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# Key Points for Cholelithiasis and Gallstone Ileus Prevention Following Biliointestinal Bypass

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**Conflict of interest:** None declared

**Patient:** Male, 48  
**Final Diagnosis:** Gallstone ileus in biliointestinal bypass  
**Symptoms:** Abdominal pain • jaundice • vomiting  
**Medication:** —  
**Clinical Procedure:** —  
**Specialty:** Surgery

**Objective:** Unusual clinical course  
**Background:** Biliointestinal bypass is a malabsorptive procedure for surgical treatment of morbid obesity. It is the evolution of jejunioileal bypass, and it is characterized by a cholecysto-jejunostomy on the proximal end of the excluded jejunum, therefore, allowing bile flow through the excluded bowel loop reducing the risk of postoperative diarrhea and malabsorption syndrome. Obesity is a well-known risk factor for cholelithiasis; moreover, bariatric surgery has been showed to increases the risk of gallstones formation.

**Case Report:** A 48-years-old male (body mass index 42 kg/m<sup>2</sup>) received a laparoscopic biliointestinal bypass. Nine years later, the patient received a cholecystotomy for removal of biliary stones. No surgical procedures were performed on the cholecysto-jejunostomy. Fourteen years after the bariatric treatment, the patient underwent enterolithotomy after a diagnosis of gallstone ileus. The impacted biliary stone was documented in the excluded loop proximal to the anti-reflux valvular system. The postoperative course and 1-year follow-up were uneventful.

**Conclusions:** Few cases of gallstone ileus following biliointestinal bypass have been described in the literature. We report a new case and also propose few tips and tricks for cholelithiasis and gallstone ileus prevention after biliointestinal bypass.

**MeSH Keywords:** Bariatric Surgery • Gallstones • Obesity, Abdominal • Postoperative Complications

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## Background

Gallstone ileus (GI) is a rare complication of cholelithiasis (0.3–0.5%) [1]. Gallstone ileus is a rare form of intestinal obstruction (< 5%) caused by an impaction of a gallstone within the lumen of the small intestine [2]. Gallstone ileus is more frequent among the elderly and the female gender (F: M: 3.5–6/1 [3–5]). It is caused by the migration of a gallstone to the bowel through a cholecysto-enteric fistula [6]. Signs and symptoms of gallstone ileus are mostly nonspecific [1,6–8]. Diagnosis is frequently delayed [8]. Abdominal radiograph and abdominal computed tomography (CT) scan are of major importance in diagnosis. Rigler's triad is pathognomonic (partial/complete intestinal obstruction; pneumobilia or contrast material in the biliary tree; aberrant gallstone) [9] but is extremely variable occurring in between 0% and 87% of cases [10]. Yu et al. proposed tomographic diagnostic criteria for gallstone ileus (small bowel obstruction; ectopic gallstone; abnormal gallbladder with complete air collection, presence of air-fluid level, or fluid accumulation with irregular wall) with high sensibility, specificity, and accuracy (93%, 100%, and 99% respectively) [11].

Biliointestinal bypass (BIBP) is a malabsorptive procedure for surgical treatment in patients affected by morbid obesity [12,13]. BIBP is the technical evolution of jejunoileal bypass with the difference of performing a cholecysto-jejunostomy on the proximal end of the excluded jejunum. Therefore, the blind bowel loop is avoided with reduction of intestinal bacterial overgrowth and increase of reabsorption of bile acid with following less postoperative diarrhea and malabsorption syndrome [14]. Three cases of gallstone ileus in patients with BIBP have been described in literature [15,16]. Herein we report an additional case of gallstone ileus in BIBP and we propose few key points for cholelithiasis and gallstone ileus prevention.

## Case Report

A 48-years-old Caucasian obese male (weight 125 kg; height 172 cm; body mass index 42 kg/m<sup>2</sup>) presented in 2002 for laparoscopic BIBP at our Institute. Nine years later (2011) at another Institute, the patient received a laparoscopic, converted to open, cholecystectomy for removal of biliary stones and later for incisional hernia repair with mesh positioning. No surgical procedure was performed on the cholecysto-jejunostomy. In 2016 (14 years after his BIBP) the patient presented to the Emergency Department of a different Institute with abdominal pain associated to vomit, leukocytosis (14.51×10<sup>9</sup>/L) and moderate jaundice (total bilirubin 2.14 mg/dL; direct bilirubin 0.64 mg/dL). Abdominal ultrasound (US) evidenced distension of the small intestine and the presence of an intestinal 20×12 mm hyperechoic foci with distal acoustic shadow.

The following abdominal CT scan confirmed the suspect of gallstone ileus and evidenced the presence of a narrow cholecysto-jejunostomy (diameter: 13 mm). The patient underwent enterolithotomy with open approach. The impacted biliary stone was documented in the excluded loop proximal to the anti-reflux valvular system. The patient's postoperative course was regular. Discharging was on 7<sup>th</sup> postoperative day with the patient in optimal clinical condition. One-year follow-up was uneventful.

## Discussion

The cholecysto-enteric fistula usually occurs between the gallbladder and the duodenum [4,7,8]. However, although rare, the stomach, small bowel, and transverse portion of the colon may also be involved by the fistula formation [3,6,17]. The size of the gallstone, the position of the fistula, and the bowel lumen will determine the impaction site, which occurs usually at the terminal ileum and the ileocecal valve [8]. Stone impactions at the stomach and the duodenum (Bouveret's syndrome) and also in the colon has rarely been documented in the literature [2,3,6,7,17]. There are reports in the literature of cases of gallstone ileus with gallstone impaction at the sites of anastomosis after partial gastrectomy and Billroth II reconstruction [18] and, in 3 cases, after BIBP upon the anti-reflux valvular system [15,16].

BIBP was introduced into clinical practice by Hallberg and Eriksson in 1979 [12,13]. BIBP technique is a technical evolution of jejunoileal bypass, by introducing a cholecysto-jejunostomy. Therefore, the blind bowel loop is avoided with reduced intestinal bacterial overgrowth within it and increased reabsorption of bile acid with following less postoperative diarrhea and malabsorption syndrome and reduced risk of hepatic failure [14,19]. Hallberg and Eriksson results were confirmed by a 30 years retrospective Italian nationwide review including 1030 morbid obese patients [20]. BIBP is a safe surgical procedure that warrants no removal of any organ; a relatively simple reversal surgical procedure can be done by taking down both the cholecysto-jejunostomy and the jejuno-ileostomy and performing a new jejuno-jejunal anastomosis with the preservation of the gallbladder. In our surgical experience, the reversal surgery of a BIBP can be easily performed through a laparoscopic approach especially if the BIBP procedure was done laparoscopically without the application of an anti-reflux valve system.

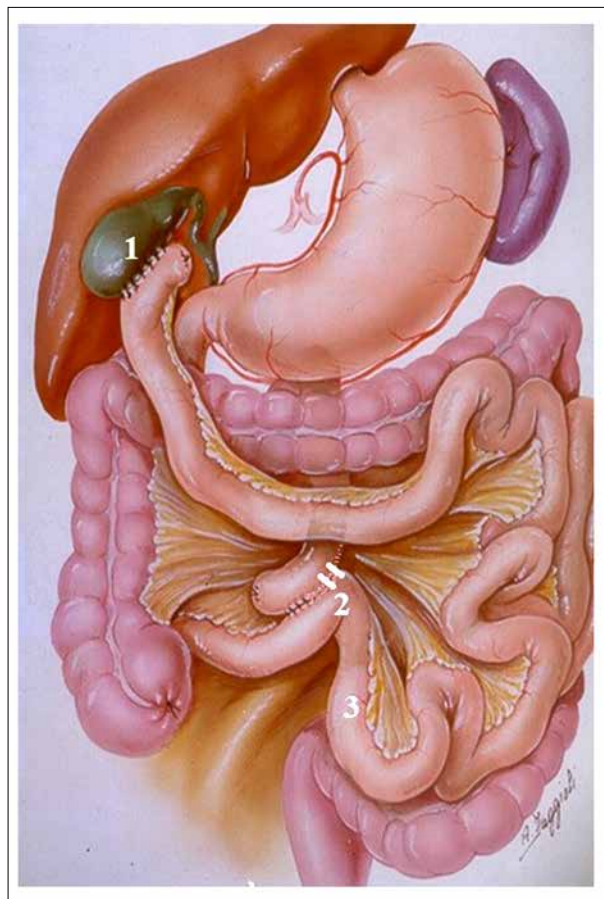
Moreover, food can be freely delivered through the duodenum without any diversion and it reaches the ileum earlier, potentially stimulating incretin secretion in the distal gut. Del Genio et al. have shown, in a 24 months prospective study on 28 patients, potential metabolic benefits of BIBP in remission of type 2 diabetes [21] confirming the results of a previous

Italian Survey [20]. Moreover, BIBP is not associated, as commonly supposed, with deficiencies of vitamins or other nutritional parameters (e.g., total proteins, albumin, iron), therefore can be better defined, as proposed by Gagner, as a hypoabsorptive surgery [21,22] if followed by a correct postoperative nutritional support.

Gallstone formation is a very frequent occurrence in patients after bariatric surgery [23–25]. In a study conducted on 105 morbidly obese patients undergoing rapid weight loss after gastric bypass surgery, gallbladder US evaluation was performed at 6, 12, and 18 months after surgery. At 6 months, a total of 36% of patients developed postoperative gallstone formation while 13% developed postoperative sludge formation [25]. These percentages remained constant in the following 12–18 months, showing that the first 6 months should be considered the high-risk period for gallstone formation during which the patient undergoes rapid weight loss [25]. However, only 40% of patients who developed gallstones became symptomatic, and 28% of patients with symptomatic gallstones were submitted to elective cholecystectomy [25]. Further studies demonstrated the role of rapid weight loss as a risk factor for cholelithiasis [25–27]. Promoting factors include high cholesterol concentration in bile, the secretion of calcium and mucin into bile during rapid weight loss, and increased concentration of arachidonic acid derivatives [28–31]. Furthermore, obesity itself is a cholecystokinin-resistant state resulting in a reduction in bile flow [21]. Also, fasting and stringent dietary restriction are associated to bile stasis [32]. Excess weight loss (%EWL) is considered the most significant risk factor affecting cholecystectomy rates in patients submitted to bariatric surgery [31]. Tsirlina et al. evidenced a 5-fold increase in cholecystectomy risk in patients with >25% EWL at 3 months follow-up [31]. The rate of weight loss is also considered an independent prognostic factor in gallstone formation [33] and is suggested to be directly correlated with cholecystectomy frequency [31]. Prophylactic cholecystectomy, during bariatric surgery, is not considered beneficial nowadays because it is associated with higher early complications rate [34,35], longer length of hospitalization [35], and longer operative time [36,37]. In a prospective study with 1398 patients who received bariatric surgery, only 7.8% of patients developed symptomatic gallbladder disease within 4 years [31].

BIBP is also considered to be a risk factor for cholelithiasis (3.8% on 1030 patients) [20], with 66% of cases associated to narrow cholecysto-jejunal anastomosis [20].

Narrow cholecysto-jejunal anastomosis is considered to be associated to higher biliary stone formation post BIBP, so cholelithiasis may be prevented by performing a wide cholecysto-jejunal anastomosis with a 60 mm linear stapler instead of previous 28-mm circular stapler or 45 mm linear stapler [15,20].



**Figure 1.** Key points for prevention of gallstone ileus post biliointestinal bypass: 1) wide cholecysto-jejunal anastomosis with a 60 mm linear stapler; 2) modified jejunio-ileal anastomosis with a tailored anastomosis (white lines represent the modified anastomosis); 3) no anti-reflux valvular system.

A wider anastomosis promotes a better bile outflow into the excluded bowel loop avoiding biliary stasis and stone formation [15]. A narrow anastomosis as well as the presence of non-absorbable sutures or staples, in the cholecysto-jejunostomy, could lead to higher risk of cholelithiasis [38].

Forestieri et al. [39] introduced the idea of anti-reflux valve system in intestinal bypass surgery for morbid obesity treatment. Double valvular system was practiced 3–6 cm proximally to the jejunio-ileal anastomosis with few introverting seroserous stitches, parallel and perpendicular to the ileal axis [39]. The anti-reflux valve system was applied to the BIBP at the jejunio-ileal anastomosis in order to avoid jejunal fluid reflux in the excluded loop and therefore avoiding intestinal absorption [20]. Two cases of gallstone ileus with stone impact at the anti-reflux valve system have been described in the literature from a previous study by Micheletto et al. [15]. In our opinion, the anti-reflux valve system may be a possible risk factor for gallstone

ileus without promoting real benefits in terms of clinical and metabolic outcomes of BIBP. In 2011 we abandoned the anti-reflux valvular system in BIBP promoting instead a modification of the jejuno-ileal anastomosis. We anchor, at the site of the jejuno-ileal anastomosis, the proximal portion of the excluded loop to the proximal portion of the alimentary loop in order to form an angled curve that facilitates a correct intestinal flow in the distal ileum, preventing alimentary reflux (Figure 1). This anastomosis modification favors a preferential flow of the intestinal flow towards the distal ileum, preventing the flow to the excluded loop and the consequent intestinal absorption.

Since the application of the described technical modification, no other episode of gallstone ileus in BIBP has been evidenced in our surgical experience. The proposed key points for prevention of cholelithiasis and gallstone ileus post BIBP are represented in Figure 1. Since our technical modifications we observed, in a 4 years survey, 1 case of cholelithiasis after 50 BIBPs. Moreover, in 5 cases of cholelithiasis post BIBP in which we performed not only the removal of the gallbladder stones but also a hand-sewed redo of the cholecysto-jejunal anastomosis, no recurrence was evidenced at a 4-year follow-up. Diagnosis was performed using abdomen US. If abdominal US is positive for gallstone, a CT scan or MRI should always be performed in order to detect false positives. In fact, the mechanical cholecysto-jejunal anastomosis can mimic biliary sludge on abdominal US.

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After a confirmed diagnosis of cholelithiasis in patients previously receiving a BIBP, we perform a laparoscopic cholecystectomy with stone extraction. A new latero-lateral cholecysto-jejunal anastomosis is performed by hand sewn technique with absorbable sutures. The anastomosis is tailored in order to be wide allowing optimal bile outflow. We emphasize the importance of a hand-sewn anastomosis with absorbable sutures in order to reduce the risk of anastomotic re-stenosis both due to surgical technique and surgical devices. In our opinion, it is important to only extract the biliary stones leaving the gallbladder *in situ* in order not to convert a BIBP into a jejuno-ileal bypass, with all the potential side effects of jejuno-ileal bypass [40].

## Conclusions

Few cases of gallstone ileus following biliointestinal bypass are described in literature. We report a new case and we propose few surgical tips and tricks for cholelithiasis and gallstone ileus prevention and treatment after biliointestinal bypass.

## Conflicts of interest

None.

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