirrhosis, and 18 had no fibrosis. The patients with cirrhosis presented for surgery at different times: one after 1 year, two between 6 months to 1 year, and one at 5 months following biliary injury. None of these patients developed significant portal hypertension, bleeding, or ascites during follow-up. Vascular injuries were seen in seven patients, four of whom had liver biopsies. Of these, three showed fibrosis, compared to 10 of 27 patients without vascular injury who also underwent biopsy. Although this finding was not statistically significant ($P = 0.19$) due to the small sample size, vascular injury could be a contributing factor to liver fibrosis.

In managing patients with biliary strictures, it is crucial to minimize both short-term and long-term complications to enhance their quality of life. In our study, the overall morbidity rate averaged 28.3%. The most significant complications identified were cholangitis and bile leaks. Cholangitis rates can range from 5% to 27% depending on the centre; in our institution, this complication occurred in 13.3% of cases and was managed conservatively. Another critical complication to consider is biliary leakage, which remains a significant concern despite the centre's experience the incidence of transient bile leak was 2.3%. All cases were managed conservatively, utilizing intraabdominal drains for patent drainage. One patient developed an intraabdominal collection that required drainage via ultrasound-guided aspiration.

In our study, we observed a mortality rate of zero, which can be attributed to our specialized and multidisciplinary management approach. This finding aligns with existing literature that emphasizes the significance of expert management in HPB surgery reference centres {12}. Our study revealed that several factors, including common bile duct dilatation greater than 1.5 cm, type I Bismuth classification, total bilirubin levels, and albumin, were statistically correlated with favourable perioperative outcomes.

Conclusion:-

The management of post-surgical biliary strictures through Roux-en-Y hepaticojejunostomy (R-en-Y HJ) demonstrates a viable pathway to achieve favourable long-term outcomes. Our 09-years experience supports that timely diagnosis, optimized preoperative preparation, and meticulous surgical technique—especially within a specialized hepatobiliary setting—play pivotal roles in reducing complications and ensuring durable success in biliary stricture management. The study identified specific preoperative and intraoperative factors, including bile duct dilatation and Bismuth classification type, as significant indicators of postoperative success. Future studies could focus on refining these approaches and exploring minimally invasive techniques to enhance outcomes further. This investigation affirms that with expertise and appropriate management strategies, patients with complex biliary strictures can achieve a significant quality of life improvement and reduction in morbidity.

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