

Management of Bile Duct Injuries Following Laparoscopic Cholecystectomy: Long-term Outcome and Risk Factors Influencing Biliary Reconstruction

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Rezumat

Managementul leziunilor căilor biliare după colecistectomia laparoscopică: rezultatele pe termen lung și factorii de risc care influențează reconstrucția biliară

Introducere: Leziunile iatrogene ale căilor biliare produse în timpul colecistectomiei laparoscopice rămân complicații severe, cu impact major asupra calității vieții pacientului.

Scop: Evaluarea rezultatelor tratamentului chirurgical și studiul factorilor de risc care pot influența evoluția reconstrucției biliare la pacienții cu leziuni ale căilor biliare produse în timpul colecistectomiei laparoscopice.

Material și metodă: Între ianuarie 2005 și decembrie 2010, 43 de pacienți cu leziuni iatrogene ale căilor biliare, secundare colecistectomiei laparoscopice au fost tratați în institutul nostru. Conform clasificării Strasberg, leziunile au fost împărțite după cum urmează: tip A în 7 cazuri (16,28%), tip D în 4 (9,3%), tip E1 în 9 (20,93%), tip E2 în 11 (25,58%), tip E3 în 10 (23,25%) și tip E4 în 2 (4,65%) cazuri. Managementul acestor leziuni a inclus ERCP cu sfincterotomie endoscopică în cazul pacienților cu leziuni minore (de tip Strasberg A) și respectiv hepatico-jejunostomie pe ansă în Y a la Roux pentru 36 de pacienți cu leziuni majore (Strasberg tip D și E). 55,55% dintre pacienții cu leziuni ductale majore prezentau tentative anterioare de reparație chirurgicală (înaintea internării). În caz de peritonită biliară sau angiolocolită acută severă, reconstrucția a fost precedată de drenaj biliar extern prelungit.

Rezultate: Toate leziuni minore au fost tratate cu succes pe cale endoscopică, cu rezultate excelente pe termen lung. Pentru pacienții cu leziuni ductale majore, rata de mortalitate și morbiditate postoperatorie a fost de 5,55% și respectiv 25%. După o perioadă medie de urmărire de 34,1 (interval, 12-68) luni, 30 de pacienți (88,23%) prezintă evoluție bună/excelentă (folosind clasificarea McDonald); 4 pacienți (11,77%) dezvoltând stenoză a anastomozei hepatico-jejunale. Analiza multivariată a factorilor de risc a identificat fistula biliară postoperatorie ($p = 0,012$), drept factor de risc independent asociat cu apariția stenozei anastomotice.

Concluzii: Leziuni minore ale căilor biliare pot fi tratate cu succes endoscopic, dacă drenajul cavității abdominale este corespunzător. Hepatico-jejunostomia pe ansă în Y a la Roux este sigură, eficientă și cu rezultate durabile pe termen lung, chiar și atunci când intervențiile chirurgicale anterioare au eșuat. Fistula biliară postoperatorie este un factor de predicție asociat cu rezultate slabe pe termen lung (stenozarea zonei de anastomoză).

Cuvinte cheie: leziuni ale căilor biliare, evoluție postoperatorie, factori de risc, hepatico-jejunostomie pe ansă în Y a la Roux

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Abstract

Background: Bile duct injury following cholecystectomy remains a severe complication with major implications for the patient outcome.

Aim: To assess the outcome of surgical treatment and study the risk factor influencing biliary reconstruction in patients with bile duct injuries following laparoscopic cholecystectomy.

Methods: Between January 2005 and December 2010, 43 patients with bile duct injuries following laparoscopic cholecystectomy were treated to our center. According to Strasberg classification, the types of injuries were as follows: type A in 7 patients (16.28%), type D in 4 (9.3%), type E1 in 9 (20.93%), type E2 in 11 (25.58%), type E3 in 10 (23.25%), and type E4 in 2 (4.65%) patients respectively. Management after referral included endoscopic sphincterotomy in patients with minor lesions (Strasberg type A) and Roux-en-Y hepaticojejunostomy in 36 patients with major duct injuries (Strasberg type D and E). 55.55% of patients with major bile duct injuries have endoscopic or surgical attempts of repairs prior to referral. In case of biliary peritonitis or acute cholangitis, the reconstruction was preceded by prolonged external biliary drainage.

Results: All minor lesions were successfully treated endoscopically, with outstanding long term results. For patients with major duct injuries, the postoperative mortality and morbidity rate were 5.55% and 25%, respectively. After a median follow-up period of 34.1 (range, 12-68) months, 30 patients (88.23%) remain in good general condition (using McDonald classification) and 4 patients (11.77%) developed a late anastomotic stricture. Multivariate analyses have identified postoperative biliary leak ($p=0.012$) as an independent predictor factor for the occurrence of late anastomotic stricture.

Conclusions: Minor bile duct injuries can be successfully treated endoscopically if proper abdominal drainage is maintained. Roux-en-Y hepaticojejunostomy is feasible and safe with contained morbidity and durable results even when previous surgery has failed. Postoperative biliary leak is a significant predictor for poor long term outcome.

Key words: bile duct injuries, long-term outcome, risk factors, Roux-en-Y hepatico-jejunostomy

Introduction

Although laparoscopic cholecystectomy is the standard treatment in patients with symptomatic gallbladder lithiasis for nearly 3 decades, bile duct injuries are reported to be more common when compared to open cholecystectomy (1). Bile duct injury following cholecystectomy remains a major concern for both surgeons and patients because of the associated morbidity and mortality.

The optimal management in order to reduce mortality and achieve the best long-term results is a medical challenge that requires skills, knowledge, dedication and a perfect collaboration between surgeons, gastroenterologists and interventional radiologists.

The aim of this study is to evaluate the morbidity and long-term outcome of surgical treatment and to study the risk factor influencing biliary reconstruction in patients with bile duct injuries following laparoscopic cholecystectomy.

Patients and Methods

Patient characteristics

Between January 2005 and December 2010, a number of 43 patients with bile duct injuries following laparoscopic cholecystectomy were treated to the Surgery Department of "O. Fodor" Regional Institute of Gastroenterology and Hepatology, Cluj-Napoca, Romania. Medical records of these patients were retrospectively reviewed and data regarding patient characteristics, type of injuries, time to referral, management prior to and after referral and the long term outcome were analysed.

A proper classification of the bile duct injuries was done using MRI cholangiography, ERCP and/or percutaneous radiology in all patients. Bile duct injuries (BDI), categorised according to Strasberg classification (2), were as follows: type A in 7 patients (16.28%), type D in 4 patients (9.3%), type E1 in 9 patients (20.93%), type E2 in 11 patients (25.58%), type E3 in 10 patients (23.25%), and type E4 in 2 patients (4.65%). No patients had liver cirrhosis and no concomitant vascular injury was detected.

All minor bile duct injuries (Strasberg type A) were detected in the early postoperative period. After excluding the presence of any abdominal collections, all 7 patients with minor bile duct lesions were successfully treated by ERCP with endoscopic sphincterotomy.

In the remaining 36 patients, a major bile duct injury was detected (Strasberg type D or E). For them, the time of referral ranged from the same operative session (6 cases-16.66%) to more than 5 years (median, 3 months) since cholecystectomy (30 patients). Out of these 30 patients, 10 patients (27.77%) had no treatment prior to referral; for the remaining of 20 patients (55.55%), the management prior to referral included endoscopic techniques and/or percutaneous biliary drainage in 8 patients (22.22%) and surgical treatment in 12 patients (33.33%) including Roux-en-Y hepaticojejunostomy in 4 of them (11.76%).

All patients with major bile duct injuries were treated by Roux-en-Y hepaticojejunostomy. Depending on the size of the hepatic/common bile duct, different artifices detailed in "Hepatico-jejunostomy technique" were used, so the final diameter of the anastomosis be greater than 1.5 cm.

Surgical management and hepatico-jejunostomy technique

After entering the peritoneal cavity, the surgeon inspected the local peritoneal involvement. In the presence of biliary peritonitis or severe (suppurative) cholangitis (we will refer to those as "adverse local factors"), the first priority was to control sepsis. This goal was achieved by external biliary drainage alongside proper cleansing and drainage of the abdominal cavity (first stage of treatment). In addition, a feeding jejunostomy or endoscopic placement of a naso-jejunal tube was also performed to enable reintroducing the bile into the alimentary tract. Patients were discharged

(when their general status allowed it) being instructed how to collect the bile and reintroduce into the alimentary tract (via jejunostomy/ nasojejunal tube) after meals. Check-ups were scheduled every 3-4 weeks in an outpatient setting. In all of these cases, reconstructive surgery was performed at a later time, in an average period of 88 days (range, 74-106) from the first stage of the treatment.

In the absence of the “adverse local factors”, the surgeon removed all local inflammatory material and scar tissue from the biliary ducts and then assessed the entire biliary tree. The type of Roux-en-Y hepaticojejunostomy depended on the diameter of the remnant bile duct. If the diameter of common hepatic duct was larger than 1.5 cm, then an end-to-side Roux-en-Y hepaticojejunostomy was performed. Otherwise, we have chosen to perform a Roux-en-Y hepaticojejunostomy according to the Hepp-Couinaud technique (it involves exposing the left hepatic duct along its extrahepatic course at the base of segment IV): the anterior surface of the left hepatic duct is exposed by incising Glisson’s capsule and dissecting overlying parenchima at the base of segment IV (without risking significant bleeding since the main vessels lie posteriorly). Starting from the edge of the remnant hepatic duct, we incised the hepatic duct, the confluence and the left hepatic duct (on the anterior aspect) thus creating the basis for a wide anastomosis.

If the biliary confluence was completely damaged (Strasberg E4 injury), we used an artifice in order to obtain one single, larger biliary partner for anastomosis: after dissecting the right and left hepatic ducts, the medial aspects of the stumps of the ducts were anastomosed together, creating a new confluence before performing the hepaticojejunostomy.

If the patients had a previous hepaticojejunostomy, the same Roux limb was used for reconstruction. Otherwise, we created a Roux limb of jejunum (at least 50-60 cm in length) which was passed retrocolically and ascended near the hepatic hilum so that a tension-free hepaticojejunostomy could be performed. One-layer, full-thickness anastomosis between the bile duct and jejunal loop was performed with a running (back wall) and interrupted (front wall) absorbable, 4/0 or 5/0 monofilament sutures starting with the back wall. All the knots were tied on the outside. After the anastomosis was completed, the enteral loop was anchored to the hilar plate (one or two sutures) in order to reduce the tension in the anastomotic area. We used no transanastomotic stents and no access loop was constructed.

Follow-up

The median follow-up period was 34.1 months (range, 12-68). Postoperative controls were performed at every 4 months after biliary reconstruction and consisted of clinical examination, laboratory tests (complete liver tests and blood count), abdominal ultrasound/contrast-enhanced abdominal CT. If any of these tests raise the suspicion of a bile duct stenosis then a magnetic resonance cholangiography (cholangio-MR) is performed.

The effectiveness of biliary repair was classified according to McDonald classification (3): grade A - no clinical symptoms from the biliary tract, normal laboratory liver function parameters tests; grade B - no clinical signs, laboratory liver function parameters tests slightly elevated, or periodically occurring episodes of pain or fever; grade C - pain, cholangitis with the presence of fever with jaundice and abnormalities in laboratory tests; grade D - condition requiring surgical or endoscopic correction. Long-term results were considered good in case of grade A or B and poor if grade C or D were reported.

Statistical analysis

The Epi Info computer package (version 3.5.3 for Windows) developed by the Center for Disease Control and Prevention was used for the statistical analysis. Student t-test and Fisher exact test were used for nominal data analysis. The chosen statistical significance level was $p < 0.05$.

Results

Outcome following minor bile duct injuries (Strasberg A)

All 7 patients with minor bile duct injuries (Strasberg A) were treated endoscopically. All injuries were detected in the early postoperative period, therefore we were able to perform an early repair in all cases (within 5 days from time of injury). Following abdominal ultrasound/contrast-enhanced abdominal CT (which excluded the presence of any abdominal collections) and endoscopic retrograde cholangiopancreatography (which confirmed the type of lesion), endoscopic sphincterotomy was the only therapeutic maneuver performed.

The duration of hospitalization since the day of endoscopic sphincterotomy was 5 days (range, 3-8). We have achieved no morbidity, no mortality and outstanding long term results for all patients (the outcome was considered good -grade A on McDonalds classification).

Outcome following major bile duct injuries

Major bile duct injury was detected in 36 patients (83.72%). There were 20 females (55.55%) and 16 (44.45%) males with a median age of 42 years (range, 19-63). Pathological characteristics of the study population included: ischemic heart disease or arterial hypertension in 8 cases (22.22%); diabetes mellitus in 4 cases (11.11%) and overweight/obesity in 12 (33.33%) patients. Ten patient (27.77%) were heavy smokers (2 packs cigarettes/day). Diameter of the hepatic /common bile duct was as follows: less than 10 mm in 8 patients (22.22%), between 10 and 15 mm in 10 (27.78%) patients and larger than 15 mm in 18 patients (50%).

On referral, patients with major bile duct injuries had presented with jaundice in 20 cases (55.55%), biliary peritonitis in 4 cases (11.11%) and cholangitis in 6 cases (16.66%). Six cases (16.66%) of biliary injuries were recognised intraoperatively and were managed in the same operative session.

We performed an early repair (within 2 weeks from the time of injury) in 17 patients (47.22%) provided that there was no biliary peritonitis or acute cholangitis. Late repair (more than 2 weeks from injury) was performed in the remaining 19 patients (52.78%), of which 4 (11.11%) with biliary peritonitis and 6 (16.66%) with angiocholitis.

Postoperative morbidity rate was 25%. Nine patients with major bile duct injuries developed postoperative complication after Roux-en-Y hepaticojejunostomy (Table 1). Wound infection was treated conservatively by removing a few cutaneous stitches followed by local cleansing with antiseptic solution and antibiotic. Biliary leaks had presented with bile on drain tubes between day 3 and 7 following repair. One of the anastomotic fistulas, which had a low output (less than 100 ml/24 hours) closed spontaneously after 11 days. The other two were treated with re-laparotomy. Partial excision of the stump of the jejunal loop, excision of non-viable tissue from the hepatic duct and re-anastomosis was performed in one case (there were minimal signs of peritoneal inflammatory changes subsequent to the presence of bile) and peritoneal cleansing and external biliary drainage was performed in the other case (unfortunately, the patient died of sepsis 12 days following re-laparotomy). The patient who developed bronchopneumonia on postoperative day 3, had a favorable outcome under conservative treatment (antibiotic, mucolytic, aerosols, breathing exercises).

The mortality rate was 5.55% (2 patients). A 62-year-old patient suffered from a myocardial infarction which did not respond to resuscitation, on postoperative day 1. The second patient developed an anastomotic fistula on postoperative day 4, underwent re-laparotomy (external biliary drainage and peritoneal cleansing were performed), but unfortunately

died of sepsis 12 days following re-laparotomy.

The average duration of postoperative hospitalization (hospitalization since the day of reconstruction) was 9 days (range, 5-21).

According to McDonald classification, a good long term outcome (grade A and B) was achieved in 30 patients (83.33%) (Table 2), two of whom continue to have sporadic episodes of cholangitis without any documented stricture on MRI cholangiography (McDonald grade B) and one patient continues to have slightly elevated laboratory liver function parameters without signs of cholangitis.

Poor long term outcome was recorded in 4 patients (11.76%) who developed late anastomotic stricture. In one patient, anastomotic stenosis occurred 14 months following reconstruction. This is the patient who developed a biliary fistula with low output which closed spontaneously 11 days following the reconstruction. Since the patient had experienced two other surgical attempts prior to referral, he refused surgical management. One percutaneous dilatation was performed and the patient remained event-free after a 12 months follow-up period. In the remaining 3 cases, anastomotic stricture occurred at 18, 20 (the patient who developed the postoperative fistula and re-anastomosis was performed) and 28 months following reconstruction. Surgical management was considered in all cases. All fibrotic tissues of the bile duct were removed, a resection of the base of segment IV and V at the level of the hilar plane was performed to facilitate exposure and placement of the jejunal limb (in two cases) and revision of the anastomosis was performed using the same Roux limb. No biliary transanastomotic stents were used. Their condition remained good at 20 (for the first two patients) and 16 (last patient) months after reconstruction.

Table 1. Postoperative morbidity following Roux-en-Y hepaticojejunostomy

Short-term outcome	Low injuries (n=23)	High injuries (n=13)	Total (n=36)	p value
Overall morbidity	4; (17.40%)	5; (38.46%)	9; (25%)	0.161
Biliary leak	0	3; (23.07%)	3; (8.33%)	0.076
Wound infection	3 (13.05%)	1; (7.69%)	4; (11.11%)	0.154
Myocardial infarction	1; (4.35%)	0	1; (2.77%)	0.446
Bronchopneumonia	0	1; (7.69%)	1; (2.77%)	0.177

Low injuries - injuries below biliary confluence.

High injuries - injuries at the level or above the biliary confluence.

Table 2. Long term outcome following Roux-en-Y hepaticojejunostomy

Long-term outcome	Low injuries (n=22)	High injuries (n=12)	Total (n=34)
Good outcome			
Grade A	20; (90.9%)	7; (58.33%)	27; (79.41%)
Grade B	2; (9.1%)	1; (8.33%)	3; (8.82%)
Poor Outcome			
Grade C			
Grade D		4; (33.33%)	4; (11.77%)

Risk factors for biliary stricture following Roux-en-Y hepaticojejunostomy

Univariate and multivariate analyses were performed in order to identify significant risk factors for late anastomotic stricture following Roux-en-Y hepaticojejunostomy in patients with bile duct injuries. Presence of postoperative bile leakage, prior attempts of surgical repair, site of the injuries (Low injuries - injuries below biliary confluence vs High injuries - injuries at the level or above the biliary confluence), diameter of common bile duct and presence of biliary peritonitis on referral were analysed as possible risk factors.

On univariate analysis (Table 3), two factors were associated with the development of anastomotic stricture and poor long term outcome: postoperative biliary leak ($p=0.008$) and prior attempts of surgical repair ($p=0.02$). Multivariate analysis with stepwise logistic regression identified postoperative biliary leak ($RR=16$; $95\%CI=1.98-301.9$; $p=0.012$) as independent risk factor for late anastomotic stricture.

Discussion

Bile duct injury (BDI) following laparoscopic cholecystectomy remains an ongoing concern for both patients and surgeons (4). The diagnosis of BDI is a major issue and the proper treatment is mandatory; it can avoid serious complications (such as angiocholitis, biliary cirrhosis or hepatic failure) and improve quality of life (5).

Definitive treatment of BDI depends on the severity of injury and timing of its recognition. Only one quarter of bile duct injuries are recognized during surgery (6), but over 2/3 are recognized in the first few days following surgery (1). The best advice given to a surgeon with limited surgical expertise who recognised this injury intraoperatively, is not to convert but only place several drainage tubes before referring the patient to a tertiary center (6).

Likewise, if the lesion is not detected during surgery, explorative laparotomy should be avoided before proper classification of injury (6), due to the fact that minor injuries can be successfully treated endoscopically (ERCP with sphincterotomy or stent placement). For minor bile duct injuries (Strasberg type A), endoscopy proves to be not only a diagnosis investigation, but also a safe and effective therapeutic tool with a published success rate between 89% and 93% (5,6). Our results are in accordance with literature findings in this respect.

In major bile duct injuries, surgery remains the main treatment. The goal of surgical treatment is to assure a proper bile flow to the alimentary tract (5). Several techniques are described and many contradictory reports on the effectiveness of reconstruction can be found in the literature. The outcome of surgical repair can be altered by many factors, including timing of repair, level of injury, presence of infection, associated vascular injury and poor operative technique (7).

The effectiveness of suturing a tangential or a complete bile duct injury (Strasberg D and E) over a T-tube is questionable, because the anastomosis tends to stricture over time (5). We do not favor end to end anastomosis or hepato-duodenostomy of a transected bile duct due to poor blood supply of the anastomosis area and inability to obtain a real tension free anastomosis (even if a Kocher maneuver is well performed in advance) which will lead to biliary leak and late stenosis. In our institution, we have always chosen Roux-en-Y hepaticojejunostomy for surgical repair of major bile duct injuries. Our management is in compliance with other reports (5,8) which have shown that this type of reconstruction is the most frequently performed and has the best long term outcome (the lower number of postoperative anastomosis strictures). According to Lubikowski et al (9), after a median follow up of 59 months (range, 6-102), 92% of patients with Roux-en-Y hepaticojejunostomy remain in good general condition with normal liver function test. Our results are in accordance with these reports, 88.23% of our patients with major bile duct injuries having had a successful long term outcome following

Table 3. Risk factors influencing anastomotic stricture following Roux-en-Y hepaticojejunostomy (univariate analysis)

Risk factor		Late anastomotic stricture		Odds ratio; (95% CI)	P value
		Absent	Present		
Postoperative bile leaks	Present	0	2	61; (3.03-330.7)	0.008*
	Absent	30	2		
Prior attempts of surgical repair	With	8	4	13.3; (1.6-304.9)	0.02*
	Without	22	0		
Site of the injuries	High injuries	9	4	14.3; (0.7-287.9)	0.069
	Low injuries	21	0		
Diameter of hepatic bile duct (mm)	Smaller than 15	14	3	3.4; (0.3-36.8)	0.594
	Larger than 15	16	1		
Biliary peritonitis on referral	Present	4	0	0.6; (0.03-14.3)	0.787
	Absent	26	4		

*- Statistical significance;

Low injuries - injuries below biliary confluence;

High injuries - injuries at the level or above the biliary confluence.

Roux-en-Y hepaticojejunostomy.

Timing of reconstructive procedure is one of the multiple factors that define a successful management of bile duct injuries. It is generally accepted that if the injury is recognized during surgery, immediate repair offers the best outcome and can decrease morbidity, mortality and hospitalization (7,10). However, in case of biliary peritonitis, it is preferable to wait (the recommended period of time is 3 months), thereby acute inflammatory phase will regress and the patient will overcome the catabolic state (11,12). Pursuant to these reports, in our cases where we have found intraoperatively the presence of peritonitis or severe acute angiocholitis, we have delayed the definitive reconstruction for an average period of 88 days. All these patients have a good long term outcome (grade A and B according to McDonald classification).

We believe that good long term outcome in our patients has predominantly resulted from the fact that we have always respected the following conditions when performing a biliary anastomosis: the edges of anastomosis were healthy, without fibrosis or signs of ischemia and a wide (at least 1.5 cm diameter), tension free anastomosis was performed only after the proper control of infection and resolution of inflammation.

The overall morbidity rate after Roux-en-Y hepaticojejunostomy in patients with major bile duct injuries is up to 34% according to the literature data (13,14). Our percentage (25%) is in accordance with reported data. In our study, bile leak following Roux-en-Y hepaticojejunostomy was observed in 3 patients (8.33%). This percentage is also in accordance with literature data which show a postoperative biliary fistula rate up to 10% (15).

Our mortality rate of 5.55% (2 patients) is in accordance with the data reported by other authors who found a postoperative mortality rate up to 9.8% (16).

Temporary stenting of the anastomosis remains controversial. Some authors recommend the use of stents and claim a lower probability of postoperative stricture (17). Others consider the use of stents as mandatory only for Bismuth III-IV-V injuries (18). Recent studies show similar results without stenting and demonstrate stenting as a high risk factor for cholangitis (19, 20). Quintero et al (19), in a group of 65 patients with Roux-en-Y hepaticojejunostomies without transanastomotic stents, had 9.2% strictures. We believe that our percentage of 11.76% late stenosis, which is a little higher, is due to a greater number of patients with severe injuries (lesions Strasberg E2 or more severe) as compared to Quintero (33.33% in our study vs. 20% in Quintero's).

The rate of concomitant vascular injuries, mainly right hepatic injuries, is reported to be between 17% and 32% (9, 21). While some studies have shown similar long term outcome (22), several other studies have demonstrated an increased risk of postoperative bile duct strictures in patients with combined bile and vascular injuries (21,23). This is particularly important, because a regulated hepatectomy can be considered appropriate in these cases. We had no concomitant vascular injuries, but hepatic angiography was not performed routinely for our patients.

The incidence of late anastomotic stricture following

hepaticojejunostomy for bile duct injuries is reported to be between 4%–24% (2,13,15). Our percentage (11.76% late stenosis) is in accordance with these reports proving that a wide anastomosis removes the need for temporary stents. Most studies admit that two-thirds of postoperative bile duct stenosis occur within the first 2 years, but stenosis has also been reported even after 20 years following reconstructive surgery (8,9). It is particularly important to assess the liver function for a proper management of these late complications. Patients who developed secondary biliary cirrhosis due to late anastomotic stenosis may be candidates for liver transplantation rather than for another surgical reconstruction, especially in the presence of portal hypertension (1).

We had 4 patients (11.76%) with late postoperative stenosis including three that were surgically treated by revision of the anastomosis using the same Roux limb. In order to avoid surgery, other authors advocate leaving a longer jejunal loop during the reconstructive surgery to facilitate subsequent access. This loop will be sutured subcutaneously in the right subcostal region (access loop). In case of anastomosis stricture, the jejunal loop can be opened and the stenosis can be endoscopically dilated (5).

Analysis of the literature data (7,15,12,20,24) showed that different authors have found one or more of the following parameters as potential risk factors for occurrence of late stricture of the anastomosis: multiple prior attempts of repair, presence of active peritonitis at the time of repair, postoperative biliary fistula, anastomosis on an undilated duct, preoperative and postoperative percutaneous biliary drainage, associated vascular injury, and level of injury (below or above the biliary bifurcation). Some authors (18) preclude an increased rate of stenosis in patients who underwent prior attempts of repair. We found postoperative biliary leak as the only significant independent predictor factor for the occurrence of late anastomotic stricture.

Conclusion

Our results indicate that minor bile duct injuries can be successfully treated endoscopically if a proper abdominal drainage is maintained. Roux-en-Y hepaticojejunostomy is feasible and safe with contained morbidity and durable results even when previous surgery has failed. Postoperative biliary leak is a significant independent predictor factor for the occurrence of late anastomotic stricture.

Conflicts of interest

All authors have nothing to declare.

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