RESEARCH ARTICLE PEER REVIEWED | OPEN ACCESS

Novel surgical technique for the management of biliary-enteric anastomotic strictures

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ABSTRACT

Aims: This study presents an invented surgical technique for dealing with biliary-enteric anastomotic strictures with the potential to replace currently used methods in certain cases. **Methods:** In this retrospective study, a novel surgical technique was introduced in the management of eight patients with bilioenteric strictures between January 2016 and May 2018. **Results:** Our new technique was associated with a 100% success rate where patency of anastomosis was achieved in all patients along the 28 month follow-up period. Only two of the patients developed a complication including wound-site infection, and cholangitis at the 17th month follow-up. None of the patients developed intrahepatic biliary dilation or stricture recurrence. **Conclusion:** This novel surgical approach may reduce recurrent medical and radiological interventions and the need for anastomosis revision. It may also lessen the rate of complications. However, larger scale studies are needed to confirm such findings.

Keywords: Biliary-enteric, Choledochojejunostomy, Hepaticojejunostomy, Strictures, Stricturoplasty

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Received: 14 May 2020
Accepted: 27 May 2020
Published: 25 June 2020

How to cite this article

Al-Munaizel T, Al-Abbadi A, Al-Jarrah R, Aljbour M, Naffa' M, Oudat E, Alfaouri A, Al-Omari MA, Ghazzawi I, Smadi S. Novel surgical technique for the management of biliary-enteric anastomotic strictures. Int J Hepatobiliary Pancreat Dis 2020;10: 100089Z04TA2020.

Article ID: 100089Z04TA2020

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doi: 10.5348/100089Z04TA2020RA

INTRODUCTION

A variety of benign and malignant hepatobiliary disorders necessitate resection of the extrahepatic biliary tree. The gold standard in these cases is reconstruction of the biliary tract with the alimentary system when feasible. Hepaticojejunostomy and choledochojejunostomy in Roux-en-Y pattern are the most commonly employed techniques for treatment. These procedures, though, have their share of complications, e.g., leak, strictures, and cholangitis. The culprit in early stricture formation is surgical technique while late strictures are mainly due to ischemia at the distal end of the biliary tree [1]. Applying the main principles of anastomosis such as tension-free repair and duct-to-mucosa anastomosis may aid in decreasing the incidence of stricture formation. Furthermore, it is important to recognize the anomalies of porta hepatis in order to avoid stricture development. Biliary-enteric anastomotic stricture is one of the difficult and serious complications of biliary surgery resulting in multiple hospital readmissions and procedures. Untreated stricture is associated with jaundice, recurrent cholangitis, intrahepatic stone formation, and may result in secondary biliary cirrhosis. Consequently, liver transplantation can be the only curative option. Treating strictures can be achieved by nonsurgical methods such as Endoscopic retrograde cholangiopancreatography (ERCP), and percutaneous transhepatic cholangiography (PTC) with different stent types. In cases of failure of these methods, surgical treatment is considered. The only described surgical method in literature is revision. In our study, we describe a simpler surgical approach that we used for treating eight patients with benign strictures. It can be described as a transjejunal hepaticojejunostomy strictureplasty.

MATERIALS AND METHODS

Thirty-two patients presented to our hepatobiliary unit at King Hussein Medical Center with benign post-anastomotic strictures between January 2016 and May 2018. Among these, 24 patients were managed successfully by endoscopic or percutaneous dilatation and biliary stenting and were, therefore, excluded from our study. The number of enrolled patients was the remaining eight, who needed surgical management after failure of nonsurgical treatment modalities. Five of them were males, and the other three were females. Ethical approval was obtained from King Hussein Medical Center ethical committee with the reference number 19-3-2019. The median age of the patients was 42 (ranging from 21 to 53). Meantime to diagnosis of strictures was 15.7 ± 22.1 months with a median of 9.3 months. Clinical presentations included jaundice in 5/8 patients, and cholangitis in 3/8 patients (Table 1). Prior to referral to our unit, all eight patients underwent transabdominal ultrasonography and magnetic resonance cholangiopancreatography (MRCP), followed by endoscopic retrograde cholangiography (ERCP) using double-balloon enteroscope. However, the process was unsuccessful due to the sharp angle between the jejunal limb and the biliary tree. Later, PTC was performed for all patients but failed in five patients due to inability to cannulate the strictures and bypass it successfully after 1–3 trials. In the remaining three patients, failure of PTC was due to the presence of intrahepatic stones (Table 2). Among the included patients, five were eligible for biliary-enteric anastomosis due to common bile duct (CBT) injury (5/8, 62.5%), and two for choledochal cyst excision (2/8, 25%). The last patient had underwent pancreaticoduodenectomy for duodenal gastrointestinal tumor (GIST), i.e., 1/8, 12.5% (Table 3).

Surgical Procedure

Surgical intervention was initiated after patients consented to the new procedure and after infection control was obtained by presurgical antibiotics and percutaneous biliary drainage in patients with cholangitis.

During the operation, we performed a 5 cm longitudinal incision at the jejunal limb, about 3 cm below the anastomotic edge (Figure 1). The narrowed anastomosis was cannulated transluminally with a 4 or 5 French catheter after dilatation with a Watson Cheyne dissector with fine probe (Figure 2A and B). We performed a cholangiogram intraoperatively to delineate the biliary anatomy. Two 5-O or 4-O polydioxanone (PDS) sutures were placed at the edges of the catheter at 9 and 3 o'clock position (Figure 2C). We made an incision from inside at 12 o'clock position for 3–5 mm with traction applied on the lateral sutures. Several stitches were then placed between the wall of the CBD and the jejunal mucosa using the same suture material (Figures 3 and 4). The incision was further extended in the same direction until the dilated part of the common hepatic duct was reached. Later on, the incision was also extended for another 5–7 mm with multiple sutures placed every 2–3 mm. Extension at the site of the left hepatic duct was needed in two cases for around 1 cm because the stricture involved the confluence site of the common hepatic bile ducts and to the left hepatic duct. Biopsy was always taken from the incision site by scalpel and sent as frozen section to rule out malignancy. Jejunal wall was closed in two layers and the abdomen was closed without drains.

Table 1: Clinical presentations in patients with strictures who presented to our unit

Jaundice	5/8 (62.5%)
Cholangitis	3/8 (37.5%)

Table 2: Causes of failure of preoperative procedures performed to our patients

Unsuccessful ERCP due to sharp angle between jejunal limb and biliary tree or difficult cannulation of strictures	8/8 (100%)
Unsuccessful PTC (after failed ERCP) due to failure of stricture cannulation	5/8 (62.5%)
Unsuccessful PTC (after failed ERCP) due to the presence of intrahepatic stones	3/8 (37.5%)

ERCP: Endoscopic retrograde cholangiopancreatography, PTC: Percutaneous transhepatic cholangiogram.

Table 3: Patient's demographics and clinical data

	Male	5/8
Gender	Female	3/8
Age (mean SD)		42 years
Primary indication for biliary-enteric anastomosis:		
Common bile duct injury		5/8 (62.5%)
Choledochal cyst excision		2/8 (25%)
Post-pancreaticoduodenectomy for duodenal gastrointestinal stromal tumor (GIST)		1/8 (12.5%)
Mean time to stricture diagnosis		15.7 ± 22.1 months
Median time to stricture diagnosis		9.3 months

SD: Standard deviation.

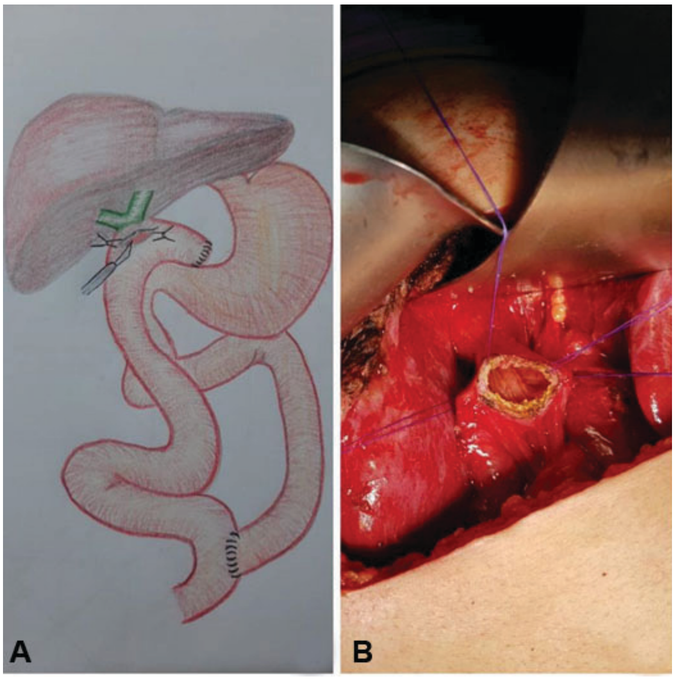

Figure 1: (A) Schematic view of the site of primary incision. (B) Intraoperative picture showing 5-cm longitudinal incision at the jejunal limb, 3 cm below the hepaticojejunal anastomosis.

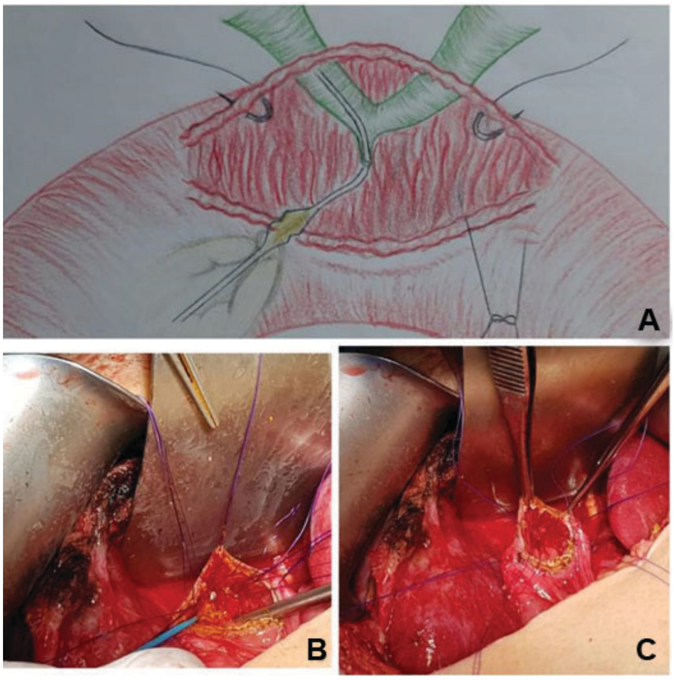

Figure 2: (A) Schematic view of transluminal cannulation of anastomotic strictures. (B) Intraoperative picture of our patient showing dilatation of strictures using Watson Cheyne dissector with fine probe. (C) 5-O PDS suture placed at 9 and 3 o'clock positions.

RESULTS

The immediate postoperative course of all enrolled patients was uneventful. They were discharged home at the third day postoperatively. We followed them up

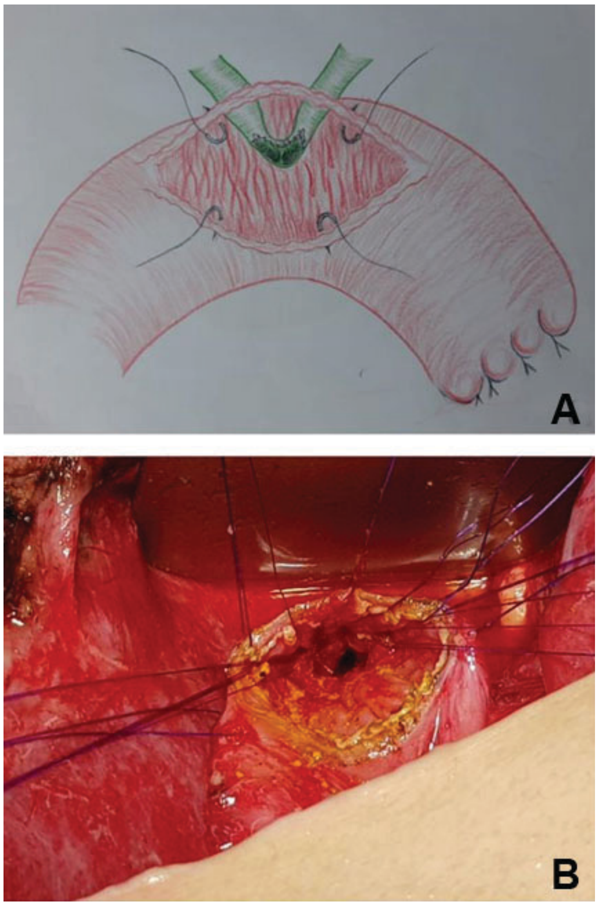

Figure 3: (A) Schematic view for transluminal incision through the anastomotic strictures. (B) Intraoperative photo showing a 5-mm long incision performed from inside at 12 o'clock position.

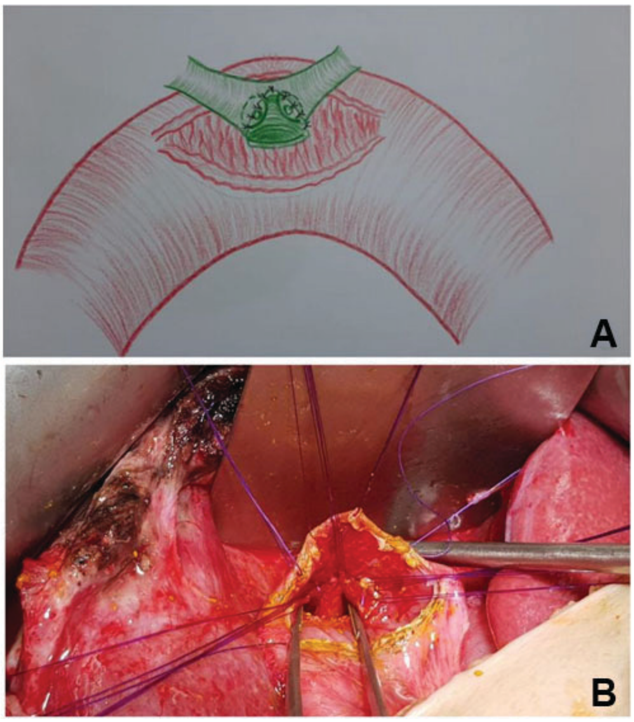

Figure 4: (A) Scheme of the final view of anastomotic stricture site before closure of enterotomy site. (B) Several stitches placed between the wall of the bile duct and the jejunal mucosa, using 5-O PDS sutures at intervals of 2–3 mm.

at intervals of 2 weeks, 3 months, and 6 monthly for 28 months. On follow-up visits we took clinical history, done physical examination, and ordered liver enzymes test, abdominal ultrasound, and MRCP. Result of liver enzymes testing came back as normal for all patients except one who developed cholangitis 17 months after surgery with mild elevation of alkaline phosphatase (ALP). Despite this complication, this patient did not have any evidence of intrahepatic biliary dilation or stricture recurrence (as shown from abdominal ultrasound and MRCP). This complication was managed successfully by intravenous fluids and intravenous antibiotics. The other complication we encountered was in another patient who developed superficial wound infection which was treated and resolved with antibiotics chosen according to culture and sensitivity testing. As for the rest of the patients, they had no complications at all along the whole 28-month follow-up period.

DISCUSSION

Bile is formed by liver cells (hepatocytes) and is deposited inside the intrahepatic duct system which, in turn, modifies its composition. This system is drained into the extrahepatic duct system through the right and left hepatic ducts that gather to form the common hepatic duct. The cystic duct then joins the common hepatic duct, therefore forming the CBD. The main pancreatic duct unites with the CBD in the posteriomedial aspect of the duodenum forming the ampulla of Vater.

The extrahepatic biliary tract can be involved in many benign and malignant biliary diseases, including iatrogenic and traumatic biliary tree injuries, congenital anomalies, and extrahepatic biliary obstruction. The latter can result from chronic pancreatitis, cholelithiasis, choledocholithiasis, radiation or drug-induced strictures, biliary infections, periampullary tumors, and carcinoma of the head of pancreas [2]. The clinical presentation of biliary obstruction includes constitutional symptoms (e.g., fever) jaundice, dark stools, vomiting, and abdominal pain among other symptoms.

Bilioenteric bypass procedures are usually performed to re-establish the bile flow. Several bilioenteric bypass procedures are available depending on the pancreaticobiliary pathology. However, Roux-en-Y hepaticojejunostomy or choledochojejunostomy are considered the procedures of choice [3–5]. These reconfigurations of biliary tree have their merit of complications. Bilioenteric stricture formation post-bilioenteric bypass procedures is a rare complication. If stricture is left untreated it may result in a significant morbidity and mortality as a result of bile stagnation which may cause recurrent cholangitis, liver abscesses, liver cirrhosis, portal hypertension, and hepatic failure. The incidence of bilioenteric strictures ranges from 4% to 10% according to several retrospective studies [6–9]. A recent analysis by Francesca M. Dimou for 3374 patients who underwent a biliary-enteric anastomosis between 1996 and 2011 found an underestimation of the true incidence of biliary-enteric anastomotic strictures with an overall incidence of (11.9%) and a cumulative incidence of 12.5% at two years [7]. Bilioenteric stricture development is related to many factors such as small-sized duct at the time of bypass, the level of bile duct injury, and concomitant hepatic arterial injury with ischemic insult to the bile duct. It may also result from multiple repair attempts, technical issues, bile leak, and the presence of infection (abscess formation or recurrent cholangitis) [8].

Management of bilioenteric strictures can be achieved using endoscopic, percutaneous, or surgical procedures. The initial management in most of the cases is by endoscopic and percutaneous endobiliary balloon dilatation with stenting of the stricture site. The success rate of endoscopic dilatation and stenting is variable and falls in the range of 30–70% [10–12] and can reach 85–95% as stated in few recent reports using biodegradable stents [13]. However, the long-term outcomes are not clear with several studies showing variable patency rates ranging from 73% to 49% at 1 year and 3 years, respectively [14–17]. Stenting of the biliary system harbors some late complications, occlusion being the most common. Stent occlusion may be managed through mechanical re-opening, stent removal, or re-stenting [18].

Percutaneous procedures have an important role in the initial management of bilioenteric strictures through balloon dilatation, stent, and the use of multiple plastic stents. Percutaneous transhepatic cholangiography carries a high patency rate but with more complications and technical challenges [12].

Surgical intervention is reserved for failed endoscopic or radiological approaches. Surgical revision can be achieved by different methods: open modality, laparoscopic approach, and robotic surgery when feasible. These procedures are better performed in expert hands to attain best outcomes.

To date, no randomized studies have compared the different treatment modalities (endoscopic, percutaneous, or surgical procedures). This ensues as a result of different types of biliary injury, types of treatment, and the inconsistencies in defining successful outcomes. Several authors have reported some degree of success with surgical revision in these patients, with decreased success rate after each operative attempt. This occurs mainly due to the lack of the bile duct length in subsequent trials [19, 20]. On the other hand, other reports claim equivalent surgical outcomes when compared with primary repairs at the same institution with a patency rate at five years reaching 80% [21]. Despite the above findings, surgical revision of the biliary enteric anastomosis, especially after pancreaticoduodenectomy, remains a challenging operation due to the altered anatomy, dense fibrosis, and adhesions in addition to the presence of chronic inflammation [22].

The advantages of our technique are

Firstly, its simplicity, this technique eliminates the need for hilar dissection or dissection through the intense fibrosis that may occur from previous surgery or recurrent cholangitis. Varices resulting from portal hypertension may lead to profuse bleeding during redo hepaticojejunostomy. The latter surgical procedure may result in portal vascular injury, which may further increase the risk of fibrosis.

Secondly, it can be applied to long strictures and strictures close to the confluence, with preservation of the biliary length in case of recurrence of the stricture.

Thirdly, theoretically, the blood supply to the bile duct remains intact because the incision is made at the fibrous stricture and at the anterior aspect of the duct, thus avoiding blood compromise to the biliary system. It also avoids magnification of surgical trauma to the original biliary system.

Fourthly, a single attempt is required in comparison to the interventional approach, which usually requires several attempts and long-term follow-up. Thus, in terms of cost-effectiveness, it may be superior to these methods.

Fifthly, the procedure is made on the same jejunal loop, without the need for creation of a new loop as in some cases of redo hepaticojejunostomy.

Finally, it may contribute to avoidance of redo Whipple procedure (resection of the pancreaticojejunostomy, hepaticojejunostomy and jejunojejunostomy, and redo of all three intestinal anastomoses) which, on its own merit, carries a high rate of complications and morbidities.

CONCLUSION

This new simple procedure and its promising result have the potential to replace the traditional complicated and high-risk procedures that are currently carried out for the management of benign hepaticojejunostomy strictures, especially in patients with pancreaticoduodenectomy. Moreover, it can replace interventional methods for biliary-enteric anastomotic strictures represented by ERCP and PTC, which usually need several attempts and need long-term follow-up.

LIMITATIONS

This is not a controlled study, so further studies consisting of larger patient populations and control groups are needed to reach a definitive conclusion. In addition, this procedure is inapplicable in case of extension of strictures intrahepatically.

REFERENCES

1. Villa NA, Harrison ME. Management of biliary strictures after liver transplantation. Gastroenterol Hepatol (N Y) 2015;11(5):316–28.
2. Husain Z, Khan KI, Vaseem M, Rana SH. Extrahepatic biliary obstruction postoperative morbidity and mortality. PAFMJ 2010;60(2):222–6.
3. Meduri B, Fritsch J, Calogero G. Pancreatic cancer: Palliative endoscopic biliary drainage. Int J Pancreatol 1988;3 Suppl 1:S143–6.
4. Tocchi A, Mazzoni G, Liotta G, et al. Management of benign biliary strictures: Biliary enteric anastomosis vs endoscopic stenting. Arch Surg 2000;135(2):153–7.
5. Gouma DJ, van Geenen R, van Gulik T, de Wit LT, Obertop H. Surgical palliative treatment in biliopancreatic malignancy. Ann Oncol 1999;10 Suppl 4:269–72.
6. Zhu JQ, Li XL, Kou JT, et al. Bilioenteric anastomotic stricture in patients with benign and malignant tumors: Prevalence, risk factors and treatment. Hepatobiliary Pancreat Dis Int 2017;16(4):412–17.
7. Dimou FM, Adhikari D, Mehta HB, Olino K, Riall TS, Brown KM. Incidence of hepaticojejunostomy stricture after hepaticojejunostomy. Surgery 2016;160(3):691–8.
8. Kasahara M, Egawa H, Takada Y, et al. Biliary reconstruction in right lobe living-donor liver transplantation: Comparison of different techniques in 321 recipients. Ann Surg 2006;243(4):559–66.
9. House MG, Cameron JL, Schulick RD, et al. Incidence and outcome of biliary strictures after pancreaticoduodenectomy. Ann Surg 2006;243(5):571–8.
10. Kadaba RS, Bowers KA, Khorsandi S, et al. Complications of biliary-enteric anastomoses. Ann R Coll Surg Engl 2017;99(3):210–15.
11. de Santibañes E, Palavecino M, Ardiles V, Pekolj J. Bile duct injuries: Management of late complications. Surg Endosc 2006;20(11):1648–53.
12. Costamagna G, Tringali A, Mutignani M, et al. Endotherapy of postoperative biliary strictures with multiple stents: Results after more than 10 years of follow-up. Gastrointest Endosc 2010;72(3):551–7.
13. Giménez ME, Palermo M, Houghton E, et al. Biodegradable biliary stents: A new approach for the management of hepaticojejunostomy strictures following bile duct injury. Prospective study. [Article in Portuguese]. Arq Bras Cir Dig 2016;29(2):112–6.
14. Shimatani M, Hatanaka H, Kogure H, et al. Diagnostic and therapeutic endoscopic retrograde cholangiography using a short-type double-balloon endoscope in patients with altered gastrointestinal anatomy: A multicenter prospective study in Japan. Am J Gastroenterol 2016;111(12):1750–8.
15. Tsutsumi K, Kato H, Muro S, et al. ERCP using a short double-balloon enteroscope in patients with prior pancreatoduodenectomy: Higher maneuverability supplied by the efferent-limb route. Surg Endosc 2015;29(7):1944–51.
16. Tsujino T, Yamada A, Isayama H, et al. Experiences of biliary interventions using short double-balloon enteroscopy in patients with Roux-en-Y anastomosis or hepaticojejunostomy. Dig Endosc 2010;22(3):211–6.
17. Itokawa F, Itoi T, Ishii K, Sofuni A, Moriyasu F. Single- and double-balloon enteroscopy-assisted endoscopic retrograde cholangiopancreatography in patients with Roux-en-Y plus hepaticojejunostomy

anastomosis and Whipple resection. Dig Endosc 2014;26 Suppl 2:136–43.
18. Moris D, Papalampros A, Vailas M, Petrou A, Kontos M, Felekouras E. The hepaticojejunostomy technique with intra-anastomotic stent in biliary diseases and its evolution throughout the years: A technical analysis. Gastroenterol Res Pract 2016;2016:3692096.
19. Lillemoe KD, Martin SA, Cameron JL, et al. Major bile duct injuries during laparoscopic cholecystectomy. Follow-up after combined surgical and radiologic management. Ann Surg 1997;225(5):459–71.
20. Walsh RM, Vogt DP, Ponsky JL, Brown N, Mascha E, Henderson JM. Management of failed biliary repairs for major bile duct injuries after laparoscopic cholecystectomy. J Am Coll Surg 2004;199(2):192–7.
21. 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(2):171–6.
22. Prawdzik C, Belyaev O, Chromik AM, Uhl W, Herzog T. Surgical revision of hepaticojejunostomy strictures after pancreatectomy. Langenbecks Arch Surg 2015;400(1):67–75.

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Acknowledgments
We are grateful to Heba Lababneh, for her artistic work on the schematic views of the photos.

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Guarantor of Submission
The corresponding author is the guarantor of submission.

Source of Support
None.

Consent Statement
Written informed consent was obtained from the patient for publication of this article.

Conflict of Interest
Authors declare no conflict of interest.

Data Availability
All relevant data are within the paper and its Supporting Information files.

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