ELSEVIER

CrossMark

Surgery for Obesity and Related Diseases 10 (2014) 647–653

SURGERY FOR OBESITY AND RELATED DISEASES

Original article

Laparoscopic choledochoduodenostomy as an alternate treatment for common bile duct stones after Roux-en-Y gastric bypass

Christopher DuCoin, M.D., Rena C. Moon, M.D., Andre F. Teixeira, M.D., Muhammad A. Jawad, M.D., F.A.C.S.*

Department of Bariatric Surgery, Orlando Regional Medical Center & Bariatric and Laparoscopy Center, Orlando Health, Orlando, Florida

Received September 27, 2013; accepted January 6, 2014

Abstract

Background: After Roux-en-Y gastric bypass (RYGB), the new gastrointestinal configuration does not permit easy endoscopic access to the biliary system in the standard fashion. Common bile duct (CBD) stones have proved to be a challenge for both the surgeon and the endoscopist in this setting. We shall review our experience with laparoscopic choledochoduodenostomy as a treatment of choledocholithiasis after gastric bypass.

Methods: Between January 2000 and July 2012, 3115 patients underwent RYGB at our institution. Patients were included if they had postoperative CBD stones regardless of previous cholecystectomy. Treatment modality was laparoscopic choledochoduodenostomy. A retrospective chart review of a prospectively collected data was completed, noting the outcomes and complications of the procedure.

Results: Of 3115 patients, 11 patients were included in this study. There were 8 female and 3 male patients with a mean age of 50.5 ± 10.9 (range, 34–66) years. The average time between primary RYGB and choledochoduodenostomy was 39.7 ± 33.8 (range 8–113) months. The average body mass index at primary surgery was 48.2 ± 8.1 (range 38.4–67.4) kg/m^2 and at choledochoduodenostomy was 29.5 ± 6.8 (range 22.7–46.9) kg/m^2. One patient had bile leak that was managed with drain. All patients had resolution of symptoms at a mean follow-up of 24.8 ± 26.9 (range 2–84) months.

Conclusion: This small case series suggests that, in experienced hands, laparoscopic choledochoduodenostomy is an option for safe and effective treatment of choledocholithiasis after gastric bypass. (Surg Obes Relat Dis 2014;10:647–653.)

Medical management of the obesity pandemic has thus far provided little utility. However, bariatric surgery has provided this population with a treatment that results in weight reduction and resolution of co-morbidities. Currently the most commonly performed bariatric surgery in the United States is the laparoscopic Roux-en-Y gastric bypass (RYGB) [1].

Gastric bypass surgery changes both the physiology and route of the gastrointestinal tract. The rapid weight loss seen after this procedure leads to mobilization of cholesterol, which results in an increased incidence of gallstone formation. In nonobese asymptomatic patients, the presence of gallstones is not an indication for surgery and is observed in roughly 10% of the adult population [2]. Yet, as many as 35% of patients with gallstones will ultimately become symptomatic and require cholecystectomy [3]. There are

*Correspondence: Muhammad A. Jawad, M.D., Medical Director, Department of Bariatric Surgery, Orlando Regional Medical Center & Bariatric and Laparoscopy Center, Orlando Health, 89 W Copeland Dr, 1st Floor, Orlando, FL.

E-mail: muhammad.jawad@orlandohealth.com

http://dx.doi.org/10.1016/j.soard.2014.01.027

multiple indications for cholecystectomy, however, it is no longer routinely performed in those undergoing bariatric surgery [2,4–6]. Many now advocate for "selective cholecystectomy" at the time of laparoscopic RYGB in patients with proven gallbladder stones on preoperative imaging [5,7–10]. The reason being if asymptomatic stones are found and not operated on at the time of surgery, 18% will require subsequent cholecystectomy [4]. Of those with no preoperative stones and not treated postoperatively with ursodeoxycholic acid, 6% will develop stones in the future [4]. All of these scenarios place patients at risk for a potential stone to migrate from the gallbladder to the common bile duct (CBD).

Choledocholithiasis is a predicament after RYGB surgery, as the new gastrointestinal configuration does not permit access to the biliary system in the standard fashion. CBD stones in this setting have proved to be a challenge for both the surgeon and the endoscopist. New techniques have been developed for accessing the biliary system after gastric bypass surgery. Such procedures include combined laparoscopic surgery and endoscopy whereby endoscopic access is achieved via a gastrostomy [11–14] or jejunostomy [15]. Another method of accessing the CBD is via a percutaneous transhepatic route [16]. This allows for lithotripsy, sphincterotomy, and balloon sphincteroplasty [17,18]. The remnant stomach has been accessed via a percutaneous transgastric approach [19,20]. However, it is a difficult technique due to the inability to insufflate the remnant stomach [21,22]. In some centers, double-balloon enteroscopy-assisted endoscopic retrograde cholangiopancreatography (ERCP) is being performed with a success rate of 90% in reaching the ampulla and roughly 80% for therapeutic intervention [23–25].

During the open era, an option for the definitive treatment for symptomatic impacted CBD stones was an open choledochoduodenostomy (CDDS). However, a mortality rate of roughly 3–8% was associated with the procedure [26,27]. The purpose of this study is to show in experienced hands, laparoscopic CDDS is an option for safe and effective treatment for choledocholithiasis in the setting of RYGB when other modes of accessing the CBD have failed.

Methods

Between January 1, 2000 and July 31, 2012, a total of 3115 patients underwent laparoscopic RYGB at our institution with screening ultrasound of the gallbladder. With approval of the Institutional Review Board and adhering to the Health Insurance Portability and Accountability Act guidelines, a retrospective chart review of a prospectively collected database was completed. Patients were included into the study if they developed symptomatic CBD stones after the initial laparoscopic RYGB, and either met the criteria for CBD exploration (3 or more CBD stones, stones >1 cm, large stones relative to cystic duct size, or a stone above the junction of the cystic duct) or failed therapy with percutaneous transhepatic stone extraction.

Choledocholithiasis was confirmed with imaging modalities such as transabdominal ultrasound, computed tomography (CT) scan, magnetic resonance cholangiopancreatography (MRCP), intraoperative cholangiogram, and percutaneous transhepatic cholangiogram. Treatment consisted laparoscopic CBD exploration with CDDS as an alternative and definitive treatment.

The study population was comprised on the initial laparoscopic RYGB, and were all performed by a single surgeon (M.J.). Laparoscopic CDDS was also performed by 1 surgeon adhering to the same technique describe below. Our surgeon is a bariatric surgeon experienced with >4000 laparoscopic bariatric procedures since 1999, had performed laparoscopic general surgery since 1989, and is experienced with >3000 hepatobiliary cases. Concomitant cholecystectomy was performed as a routine procedure when gallstones were present on preoperative imaging at the time of original laparoscopic RYGB. During the initial laparoscopic RYGB with selective cholecystectomy, an intraoperative cholangiogram was not performed unless indicated by either imaging or preoperative laboratory results. Ursodiol to prevent postoperative gallstones was not used in this patient population.

Data points included age, sex, date of laparoscopic RYGB, presence of stones at primary surgery, cholecystectomy at primary surgery, BMI at primary and secondary surgery, date of laparoscopic CDDS, duration of follow up, resolution of symptoms, and complications. Descriptive statistics were performed and data was reported as mean $\pm$ standard deviation and range.

Surgical technique

All CDDS were performed in a similar manner whereby the duodenum was kocherized after gaining laparoscopic access. The CBD was confirmed via needle aspiration, and a longitudinal choledochotomy (Fig. 1) was created. Lateral stay-stitches were placed to assist in opening the CBD. Various means were used to extract the stones such as usage of a Fogarty catheter, stone baskets, and flushing. A duodenotomy was then created in the first portion of the duodenum, and a tension-free CDDS was completed (Fig. 2). A side-to-side choledochoduodenostomy was then created with 8–10 interrupted 3–0 Polysorb stitch. If the patient did not have a cholecystectomy and was with cholelithiasis at the time of this procedure, a cholecystectomy was also performed. At the completion of surgery, a 10 French Jackson-Pratt drain was placed at the CDDS to control a possible future leak.

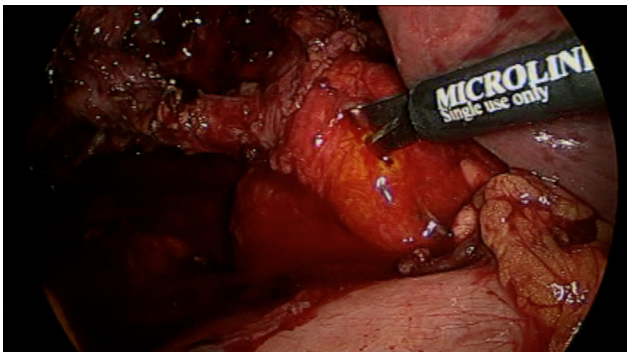

Fig 1. Longitudinal opening of the common bile duct.

Results

Of 3115 patients, 11 were found to fit the inclusion criteria for this study. There were 8 female and 3 male patients with a mean age of 50.5 ± 10.9 (range, 34–66) years. The average time between primary RYGB and CDDS was 39.7 ± 33.8 (range 8–113) months excluding 1 patient who had both procedures done at the same time. This patient underwent intraoperative cholangiogram at the time of RYGB, which revealed CBD and hepatic duct full of multiple stones. The average BMI at primary RYGB was 48.2 ± 8.1 (range 38.4–67.4) kg/m^2 and at CDDS was 29.5 ± 6.8 (range 22.7–46.9) kg/m^2, corresponding to an average drop in BMI of 18.2 ± 4.1 (range, 13.5–24.8) kg/m^2 excluding the same patient. Demographic characteristics of these patients are listed in Table 1.

Of these 11 patients, 3 had a previous cholecystectomy and 1 was found to have cholelithiasis during the preoperative imaging for the initial laparoscopic RYGB. The patient with cholelithiasis at the initial RYGB was treated with a concomitant cholecystectomy. Two other patients had their gallbladder removed after RYGB but before CDDS. The period between cholecystectomy and CDDS was 12 months in 1 patient and 18 months in the other. One patient had recurrent abdominal pain with elevated liver enzymes, and the other patient had multiple attacks of ascending cholangitis with sepsis. These 6 patients developed symptomatic primary biliary stones within the CBD, which resulted in a primary CBD stone formation rate of .2% in our study population. Five patients who had no stones or sludge within the gallbladder on initial RYGB developed multiple stones within both the CBD and gallbladder. These 5 patients were treated with CDDS and cholecystectomy.

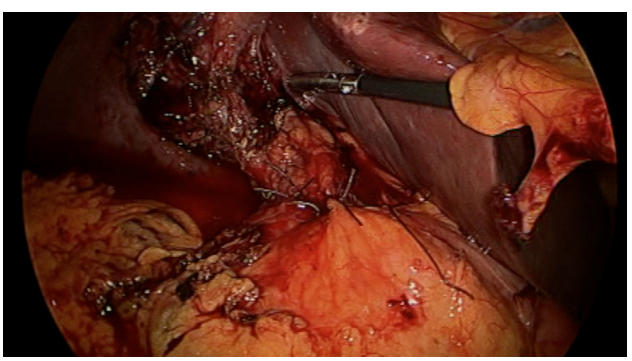

Fig 2. Completed choledochoduodenostomy.

Table 1
Demographic characteristics of patients who underwent CDDS

Patient no.	Gender	Age* (yr)	Co-morbidities at RYGB	BMI at RYGB (kg/m^2)	BMI at CDDS (kg/m^2)	Period between RYGB and CDDS (mo)
1	M	41	OSA	67.4	46.9	12
2	F	50	HTN, GERD	46.1	30.5	27
3	M	57	HTN, GERD	50.7	25.9	115
4	F	34	GERD	44.3	30.8	82
5	F	46	OSA	38.4	22.7	27
6	F	52	HTN, GERD	39.3	24.4	8
7	M	64	HTN, DM, GERD, OSA	47.5	29.9	37
8	F	35	HTN, OSA	54.1	54.1	Concomitant
9	F	47	GERD	48.4	25.2	29
10	F	66	HTN, DM, GERD, Dyslipidemia	41.9	27.8	17
11	F	62	None	52.1	30.5	46

BMI = body mass index; CDDS = choledochoduodenostomy; DM = diabetes mellitus; F = female; GERD = gastroesophageal reflux disease; HTN = hypertension; M = male; No = number; OSA = obstructive sleep apnea; RYGB = Roux-en-Y gastric bypass.
*Age at the time of CDDS.

Patients presented with right upper quadrant abdominal pain, with or without radiation to the back, and nausea. Two patients presented with recurrent ascending cholangitis with sepsis, and 2 other patients had pancreatitis. Descriptions of diagnosis and additional findings are listed in Table 2.

After CDDS, the average postoperative follow-up period was 24.8 ± 26.9 (range 2–84) months. Patients were followed-up in the clinic and contacted at the termination of this study. Upon closing this study, no patient had developed cholangitis or symptomatic recurrence of common bile duct stones. One patient had a postoperative biliary leak that was managed by a drain placed at the time of operation and did not require additional surgery.

Discussion

CBD stones that develop status post-RYGB are a difficult pathology to treat. This is because the postoperative alteration in the gastrointestinal tract does not permit easy endoscopic access to the biliary system in the standard fashion via an ERCP.

In the nonobese asymptomatic patients, gallstones present in roughly 10% of the adult population, and as many as 35% of these patients will ultimately require a cholecystectomy [2,3]. In the nonbariatric patients, choledocholithiasis at the time of cholecystectomy has been reported to be

Table 2
Diagnosis methods and findings at the time of CDDS

Pt no.	Previous cholecystectomy*	Diagnosis methods	Other findings*	Complication
1	No	MRCP, IOC	Jaundice, multiple stones blocking the CBD at the ampulla	None
2	Yes	MRCP	Elevated liver enzymes	None
3	Yes	IOC	Multiple attacks of ascending cholangitis with septic shock	None
4	Yes	MRCP	Elevated liver enzymes, pancreatitis	None
5	No	CT, IOC	Dilated CBD	None
6	No	US, IOC	Persistent obstruction at the ampulla of the CBD after removing stones	Bile leak
7	Yes	IOC	Recurrent ascending cholangitis with sepsis	None
8	Yes	US, IOC	Gallbladder stones, CBD and hepatic duct full of stones	None
9	Yes	PTC	Stricture of the CBD	None
10	No	IOC	Pancreatitis	None
11	No	CT	Dilated CBD, elevated liver enzymes	None

CBD = common bile duct; CDDS = choledochoduodenostomy; CT = computed tomography; IOC = intraoperative cholangiogram; MRCP = magnetic resonance cholangiopancreatography; No. = number; Pt = patient; PTC = percutaneous transhepatic cholangiogram; US = ultrasound.
*At the time of CDDS.

between 3–11% [3,28,29] and as high as 15–16% in other series [30,31]. This exemplifies a possible high prevalence of choledocholithiasis in the general population, which could correlate to an equal prevalence in the post-RYGB population.

Gallstone formation rates in the morbidly obese patients can range from 28–45% [32,33]. In the bariatric population, 21–30% of the patients who are candidates for surgery will have already under gone cholecystectomy, and 14% will present with asymptomatic gallstones at the time of surgery [5,34,35]. If asymptomatic stones are found and not operated on at the time of RYGB, 18% will require subsequent cholecystectomy [4]. In patients who undergo RYGB without any findings of stones preoperatively and not treated postoperatively with ursodiol, 6–22% will develop stones in the future [4,5]. Of these who develop postoperative RYGB gallstones, 7–16% will eventually require cholecystectomy for symptoms [5]. We have previously reported a rate of 6% in patients without any finding of stones at the time of RYGB, requiring cholecystectomy after RYGB [36].

In regard to postoperative treatment with ursodiol, the incidence of gallstone formation drops to between 2–6% with a 6-month postoperative course of treatment [37]. Although this has been shown to be statistically significant, it is felt that this is of little clinical significance. In this institute, the routine use of ursodiol has not been implemented because the number needed to treat to avoid 1 cholecystectomy was roughly 50 postoperative RYGB. The modes to diagnosis choledocholithiasis are similar to that of cholelithiasis. The most commonly used screening tool is transabdominal ultrasound, and a CBD diameter >6 mm is associated with an increased prevalence of choledocholithiasis [38]. The sensitivity of the CT scan in this setting can be as high as 96% [39]. MRCP provides excellent anatomic detail of the biliary tract and has a sensitivity of 81–100% and a specificity of 92–100% in detecting choledocholithiasis [40]. ERCP is not only the gold standard for the diagnosis of choledocholithiasis, but also the preferred modality for stone extraction [40]. However, in the setting of RYGB this tool has little utility secondary to the new gastrointestinal configuration [40,41]. Thus, surgeons and endoscopists have been forced to explore new modes of cannulating the CBD in an attempt to treat choledocholithiasis.

Originally, during the open era, CBD exploration was performed in the setting of impacted stones and cholangitis. The CBD was then closed over a "T" tube or a CDDS was created. With the advances in laparoscopy, minimally invasive techniques of accessing the CBD were developed. In experienced hands, the CBD clearance rate is as high as 97% [30,42]. Between 66% and 83% of laparoscopic CBD explorations can be performed via the cystic duct [41,42]. However, indications for laparoscopic CBD exploration by choledochotomy are 3 or more CBD stones, stones greater than 1 cm, large stones relative to cystic duct size, or a stone above the junction of the cystic duct and CBD [43]. However, the morbidity of these procedures was found to be approximately 10% and retained stone rate 3% [30].

Thus, surgical intervention progressed to even less invasive measures over time. Examples included laparoscopic transgastric endoscopic retrograde cholangiopancreatography [11–14,44,45], percutaneous transhepatic instrumentation of the CBD [16], and double-balloon enteroscopy-assisted ERCP [23–25]. These newer methods all provided means of cannulating the CBD and stone retrieval, but did not offer a definitive treatment to a possible recurring problem.

In contrast, the definitive historical procedure had been CDDS, in which the open procedure carried a mortality rate of 3% at a range of 0–8% [26,27,29,46] and roughly 20% in morbidity [27,46]. There was a biliary leak rate of 2–4% of these patients [27,46]. There also was a concern in developing blind sac syndrome, reported between 2.5% and 9.6% in several studies. This condition, also known as sump syndrome, was thought to be derived from stasis and

refluxed duodenal contents into the terminal common duct with bacterial overgrowth enhancing bile salt deconjugation [47]. However, CDDS was extremely effective in treating CBD stones with no return of symptoms in most reports, over a follow-up period of 3 years [26,27]. One study showed a recurrence rate of cholangitis secondary to stricture at the CDDS in 1% of the study population [46].

Using this historical data regarding open CDDS as a baseline measurement, we can argue that laparoscopic CDDS is both safe and effective. In our study, we had no postoperative deaths and had only 1 biliary leak, which was controlled with a drain that was put in at the time of CDDS. The average follow-up time was 2 years, with a patient followed for as long as 7 years in 1 instance. None of the patients in our study developed symptoms secondary to common bile duct pathology such as impacted stones, cholangitis, pancreatitis, or jaundice. Thus, laparoscopic CDDS at the time of CBD exploration is a definitive treatment for CBD stones in the postoperative RYGB patients. Again this was only attempted in the study population when other modes of treatment had failed, mainly percutaneous transhepatic stone extraction, or when they were expected to fail based on historic criteria for CBD exploration (3 or more CBD stones, stones >1 cm, large stones relative to cystic duct size, or a stone above the junction of the cystic duct).

This algorithm is 1 of the limitations to the study as other methods of stone extraction were not implemented or available at our institute, specifically endoscopy canulation via a gastrostomy, jejunostomy, or remnant stomach, nor an approach via double-balloon enteroscopy-assisted ERCP. The retrospective nature of the data collection and that all data came from a single center and only 1 surgeon, is also a limitation in regard to the unrealistic vast application of this complex surgical technique.

Conclusion

CBD stones that develop status post-RYGB will continue to be a challenging issue facing the surgeon. Although various means of gaining access to the CBD exist, none provided a definitive treatment and all allowed the possibility of future stone impaction. Historically open CDDS has been associated with an almost zero recurrence rate of symptomatic stones, as those stones that do develop simply fall into the duodenum via the enlarged CDDS. Thus, we suggest laparoscopic CDDS as an additional and definitive way to treat CBD stones in patients who have had a previous RYGB with failed attempts at stone removal via less invasive procedures or who likely require CBD exploration for stone removal.

Disclosures

The authors have no commercial associations that might be a conflict of interest in relation to this article.

References

[1] Buchwald H, Oien DM. Metabolic/bariatric surgery worldwide 2011. Obes Surg 2013;23:427–36.

[2] Freitas ML, Bell RL, Duffy AJ. Choledocholithiasis: evolving standards for diagnosis and management. World J Gastroenterol 2006;12:3162–7.

[3] Schirmer BD, Winters KL, Edlich RF. Cholelithiasis and cholecystitis. J Long Term Eff Med Implants 2005;15:329–38.

[4] Tucker O, Fajnwaks P, Szomstein S, Rosenthal R. Is concomitant cholecystectomy necessary in obese patients undergoing laparoscopic gastric bypass surgery? Surg Endosc 2008;22:2450–4.

[5] Villegas L, Schneider B, Provost D, et al. Is routine cholecystectomy required during laparoscopic gastric bypass? Obesity Surg 2004;14:60–6

[6] Swartz D, Felix E. Elective cholecystectomy after Roux-en-Y gastric bypass: why should asymptomatic gallstones be treated differently in morbidly obese patients? Surg Obes Relat Dis 2005;1:555–60

[7] Iglezias O, Adami C, da Silva B. Impact of rapid weight reduction on risk of cholelithiasis after bariatric surgery. Obes Surg 2003;13:625–8.

[8] Hamad G, Ikramuddin S, Gourash W, Schauer P. Elective cholecystectomy during laparoscopic Roux-en-Y gastric bypass: is it worth the wait? Obes Surg 2003;13:76–81.

[9] Scott D, Villegas L, Sims T, Hamilton E, Provost D, Jones D. Intraoperative ultrasound and prophylactic ursodiol for gallstone prevention following laparoscopic gastric bypass. Surg Endosc 2005;17:1796–802.

[10] Silidker M, Cronan J, Scola F, et al. Ultrasound evaluation of cholelithiasis in the morbidly obese. Gastro Rad 1998;13:345–6.

[11] Peters M, Papasavas P, Caushaj P, Kania R, Gagne D. Laparoscopic transgastric endoscopic retrograde cholangiopancreatography for benign common bile duct stricture after Roux-en-Y gastric bypass. Surg Endosc 2002;16:1106.

[12] Ceppa F, Gagne D, Papasavas P, Caushaj P. Laparoscopic transgastric endoscopy after Roux-en-Y gastric bypass. Surg Obes Relat Dis 2007;3:21–4.

[13] Dapri G, Himpens J, Buset M, Vasilikostas G, Ntounda R, Cadiere G. Laparoscopic transgastric access to the common bile duct after Roux-en-Y gastric bypass. Surg Endosc 2009;3:416–9.

[14] Gigot JF, Navez B, Etienne J, et al. A stratified intraoperative surgical strategy is mandatory during laparoscopic common bile duct exploration for common bile duct stones. Lessons and limits from an initial experience of 92 patients. Surg Endosc 1997;11:722–8.

[15] Mergener K, Kozarek R, Traverso L. Intraoperative transjejunal ERCP: case reports. Gastrointest Endosc 2003;58:461–3.

[16] Ahmed A, Husain S, Saad N, Patel N, Waldman D, O'Malley W. Accessing the common bile duct after Roux-en-Y gastric bypass. Surg Obes Relat Dis 2003;3:640–3.

[17] Nagashima I, Takada T, Shiratori M, Inaba T, Okinaga K. Percutaneous transhepatic papillary balloon dilation as therapeutic option for choledocholithiasis. J Hepatobiliary Pancreat Surg 2004;11:252–4.

[18] Itoi T, Shinohara Y, Takeda K, et al. A novel technique for endoscopic sphincterotomy when using a percutaneous transhepatic cholangioscope in patients with an endoscopically inaccessible papilla. Gastrointest Endosc 2004;59:708–11.

[19] Baron T, Vickers S. Surgical gastrostomy placement as access for diagnostic and therapeutic ERCP. Gastrointest Endosc 1998;48:640–1.

[20] Martinez J, Guerrero L, Byers P, et al. Endoscopic retrograde cholangiopancreatography and gastroduodenoscopy after Roux-en-Y gastric bypass. Surg Endosc 2006;20:1548–50.

[21] McNeely G, Stork J, Macgregor A, Burns E. Percutaneous examination of the bypassed stomach. Obes Surg 1991;1:427.

[22] Sundborn M, Nyman R, Hededstrom H, Gustavsson S. Investigation of the excluded stomach after Roux-en-Y gastric bypass. Obes Surg 2001;11:25–7.

[23] Emmett DS, Mallat DB. Double-balloon ERCP in patients who have undergone Roux-en-Y surgery: a case series. Gastrointest Endosc 2007;66:1038–41.
[24] Monkemuller K, Fry LC, Bellutti M, Neumann H, Malfertheiner P. ERCP with the double balloon enteroscope in patients with Roux-en-Y anastomosis. Surg Endosc 2009;23:1961–7.
[25] Parlak E, Cicek B, Disibeyaz S, et al. Endoscopic retrograde cholangiography by double balloon enteroscopy in patients with Roux-en-Y hepaticojejunostomy. Surg Endosc 2010;24:466–70.
[26] Thomas C, Nicholson C, Owen J. Effectiveness of choledochoduodenostomy and transduodenal sphincterotomy in the treatment of benign obstruction of the common bile duct. Ann of Surg 1971;173:845–56.
[27] Madden J, Chun J, Kandalaftm S, Parekh M. Choledochoduodenostomy. An unjustly maligned surgical procedure? Amer J Surg 1970;119:45.
[28] Rojas S, Arizpe D, Marin Lopez E, Sanchez R, Roman G, Gomez C. Transcystic common bile duct exploration in the management of patients with choledocholithiasis. J Gastrointest Surg 2003;7:492–6.
[29] Hunter J. Laparoscopic transcystic common bile duct exploration. Am J Surg 1992;163:53–6.
[30] Riciardi R, Islam S, Canete JJ, Arcand PL, Stoker ME. Effectiveness and long-term results of laparoscopic common bile duct Exploration. Surg Endosc 2003;17:19–22.
[31] Southern Surgeon's Club. A prospective analysis of 1518 laparoscopic cholecystectomies. N Engl J Med 1991;324:1073–8.
[32] Fobi M, Lee H, Igwe D, et al. Prophylactic cholecystectomy with gastric bypass operation: incidence of gallbladder disease. Obes Surg 2002;12:350–3.
[33] Seinige UL, Sataloff DM, Lieber CP, DellaCroce JM, Sorouri ES. Gallbladder disease in the morbidly obese patient. Obese Surg 1991;1:51–6.
[34] Bastouly M, Arasaki CH, Ferreira JB, Zanoto A, Borges FG, Del Grande JC. Early changes in postprandial gallbladder emptying in morbidly obese patients undergoing Roux-en-Y gastric bypass: correlation with occurrence of biliary sludge and gallstone. Obes Surg 2009;19:22–8.
[35] Rimm A, Werner L, Yserloo B, Bernstein R. A relationship of obesity and disease in 72,532 weight-conscious women. Public Health Rep 1975;90:44–5.
[36] Moon RC, Teixeira AF, DuCoin C, Varnadore S, Jawad MA. Comparison of cholecystectomy cases after Roux-en-Y gastric bypass, sleeve gastrectomy, and gastric banding. Surg Obes Relat Dis 2013 Jun 4. [Epub ahead of print].
[37] Sugerman J, Brewer W, Schirmer B, et al. A multicenter, placebo-controlled, randomized, double-blind, prospective trial of prophylactic ursodiol for the prevention of gallstone formation following gastric-bypass-induced rapid weight loss. Am J Surg 1995;169:91–7.
[38] Paolo P, Nicoletta P, Carla M, Andrea M. Ultrasonographic diagnosis of choledocholithiasis. Acta Biomed Ateneo Parmense 1990;62:213–8.
[39] Cabada T, Sarria L, Martinez MT, et al. Helical CT cholangiography in the evaluation of the biliary tract: application to the diagnosis of choledocholithiasis. Abdom Imaging 2002;27:61–70.
[40] Halla A, Amortegui J, Jeroukhimov I, et al. Magnetic resonance cholangiopancreatography accurately detects common bile duct stones in resolving gallstone pancreatitis. J Am Coll Surg 2005;200:869–75.
[41] Nathanson L, O'Rourke N, Martin I, et al. Postoperative ERCP versus laparoscopic choledochotomy for clearance of selected bile duct calculi: a randomized trial. Ann Surg 2005;242:188–92.
[42] Petelin J. Laparoscopic common bile duct exploration. Surg Endosc 2003;17:1705–15.
[43] Lauter D, Froines E. Laparoscopic common duct exploration in the management of choledocholithiasis. Am J Surg 2000;179:372–4.
[44] Malherbe V, Badaoui A, Huybrecht H, DeRonde T, Michel L, Rosiere A. Management of common bile duct stone late after laparoscopic Roux-en-Y gastric bypass for obesity. Acta Chir Belf 2009;109:820–3.
[45] Meregener K, Kozarek R, Traverso L. Intraoperative transjejunal ERCP: case reports. Gastroinest Endosc 2003;58:461–3.
[46] Degenshein G. Choledochoduodenostomy: an 18-year study of 175 consecutive cases. Surgery 1974;76:319–24.
[47] Abdelmajid K, Houssem H, Rafik G, Jarrar MS, Fehmi H. Open choldecho-enterostomy for common bile duct stones: is it out of date in laparo-endoscopic era? N Am J Med Sci 2013;5:288–92.

Editorial comment

Choledocholithiasis after gastric bypass: a growing problem

In their manuscript, DuCoin et al. address an important and growing problem, namely, access to and treatment of common bile duct stones in patients with Roux-en-Y reconstructions. Roux-en-Y gastric bypass (RYGB) comprises half of all weight loss procedures performed in the United States [1]. Given the current rate of approximately 100,000–200,000 bariatric procedures/year, an additional 500,000 to 1 million Americans/decade, who are at higher-than-average risk for symptomatic gallstones, will have access to their biliary trees complicated by surgically altered anatomy. The authors offer a single center's experience with a laparoscopic approach to internal drainage for choledocholithiasis after gastric bypass. While their approach represents an interesting option, it is not likely to be the first choice for treatment of choledocholithiasis in Roux-en-Y patients by a majority of surgeons.

There has been a national trend away from open or laparoscopic common bile duct exploration, and there has been an increase in the use of endoscopic retrograde cholangiopancreatography (ERCP) for treatment of choledocholithiasis. It is becoming more difficult to train new surgeons to perform common bile duct exploration and for practicing surgeons and their operating room staff to remain facile with it. In addition, surgeons are performing fewer intraoperative cholangiograms, lessening their ability to define biliary anatomy and guard against bile duct injury during cholecystectomy. The steadily increasing numbers of patients with difficult biliary access only adds to the necessity for increasing the experience general surgeons have with routine bile duct imaging, biliary anatomy, and performance of routine biliary surgery including common bile duct exploration.

In the meantime, it is likely that the majority of surgeons will continue to rely on treatments offered by medical and surgical endoscopists for most bile duct stones, or to consider referral to a hepatobiliary surgeon for those not