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Review Article

Current management of choledocholithiasis after bariatric surgery

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ABSTRACT

The increasing prevalence of obesity all over world has led to a growing number of metabolic and bariatric surgeries. Bariatric surgery is more effective for weight loss than medical therapy, with Roux-en-Y gastric bypass (RYGB) being considered the gold standard of care over the past decade. Bariatric surgery and the subsequent weight loss are associated with an increased risk for the development of gallstone formation. Common bile duct stones prevalence around 10% among patients with symptomatic gallbladder stones. Choledocholithiasis can be technically challenging problem to treat in patients post-laparoscopic RYGB (LRYGB) or a biliopancreatic diversion (BPD/DS) due to the altered upper gastrointestinal anatomy. This review describes the different treatment options of common bile duct stones after malabsorptive bariatric surgery, success rate, and adverse effects of each treatment modality including enteroscopy-assisted endoscopic retrograde cholangiopancreatography (EA-ERCP), percutaneous transhepatic cholangiography (PTC), endoscopic ultrasound-directed transgastric retrograde cholangiopancreatography (EDGE), and laparoscopic-assisted ERCP (LAERCP).

Keywords: Choledocholithiasis, Bariatric surgery, EA ERCP, LA-ERCP, EDGE

INTRODUCTION

Obesity is a rising epidemic with 39% of adults aged 18 years and over were overweight and 13% were obese per the most recent WHO global health observatory data, collated in 2016.[1] Obesity itself is factor for development of gallstone disease. However, bariatric surgery and also the subsequent weight loss, is associated with an increased risk for development of gallstone formation.[2]

The overall postoperative incidence of cholelithiasis ranging from 6.53%-52.8%.[2-7] Around 25% of patients carrying gallstones develop complications, like cholecystitis, cholangitis, or pancreatitis with annual risk for biliary colic in patients with asymptomatic gallstones has been estimated about 1%.

Common bile duct stones prevalence ranging from 4.6% to 12% in Europe, and up to 20.9% in South America in patients with symptomatic gallbladder stones.[8-12]

There are various bariatric procedures including restrictive, malabsorptive and mixed mechanisms to reduce body weight.

The restrictive bariatric procedures are gastric banding and sleeve gastrectomy.

The anatomy is merely slightly modified from the perspective of endoscopic papillary access in the restrictive bariatric procedures, this enables an easy approach of the biliary ducts and enable a transoral route for ERCP.[13]

The mixed, restrictive-malabsorptive, bariatric procedures are: LRYGB, laparoscopic mini-gastric bypass (MGB)/ a biliopancreatic diversion (BPD/DS). Choledocholithiasis can be a technically challenging problem to treat in such patients due to the altered upper gastrointestinal anatomy.[14]

RISK FACTORS OF GALLSTONE FORMATION AFTER BARIATRIC SURGERY

Risk factors for cholelithiasis among general population aren't predictive of symptomatic gallstones formation after bariatric procedure.[2]

Rapid weight loss

Well established risk factors of gallbladder disease after bariatric surgery include rapid weight loss in a short period of time; losing more than 25% of body weight after bariatric surgery increases the risk of developing gallstones.[2]

The rapid weight loss causes cholelithiasis through cholesterol oversaturation in the bile, which impedes the ability of bile salts and phosphatidylcholine to incorporate and eventually be discharge cholesterol from the body. This leads to the accumulation of cholesterol crystals and the formation of cholesterol stones.[15]

The type of bariatric surgery

The bariatric procedure type affects incidence rates. RYGB was found to have a markedly higher incidence rate than that of LSG or mini-gastric bypass (14.5%-32.5%, 4.4 % and 7.5%, respectively).[16,17]

The dissection of the lesser curvature during RYGB might limit cholecystokinin release and promote gallstone formation due to gallbladder stasis in addition to the rapid weight loss after surgery resulting in such high rates of gallstone formation.[18]

Gender

Studies found no significant association between cholelithiasis and gender after bariatric surgery.[3,19]

Co-morbidities

The co-morbidities [diabetes mellitus (DM), hypertension (HTN), and dyslipidemia (DLP)] among LSG patients have no significant correlation with the development of symptomatic gallstone.[20]

Clinical presentation and preoperative evaluation

Common bile ducts (CBDs) are present in about 4% of the general population, and up to half of these are asymptomatic. The majority of choledocholithiasis are formed in the gallbladder, and stones small enough can pass into the duodenum through the ampulla following the normal path of the bile. CBD obstruction from stones can present with identical biliary pain. Passage of the obstructing stone into the duodenum could relieve pressure in the biliary tree and the associated symptoms; movement of the stone retrograde into the dilated duct has the same effect. Thus, assuming that a stone has passed because a patient's pain resolved is not a safe assumption.

Obstructive CBDS may present with painless jaundice. Up to 75% of cholangitis cases present with Charcot's triad: jaundice, right upper quadrant pain, and fever.[9] The addition of these findings to Charcot's triad is known as Reynolds' Pentad and is seen in about 5-7% of cases.

The presence of Charcot's triad has high specificity, but only a 50-70% sensitivity given that not all patients with cholangitis develop all three symptoms.

About 12.3% of gallstone-related acute cholangitis cases present with some degree of end-organ dysfunction and qualify as severe according to the Tokyo guidelines.

The CBD and pancreatic duct converge at the ampulla of vater, where gallstones following the natural flow of bile may become impacted and cause biliary pancreatitis.

PREOPERATIVE EVALUATION

Liver function tests (LFTs)

The sensitivities of bilirubin (cutoff >1.3 mg/dL) and alkaline phosphatase (cutoff >125 U/L) for CBDSs were 84% and 91% respectively; the specificities were 91% and 79%, respectively.[21]

Abdominal ultrasound

Ultrasonography findings are considered positive if there is visualization of CBDSs and/or CBD dilatation which was defined as >6 mm in adults who haven't undergone cholecystectomy and eight mm in those that have undergone cholecystectomy. Gurusamy et al showed that the sensitivity of ultrasonography was 73% and specificity was 91%.[21]

Magnetic resonance cholangiopancreatography (MRCP)

European society of gastrointestinal endoscopy (ESGE) guideline recommends MRCP to diagnose common bile duct stones in patients with abnormal LFTs and/or CBD dilation on US in the absence of a morphological diagnosis of CBDSs or cholangitis.[22]

Sensitivity and specificity of MRCP for the detection of CBDSs is 93% and 96%.[23]

ERCP

ERCP should be performed in patients with a clinical picture of cholangitis or CBDSs identified at US or MRCP.[22]

The anatomy is only slightly modified from the perspective of endoscopic papillary access after the restrictive bariatric procedures which enable transoral route for ERCP and allows an easy approach of the biliary duct.[13]

ERCP is technically challenging in patients with RYGB anatomy and impossible after biliopancreatic diversion because of the length of the interposed intestinal segment.

CBD STONE PREDECTION

In 2010 American society for gastrointestinal endoscopy (2010) a proposed strategy to assign risk of choledocholithiasis by using factors such as age, liver test results, and US findings, patients can generally be the categorized into low (10%), intermediate (10% to 50%), and high (50%) probability of tcholedocholithiasis.[24]

This strategy was updated in 2019 as following:

High-risk criteria for suspected choledocholithiasis which need prompt ERCP

The presence of common bile duct stone on US or cross-sectional imaging. Patient with total bilirubin >4 mg/dl and dilated common bile duct or patient with clinical features of ascending cholangitis.

Intermediate-risk criteria

Abnormal liver biochemical tests, age >55 years, or common bile duct dilation on ultrasound.

ASGE guideline 2019 proposed that patients intermediate-risk criterion undergo EUS, MRCP, laparoscopic intraoperative cholangiography (IOC), or intraoperative US.

Low-risk for choledocholithiasis

Those with symptomatic cholelithiasis but without any of these risk factors should undergo cholecystectomy with or without IOC.[25]

Treatment of choledocholithiasis after malabsorptive bariatric surgery

Several techniques are available to facilitate ERCP in patients with Roux-en-Y anatomy.

Transoral endoscopic approaches employ side-viewing duodenoscopes/forward-viewing endoscopes, such as push enteroscopes, colonoscopes, and single/double-balloon endoscopes advanced perorally. Other techniques use combined endoscopic and surgical/percutaneous access.

TRANSORAL ACCESS TECHNIQUE AFTER GASTRIC BYPASS

Conventional ERCP

The technique of using a conventional side-viewing duodenoscope to access the papilla is deemed almost impossible in patients with a Roux-en-Y reconstruction due to the acute angulation at the level of the jejuno-jejunal anastomosis with a success rate of only 33% in accessing the papilla after previous Roux-en-Y reconstruction.[26]

EA-ERCP

Push enteroscopy

This can be performed using a Pediatric colonoscope or longer versions of a standard endoscope. The length of the endoscope and the anatomy of the small bowel make push enteroscopy technically more challenging.[27]

Double balloon EA-ERCP

The DBE system uses a high-resolution, dedicated video-endoscope with a working length of 200 cm and two soft, latex balloons; one balloon is attached to the tip of the endoscope, and therefore the other is also attached to the distal end of a soft, flexible over tube. The balloons can be inflated and deflated by the endoscopist using an air pump while monitoring the air pressure.[28]

The success rates varying from 60 to 90% for reaching the biliopancreatic limb with a success rate ranging from 46 to 80% among patients with Roux-en-Y anatomy.[29-37]

Single-balloon EA-assisted ERCP

It is technically easier and less time-consuming than double-balloon enteroscopy with a success rate of around 88%.[38]

Interventional radiology

Case reports described a successful percutaneous transhepatic cholangiography (PTC) in patients with bile duct stones after a previous RYGB. This was performed under a local anesthetic using a right anterior segmental duct puncture. A balloon catheter was used to push the stone into the duodenum after sphincter dilatation then an internal-external drain was left in temporarily.[39,40]

COMBINED SURGERY AND ENDOSCOPY

EDGE

Kedia et al first described EDGE in 2014.[41] For this procedure, the author created a gastrogastric or jejunogastric fistula secured with a lumen-apposing metal stent to access the bypassed gastric remnant using EUS. Then, ERCP was performed through the fashioned fistula in one stage by the same team in the minimally invasive way.

The technical success and clinical success rate of EDGE in RYGB patients was (95.5% and 95.9%), respectively.[42]

The associated risks of the technique include stent migration requiring restenting in 13.3%, post-ERCP pancreatitis, bleeding, and perforation. An adverse event that was a concern is weight gain due to the presence of a persistent fistula following EDGE.[43]

LA-ERCP

LA-ERCP is performed by laparoscopically creating a gastrostomy in the excluded stomach through which a standard duodenoscope is usually advanced into the pylorus and duodenum.[44] ERCP is then done in standard fashion using standard accessories.

The therapeutic success rates range from 92.9-97.9 %.[42,45]

The rate of all adverse events with LA-ERCP is significantly higher than EA-ERCP (19% vs 6.5%) respectively.[45] The higher AEs mainly associated with infectious and bleeding AEs related to the laparoscopic approach of the procedure rather than ERCP itself.

The laparoscopy-related complications of LA-ERCP include: port-site infection, bleeding, gastric site leak, postoperative respiratory and cardiovascular adverse events, intraperitoneal abscess, incisional hernia, wound dehiscence, and a bowel perforation. ERCP-related complications including pancreatitis, cholangitis, duodenal perforation, ERCP-related bleeding, and Stent migration.[46-49]

Surgical technique

The conventional treatment of choledocholithiasis in patients who are not suitable for or failed ERCP is a surgical exploration of the bile duct with either laparoscopic or open common bile duct exploration.

CONCLUSION

In conclusion, the selection of the optimal ERCP modality in patients with RYGB depends on multiple factors including patient preference, indications for ERCP, local expertise, the clinical importance of preserving the integrity of the RYGB, and device availability.

EA-ERCP can be attempted in a patient with a short Roux limb in situations in which it is the only available modality or for patients not willing to undergo LA-ERCP or EDGE although this approach is frequently unsuccessful.

The endoscopist should choose between LAERCP, EDGE, ERCP through a gastrostomy tract, and percutaneous interventions for a patient with a long Roux limb. LA-ERCP is often considered the best modality when a single ERCP is likely to address the clinical problem e. g., choledocholithiasis or when cholecystectomy is indicated thus allowing the ERCP and the cholecystectomy to be done at the same time. EDGE may be considered when multiple ERCPs are anticipated (e. g. endoscopic therapy for benign biliary stricture or chronic pancreatitis).

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