

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Evaluation Of Permanent Duodenal Access Loop In Treatment Of Iatrogenic Bile Ducts Injuries, Comparative Study.

Hatem Mohammad¹, Tamer Mohamed Elshahidy², Mohamed Mahmoud Mokhtar², and Hazem Nour^{1*}.

¹Assistant professor of general surgery, Zagazig university, Egypt.

²Lecturer of general surgery, Zagazig university, Egypt.

ABSTRACT

Iatrogenic bile duct injuries are surgically treated with ROUX en Y hepaticojejunostomy but, complications as biliary-enteric anastomosis stricture, intrahepatic stones, and recurrent cholangitis are not uncommon, radiological interventional techniques for dilatation of the stricture and stone extraction are not successful in all patients, it needs a special facilities and expertise, the need for an access loop emerged to make use of the availability of ERCP and its therapeutic applications. A comparative study between two groups, group I; retrospective group, 21 patients underwent hepaticojejunostomy for treatment of iatrogenic bile duct injuries without access loop, in the period between January 2013 and December 2014, group II; a prospective group, 23 patients underwent hepaticojejunostomy for iatrogenic bile duct injuries with duodenojejunostomy as a permanent access loop, in the period between June 2017 and May 2019. Primary (early and late outcome) and management of complications data were collected and analyzed properly. Jaundice, pain and cholangitis are the main presentations, BDI occurred mostly post laparoscopic cholecystectomy, and Bismuth II level was the most common injury pattern, biliary stricture complicated 4 cases in group I and 3 cases in group II, incisional hernia occurred in 2 cases of each group, 2ry biliary cirrhosis complicated two cases of group I. Management of biliary enteric anastomotic stricture shows significant difference in favor of access loop group, as in group I we performed redo surgery in 3 of the 4 cases, in group II the 3 cases were managed successfully by ERCP balloon dilatation through the access loop. ROUX en Y hepaticojejunostomy with permanent duodenojejunostomy access loop is better in management of biliary enteric anastomotic complications without any need for surgical intervention.

Keywords: Bile duct injuries, access loop, duodenojejunostomy, hepaticojejunostomy

<https://doi.org/10.33887/rjpbcs/2020.11.4.7>

**Corresponding author*

INTRODUCTION

The incidence of iatrogenic bile duct injuries (BDI) is below 1% after open cholecystectomy, but with laparoscopic cholecystectomy, it reaches three folds that with open surgery. (1,2,3, 4)

When diagnosis of (BDI) is established, broad-spectrum parenteral antibiotics covering the common biliary pathogens was initiated, intraperitoneal collections could be drained through percutaneous route. (5,6,7).

Definitive management varies according to the class of biliary injury and timing of diagnosis, this includes, percutaneous transhepatic drainage (PTD), endoscopic retrograde cholangiography (ERC) with or without stent insertion in common bile duct (CBD), primary repair over T tube, choledocoduodenostomy, or hepaticojejunostomy. (8,9, 10).

The incidence of anastomotic stricture following hepaticojejunostomy in experienced centers is 4%–10% (11, 12) interventional techniques are less hazardous in management of biliary enteric anastomotic stricture, than surgery as the later carries a higher rate of morbidity and mortality (13,14,15,16) However, interventional techniques are prone also to complications and has some limitations for example management with conventional endoscopic retrograde cholangiography (ERC) via the oral route is impossible due to inaccessibility of the anastomosis (17,18).

Access loops were recommended for patients who are at risk of developing anastomotic strictures, such as those with stenotic proximal biliary tree, intra-abdominal abscesses, biliary fluid collections, external or internal biliary fistula, and revised hepaticojejunostomy (11,12). The aim of this study is to evaluate duodenojejunostomy as a permanent access loop in treatment of biliary-enteric anastomotic stricture following ROUX en Y hepaticojejunostomy as surgical treatment of iatrogenic bile ducts injuries.

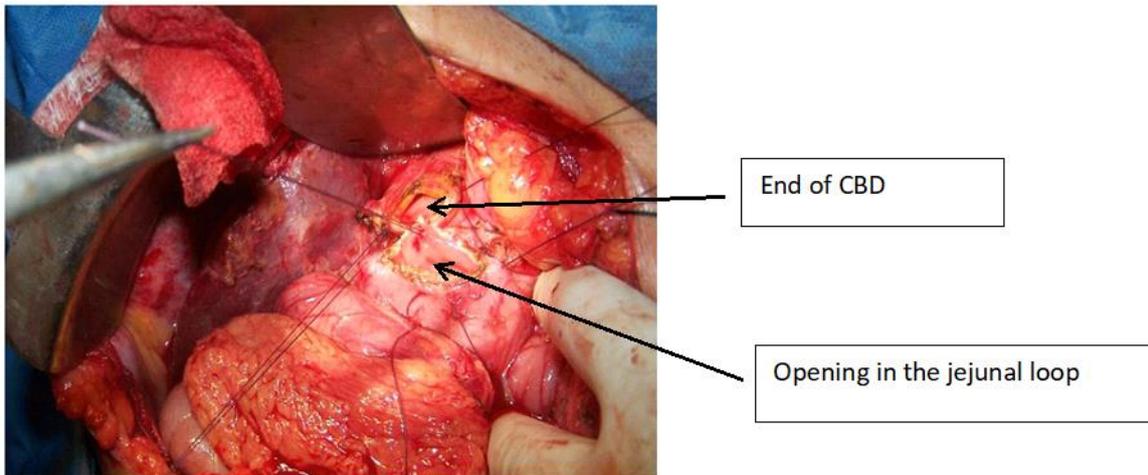
PATIENTS AND METHOD

This comparative study was held between two groups of patients with post cholecystectomy biliary injury; group (I) 21 patients, a retrospective group where data was collected from the medical records of patients presented with post cholecystectomy biliary injury and managed with hepaticojejunostomy without access loop in a period of 2 years between January 2013 and December 2014, and group (II) 23 patients, a prospective group, where patients presented with post cholecystectomy biliary injury in a 2 years period between January 2017 and December 2018, and managed by hepaticojejunostomy and jejunoduodenostomy as a permanent access loop.

The data collected from both groups included, demographic criteria of patients, type of the previous surgery, place of surgery, the class of the biliary injury according to bismuth classification, (Bismuth classification; type I (Low injury, stump length > 2 cm), type II) (higher injury, stump length < 2 cm), type III (high CHD injury but confluence is preserved), type IV (high injury both hepatic ducts are no more connected.). And any diagnostic or therapeutic intervention carried out before surgical management.

The detailed surgical management; in group I a roux en y hepaticojejunostomy was done, after abdominal exploration and identification of the level of injury or stricture a ROUX en Y loop of the jejunum was prepared 40 cm post duodenojejunal junction, it was separated and anastomosed to the jejunum at a more distal point (60 cm) the proximal end of the distal loop was closed in two layers with Vicryl 3\0 the loop was extracted retrocolic towards the site of injury where a hepaticojejunostomy was done end(biliary)to side (jejunum with Vicryl 4\0 size single layer .figure 1

Figure 1: hepaticojejunostomy



In the second group the same was done but with jejunoduodenostomy side to side at 5-10 cm distal to the site of hepaticojejunostomy as a permanent access loop.(fig 2a, 2b,2c)

Figure 2 a

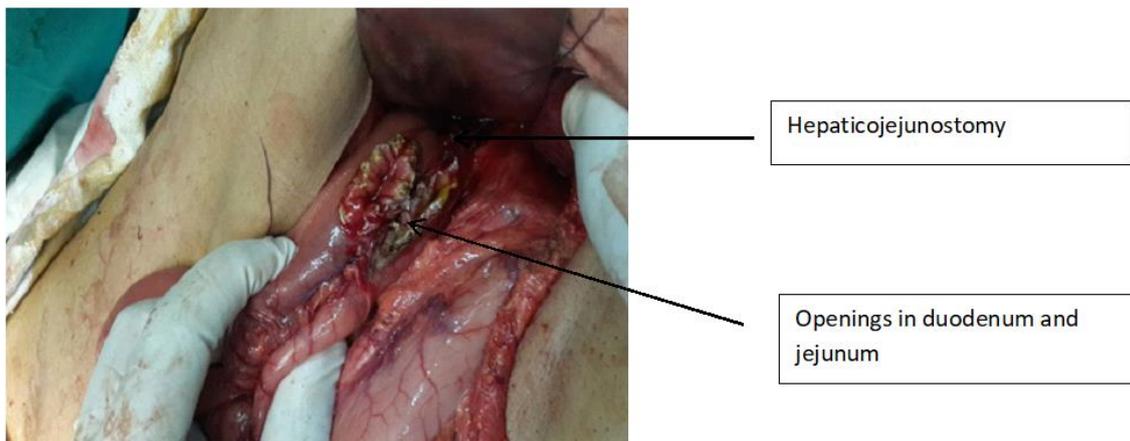


Figure 2b

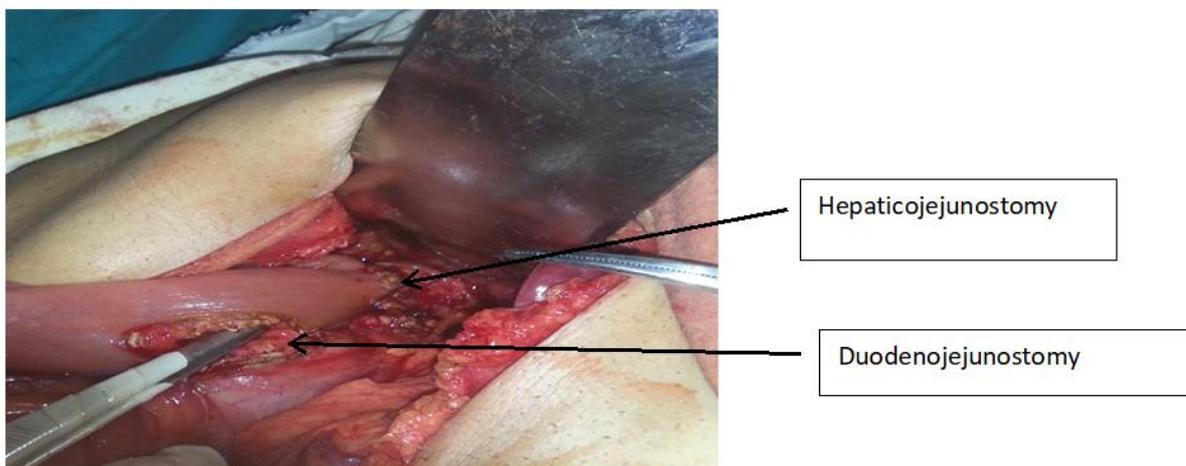
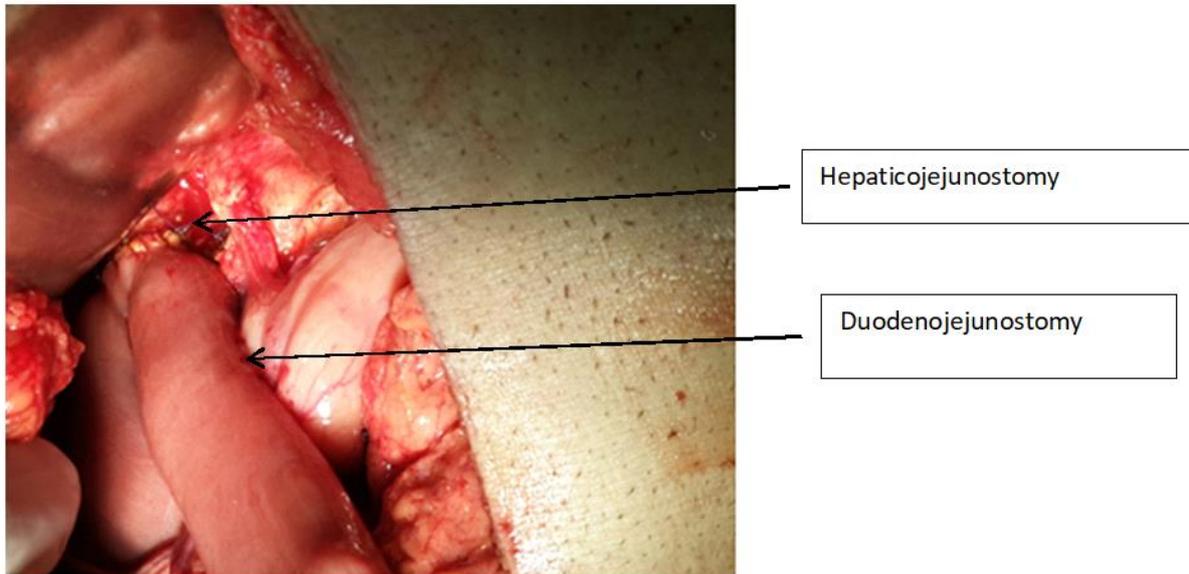


Figure 2c hepaticojejunostomy, duodenojejunostomy



Follow up data either clinical, laboratory or radiologic were collected, findings of MRCP (if needed) was reported as primary outcome.

Secondary outcome (management of complications of hepaticojejunostomy), including the operative time needed for correction of the complications, early and late postoperative morbidity and mortality.

Statistical analysis was carried out using SPSS V. 18, software. Statistical significance was achieved if P value was less than 0.05, numerical data were presented in means and standard deviation, we used t test , chi square as appropriate.

The current study has been reported in line with Consolidated Standards of Reporting Trials (CONSORT) Guidelines.

The study was approved by the institutional review board and ethical committee of our university hospitals, patients of the prospective group signed an informed written consent, the stud was registered in clinical trials with identifying number NCT04150679.

RESULTS

The mean age of patients in group I was 46.1±SD 13.4 and in group II; 47.7±SD 12.9. Gender presentation in group I; male to female was 28.6%:71.4%. In group II male and female presentation was 34.8% and 65.2%. Demographic data and associated diseases presented in table I.

Table (1). Demographic data of the study patients.

		Group I n=21	Group II n=23	P value
Age		Mean 46.1±SD 13.4	Mean 47.7±SD 12.9	0.36
gender	Male	6 (28.6%)	8 (34.8%)	0.65
	Female	15 (71.4%)	15 (65.2%)	0.65
Associated disease	DM	2 (9.5%)	4 (17.4%)	0.45
	IHD	2 (9.5%)	1 (4.35%)	0.5
	HTN	0	2 (8.7%)	0.16

(p < 0.05 = significant difference)

As presented in table (2) the most common presentation in both groups was jaundice followed by abdominal pain cholangitis and external biliary fistula without any significant difference between both groups. Acute cholecystitis occurred in 4 patients of group I and 5 cases of group II

Table (2), the presenting manifestations.

	Group I n=21	Group II n=23	P value
Jaundice	17 (80.9 %)	18 (78.2%)	0.82
Pain	15 (71.4)%	14 (60.8%)	0.46
Cholangitis	8 (38.1 %)	10 (43.4%)	0.71
EBF	6 (28.5 %)	7 (30.4%)	0.89

(p < 0.05 = significant difference)

Type and place of surgery presented in table (3) shows no significant difference between both groups.

Table (3), type and place of surgery.

		Group I n=21	Group II n=23	P value
Type of surgery	Lap	16 (76.2%)	17 (74%)	0.86
	Open	3 (14.3%)	3 (13%)	0.9
	converted	2 (9.5%)	3 (13%)	0.71
Place of surgery	Private	14 (66.7%)	15 (65.2%)	0.92
	MOH	5 (23.8%)	6 (26%)	0.86
	university	2 (9.5%)	2 (8.6%)	0.92

(MOH= ministry of health hospitals)

Preoperative findings as presented in table 4 shows no- significant difference between both groups.

Table (4), preoperative data

	Group I n=21	Group II n=23	P value
Bilirubin	10.6±6.58	11.1±6.3	0.79
Albumin	3.78±0.43	3.59±0.47	0.28
ALK-P	338.4±74.8	342.4±69.8	0.98
Fluid collection (US)	6 (28.6%)	8(34.8%)	0.65

Results of MRCP as a diagnostic tool shows a non-significant difference between both groups.

As shown in table (5) US drainage, done in 6 patients of group I and 8 patients of group II. PTD, done in one patient of group I and 2 patients of group II ERCP done to some patient as diagnostic tool , and stenting for one in group I and 3 in group II.

Table (5), preoperative intervention

		Group I n=21	Group II n=23
drainage	PTD	1(4.8%)	2 (8.7)
	US	6 (286%)	8 (34.8%)
	both	0 (0%)	1 (4.3%)
ERCP	stent	1 (4.8%)	3 (13%)

In both groups the operative findings presented in table 6 , as a rule group I patient had roux en y hepaticojejunostomy , the anastomosis carried out with Vicryl 4\0 , interrupted sutures. Group II patients has the same anastomoses with the same materials but with duodenojejunostomy , as the biliary limb of Roux en Y anastomosed to the duodenum side to side.

Table (6), the operative findings

		Group I n=21	Group II n=23
Cirrhosis		2	3
Biloma		6	8
Associate injury		0	0
Level of injury	I	5	4
	II	10	14
	III	3	3
	IV	3	2
Hepatotomy		2	2
Operative time		218.6±64.2	249.8± 70.58

The outcome in the terms of early postoperative complications in the 1st month revealed a near rate of early postoperative complications as shown in table 7,

Table (7) early postoperative complications.

	Group I n=21	Group II n=23	P value
Peritoneal collection	8 (38%)	9 (39%)	0.94
Bile leak	8 (38%)	7 (30.4%)	0.53
Wound infection	3 (14.2%)	3 (13%)	0.9

The late postoperative complications of patients of both groups (range of long term follow up 48 to 72 months in group I and 7 to 30 months in group II) which revealed as shown in table 8.

Table (8) late postoperative complications.

	Group I n=21	Group II n=23	P value
Biliary stricture	4 (19%)	3 (13%)	0.58
Recurrent cholangitis	7 (33.3%)	9 (39%)	0.69
2ry biliary cirrhosis	2 (9.5%)	0 (0%)	0.13
Incisional hernia	2 (9.5%)	2 (8.7%)	0.92

Regarding biliary leak the first line of treatment was drainage, with good results in 7 cases of group I, and 6 cases of group II, it failed to manage 1 cases in group I and one case in group II, the two cases underwent refashioning of the hepaticojejunostomy.

Biliary gastritis and cholangitis not associated with stricture underwent conservative measures with good results. In both groups

Biliary cirrhosis was managed medically and incisional hernia underwent mesh repair in both groups.

Regarding biliary stricture we got 4 cases in group I all underwent percutaneous transhepatic dilatation which succeeded in only one case and failed in 3 they underwent redo surgery, In group II we got 3 cases they underwent endoscopic dilatation and stent placement fig (3,4) through the access loop without any complications. By statistical analysis we got a significant difference between both groups in the need for surgical intervention to manage biliary stricture as a complication of the primary surgery. Table 9 shows the need for surgery to manage bile leak and stricture.

Fig 3 hepaticojejunostomy endoscopic view

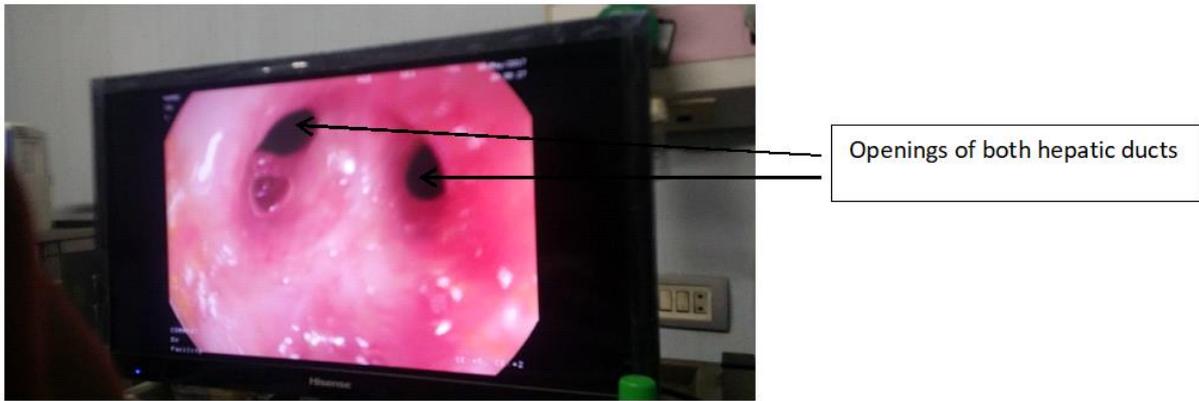


Fig 4 introduction of endoscopic balloon into stenotic biliary enteric anastomosis

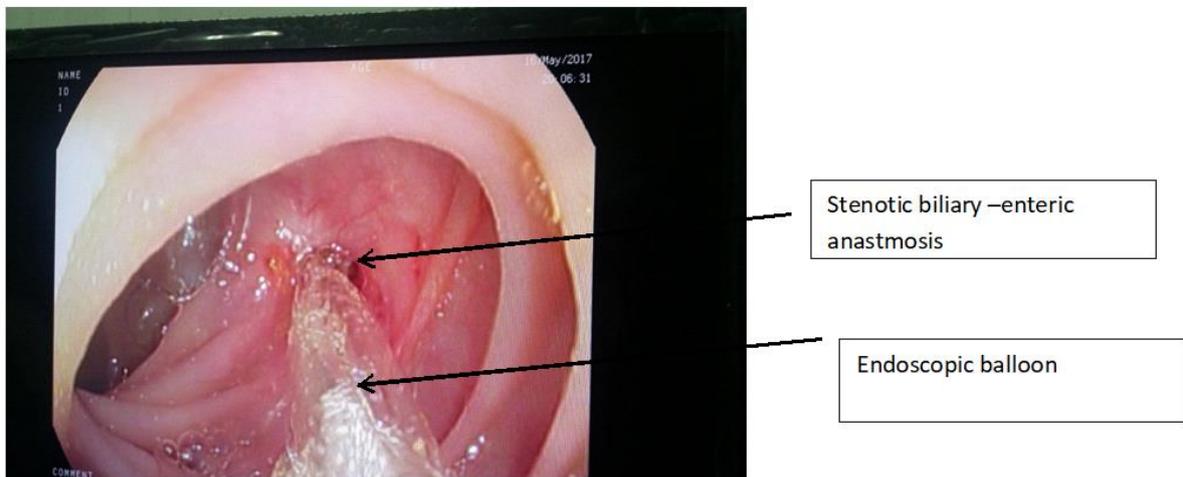


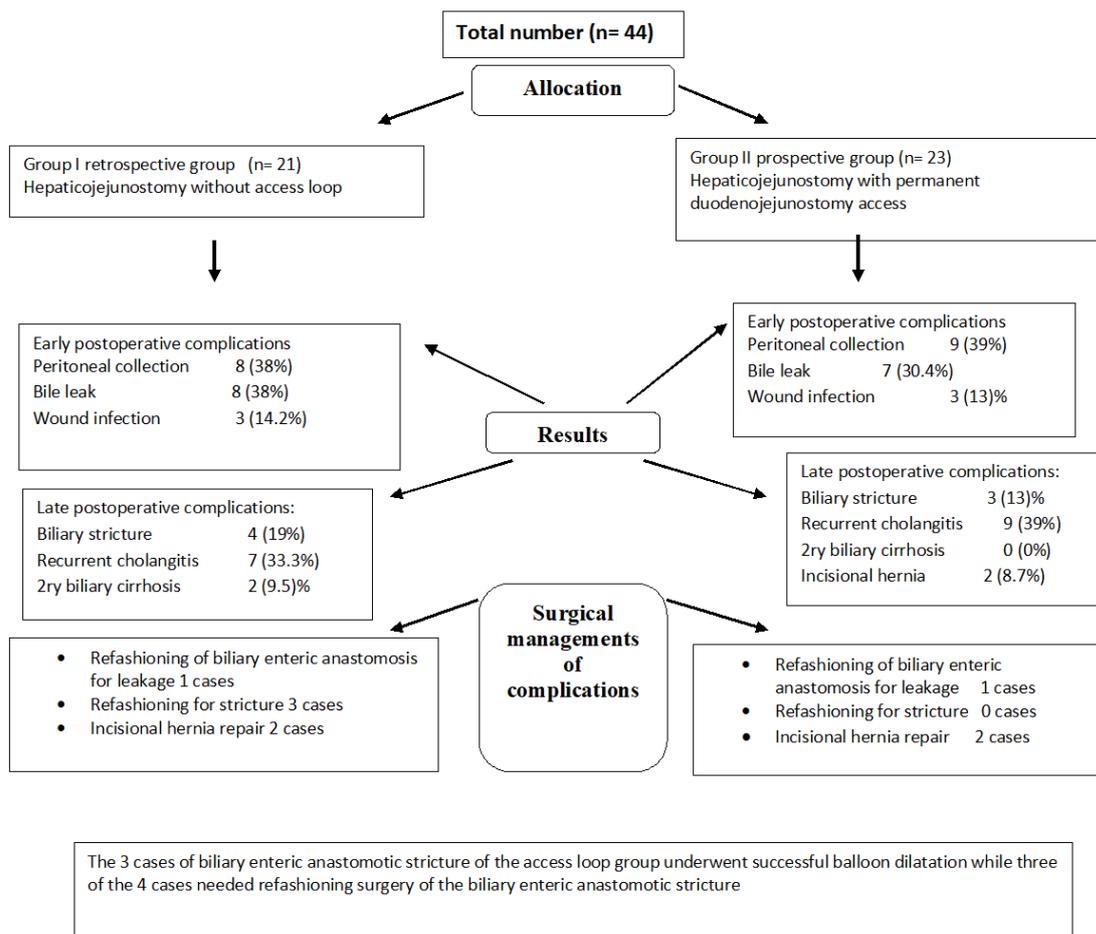
Table (9), the need for surgery to manage complications

	Group I n=21		Group II n=23		P value
	surgical	conservative	surgical	conservative	
Bile leak	1 (12.5%)	7 (87.5%)	1(14.3%)	6 (85.7%)	0.92
Biliary stricture	3 (75%)	1 (25%)	0	3 (100%)	0.04 *

*significant difference

Study flow is summarized in flow chart 1

Flow chart 1



DISCUSSION

Bile duct injury (BDI) is the most gruesome complication of cholecystectomy as it carries a significant morbidity, costs, impaired quality of life, and decreased survival. (19, 20).

BDI is a considerable challenge for surgeons (21-22). Hepaticojejunostomy (HJ) is thought by different authors as the definitive management of BDI as it offers the best possible long-term results (23-24-25)

Anastomotic site stricture is a recognized complication of hepaticojejunostomy. That may be caused by, Bismuth level of the injury, revision surgery, non-dilated proximal biliary system and electro cautery damage of the biliary duct (26, 27, 28). Stricture dilation by jejunal or transhepatic approach has shown good outcomes as in the study of **Booij** et al in 2018, however, the expertise and facilities may not be frequently available in some parts of the world (29).

The need for access loop for management of recurrent stones and recurrent biliary enteric anastomotic stricture emerged, and many studies evaluated different types of access loops, **Parlak et al** in 2011 evaluated the formation of permanent jejunal access loop stated and concluded that endoscopic intervention via a permanent access loop was safe and reliable in extracting biliary stones and for the management of anastomotic leakage without any complications, even if a permanent access loop has not been established during initial surgery, de novo access for the sake of endoscopic treatment is always possible. This method as a drawback, it needs surgical approach to reach the access loop thus subjecting patients to hazards of surgery and anesthesia (18).

Gastric access loop is generally not considered by many because of the risk of bile gastritis although there is no documented evidence of morbidity related to such access. (27). But **Jayasundara** concluded in his study in 2010 that Gastric access loop is useful adjunct in the surgical treatment of iatrogenic bile duct injuries especially if there is lack of radiologic expertise and equipment. Gastric access loop is accessible and safe for stricture dilatation and other endotherapeutic procedures, but it creates a possible route for bile to reach stomach increasing the incidence of biliary gastritis.(28)

Duodenal access loop for endoscopic access to hepaticojejunostomy was originally described by **Stiegmann et al.**(30) on seven patients. Endoscopic inspection of the biliary-enteric anastomosis was possible in three.

In our study the patients of both groups had nearly the same demographic data and there is no significant difference regarding the presenting symptoms of CBD injury, the type of surgery that led to CBD injury, the hospital where the primary surgery was carried out and the associated comorbidity, the level of CBD injury is slightly different in both groups but without significance.

ROUX en Y hepaticojejunostomy was the surgical procedure performed in group I, to manage the biliary injury while in group II we performed ROUX en Y hepaticojejunostomy with permanent access duodenojejunostomy side to side with the biliary limb in all patients, the operative time, intraoperative findings in both group are more or less nearby, the post-operative complications rate are more or less the same except secondary biliary cirrhosis which is higher in group I as the time of follow up in group II may be not sufficient for its development.

The results of management of complications as peritoneal collection, cholangitis, bile leak, wound infection or even incisional hernia had a non-significant difference between the two groups.

Patients with complicated biliary enteric anastomosis as a result of surgical correction of primary iatrogenic bile duct injury mostly suffer from impaired liver function, impaired healing power and are prone more to bleeding and biliary fistula formation, so if we offered a solution to manage complications of biliary enteric anastomosis without the need for surgery it is of great importance, permanent access duodenojejunostomy in our study achieved the target of safety and efficacy in treating complications of biliary enteric anastomosis as, in group I stricture occurred in 4 cases (19%) trial of management by PTD and balloon dilatation succeeded only in one case and surgery was needed in 3 cases to refashion the biliary enteric anastomosis, while in group II stricture occurred in 3 cases (13%), ERCP balloon dilatation and stent placement managed the condition in the three cases, the procedures were performed easily without any difficulty, without any need for surgery to approach the access loop, thus there is no need for surgical refashioning, especially if those patient had impairment of liver function that increased possibility of bleeding, fistula formation and further liver function impairment.

Limitations of this study may be attributed to the relatively small sample number and the surgical maneuver being carried out by different group of surgeons and the difference in the follow up time of both groups.

Conclusion

Management of BDI by ROUX en Y hepaticojejunostomy with permanent access duodenojejunostomy is better than ROUX en Y hepaticojejunostomy without access loop as it provides an easy way to manage complications of biliary enteric anastomoses without the need for another surgery.

REFERENCES

- [1] McKinley SK, Brunt LM, Schwaitzberg SD. Prevention of bile duct injury: the case for incorporating educational theories of expertise. *Surg Endosc.* 2014; 28: 3385– 91.
- [2] Suo T, Chen L, Liu H, Ni X, Shen S, Wang Y, et al. Management for a complicated biliary stricture after iatrogenic bile duct injury. *J Vis Surg* 2017;3:33.
- [3] Vikas G, Ashish G, Thakur D, Bhagwant R, Rakesh K. Post-cholecystectomy acute injury: What can go wrong? *Ann Hepatobiliary Pancreat Surg* 2019;23:138-144.

- [4] Lau W-Y, Lai ECH: Classification of iatrogenic bile duct injury. *Hepatobiliary Pancreat Dis Int* 2007; 6:459–463.
- [5] Lillemoe KD: Benign post-operative bile duct strictures. *Baillieres Clin Gastroenterol* 1997; 11: 749–779.
- [6] Karanikas M, Bozali F, Vamvakierou V, Marou M, Chassan M, Efraimidou E et al: Biliary tract injuries after lap cholecystectomy types, surgical intervention and timing. *Ann Transl Med* 2016; 4: 163.
- [7] Renz B, Bösch F, and Angele M . Bile Duct Injury after Cholecystectomy: Surgical Therapy. *Visc Med* 2017;33:184–190.
- [8] Aggarwal R, Crochet P, Dias A, Misra A, Ziprin P, Darzi A: Development of a virtual reality training curriculum for laparoscopic cholecystectomy. *Brit J Surg* 2009; 96: 1086–1093.
- [9] Lillemoe KD: Benign post-operative bile duct strictures. *Baillieres Clin Gastroenterol* 1997; 11: 749–779.
- [10] Pesce A, Palmacci S, LaGreca G and Puleo S. Iatrogenic bile duct injury: impact and management challenges *Clinical and Experimental Gastroenterology* 2019;12 121–128
- [11] Stewart L, Way LW. Bile duct injuries during laparoscopic cholecystectomy. Factors that influence the results of treatment. *Arch Surg* 1995; 130: 1123–1129
- [12] Davids PH, Tanka AK, Rauws EA, van Gulik TM, van Leewen DJ, de Wit LT et al. Benign biliary strictures. Surgery or endoscopy? *Ann Surg* 1993; 217: 237–243
- [13] Way LW, Bernhoft RA, Thomas MJ. Biliary strictures. *Surg Clin North Am* 1981; 61: 963–972
- [14] Pitt HA, Miyamoto T, Parapatis ST , Tompkins RK, Longmire WP. Factors influencing outcome in patients with postoperative biliary strictures. *Am J Surg* 1982; 144: 14–21
- [15] Kim JH, Lee SK, Kim MH, Song MH, Park DH, Kim SY, Lee SS, et al. Percutaneous transhepatic cholangioscopic treatment of patients with benign bilio-enteric anastomotic strictures. *Gastrointest Endosc* 2003; 58: 733–738
- [16] Vos PM, van Beek EJ, Smits NJ, Rauws EA, Gouma DJ, Reeders JW. Percutaneous balloon dilatation for benign hepaticojejunostomy strictures. *Abdom Imaging* 2000; 25: 134–138
- [17] Parlak E, Çiçek B, Dişibeyaz S et al. Endoscopic retrograde cholangiography by double balloon enteroscopy in patients with Roux-en-Y hepaticojejunostomy. *Surg Endosc* 2010; 24: 466–470
- [18] Parlak E, Disibeyaz S, Oztas E, Cicek B, Ulas M, Ozogul Y, et al. Endoscopic treatment of biliary disorders in patients with Roux-en-Y hepaticojejunostomy via a permanent access loop. *Endoscopy*. 2011;43(1):73–6.
- [19] 19-Flum DR, Cheadle A, Prela C, Dellinger EP, Chan L. Bile duct injury during cholecystectomy and survival in medicare beneficiaries. *JAMA* 2003;290:2168-73.
- [20] Booij KAC, de Reuver PR, van Dieren S, van Delden OM, Rauws EA, Busch OR, et al. Long-term impact of bile duct injury on morbidity, mortality, quality of life, and work related limitations. *Ann Surg*. 2018;268(1):143–150..
- [21] Strasberg SM, Helton WS. An analytical review of vasculobiliary injury in laparoscopic and open cholecystectomy. *HPB (Oxford)* 2011;13:1-14.
- [22] Stilling NM, Fristrup C, Wettergren A, Ugianskis A, Nygaard J, Holte K, et al. Long-term outcome after early repair of iatrogenic bile duct injury. A national Danish multicentre study. *HPB (Oxford)* 2015;17:394-400.
- [23] Sicklick JK, Camp MS, Lillemoe KD, Melton GB, Yeo CJ, Campbell KA, et al., Surgical management of bile duct injuries sustained during laparoscopic cholecystectomy: perioperative results in 200 patients, *Ann. Surg.* 2005; 241 786-795.
- [24] Tocchi A, Mazzoni G, Liotta G, Costa G, Lepre L, Miccini M, et al., Management of benign biliary strictures: biliary enteric anastomosis vs endoscopic stenting. *Arch. Surg.* 2000; 135 (2) 153-157.
- [25] W.R. Jarnagin, L.H. Blumgart, Operative repair of bile duct injuries involving the hepatic duct confluence, *Arch. Surg* 1999, 134 (7) 769-775.
- [26] Selvakumar E, Rajandran S, Balachandar TG, Kannan DG, Jeswanth S, Ravichandran P, et al. Long-term outcome of gastric access loop in hepaticojejunostomy. *Hepatobiliary Pancreat Dis Int* 2008;7:152e5.
- [27] Dawson SL, Mueller PR. Interventional radiology in the management of bile duct injuries. *Surg Clin North Am* 1994;74: 865e74.
- [28] Jayasundara JASB, De Silva WMM, Pathirana AA: Therapeutic value and outcome of gastric access loops created during hepaticojejunostomy for iatrogenic bile duct injuries. *Surgeon*. 2010, 8: 325-329.



- [29] Klaske A.C, Robert J, Philip R, Marc G. B, Otto MV, Erik A et al. Long-term follow-up and risk factors for strictures after hepaticojejunostomy for bile duct injury: An analysis of surgical and percutaneous treatment in a tertiary center. *Surgery* 2018; 163; (5), 1121-1127
- [30] Stiegmann GV, Mansour MA, Goff JS, Pearlman NW. Roux-en- Y jejunoduodenostomy for endoscopic access to hepaticojejunostomy. *Surg Gynecol Obstet* 1991;173:153e4.