Postoperative outcomes of hepaticojejunostomy for benign biliary diseases

Original Article

Ahmed M. Ghanem, Mohamed Amer and Waleed M. Ghareeb

Department of General Surgery, Faculty of Medicine, Suez Canal University, Suez Canal, Egypt.

ABSTRACT

Background: Roux-en-Y hepaticojejunostomy (RYHJ) is currently considered the definitive treatment for iatrogenic bile duct injuries. This work aimed to assess the medical indications for HJ and analyze the postoperative complications of HJ.
Patients and Methods: This prospective observational was conducted on 33 patients who underwent HJ for various benign diseases. The patients were divided into two groups: Patients with complications (n=19) and no complications group (n=14).
Results: Patients with complications had a longer mean hospital stay and a higher average blood loss compared with those without complications. The logistic regression analysis identifies several variables potentially impacting the likelihood of postoperative complications, though none achieve statistical significance under the traditional *P value* threshold of 0.05. Age (*P=0.075*) and diabetes (*P=0.078*) approach significance, suggesting their possible influence on complication rates.
Conclusion: Our study concluded that age and diabetes demonstrate higher associations with complication rates. Chest infections is the most common postoperative complication. In the group with complications exhibited elevated bilirubin levels greater than 2 mg/dl.

Key Words: Benign biliary diseases, complications, hepaticojejunostomy, outcomes.

Received: 2 May 2024, **Accepted:** 10 May 2024, **Publish:** 4 October 2024

Corresponding Author: Ahmed M. Ghanem, MD, Department of General Surgery, Faculty of Medicine, Suez Canal University, Suez Canal, Egypt. **Tel.:** +201141299729, **E-mail:** ahmedghanem215@gmail.com

ISSN: 1110-1121, October 2024, Vol. 43, No. 4: 1344-1350, © The Egyptian Journal of Surgery

INTRODUCTION

While most hepatobiliary surgeons perform hepaticojejunostomy (HJ) often, this time-tested and robust treatment is very uncommon in routine general surgical practice[1]. To guarantee great long-term outcomes, it is important to understand the technical components of this reconstructive process, particularly the latest developments in precise suturing procedures of the colon to the bile ducts. The need for improved anastomotic procedures was underlined by disappointing results (stricture, leak, sepsis) of bile duct-to-bile duct or bile duct-to-intestine anastomoses[2]. Exciting developments have occurred recently in the creation of absorbable tiny sutures and their use for careful side-to-side or end-to-side biliary enteric anastomoses. Due to the increased risk of bile duct damage associated with laparoscopic cholecystectomy, HJ is currently being utilized more often[3,4].

Aside from choledochal cyst resections, penetrating trauma of the porta hepatis, previous bilioenteric operations with subsequent stricture formation, biliary fibrosis caused by chronic pancreatitis, and other causes of iatrogenic biliary trauma like gastrectomy, pancreatic and hepatic resections, portal decompressive procedures, and liver transplantation, these are other significantly less common indications for HJ[5,6]. As the last stage of the respective procedure or as a palliative attempt to relieve jaundice in cases of unrespectability, HJ may also be indicated for malignant conditions such as cholangiocarcinomas and carcinomas of the gallbladder infiltrating the common bile duct (CBD) or hepatic ducts[7].

HJ surgery has had excellent recent results, with numerous series reporting success rates over 90% after a lengthy period of follow-up. These success rates from centers of excellence are attributed to good surgical skill, a thorough understanding of biliary anatomy, and the ability to adjust intraoperatively to account for anatomic variations[8]. They have also improved outcomes over the previous ten years.

Similar contributions to better results have come from drainage tubes, stents, interventional radiologic methods, and enhanced postoperative care. Before beginning reconstruction, all patients undergoing HJ must have a ‘road map‘ of their biliary trees. To identify the anatomy that may be challenging to delineate intraoperatively, invasive procedures like endoscopic retrograde cholangiography or, more frequently, percutaneous

DOI: 10.21608/EJSUR.2024.286801.1063

transhepatic cholangiography and noninvasive procedures like magnetic resonance cholangiography are available[9].

The use of these imaging modalities is contingent upon the suspicion of the stricture/tumor placement; percutaneous transhepatic cholangiography is the most effective method for studying high (proximal) stenoses, while endoscopic retrograde cholangiography is the best method for studying low (distal) stenoses. Magnetic resonance cholangiography is used to examine patients with contrast allergies, albeit we prefer the higher resolution of the earlier procedures. Complementary examinations like computed tomography and ultrasonography come in handy in some circumstances, such as confirming the existence of a biloma or elucidating the extent of the tumor[10,11].

PATIENTS AND METHODS:

This study was prospective study and included 33 cases who had HJ for benign biliary conditions and followed-up for 90 days postoperative in the period between January 2022 and December 2023 It was conducted at Suez Canal University Hospitals. All subjects provided written informed consent

Inclusion criteria:

patients with nonmalignant biliary Conditions requiring biliary bypass, and from both sex and included American Society of Anesthesiologists (ASA) I, II, III patients.

Exclusion criteria:

Patients with malignant biliary conditions, patients who underwent previous HJ, patients who had cholodecojejunostomy or cholodecodoudenostomy, ASA IV, and patients lost in follow-up period.

The patients were divided into two groups: patients with complications (n=19) and no complications group (n=14).

All patients were subjected to full history taking including demographics (age, sex, and BMI), comorbidities (Diabetes), and ASA classification. Laboratory parameters include hemoglobin, total leukocyte counts, serum bilirubin, and serum albumin. Preoperative stenting. Intraoperative variables include operative time and blood loss. Postoperative assessment as total hospital stay, complications, reintervention, and mortality

Procedure

The location selected for the Roux limb is around 40 cm away from the duodenojejunal junction. The jejunum is divided with a stapler. To get to the CHD region, the Roux limb is passed retrocolically, to the right of the main colic artery. With an end-to-side anastomosis, the jejunum is cut across its ant mesenteric border one centimeter in front of the stapled site; the long portion distal to the planned anastomosis should not be preserved since it might result in a blind loop and recurring infection. Polydioxanon (4/0) sutures were used to close the anastomosis. Either continuous sutures or interrupted sutures were used for posterior-wall anastomosis. An interrupted pattern of anterior sutures was obtained. Knots are knotted consecutively at the end after all bites have been taken.

It is not necessary to stent the HJ; however, it can be done using an epidural or 6-to 8-Fr tiny stent. When finished, it is removed externally by the Roux jejunal limb and exits the body through an abdominal stab incision. To finish the Roux-en-Y anastomosis, an entero-enterostomy is performed 60 cm distal to the stoma. This is often done side-to-side using a stapler or hand sewing. Lastly, a second stab hole in the abdominal wall is used to bring out a tubal drain.

Postoperative assessment

The Clavien Dindo categorization system was used to grade all postoperative problems. ‘Severe complications’ were defined as Clavien Dindo grade III or greater complications. The length of hospital stay was calculated from the day of operation to release. Patients were tracked until at least 90 days after surgery to track their recovery and look for any problems.

Statistical analysis

The collected data was analyzed using the Statistical package for Social Science v.25 (IBM Corp. Released 2017, Armonk, NY: IBM Corp.). Mean, Standard deviation (± SD), Median and range for numerical data. Frequency and percentage of non-numerical data. Student T Test was used to assess the statistical significance of the difference between the two study group means. Mann–Whitney Test was used to assess the statistical significance of the difference of a non-parametric variable between two study groups. χ^2 test was used to examine the relationship between two qualitative variables. Logistic regression analyses were used for prediction of risk factors when dependent variable is categorical, using generalized linear models. A two-tailed *P value* less than 0.05 was considered significant.

RESULTS:

Age shows that individuals with complications are older on average compared with those without complications. The statistical test yields a significant difference (*P=0.029*). No significant difference between studied groups according to sex distribution, Comorbidities, ASA classification, BMI, and Bilirubin (Table 1).

No statistical difference between the two groups regarding preoperative stenting, indication for HJ, operative time, and Blood loss. Patients with complications had a longer mean hospital stay compared with those without complications statistically significant difference with a *P value* of 0.03 (Table 2).

Regarding postoperative complications, the analysis shows varied frequencies of complications, including visceral injury (5.3%), biliary leakage (15.8%), bilomas (5.3%), postoperative bleeding (5.3%), cholangitis (15.8%), chest infections (47.4%), and wound infections (26.3%) among the group with complications (Table 3).

Table 4 shows a comparison between studies according to reintervention and mortality.

The logistic regression analysis identifies several variables potentially impacting the likelihood of postoperative complications, though none achieve statistical significance under the traditional *P value* threshold of 0.05. Age (*P=0.075*) and diabetes (*P=0.078*) approach significance, suggesting their possible influence on complication rates. The total hospital stay also shows a nearly significant association (*P=0.073*). Other variables, including sex, BMI, bilirubin levels, and operative factors like preoperative stenting and blood loss, demonstrate weaker associations, suggesting that while certain demographic and clinical characteristics may influence complication risks, the complex interplay of multiple factors determines the overall complication trajectory in surgical patients (Table 5).

Table 1: Comparison between studied groups according to demographic data, comorbidities, American Society of Anesthesiologists classification, BMI and Bilirubin

	With complications	No complications	
	N=19 [*n* (%)]	*N*=14 [*n* (%)]	Test Result
Age (years)	48.68±12.06	38.50±18.54	*P*=0.029*
Sex			
Female	11 (57.9)	10 (71.4)	*P*=0.486
Male	8 (42.1)	4 (28.6)	
Comorbidities			
Diabetes	10 (52.6)	3 (21.4)	*P*=0.087
ASA classification			
I	10 (52.6)	5 (35.7)	*P*=0.214
II	7 (36.8)	4 (28.6)	
III	2 (10.5)	5 (35.7)	
BMI (kg/m^2)	32.42±5.81	30.57±6.30	*P*=0.432
Bilirubin > 2 mg\dl	11 (57.9)	10 (71.4)	*P*=0.486

Data is expressed as the mean±SD, * for significant *P value* (*<0.05*).

Table 2: Comparison between studies according to preoperative stenting, indication for hepaticojejunostomy, operative time, blood loss, hospital stay

	With complications	No complications	
	N=19 [*n* (%)]	*N*=14 [*n* (%)]	*P* value
Preoperative stenting	8 (42.1)	6 (42.9)	*P*=1.000
Indication			
BDI post-cholecystectomy	12 (63.2)	6 (42.9)	*P*=0.187
Cholecystocholedochal fistula	2 (10.5)	1 (7.1)	
Choledochal cyst	0	3 (21.4)	
Inflammatory stricture	5 (26.3)	4 (28.6)	
Operative time (min)	222.11±46.26	195.00±40.71	*P*=0.090
Blood loss (ml)	910.53±357.69	721.43±254.74	*P*=0.102
Total hospital stay (days)	8.74±4.01	6.43±1.79	*P*=0.039*

Data is expressed as the mean±SD, * for significant *P value* (*<0.05*).

Table 3: Distribution of postoperative complications

	With complications
	N=19 [*n* (%)]
Complications	
Visceral injury	1 (5.3)
Biliary leakage	3 (15.8)
Bilomas	1 (5.3)
Postoperative bleeding	1 (5.3)
Cholangitis	3 (15.8)
Chest infection	9 (47.4)
Wound infection	5 (26.3)

Table 4: Comparison between studies according to reintervention and mortality

	With complications	No complications	
	N=19 [*n* (%)]	*N*=14 [*n* (%)]	Test Result
Reintervention			
Reoperation	2 (10.5)	0	*P*=0.296
Us guided drainage	1 (5.3)	0	
Mortality			
No	19 (100.0)	14 (100.0)	*P*=1.000

Table 5: Logistic regression analysis of predictors associated with for complication

Variable	*P*-value	OR	CI Lower 5%	CI Upper 95%
Age	0.075	1.049	1.004	1.095
Sex	0.427	0.550	0.160	1.896
Diabetes	0.078	4.074	1.098	15.116
ASA classification	0.337	0.500	0.152	1.641
BMI	0.381	1.057	0.952	1.174
Bilirubin > 2 mg\dl	0.427	0.550	0.160	1.896
Preoperative stenting	0.966	0.970	0.300	3.130
Operative time	0.098	1.015	1.000	1.030
Blood loss	0.107	1.002	1.000	1.004
Total hospital stay	0.073	1.394	1.027	1.892

CI, confidence interval; OR, odds ratio.
*: Significant less than or equal to 0.05.

DISCUSSION

Roux-en-Y Hepaticojejunostomy, or RYHJ, is a typical operation. It is the most popular method of reconstructing the biliary channel due to its high success rates, which were documented as early as the century1-4, and its ongoing safety legacy. The procedure's indications have been numerous and diverse. The use of RYHJ has been questioned due to the development of interventional radiology (such as transhepatic stenting), endoscopic procedures (such as ERCP stenting), and the demand for alternative bilioenteric anastomosis, including choledochoduodenostomy, cholecystoduodenostomy, hepaticoduodenostomy (HD), and choledochocholedochal anastomosis[2].

According to demographic data in the studied groups, age shows that individuals with complications are older on average (mean age 48.68 years, SD = 12.06) compared with those without complications (mean age 38.50 years, SD = 18.54). The statistical test yields a significant difference (*P=0.029*). Regarding sex distribution, 57.9% of the group with complications are female, compared with 71.4% in the no complications group. No significant difference between studied groups according to sex distribution.

Shalayiadang and colleagues retrospectively analyzed 61 patients with biliary stricture undergoing revisional cholangiojejunostomy. There were 23 male

and 38 female patients, whose ages ranged from 21 to 74 years with a mean age of (49.87 ± 12.47) years[12].

Jha *et al*., included 51 patients undergoing Roux-en-Y HJ for benign biliary diseases. They noted that mean age of patients was 37.9±15.1 years and 34 (66.7%) were female. The mean age of patients with BDI was 41.38±10.859 years while the mean age of those with choledochal cyst excision was 29.06±17.796 years[13].

The current research found that in the group with complications, diabetes is significantly more prevalent, affecting 10 individuals or 52.6% of the group, compared with just three individuals or 21.4% in the group without complications. There is no significant difference between the studied groups according to the distribution of diabetes.

The current investigation found that in examining the ASA classification, the distribution reveals no statistically significant difference (*P=0.214*). Specifically, a higher percentage of patients with complications are categorized as ASA I (52.6%) compared with those without complications (35.7%), while a surprisingly higher percentage of those without complications are rated as ASA III (35.7%) compared with those with complications (10.5%). The mean BMI for those with complications is slightly higher at 32.42 (±5.81) compared with 30.57 (±6.30) for those without complications. No statistically significant difference in BMI between study groups.

Comparable with our findings, Jha *et al*., concluded that ASA class 1 was 22 (68.8%), ASA class 2 was 8 (47.1%), and ASA class 3 was 3 1 (50%) in group without complications 10 (31.2%), ASA class 2 was 9 (52.9%) and ASA class 3 was 3 1 (50%) in group without complications with no significant difference between both groups. BMI was insignificant difference between group without complications and group with complications[13].

In the current study, in the group with complications, 11 (57.9%) patients exhibited elevated bilirubin levels, while a slightly higher percentage of 10 (71.4%) patients was noted in the group without complications. Despite the greater prevalence of elevated bilirubin levels in the no complications group, the statistical test indicates no statistically significant difference between the two groups.

In agreement with our study, Jha and Adhikar, documented that mean bilirubin level in patients with severe complications was 11.84 mg/dl compared with 4.59 mg/dl in those without[13].

Shalayiadang and colleagues showed that the first preoperative total bilirubin level was more than 200 μmol/L in nine patients and there were varying degrees of short- and long-term postoperative complications in these patients[12].

In the present work, according to the prevalence of preoperative stenting in studied groups. The data shows an identical percentage of patients with preoperative stents in both groups eight (42.1%) patients in the group with complications and six (42.9%) patients in the group without complications. The statistical test showed no statistical difference between the two groups regarding preoperative stenting.

Some authors place these stents as a way to lower the intraductal pressure and obtain adequate flow through the anastomosis. Nevertheless, since there is a tendency to create the anastomosis at the hilar level, no transanastomotic stents are needed. Even more, they can cause pressure necrosis on the duct, promote scar formation, or cause arteriobiliary fistula formation[14].

Hochwald and colleagues noted markedly increased incidence of postoperative infectious complications in patients with endoscopic or percutaneous stents[15].

According to our study, the group experiencing complications had a longer average operative time of 222.11 min with a standard deviation of 46.26 min, compared with 195.00 min (SD = 40.71 min) in the group without complications. However, the statistical analysis indicates that the difference in operative times is not statistically significant.

Parallel to our study, Jha and Adhikar revealed that the mean operative duration 4.37 h in group without complication and 4.5 h in group with complication with insignificant difference (*P=0.591*)[13].

In the present study, the group with complications experienced a higher average blood loss at 910.53 ml (SD = 357.69 ml) compared with the no complications group, which lost an average of 721.43 ml (SD = 254.74 ml). Despite these differences, statistical test result indicating that the difference in blood loss between the two groups does not reach statistical significance. Patients with complications had a longer mean hospital stay of 8.74 days (SD = 4.01 days) compared with 6.43 days (SD = 1.79 days) for those without complications. The statistical test indicates a statistically significant difference with a *P value* of 0.039, confirming that patients with complications tend to have longer hospital stays.

Jha *et al*., found that blood loss and hospital stay were insignificantly different between both groups[13].

Our study showed regarding postoperative complications, the analysis shows varied frequencies of complications, including visceral injury (5.3%), biliary leakage (15.8%), bilomas (5.3%), postoperative bleeding (5.3%), cholangitis (15.8%), chest infections

(47.4%), and wound infections (26.3%) among the group with complications.

Zafar *et al*., reported that the most frequent complications were wound infection (23%) and bile leak (10%). Four (5%) patients died[16].

Antolovic *et al*., presented a series of 519 patients undergoing HJ. Bile leaks occurred in 5.6% of patients[17].

The logistic regression analysis identifies several variables potentially impacting the likelihood of postoperative complications, though none achieve statistical significance under the traditional p-value threshold of 0.05. Age (*P=0.075*) and diabetes (*P=0.078*) approach significance, suggesting their possible influence on complication rates. The total hospital stay also shows a nearly significant association (*P=0.073*). Other variables, including sex, BMI, bilirubin levels, and operative factors like preoperative stenting and blood loss, demonstrate weaker associations, suggesting that while certain demographic and clinical characteristics may influence complication risks, the complex interplay of multiple factors determines the overall complication trajectory in surgical patients.

CONCLUSION

Our study concluded that age and diabetes demonstrate higher associations with complication rates. Chest infections is the most common postoperative complication. In the group with complications exhibited elevated bilirubin levels, greater than 2 mg/dl (Figs 1-6).

Case presentation

Case (1)

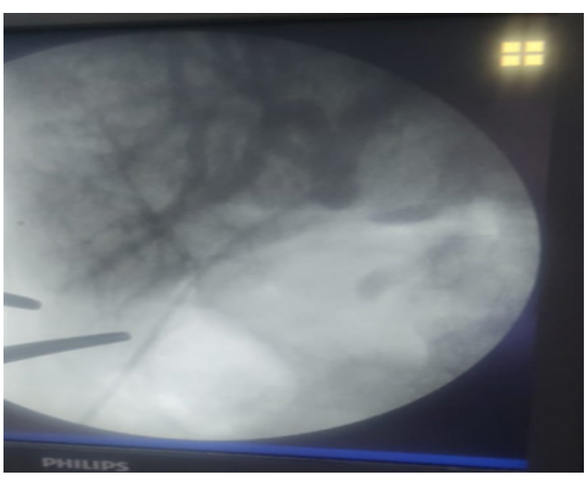

Fig. 1: Intraoperative cholangioraphy of bismuth 1 biliary injury.

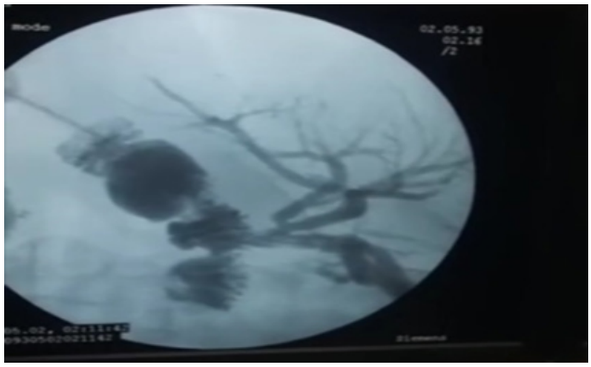

Fig. 2: Showed trans stent cholangiography after 6 weeks.

Case (2)

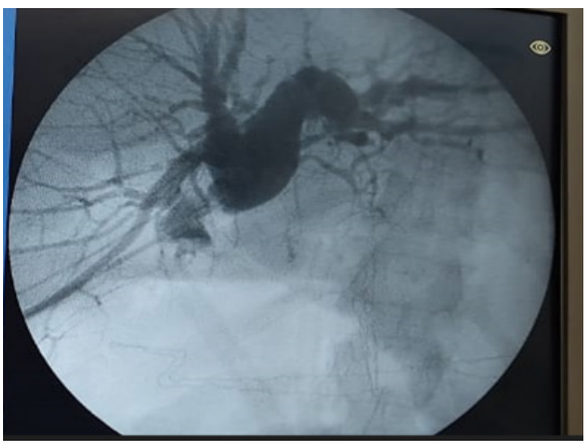

Fig. 3: Intraoperative cholangioraphy of bismuth 2 biliary injury.

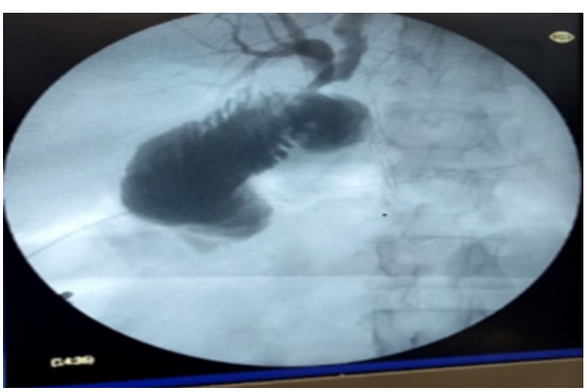

Fig. 4: Showed trans stent cholangiography after 6 weeks.

Case (3)

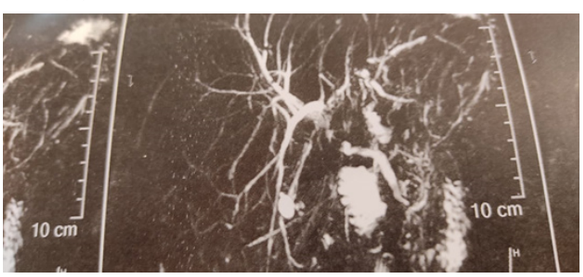

Fig. 5: Bismuth 3 biliary injury MRCP.

Fig. 6: MRCP 3 months post repair.

CONFLICT OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Hinojosa-Gonzalez DE, Roblesgil-Medrano A, Leon SU, Espadas-Conde MA, Flores-Villalba E. Biliary reconstruction after choledochal cyst resection: a systematic review and meta-analysis on hepaticojejunostomy vs hepaticoduodenostomy. Pediat Surg Int 2021; 37:1313–22.
2. Marichez A, Adam JP, Laurent C, Chiche L. Hepaticojejunostomy for bile duct injury: state of the art. Langenbeck's Arch Surg 2023; 408:107.
3. Pinsak A, Gielis M, Viscido G, Doniquian AM, Alvarez FA. Laparoscopic hepaticojejunostomy for the treatment of bile duct injuries in difficult scenarios (With video). Mini-invasive Surg 2022; 6:47.
4. Natsume S, Shimizu Y, Okuno M, Kawakatsu S, Matsuo K, Hara K, *et al*. Continuous suture is a risk factor for benign hepaticojejunostomy stenosis after pancreatoduodenectomy in patients with a non-dilated bile duct. HPB 2021; 23:1744-50.
5. Kobayashi S, Nakahara K, Umezawa S, Ida K, Tsuchihashi A, Koizumi S, *et al*. Benign hepaticojejunostomy strictures after pancreatoduodenectomy
6. Halle-Smith JM, Hall LA, Mirza DF, Roberts KJ. Risk factors for anastomotic stricture after hepaticojejunostomy for bile duct injury–a systematic review and meta-analysis. Surgery 2021; 170:1310–6.
7. Tomoda T, Kato H, Miyamoto K, Saragai Y, Mizukawa S, Yabe S, *et al*. Comparison between endoscopic biliary stenting combined with balloon dilation and balloon dilation alone for the treatment of benign hepaticojejunostomy anastomotic stricture. J Gastrointest Surg 2020; 24:1352–8.
8. Sahoo MR, Ali MS, Sarthak S, Nayak J. Laparoscopic hepaticojejunostomy for benign biliary stricture: a case series of 16 patients at a tertiary care centre in India. J Min Access Surg 2022; 18:20.
9. Younis M, Pencovich N, El-On R, Lubezky N, Goykhman Y, Phillips A, Nachmany I. Surgical treatment for choledocholithiasis following repeated failed endoscopic retrograde cholangiopancreatography. J Gastrointest Surg 2022; 26:1233–1240.
10. Ahmad H, Zia HH, Salih M, Naseer M, Khan NY, Bhatti AB. Outcomes of hepaticojejunostomy for post-cholecystectomy bile duct injury. J Int Med Res 2023; 51:03000605231162444.
11. Röthlin MA, Löpfe M, Schlumpf R, Felix Largiadèr MD. Long-term results of hepaticojejunostomy for benign lesions of the bile ducts. Am j surg 1998; 175:22–26.
12. Shalayiadang P, Yasen A, Abulizi A, Ahan A, Jiang T, Ran B, *et al*. Long-term postoperative outcomes of Roux-en-Y cholangiojejunostomy in patients with benign biliary stricture. BMC Surg 2022; 22:231.
13. Jha IK, Adhikar SK. Post-Operative outcomes of hepaticojejunostomy for benign biliary diseases. Post-Graduate Med J NAMS 2020; 20:1–8.
14. Cuendis-Velázquez A, Morales-Chávez C, Aguirre-Olmedo I, Torres-Ruiz F, Rojano-Rodríguez M, Fernández-Álvarez L, *et al*. Laparoscopic hepaticojejunostomy after bile duct injury. Surg Endosc 2016; 30:876–82.
15. Hochwald SN, Burke EC, Jarnagin WR, Fong Y, Blumgart LH. Association of preoperative biliary stenting with increased postoperative infectious complications in proximal cholangiocarcinoma. Arch Surg 1999; 134:261–6.
16. Zafar SN, Khan MR, Raza R, Khan MN, Kasi M, Rafiq A, *et al*. Early complications after biliary enteric anastomosis for benign diseases: a retrospective analysis. BMC Surg 2011; 11:19.
17. Antolovic D, Koch M, Galindo L, Wolff S, Music E, Kienle P, *et al*. Hepaticojejunostomy-analysis of risk factors for postoperative bile leaks and surgical complications. J Gastrointest Surg 2007; 11:555–61.