Endoscopic retrograde cholangiopancreatography through laparoscopically created gastrotomy for the management of biliary complications of Roux-en-Y gastric bypass

Mustafa Bayoumi[a], Hisham Hussein[a], Badawy A. Abdul Aziz[b], Hatem S. Abd El-Raouf[b]

[a]Departments of General Surgery, [b]Hepatology, Gastroenterology and Infectious Diseases, Faculty of Medicine, Benha University, Benha, Egypt

Correspondence to Hisham Hussein, MD, Department of General Surgery, Faculty of Medicine, Benha University, Benha, 13511, Egypt, Tel: 01025454996; e-mail: hsurgeon71@gmail.com

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Objective
The aim of this study was to evaluate the feasibility, safety, and surgical outcome of laparoscopically assisted endoscopic retrograde cholangiopancreatography (ERCP) through gastrotomy in patients who had undergone Roux-en-Y gastric bypass as a bariatric procedure and indicated for ERCP.
Patients and methods
The study included 12 patients who had undergone Roux-en-Y gastric bypass surgery in the past 1–4 years and developed biliary obstruction since 23.3±7 days (range: 13–36 days). The operative procedure involves laparoscopic creation of gastrotomy; a sterile ERCP scope was inserted through a 12-mm port site and passed manually under laparoscopic visualization through the gastrotomy orifice, and then sphincterotomy (papillotomy) and cannulation were performed. Preprocedural and postprocedural dye injection was performed to ensure the patency of biliary passages. The gastrotomy site was closed in two layers.
Results
Laparoscopic exploration was performed successfully in all patients, with successful adhesiolysis in three patients. In all patients, laparoscopic creation of gastrotomy in the gastric remnant was uneventful and successful, but gastrotomy site bleeding occurred in two cases and was controlled. Sphincterotomy was successful in all patients, but cannulation and injection of dye for intraoperative choledochography were performed successfully in 10 (83.3%) patients. Two patients required sphincter stenting. The mean operative time was 66.9± 10.5 min (range: 55–90 min); the mean time until first ambulation and oral intake was 1.6 and 11.5 h, respectively, and the mean duration of postoperative hospital stay was 32.9 h. Eight minor postoperative complications were encountered.
Conclusion
Laparoscopic transgastrotomy ERCP is feasible and safe for the diagnosis and treatment of biliary complications secondary to bariatric surgery, with minimal treatable complications.

Keywords:
biliary obstruction, endoscopic retrograde cholangiopancreatography, gastrotomy, Roux-en-Y gastric bypass

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Introduction

Obesity occurs because of a positive energy balance, in which case the surplus energy is stored as adipose tissue [1]. Variation in BMI is determined genetically by the influence of various complex neuroendocrine systems; ultimately, it is the interaction between genetic predisposition and environment that finally determines the body weight gained. Overweight and obesity are becoming endemic, particularly because of increasing the caloric intake with decrease physical exercise [2].

Bariatric surgery is increasingly being performed in an attempt to reduce the physiological and social costs. For many patients, bariatric surgery results in enduring weight loss and resolution of comorbidity. One of the most well-known and successful surgical procedures involves gastric resection and anastomosis to the jejunum 'Roux-en-Y gastric bypass' (RYBG), in particular, laparoscopic Roux-en-Y gastric bypass (LRYGB) [3].

Gallstones are commonly observed after rapid weight loss, particularly after bariatric surgery. Preventive measures against gallstone formation and potential related complications are still debated [4]. Moreover,

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controversy exists on the importance and consequences of gallstones in these patients. There are surgeons who consider gallstone-related complications after gastric bypass important enough to require routine removal of the gallbladder during gastric bypass (prophylactic cholecystectomy), but this can lead to increased costs and risks [5].

Endoscopic retrograde cholangiopancreatography (ERCP) remains the gold standard in both the diagnosis and the therapeutic management of pancre atobiliary diseases. In patients with normal anatomy, the rate of successful cannulation and sphincterotomy by expert endoscopists is 90% or more. However, patients with surgically altered anatomy, especially those who have undergone reconstructive gastrointestinal surgery reaching the ampulla, present a unique endoscopic challenge where conventional ERCP is technically difficult. In large case series, technical failures varied from 13 to 67%, and the rate of perforation was as high as 18%, with a mortality rate of 3% [6].

After RYBG, the new gastrointestinal configuration does not enable easy endoscopic access to the biliary system in the standard manner. Common bile duct (CBD) stones have proved to be a challenge for both the surgeon and the endoscopist in this setting. Both endoscopic and ERCP success rates were the highest in patients with Billroth II anatomy, followed by those with pancreaticoduodenectomy and Roux-en-Y hepaticojejunostomy; the lowest success rates were in patients with RYBG [7,8].

The current study aimed to evaluate the feasibility, safety, and surgical outcome of laparoscopically assisted ERCP through gastrotomy in patients who had undergone RYGB as a bariatric procedure and developed obstructive jaundice.

Patients and methods

The current prospective study was carried out at the Department of General Surgery at Benha University Hospital (Benha, Egypt) and Aladwani General Hospital (Taif, KSA) from January 2013 till June 2015. Inclusion criteria included previous RYGB as a bariatric procedure in the presence of a clear indication of ERCP:

(1) Assessment and treatment of biliary obstruction secondary to choledocholithiasis.
(2) Assessment and treatment of bile duct strictures.
(3) Assessment and treatment of selected patients with suspected sphincter of Oddi dysfunction.
(4) Assessment and possible treatment in patients with an unknown underlying cause of recurrent, acute pancreatitis.
(5) Assessment and treatment of symptomatic strictures associated with chronic pancreatitis.

Preoperative data included age, sex, and BMI, duration since bariatric surgery, and duration of jaundice. Collected postoperative (PO) data included duration of surgery, time till first ambulation and oral intake, duration of PO hospital stay, and frequency of intraoperative and PO complications.

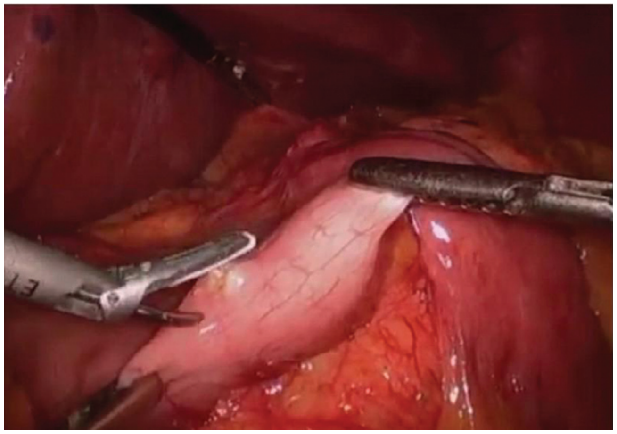
Operative procedure

All surgeries were performed under general inhalational anesthesia with tracheal intubation. Patients were positioned in the classic Lloyd Davies position and carbon dioxide pneumoperitoneum was achieved through the standard 10-mm umbilical port. Two subsequent port sites were used: a 5-mm port site in the right upper quadrant and a 12-mm port in the left upper quadrant to enable abdominal exploration and visualization of the gastric remnant. A site on the anterior wall of the stomach was chosen. A gastrotomy was performed using a Harmonic scalpel (HARMONIC ACE+ Shears; Johnson & Johnson (New Brunswick, New Jersey, U.S.)) and purse–string sutures were placed around the gastrotomy site to allow for seal around the endoscope and facilitate insufflation and traction of the stomach. A sterile ERCP scope was inserted manually through a left 12-mm port site under laparoscopic visualization. ERCP and sphincterotomy were performed and obstructing stone, if any, was dislodged. Preprocedural and postprocedural dye injection was performed to ensure patency of the biliary passages. The gastrotomy site was closed in two layers: a running stitch, followed by a layer of inverting Lembert sutures using 2/0 Vicryl; Johnson & Johnson (New Brunswick, New Jersey, U.S.) (Figs. 1–10).

Results

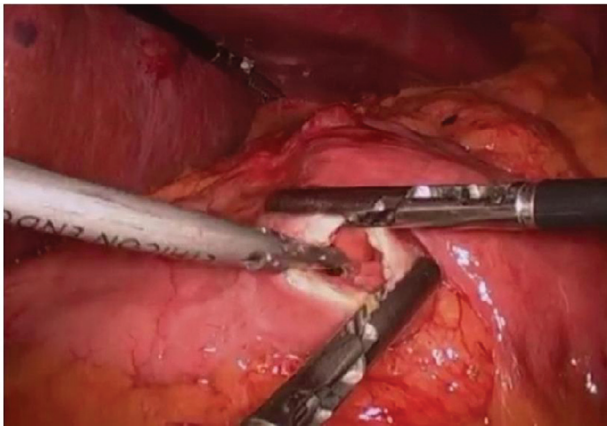
The study included 12 patients, nine women and three men with a mean age of 44.8±5.8 years (range: 36–54 years). Patients who had bariatric surgery (range: 1–4 years), and the mean BMI at the time of development of biliary manifestations was 31.8±2.4 kg/m^2 (range: 28.7–34.7 kg/m^2). The mean duration of symptoms was 23.3±7 days (range: 13–36 days). The indication for ERCP was biliary obstruction that was most probably secondary to choledocholithiasis on imaging of six (50%) patients, whereas no evident stone was detected on imaging of the remaining patients. Details of preprocedural data are shown in Table 1.

Figure 1



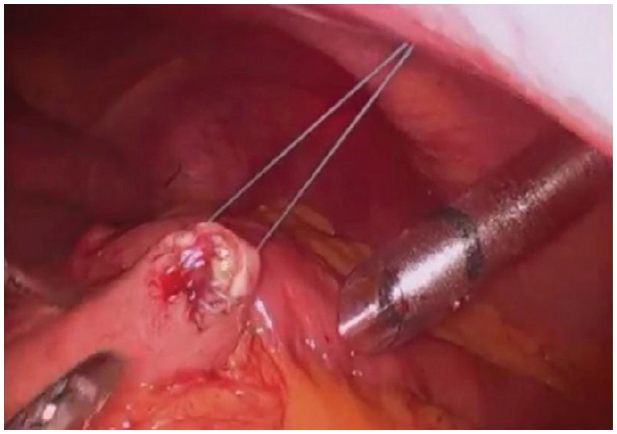
A site on the anterior wall of stomach was chosen.

Figure 2



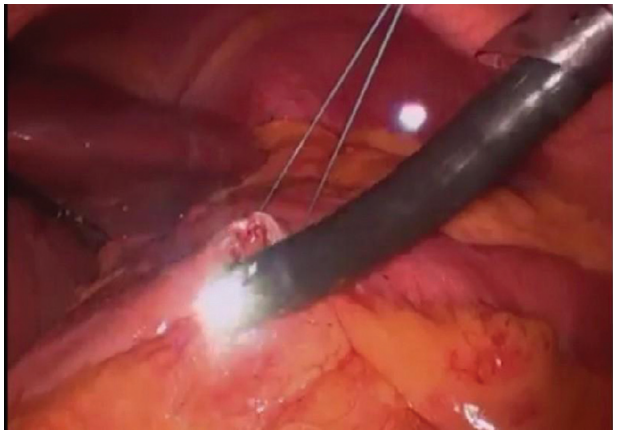
A gastrotomy was performed using Harmonic scalpel.

Figure 3



Purse-string suture was placed around the gastrotomy site.

Figure 4

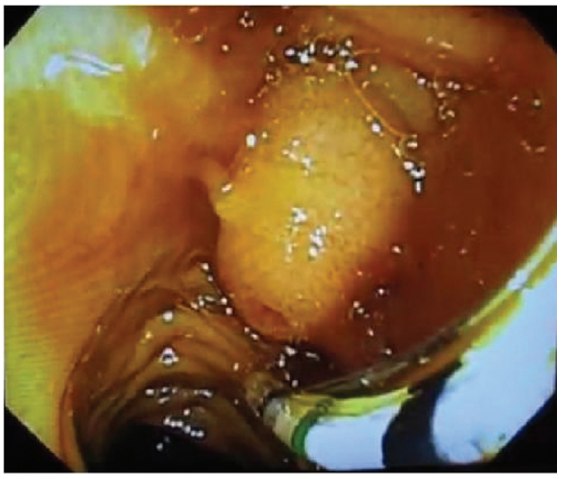


A sterile ERCP scope inserted under laparoscopic visualization.

Figure 5

Sphincterotomy performed by ERCP sphincterotome.

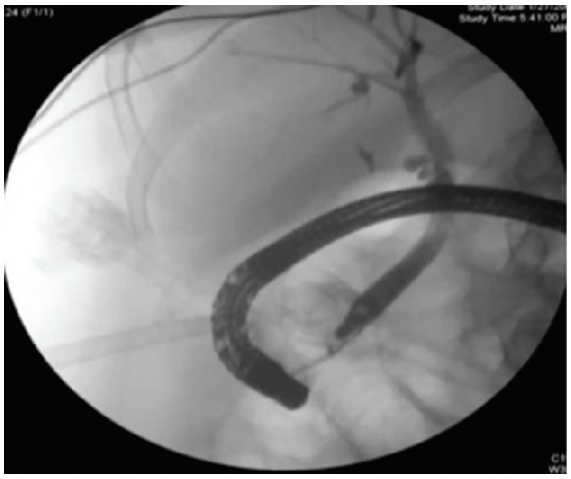
Figure 6



ERCP sphinctrotome advanced ERCP sphinctrotome towards the papilla.

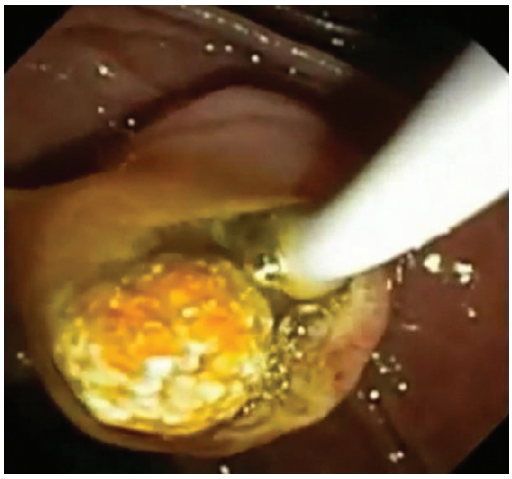
Clinically, six (50%) cases presented with recurrent biliary colic and intermittent jaundice; Magnetic resonance cholangio-pancreatography (MRCP) showed choledocholithiasis and gallstones in five cases, but in the sixth case, MRCP showed choledocholithiasis with

Figure 7



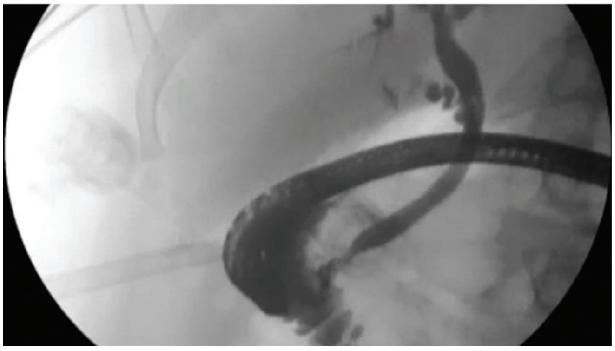
Cholangiography shows a stone at the distal end of the CBD.

Figure 8



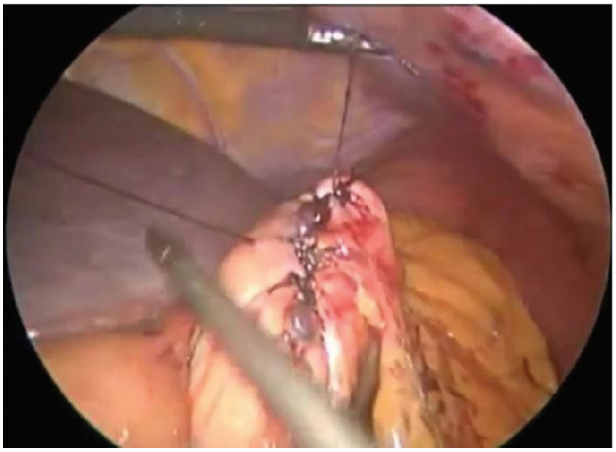
Stone extraction by ERCP balloon.

Figure 9



Completion cholangiogram showing patent CBD.

Figure 10



Gastrotomy site closed in two layers.

absent gallbladder because of previous cholecystectomy during the gastric resective surgery. Two cases presented with recurrent biliary pancreatitis and MRCP showed a distal CBD stone with a dilated pancreatic duct. One patient presented with recurrent upper abdominal pain and MRCP showed distal CBD stricture. Another patient presented with emergency acute cholangitis secondary to impacted stone at the distal end of CBD. Two patients presented with recurrent upper abdominal pain associated with temporary recurrent jaundice that was most probably because of Oddi sphincter dysfunction (Table 2).

Laparoscopic exploration was performed successfully, with successful adhesiolysis in three (25%) patients. Laparoscopic procedures for the creation of gastrotomy in the gastric remnant were performed successfully in all patients. Bleeding at the site of gastrotomy occurred in two (16.7%) cases and was controlled uneventfully.

In all patients, endoscopic access to the gastrotomy orifice in the distal gastric segment was through 15-mm trocar in the left upper quadrant of the abdomen and was guided laparoscopically till the gastrotomy orifice, and was then advanced through the gastric remnant till reaching the duodenal papilla.

Successful sphincterotomy was performed in all 12 patients. Choledecolithotomy and cholecystectomy were performed in five cases and choledecolithotomy alone was performed in one case. However, cannulation and injection of urografin dye for intraoperative choledochography to ensure patency was performed successfully in 10 (83.3%) patients, whereas in two patients, cannulation could not be approached to ensure patency, but bile flow as judged endoscopically was evident. Two patients required stenting of the sphincter; one had stricture and the other had recurrent biliary pancreatitis. The operative time was less than 60 min in five (41.7%) cases and more than

Table 1 Preoperative data

Data	Findings
Age (years)	
Strata	
<40	3 (25)
40–50	7 (58.3)
>50	2 (16.7)
Total	44.8±5.8 (36–54)
Sex	
Men	3 (25)
Women	9 (75)
BMI data	
Weight (kg)	91.5±10 (77–109)
Height (cm)	169.4±4 (163–178)
BMI (kg/m^2)	
Strata	
25–30	4 (33.3)
>30	8 (67.7)
Total	31.8±2.4 (28.7–34.7)
Duration since bariatric surgery (years)	
Strata	
1	2 (16.7)
2	4 (33.3)
3	3 (25)
4	3 (25)
Total	2.5±1 (1–4)
Duration of symptoms (days)	
Strata	
≤15	2 (16.7)
>15–30	8 (66.6)
>30	2 (16.7)
Total	23.3±7 (13–36)
Radiological findings	
Choledocholithiasis	6 (50)
No stone CBD	6 (50)

Data are presented as mean±SD and numbers; ranges and percentages are in parenthesis. CBD, common bile duct.

Table 2 Clinical and MRCP findings

Clinical findings	MRCP findings	*N* (%)
Recurrent biliary colic and intermittent jaundice	Choledocholithiasis and gallstones	5 (41.7)
	Choledocholithiasis with invisible gallbladder	1 (8.3)
Recurrent biliary pancreatitis	Distal CBD stone with dilated pancreatic duct	2 (16.7)
Recurrent upper abdominal pain	Distal CBD stricture	1 (8.3)
Acute cholangitis	Impacted stone at the distal end of CBD	1 (8.3)
Recurrent upper abdominal pain associated with temporary recurrent jaundice	Oddi sphincter dysfunction	2 (16.7)

CBD, common bile duct.

60 min in seven (58.3%) cases, with a mean operative time of 66.9±10.5 min (range: 55–90 min).

Table 3 Postoperative data

Data	Findings
Time till first ambulation (h)	
Strata	
1–	5 (41.7)
2–	6 (50)
3–	1 (8.3)
Total	1.6±0.6 (1–3)
Time till first oral intake (h)	
Strata	
<9	2 (16.7)
9–12	7 (58.3)
>12	3 (25)
Total	11.5±2.8 (7–15)
PO hospital stay (days)	
Strata	
Same operative day	3 (25)
Next morning	4 (33.3)
Two days PO	4 (33.3)
Three days PO	1 (8.4)
Total (h)	32.9±19.3 (12–72)
PO complications	
Transient colicky abdominal pain	4 (33.3)
Abdominal pain because of postprocedural	1 (8.3)
Nausea and occasional vomiting	3 (25)

Data are presented as mean±SD and numbers; ranges and percentages are in parenthesis. PO, postoperative.

All patients could move after 1.6±0.6 h (range: 1–3 h) and were able to have their first oral intake after 11.5± 2.8 h (range: 7–15 h). Three (25%) patients were discharged on the same operative day, four (33.3%) patients were discharged the next morning, and four (33.3%) patients were discharged on the second PO day, whereas only one stayed for 3 days after surgery for a mean duration of PO hospital stay of 32.9±19.3 h (range: 12–72 h).

PO complications included abdominal pain in four (41.7%) patients; one patient developed postprocedural pancreatitis that responded to conservative treatment and was discharged 3 days after the procedure. Three patients developed nausea and occasional vomiting that responded to antiemetic therapy; however, no serious complication was encountered (Table 3).

Discussion

The study included six patients with choledo cholithiasis; two with recurrent biliary pancreatitis, two with distal CBD stone, one of them presenting with emergency acute cholangitis, and two patients pres ented with recurrent upper abdominal pain associated with temporary recurrent jaundice secondary to Oddi sphincter dysfunction. This frequency of biliary complications after LRYGB is in agreement with Nagem *et al.* [5], who reported that gallstone-related

complications after LRYGB were relatively common and some of these complications, such as acute pancreatitis, are potentially severe outcomes.

Five patients with choledocholithiasis had coexisting gallstones, whereas only one patient had undergone a previous cholecystectomy, a finding indicating the high frequency of concomitant choledocholithiasis and cholecystolithiasis and pointing to the beneficial effect of prophylactic cholecystectomy during endoscopic retrograde roux en y gastrojejunostomy (ERYGP). These five patients underwent choledecolithotomy and cholecystectomy to prevent recurrent choledocholithiasis. In line with this management, Nagem *et al.* [5] documented that it seems reasonable to perform cholecystectomy during gastric bypass in the presence of cholelithiasis or after this procedure if gallstones develop. Recently, Amstutz *et al.* [9] retrospectively reported that nearly 50% of patients who had undergone LRYGB experienced gallstones either before LRYGB or developed it after LRYGB and 50% of patients who developed gallstone required emergency cholecystectomy, and concluded that these results, the reported better quality of life after a combined procedure, and the reported economic benefits support the use of concomitant prophylactic cholecystectomy in patients undergoing LRYGB.

The current study showed the feasibility of laparoscopic management of biliary complications of bariatric surgery with successful exploration, management of adhesions, and creation of gastrotomy within a reasonable operative time and with minimal complications. Endoscopic sphincterotomy was performed successfully in 12 cases, whereas cannulation was successful in 10 cases, yielding a success rate of 83.3%.

The recorded success rate for laparoscopic and endoscopic management supported that reported previously by Ceppa *et al.* [10], who retrospectively studied 10 patients who had undergone laparoscopic transgastric endoscopy; five patients had biliary pathologic findings and four of these five patients underwent successful ERCP and papillotomy, whereas the procedure was unsuccessful in the fifth patient because of stone impaction at the ampulla. Also, Roberts *et al.* [11] studied five patients who had undergone previous LRYGB; all patients required ERCP. In each patient, a flexible endoscope was inserted into the stomach through a gastrotomy under direct visualization, all therapeutic endoscopic procedures were successful, and anterior gastrotomies were either closed primarily or a feeding tube was placed. The operative time ranged from 64 to 93 min; patients reported minimal PO pain, but no complications resulted from the procedures.

Richardson *et al.* [12] evaluated 11 patients who underwent successful biliary cannulation and sphinc terotomy using laparoscopic transgastric endo scopy and concluded that the procedure is a safe and reliable method to access the excluded stomach and biliary tree in patients with a history of RYGB. Falcão *et al.* [13] evaluated transgastric ERCP for managing common biliary tract diseases in patients who underwent RYGB treatment for obesity and reported that all patients underwent an ERCP and papillotomy without incident; the average gastrotomy duration was 92.69 min and the average hospital stay was 2 days. One patient had mild acute pancreatitis that resolved clinically and it was concluded that laparoscopy-assisted transgastric ERCP was feasible and safe for patients after RYGB.

Saleem *et al.* [14] studied 15 patients with post-RYGB surgery who underwent laparoscopic-assisted ERCP and reported that successful endoscopic antegrade access to the papilla was achieved through the gastric remnant and cannulation and interventions in the pancreaticobiliary tree were successful in all cases and therapeutic interventions included biliary sphincterotomy in 14 and pancreatic sphincterotomy in two patients; the mean duration of the procedure and the median postprocedure hospital stay were 45 min and 2 days, respectively, and no PO complications occurred.

Dickinson *et al.* [2] documented that laparoscopic transgastric sphincterotomy enabled definite treatment and excellent symptomatic relief in a patient with sphincter of Oddi dysfunction after LRYGB. Martel *et al.* [15] also documented that in patients with gastric bypass anatomy and severe adhesions, successful salvage therapeutic ERCP can be achieved using a gastrotomy tract and a large-bore laparoscopy trocar for access to the defunctioned stomach; the total endoscopy time was 120 min, the postprocedure length of stay was 2 days, and no complications associated with the procedure were encountered.The reported outcome using a laparoscopic approach for the creation of gastrotomy for endoscopic advancement superseded that reported previously by Choi *et al.* [16], who compared the technical outcomes of ERCP by percutaneous gastrotomy (GERCP) and double-balloon enteroscopy (DBERCP) for patients with previous bariatric RYGB and concluded that GERCP is more effective than DBERCP in gaining access to the pancreatobiliary tree in patients with

RYGB, but it is hindered by the gastrotomy maturation delay and a higher morbidity.

In support of the applied technique and obtained results, recently, in 2015, Grimes *et al.* [17] retrospectively evaluated 85 transgastric ERCP and reported that RYBG eliminates the normal approach to the duodenum for ERCP, transgastric access has a high rate of successful cannulation, the operative intervention rate was 2.4%, conversion to open procedure occurred in 4.8%, and 16% developed a complication related to the access site. Facchiano *et al.* [18] documented that in patients with a previous history of RYGB, ERCP enables safe and reproducible access to the major papilla and the biliary tree using a transgastric access.

Conclusion

The results obtained indicate the feasibility and safety of laparoscopic transgastrotomy ERCP for both the diagnosis and the treatment of biliary complications secondary to bariatric surgery with minimal treatable PO complications. The procedure applied could be advocated for the management of similar cases with altered abdominal anatomy secondary to surgery or other causes.

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Nil.

Conflicts of interest

The aims and concerns of our study are compatible with the other studies made on the same subject topic.

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