Biliary stricture after Roux-en-Y hepaticojejunostomy for bile duct injury–surgical challenge: a single-center expertise

Mohamed A.S.A. Hamid[a], Haytham M. Nasser[b], Hatem Sayed[a]

Departments of [a]General surgery, [b]Radiology, Faculty of Medicine, Ain Shams University, Cairo, Egypt

Correspondence to Mohamed A.S.A. Hamid, MBBCh, MSc, FACS, MD, Department of General Surgery, Faculty of Medicine, Ain Shams University, Cairo 11566, Egypt.
Tel: +201001078280l;
E-mail: mohamed_omran@med.asu.edu.eg

Received: 19 December 2019
Accepted: 12 January 2020
Published: 27 April 2020

The Egyptian Journal of Surgery 2020, 39:393–400

Background
Laparoscopic cholecystectomy has been considered the gold standard since the 1990. Yet the incidence of bile duct injury (BDI) has increased from 0.06 to 0.3% for open cholecystectomy to 0.5 to 1.4% when done laparoscopically. Roux-en-Y hepaticojejunostomy (RYHJ) is the most widely approved management for most post-cholecystectomy BDIs, yet some patients experience incapacitating biliary complications, such as jaundice or recurrent attacks of cholangitis, in addition to anastomotic stricture.

Aim
The aim of this study was to assess the short-term outcomes of a multidisciplinary approach regarding failed RYHJ after post-cholecystectomy BDI.

Materials and methods
A total of 15 patients were enrolled in the descriptive study after failure of RYHJ performed because of post-cholecystectomy BDI. Patients comprised six males and nine females. All patients after definitive treatment underwent follow-up by abdominal ultrasound and liver function tests for at least 11 months.

Results
One (6.7%) patient had liver transplantation because of liver cirrhosis. Four (26.7%) other cases were managed by revisionary surgery for the hepaticojejunostomy as the stricture was so tight. The reminder 10 cases underwent trial of percutaneous trans-hepatic cholangiography (PTC), but unfortunately six of them (40% of the whole group) failed to be dilated adequately, and they indeed underwent surgery, and the other four (26.7%) were dilated successful. During the follow-up, three (20%) patients had biliary leakage and two patients developed re-stricture, with one mortality because of pulmonary embolism.

Conclusion
Good long-term results can be achieved in patients with RYHJ stricture through a case-by-case analysis and an immediate multidisciplinary approach in expert hepatobiliary center.

Keywords:
bile duct injury, hepaticojejunostomy stricture, PTC and biliary leakage

Egyptian J Surgery 39:393–400

1110-1121

Introduction

Since its introduction in the 1990s [1], laparoscopic cholecystectomy has been considered to be the 'gold standard' management for chronic calcular cholecystitis. Minimal postoperative pain, less hospital stay, and rapid recovery and return to work are the main advantages over open cholecystectomy.

However, it became evident that the incidence of bile duct injury (BDI) increased from 0.06 to 0.3%, as known for open cholecystectomy, to 0.5 to 1.4% when done laparoscopically [2,3]. Such type of injury is an iatrogenic catastrophe associated with marked perioperative morbidity and reduced long-term survival and quality of life [4,5].

Roux-en-Y hepaticojejunostomy (RYHJ) is the most widely approved management for most post-cholecystectomy BDIs, with long-term clinical success rates reaching 90% [6]. Some patients who undergo hepaticojejunostomy for BDI will experience incapacitating biliary complications, such as jaundice or recurrent attacks of cholangitis [7]. However, pathogenic factors other than anastomotic stricture that lead to RYHJ failure include intrahepatic calculi, intrahepatic stricture, and improper technique of construction of the Roux-en-Y limb. Management of this complex situation necessitates careful and professional plan of management and preparation for the possibility of having a combination of operative, intervention radiologic, and endoscopic techniques after being discussed with the multidisciplinary team involving those specialties.

 DOI: 10.4103/ejs.ejs_224_19

Obviously, it is a difficult surgical challenge to manage biliary stricture after RYHJ for BDI. The procedure can be much more difficult and complex in comparison with the first operation for reconstruction.

Few studies have specifically analyzed the results of management of failed bilioenteric repair for post-cholecystectomy BDI [8].

Aim

The aim of our study was to assess the short-term outcomes of a multidisciplinary approach regarding failed RYHJ after post-cholecystectomy BDI.

Materials and methods

Study design

A descriptive study was conducted on prospectively collected data. An approval from Ain Shams Ethical Committee was taken before the study.

Between June 2017 and January 2019, 15 consecutive patients were treated in our department (Hepatobiliary Pancreatic Surgery Unit, Ain Shams University Hospitals) for the failed RYHJ performed after post-cholecystectomy BDI.

Preoperative

Patients with a clinically significant anastomotic stricture were defined as those who presented with jaundice and recurrent cholangitis with/without abnormal liver function tests (bilirubin and liver enzymes). All these patients had full laboratory investigations, including complete blood picture, full liver and kidney functions, partial prothrombin time (PTT), and hepatitis markers. Regarding imaging studies, magnetic resonance cholangiopancreatography (MRCP) along with duplex for right hepatic artery was done for all patients.

The follow-up period, in our study, after the definitive intervention was at least 11 months. Follow-up in the early postoperative period clinically is by following up the vital data, jaundice, color of urine, stool, and itching and also by daily laboratory investigations (complete blood count, international normalized ratio, alanine aminotransferase, aspartate aminotransferase, bilirubin, and alkaline phosphatase) for 3 days and then every other day till discharge and by abdominal ultrasound (US) once just before discharge. Thereafter, in the outpatient clinic, follow-up was by liver function tests and US every 3 month after discharge for 1 year and then annually. MRCP is done when necessary (elevated liver enzymes, jaundice, or itching)

Our group of patients consisted of six males (40%) and nine females (60%), with a mean ±SD age of 32.20±6.64 years, ranging between 25 and 50 years.

BDIs were all due to cholecystectomy done in other hospitals, including 12 (80%) cases underwent laparoscopic cholecystectomy and three (20%) cases were converted to open cholecystectomy. In two of the 15 cases, the injury was detected intraoperatively, so repair was done by RYHJ in the same session. In the other 13 cases, the RYHJ was done later on in another operation; four of them were done early (<6 weeks postoperative) in the 7th, 10th, and 14th days and the other nine cases were delayed (>6 weeks) within 40–55 days after the cholecystectomy. All these patients had RYHJ in other hospitals not in our hospital. The median [interquartile range (IQR)] of the overall time between BDI (cholecystectomy) and initial repair was 40 (7–45) days, ranging between 0 and 55 days. Unfortunately, all those patients experienced biliary stricture during the follow-up period and were therefore admitted in our hospital, and they all had undergone MRCP and hepatic duplex.

Patients with a clinically significant anastomotic stricture were defined as those who presented with jaundice and recurrent cholangitis, with/without abnormal liver function tests, in addition to a radiological stenosis in the MRCP which is done routinely for all these patients (Fig. 1). Recurrent cholangitis was defined as fever above 38°C and/or right upper quadrant pain with no definite source outside the hepatobiliary system occurring at least three times in the preceding year. Five (33%) patients were presented with recurrent attacks of cholangitis and seven (46.7%) with jaundice and three (20%) patients presented with both.

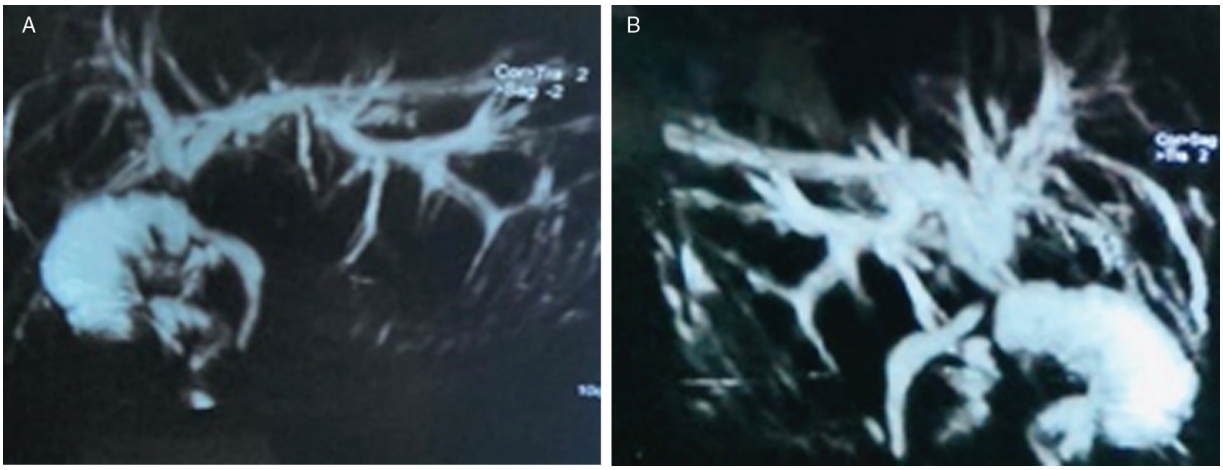
BDI was classified according to Strasberg *et al*. [9] according to the MRCP examination. Type E1 injury was found in two (13.3%) patients, type E2 and E3 injury in six (40%) patients each, and type E4 injury in one (6.7%) patient (Figs 2 and 3). Two (13.3%) patients had a vascular lesion of the right hepatic artery, and one of them was type E3 and the other E4.

The mean±SD) time between initial repair and admission in our hospital was 8.47±4.13 months, ranging between 0.5 and 13 months (Table 1).

Technique of surgery

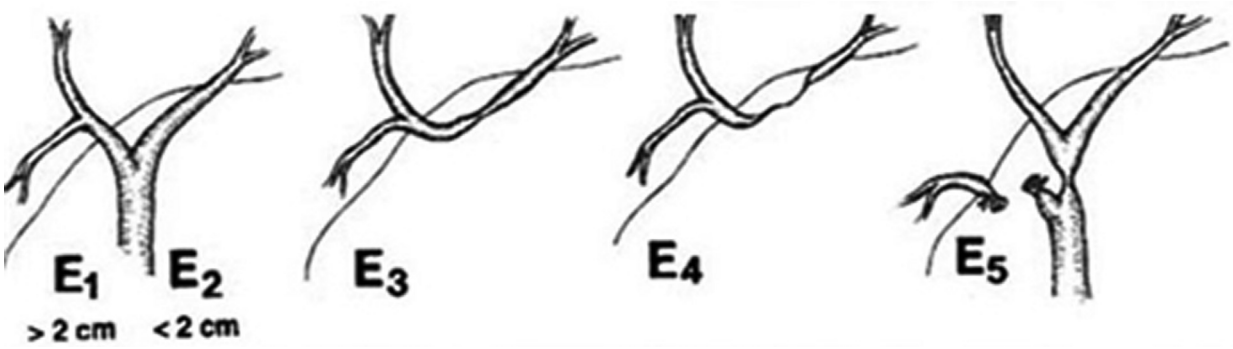
An end to side, wide, viable, mucosa to mucosa HJ with no tension and with a 70 cm long Roux-en-Y limb, which is created retrocolic, was the goal in each patient.

Figure 1



(a,b) MRCP showing hepaticojejunostomy stricture with proximal biliary dilatation.

Figure 2



Strasberg classification (type E). Type E1: stricture or transection greater than 2 cm from the confluence of right and left hepatic duct. Type E2: stricture less than 2 cm from the confluence. E3: stricture at the Hilum. E4: separation of major duct at the hilum. E5: combined injury to the main duct at hilum and right segmental bile duct [10].

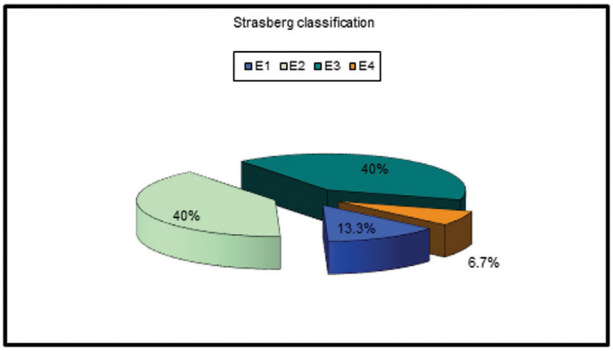
Operation consisted of three steps

All patients had a hockey stick incision with both sharp and blunt dissection of intra-abdominal adhesions, followed by exposure of hepatic pedicle with assessment of both right and left hepatic arteries, and then assessment of the wrong construction of the Roux-en-Y limb, exposure of the HJ anastomosis with collection of a sample of bile, and identification of anatomy and/or abnormalities (stricture, calculi) in bile duct by cholangiography were done.

Identification of the biliary limb and dissection of the hilar plate to identify the primary biliary confluence and notably the left bile duct were done. A hepatotomy between segments 5 and 4 through of the bed of the gallbladder was used in some cases to access the secondary right biliary confluence.

Before the creation of anastomoses, assessment of Roux loop was done to ensure good anastomosis,

Figure 3



Distribution of patients according to Strasberg classification.

which was performed using monofilament absorbable sutures (Polydioxanone 5-0, 6-0 PDS; Ethicon Inc., 202 Raritan, New Jersey, USA) in all patients, with the knots on the outer surface of the anastomosis (Fig. 4).

Percutaneous technique

All percutaneous procedures were done in the operating room or the intervention radiology unit under complete aseptic conditions as occurred to any operative maneuver. The operating theater was equipped with a Doppler US (Aloka SSD 68;, Aloka, Tokyo, Japan).

These procedures were carried out under either local, neuroleptic analgesia with premedication, or general anesthesia if the time of the procedure was expected to take a long duration. Percutaneous US-guided puncture of dilated biliary system was done using Chipa needle. Diagnostic cholangiography was done to detect anatomy and localize site of stricture, and then guide wire is inserted through chipa needle in a trial to pass the site of stricture. If stricture site is successfully passed, a 5 F copra catheter is introduced over the wire, and contrast injection is done to ensure site of the catheter. After ensuring site of the catheter, a super Stiff wire is introduced through the catheter, and then a 40×4 mm balloon is passed over the wire to dilate stricture followed by insertion of internal external drain Cook Cope Type Locking Loop Biliary Drainage Catheter, Hydrophilic 12 f×40 cm, 0.035', for 4–6 weeks. Afterward, diagnostic cholangiography was done to ensure no residual stricture before removal of the drain. If residual stricture or failure to pass stricture from the start, external drain is left and surgical redo is to be considered (Figs 5 and 6).

Table 1 Basic geographical distribution and presentation

	N=15 [*n* (%)]
Age	
Mean±SD	32.20±6.64
Range	25–50
Sex	
Female	9 (60.0)
Male	6 (40.0)
Open vs laparoscopically	
Open	3 (20.0)
Lap	12 (80.0)
Time between BDI (cholecystectomy) and initial repair (day)	
Median (IQR)	40 (7–45)
Range	0–55
Time between initial repair and our admission (months)	
Mean±SD	8.47±4.13
Range	0.5–13
Presentation	
Cholangitis	5 (33.3)
Jaundice	7 (46.7)
Cholangitis and jaundice	3 (20.0)
Strasberg classification	
E1	2 (13.3)
E2	6 (40.0)
E3	6 (40.0)
E4	1 (6.7)
Vascular injury	
No	13 (86.7)
Yes	2 (13.3)

BDI, bile duct injury; IQR, interquartile range.

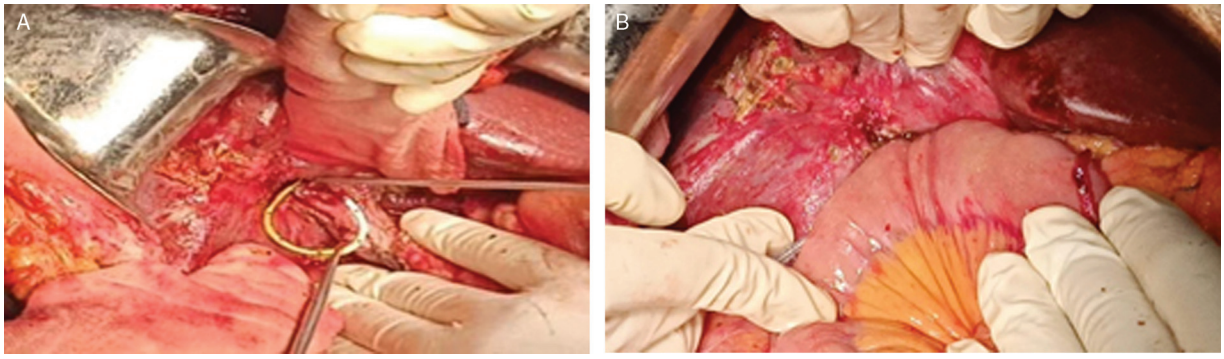
Statistical analysis

Data were collected, revised, coded, and entered to the Statistical Package for the Social Sciences (IBM SPSS) version 23 (SPSS Inc., an IBM Company, Chicago, Illinois, USA). The quantitative data were approaching as mean, SD, and ranges when parametric and presented as median with IQR when nonparametric. Moreover, qualitative variables were approached as number and percentages.

Results

All cases were discussed in our multidisciplinary team for the proper intervention in each case separately. The type E4 case that had vascular injury required liver transplantation as it developed biliary cirrhosis according to the liver functions and confirmed by liver biopsy. Four other cases (26.7%) were decided to undergo upfront revisionary surgery for the hepaticojejunostomy as the stricture was so tight and a long segment was seen in their MRCP. The remainder of

Figure 4

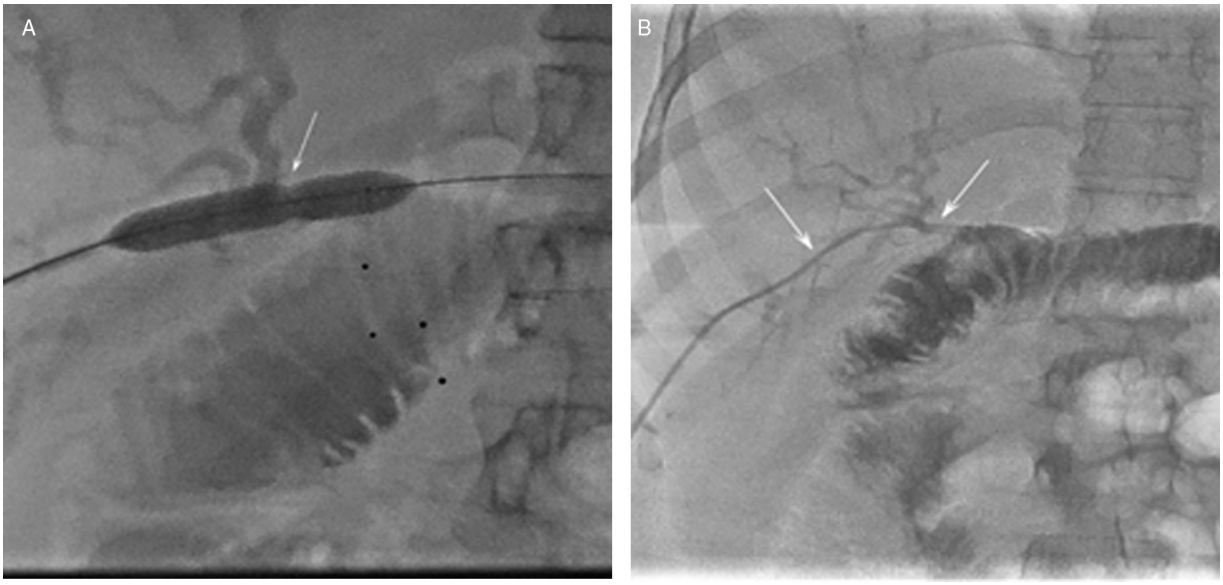


(a) Exposure of the anastomotic area, and assessment of biliary anatomy and/or abnormalities; (b) redo of hepaticojejunostomy.

Figure 5

(a) Contrast injection is done to ensure site of catheter. (b) Stricture site is successfully passed by 0.35 guide wire.

Figure 6

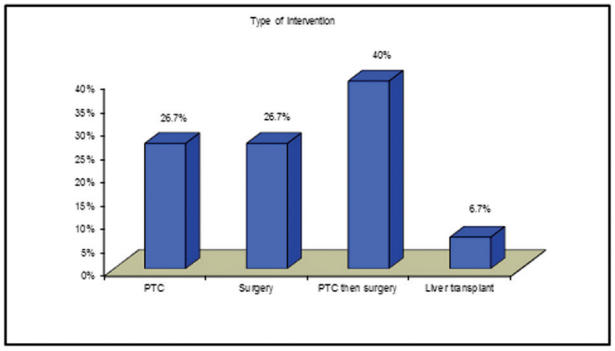


(a) 40×4 mm balloon is passed over the wire to dilate stricture. (b) Insertion of internal external drain Cook Cope Type Locking Loop Biliary Drainage Catheter.

the 10 cases underwent trial of percutaneous transhepatic cholangiography (PTC), but unfortunately six of them (40% of the whole group) failed to be dilated adequately so PTD was left for drainage until being prepared for surgery and they indeed had underwent surgery and the other four (26.7%) were dilated successfully. A percutaneous transhepatic dilatation was defined as successful if no residual significant stenosis was seen on cholangiography and no evident clinical signs after removal of the drainage catheter, denoting residual stenosis (Fig. 7).

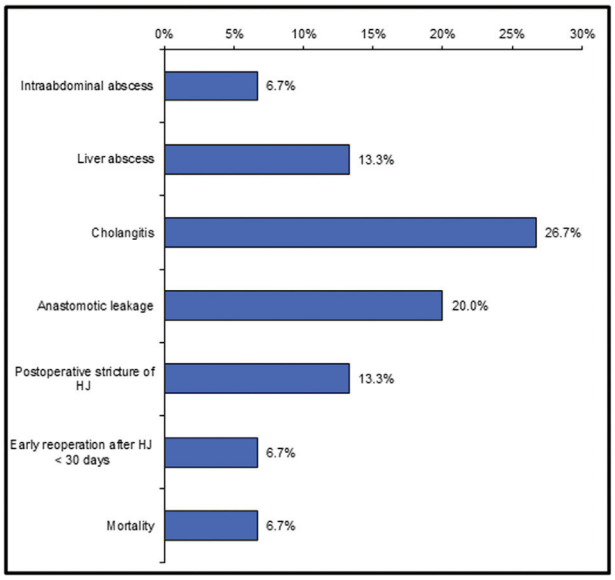
During the follow-up period, three (20%) patients had early postoperative biliary leakage: one of them had diffuse collection that required early reoperation after 10 days for peritoneal lavage and drainage, and the leakage stopped after 3 weeks; one patient developed intra-abdominal abscess owing to minor leak from the anastomosis, which stopped spontaneously, but the collection was infected and developed abscess, so percutaneous drainage by pigtail insertion was done successfully, and collection resolved within 5 days; and the third patient did not need any intervention as the

Figure 7



Type of intervention.

Figure 8



Postoperative complication.

bile was drained in the abdominal drains for 8 days and then stopped. Moreover, four (26.7%) patients developed ascending cholangitis; they were managed by broad spectrum IV antibiotics, but two of them developed liver abscess, which necessitated percutaneous drainage by pigtail insertion, and the other two cases resolved totally on antibiotics, with no further complications (Table 2).

As for the postoperative re-stricture, only two (13.3%) cases developed it on the sixth and eighth month, correspondingly. They both were dilated successfully by PTC. It is to be noticed that both patients experienced early postoperative significant anastomotic biliary leakage as mentioned before (Fig. 8).

We had one (6.7%) case of early mortality on postoperative day 2 owing to pulmonary embolism.

Table 2 Type of intervention and postoperative complication

	N=15 [*n* (%)]
Type of intervention	
PTC	4 (26.7)
Surgery	4 (26.7)
PTC then surgery	6 (40.0)
Liver transplant	1 (6.7)
Anastomotic leakage	
No	12 (80.0)
Yes	3 (20.0)
Cholangitis	
No	11 (73.3)
Yes	4 (26.7)
Intraabdominal abscess	
No	14 (93.3)
Yes	1 (6.7)
Liver abscess	
No	13 (86.7)
Yes	2 (13.3)
Postoperative stricture of HJ	
No	13 (86.7)
Yes	2 (13.3)
Early reoperation after HJ <30 days	
No	14 (93.3)
Yes	1 (6.7)
Mortality	
No	14 (93.3)
Yes	1 (6.7)

Discussion

This study shows that with an experienced multidisciplinary approach in patients with biliary stricture of RYHJ after post-cholecystectomy, BDI can attain good long-term clinical success.

Most HJ strictures (40%) were successfully treated by revisionary surgery (RYHJ) after PTC trials for dilatation by percutaneous dilatation. Literature on PTC management for HJ strictures, especially after BDI, is infrequent, with success rates of 45–71% [11,12]. Because percutaneous transhepatic dilatation is nowadays easily done in expert centers with good outcomes, an initial intervention by PTC is recommended for surgical revision. We strongly support PTC dilatation as an initial management for HJ stenosis. However, repeated dilatation is also suitable for recurrent stenosis and can be considered as a step-up approach to surgical revision.

In a similar study by Yan *et al.* in 2007 [13], eight patients with biliary restructure after Roux-en-Y were managed by surgery. One patient underwent liver transplantation owing to the main artery injury and 1 patient failed intraoperative reconstruction owing to severe scarring of the opening of right bile duct, so

external biliary drainage had to be carried out and then prepared for liver transplantation. After an average follow-up of 10 (range: 4–17) months, the six patients who had RYHJ for the second time were clinically and biochemically stable without any pathologic findings.

In our study, the type E4 case that had vascular injury required liver transplantation, other four (26.7%) cases were managed by revisionary surgery for hepaticojejunostomy owing to tight stricture, and the remainder of the 10 cases underwent trial of PTC, but unfortunately six of them (40% of the whole group) failed to be dilated, so had surgical revision to hepaticojejunostomy.

In another study by Benkabbou and colleagues [14], the first-line management in 26 cases was primary revisionary surgery (59%; repeat RYHJ in 22 and hepatectomy in four) and a percutaneous approach occurred in18 cases (41%; biliary interventions in 16 and portal vein embolization in two). The mean±SD follow-up period was 49±40 months (range: 2–153 months). Mortality postoperatively was nil, and postoperative morbidity was 11% after repeat RYHJ without hepatectomy, 80% (bile leaks) after hepatectomy, and 10% (mild cholangitis and hemobilia) after a percutaneous approach.

In our study, three (20%) patients had early postoperative biliary leakage: one of them had diffuse collection that required early reoperation, and one patient developed intraabdominal abscess due to minor leak from the anastomosis. Moreover, four (26.7%) patients developed ascending cholangitis and two of them developed liver abscess that necessitated percutaneous drainage.

On the contrary, Booij and colleagues conducted their study on 281 patients who underwent HJ for BDI, and after average follow-up of 10.5 years (range: 6.7–14.8 years), clinically relevant strictures were found in 37 (13.2%) patients. Percutaneous dilatation was the initial treatment of stricture in 33 (89.2%) patients. In total, 19 of the 33 patients (57.6%) had repeated successful dilatation. The remaining 14 patients were managed successfully by antibiotics without invasive intervention.

In 14 of the 33 patients (42.4%) managed by dilatation, a re-stricture occurred after a median of 22.7 (IQR: 10.7–52.2) months. One patient had revisionary surgery, and the remaining 13 patients were treated successfully by repeated dilatation for stricture. In two of the latter 13 patients, the recurrent stenosis persisted after repeated dilatations, and revision of the HJ was done after 61 and 28 months after the initial HJ, respectively. Overall, surgical revision of the HJ was done in four (1.4%) patients after a median of 17.7 (IQR: 6.8–52.7 months) without single mortality. In five of the 33 patients (15.2%), stricture occurred for the third time after a stricture-free interval of a median of 57.6 (IQR: 27.6–96.4) months. These patients were managed with a third period of percutaneous dilatations.

In our study as for the postoperative restricture, only two (13.3%) cases developed it on the sixth and eighth month, correspondingly. They both were dilated successfully by PTC. It is to be noticed that both patients experienced early postoperative significant anastomotic biliary leakage as mentioned before.

We had one (6.7%) case of early mortality on postoperative day 2 owing to pulmonary embolism.

Conclusion

In conclusion, good long-term results can be achieved in patients treated for RYHJ stricture following cholecystectomy BDI through a case-by-case analysis and a thorough multidisciplinary approach including revision of the biliary surgery and/or percutaneous approach in expert hepatobiliary center.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Dubois F, Icard P, Berthelot G, Levard H. Coelioscopic cholecystectomy. Preliminary report of 36 cases. Ann Surg 1990; 211:60–62.

2 De Reuver PR, Rauws EA, Bruno MJ, Lameris JS, Busch OR, van Gulik TM, Gouma DJ. Survival in bile duct injury patients after laparoscopic cholecystectomy: a multidisciplinary approach of gastroenterologists, radiologists, and surgeons. Surgery 2007; 142:1–9.

3 Archer SB, Brown DW, Smith CD, Branum GD, Hunter JG. Bile duct injury during laparoscopic cholecystectomy: results of a national survey. Ann Surg 2001; 234:549–558.

4 Flum DR, Cheadle A, Prela C, Dellinger EP, Chan L. Bile duct injury during cholecystectomy and survival in medicare beneficiaries. JAMA 2003; 290:2168–2173.

5 Moore DE, Feurer ID, Holzman MD, Wudel LJ, Strickland C, Gorden DL, *et al.* Long-term detrimental effect of bile duct injury on health-related quality of life. Arch Surg 2004; 139:476–481.

6 Murr MM, Gigot JF, Nagorney DM, Harmsen WS, Ilstrup DM, Farnell MB. Long-term results of biliary reconstruction after laparoscopic bile duct injuries. Arch Surg 1999; 134:604–609.

7 Kozicki I, Bielecki K, Kawalski A, Krolicki L. Repeated reconstruction for recurrent benign bile duct stricture. Br J Surg 1994; 81:677–679.

8 Pottakkat B, Sikora SS, Kumar A, Saxena R, Kapoor VK. Recurrent bile duct stricture: causes and long-term results of surgical management. J Hepatobiliary Pancreat Surg 2007; 14:171–176.

9 Strasberg SM, Hertl M, Soper NJ. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. J Am Coll Surg 1995; 80:101–125.

10 Kimura T, Suzuki K, Umehara Y, Kawabe A, Wada H. Features and management of bile leaks after laparoscopic cholecystectomy. J Hepatobiliary Pancreat Surg 2005; 12:61–64.

11 Stilling NM, Fristrup C, Wettergren A, Gianskis AU, Nygraard 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.

12 Janssen JJ, van Delden OM, van Lienden KP, Rauws EJ, Busch ORC, van Gulik TM, *et al.* Percutaneous balloon dilatation and long-term drainage as treatment of anastomotic and nonanastomotic benign biliary strictures. Cardiovasc Intervent Radiol 2014; 37:1559–1567.

13 Yan JQ, Cheng-hong P, Jia-Zeng D, Wei-Ping Y, Guang-Wen Z, Yong-Jun C, Zong-Yuan T. Surgical management in biliary restricture after Roux-En-Y hepaticojejunostomy for bile duct injury. World J Gastroenterol 2007; 13:6598–6602.

14 Benkabbou A, Denis C, Chady S, Adam R, Azoulay D, Vibert E. Treatment of failed Roux-En-Y hepaticojejunostomy after post-cholecystectomy bile ducts injuries. Surgery 2013; 153:95–102.