Chapter

Gallstones Ileus

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Abstract

The ileus of gallstones is a rare complication of cholelithiasis which occurs in less than 1% of patients and is the cause of 1–4% of cases of obstruction of the small intestine. The pathogenesis involves the formation of a bilioenteric fistula. Abdominal computed tomography (CT) shows pneumobilia, dilated loops of small intestine, and ectopic gallstones that obstruct the intestinal lumen. In literature, enterolithotomy is the most frequently used procedure for the ileum of gallstones. Enterolithotomy plus cholecystectomy and/or fistulectomy are indicated only in selected patients. The clinical signs and symptoms depend on the site of the obstruction and usually include abdominal pain, nausea, and vomiting. The diagnostic test of choice is an abdominal CT scan.

Keywords: gallstone ileus, cholecystoenteric fistula, cholecystitis

1. Introduction

The biliary ileum is defined as a mechanical intestinal obstruction due to the impact of one or more gallstones in the gastrointestinal tract and is a rare complication of cholelithiasis. The term "ileum" is an improper term, since obstruction is a true mechanical phenomenon [1, 2], while gastrointestinal obstruction from gallstones would be an appropriate term. Biliary ileum is not very common and diagnosis and treatment can be problematic.

1.1 Epidemiology

Biliary ileus causes 1–4% of all cases of obstruction of the small intestine. This is 25% in patients over 65 years of age and is responsible for about three of the 10 million admissions to hospital and 15 for about 1 million surgical procedures (0.0015%). It is more common in women than in men with a 5:1 female-to-male ratio.

1.2 Pathophysiology

The biliary ileum is often preceded by an initial episode of acute cholecystitis. Inflammation in the gallbladder and surrounding structures leads to the formation of adhesion. Inflammation and the pressure effect of gallstones causes erosion through the gallbladder wall, leading to the formation of fistulas between the gallbladder and the adiacent portion of the gastrointestinal tract, with further passage of gallstones [3, 4]. Less commonly, a gallstone can enter the duodenum through the common bile duct and through a dilated papilla of Vater [5]. The most frequent fistula occurs between the gallbladder and the duodenum due to their proximity [6–9]. The stomach, small intestine, and transverse portion of the colon may also be involved (**Table 1**) [1–4, 10, 11].

Once inside the duodenal, intestinal, or gastric lumen, gallstones usually proceed distally and can pass spontaneously through the rectum, or they can cause obstruction. Less commonly if the bile stone is in the stomach, proximal migration can occur and the bile stone can be vomited [4]. The size of the gallstones, the site of fistula formation, and the intestinal lumen will determine whether or not intestinal obstruction will occur. Most gallstones less than 2–2.5 cm can pass spontaneously through a normal gastrointestinal tract and will be excreted in the stool without problems [1–4]. Clavien et al. [12] reported that an obstructive gallstone size ranges from 2 to 5 cm. Nakao et al. [6] found that gallstones had sizes ranging from 2 to 10 cm, with an average of 4.3 cm. The obstruction site can be found in any portion of the gastrointestinal tract. If gallstones enter the duodenum, the most common intestinal obstruction will be the terminal ileum and ileocecal valve due to their relatively narrow lumen and potentially less active peristalsis. Less frequently, gallstones obstruct the proximal ileum or jejunum, especially if the gallstones are large enough. Less common positions include the stomach and duodenum (Bouveret syndrome) and colon (**Table 2**) [1, 3, 4, 8, 9, 13].

The presence of diverticula, neoplasms, or intestinal stenoses secondary to Crohn's disease, reduce the size of the lumen and can cause an occlusion of gallstones on the narrowing site [1–3, 14]. Biliary ileum has been reported at anastomosis sites after partial gastrectomy and Billroth II reconstruction and after biliointestinal bypass in two cases [15, 16]. Ischemia can develop at the occlusion site of gallstones due to the pressure generated against the intestinal wall and proximal distension. Necrosis and perforation may occur followed by peritonitis [3]. The presentation of the biliary ileum may be preceded by a history of previous biliary symptoms, with rates ranging between 27 and 80% of patients [7, 12, 13, 17–19]. Acute cholecystitis can be present in 10–30% of patients at the time of intestinal obstruction. Jaundice was found in only 15% of patients or less. Bile symptoms can be absent in up to a third of cases [1–3, 8, 9, 12, 20, 21].

Type of fistula	**(%)**
Colecystoduodenal	32.5 to 96.5
Colecystogastric	0 to 13.3
Colecystoduodenal	0 to 2,5
Colecystoileal	0 to 2,5
Colecystocolic	0 to 10.9

Table 1.
Frequency of bilio-enteric fistulas in patients with ileus from gallstones.

Place	**%**
Duodenum	0-10.5
Stomach	0-20
Proximal ileus	0-50
Distal ileus	0-89.5
Colon	0-8.1
Undetermined	0-25

Table 2.
Place range (%).

The biliary ileum can manifest itself as an acute, intermittent, or chronic episode of gastrointestinal obstruction. Nausea, vomiting, cramping abdominal pain, and variable distension are commonly present [1, 3, 8, 12, 13, 20, 22–29]. The intermittent nature of pain and vomiting of the proximal gastrointestinal material, which later becomes dark and fecaloid, is due to partial or total occlusion of gallstones [5, 18]. The character of vomiting depends on the location of the obstruction. When gallstones are in the stomach or upper small intestine, vomiting is mainly gastric in content (becoming fecaloid when the ileum is obstructed). In particular, Bouveret's syndrome presents signs and symptoms of gastric outlet obstruction. Nausea and vomiting were reported in 86% of cases, while abdominal pain or discomfort was reported in 71%. If the bile stone does not completely obstruct the lumen, the presentation will be partially obstructed. Recent weight loss, anorexia, early satiety, and constipation can be reported by the patient. Bouveret syndrome has also been reported to be preceded by bleeding of the upper gastrointestinal tract secondary to duodenal erosion caused by gallstones, with hematemesis and melena, respectively, in 15 and 7% [8, 9, 30, 31]. The physical examination can be nonspecific. Patients are often seriously ill, with signs of dehydration, abdominal distension, and decrease in intestinal peristalsis and obstructive jaundice. Fever, toxicity, and physical signs of peritonitis can be noted if perforation of the intestinal wall occurs. The examination can be completely normal if no obstacles are currently present [1–4, 30].

2. Diagnosis

The symptoms and signs of the biliary ileum are mostly nonspecific [7, 26, 29]. The intermittence of symptoms could also interfere with a correct diagnosis, if the clinical manifestations at the moment correspond to a partial obstruction or a distal migration of the gallstones. Patients usually present 4–8 days after the onset of symptoms, and diagnosis is usually made 3–8 days after the onset of symptoms [1, 2, 29, 32–38]. A high index of suspicion will be useful, particularly in an elderly patient with intestinal obstruction and previous gallstone disease; Bouveret syndrome can be suspected in a patient with gastric outlet obstruction.

2.1 Normal abdominal radiography

Simple abdominal radiographs are of fundamental importance for establishing the diagnosis. In 1941, Rigler et al. [39] described four radiographic signs in the biliary ileum: (1) partial or complete intestinal obstruction; (2) pneumobilia or contrast material in the biliary tree; (3) an aberrant limestone; and (4) changing the position of such gallstones on serial film. The presence of two of the first three signs was considered pathognomonic and was found in 20–50% of cases [1, 2, 20, 37, 38, 40–44]. Although pathognomonic, Rigler's triad ratios range from 0 to 87% [19]. Careful inspection for pneumobilia should be performed, as it is present in most patients with biliary ileus but is sometimes identified only in retrospective observation [20, 37, 38, 41–43]. Pneumobilia can occur following previous biliary surgery or endoscopic interventions. Therefore, clinical evaluation must be taken into account when evaluating this radiological sign [1, 2, 37, 38, 40–44]. In 1978, Balthazar et al. [45] described a fifth sign, which consists of two hydro-plane levels in the upper right quadrant of the abdominal radiography. The medial air fluid level corresponds to the duodenum and the lateral level to the gallbladder. These authors found that this sign was present in 24% of patients at the time of hospitalization. In Bouveret's syndrome, a dilated stomach is expected to be seen on a

simple abdominal radiograph due to gastric obstruction [37, 42, 43, 46–49]. Cappell et al. [31], in a review of 64 cases of Bouveret syndrome, found pneumobilia (39%), calcified upper right quadrant mass or gallstones (38%), and gastric distension (23%) as relatively common findings and dilated loops of the intestine (14%).

2.2 Abdominal ultrasound

When the diagnosis is still doubtful, an abdominal ultrasound (US) will be indicated for gallbladder stones, fistula, and gallstones visualization. It can also confirm the presence of choledocholithiasis [1, 2, 50]. The use of ultrasound in combination with abdominal radiography has been recommended to increase the sensitivity of the diagnosis. Ultrasound is more sensitive to the detection of pneumobilia and ectopic gallstones. The combination of abdominal and US radiography increased the sensitivity of the diagnosis of the biliary ileum to 74% [51]. The most frequent findings in Bouveret syndrome are gallstones in the gallbladder (53%), pneumobilia or gallbladder fistula (45%), gallstones in the duodenum (25%), dilated or distended stomach (15%), and a contracted gallbladder (13%) [31, 41, 43, 52, 53].

2.3 Computed tomography

Computed tomography (CT) is considered superior to abdominal radiography or US in the diagnosis of biliary ileum cases, with a sensitivity of up to 93% [47, 51, 54–57]. The detection frequency of Rigler's triad is higher during the CT exam. In a retrospective study by Lassandro et al. [55–58], the Rigler triad was observed in 77.8% of cases by CT, compared to 14.8% with radiographs and 11.1% with the US. Intestinal loop dilation was observed in 92.6% of cases, pneumobilia in 88.9%, ectopic gallstones in 81.5%, hydroaero levels in 37%, and bilio-digestive fistula in 14.8%. Yu et al. [54, 59] conducted a prospective study in which 165 patients with acute small bowel obstruction were evaluated for biliary ileus, with retrospective identification of three diagnostic criteria: (1) small bowel obstruction; (2) ectopic gallstones, both calcified and removed; and (3) abnormal gallbladder with complete air collection, presence of hydro-aircraft levels, or fluid accumulation with irregular wall. The overall sensitivity, specificity, and precision were 93, 100, and 99%, respectively. Rigler's triad was detected only in 36% of cases. These tomographic diagnostic criteria require further prospective validation. Current CT scanners can describe the position of the fistula, gallstones, and gastrointestinal obstruction with greater precision helping in therapeutic decisions [37, 56–58].

2.4 Esophagogastroduodenoscopy

In an 81-case review of Bouveret syndrome [37, 43, 59–62] in which esophagogastroduodenoscopy (EGD) was performed, gastroduodenal obstruction was revealed in all, but visualization of gallstones was only possible in 56 (69%). Among these 56 cases, such gallstones were observed in the duodenal bulb in 51.8%, in the postbulbar duodenum in 28.6%, in the pylorus or in the prepilorum in 17.9%, and in one case the position was not reported. Gallstones were not recognized in 31% of cases because they were deeply embedded in the mucosa. When gallstones are not displayed, the diagnosis should be strongly suspected when the observed mass is hard, convex, smooth, non-friable and non-fleshy, which are all characteristics of a biliary calculus and can improve the sensitivity of the EGD. For such cases, US and CT are the preferred noninvasive diagnostic tests to confirm endoscopic diagnosis, delineate gastroduodenal anatomy, and demonstrate a cholecystoduodenal fistula [27, 31, 52, 53, 63–65].

3. Treatment

The main therapeutic goal is the relief of intestinal obstruction by extraction of gallstones. Hydroelectrolytic imbalances and metabolic disorders due to intestinal obstruction and preexisting comorbidities are common and require management before surgery [1, 2, 14, 29, 31, 52, 53, 66–68].

There is no unanimous consensus on the surgical procedure. Current surgical procedures are: (1) simple enterolithotomy; (2) enterolithotomy, cholecystectomy and closure of the fistula (one-stage procedure); and (3) enterolithotomy with cholecystectomy performed subsequently (two-stage procedure). Intestinal resection is necessary in some cases after performing the enterolithotomy.

Enterolithotomy was the most commonly performed surgical procedure. Through an exploratory laparotomy, the gastrointestinal obstruction site is located. A longitudinal incision is made on the antimesenteric edge proximal to the site of obstruction of the gallstones [12, 24, 66]. Whenever possible, through light manipulation, the bile stone is brought proximally to a non-edematous segment of the intestine. Most of the time, this is not possible due to the degree of impact of gallstones. Enterotomy is performed over the gallstones and extracted. Careful closure of the enterotomy is necessary to avoid narrowing of the intestinal lumen and cross-closure is recommended. Intestinal resection is sometimes required, particularly in the presence of ischemia, perforation, or underlying stenosis [12, 66]. Manual propulsion of gallstones through the ileocecal valve should be reserved for highly selected situations due to the danger of mucosal injury and intestinal perforation [12, 20, 24, 27, 28, 66]. Likewise, attempts to crush gallstones in situ can damage the intestinal wall and should be avoided [20, 27, 66, 69]. Multiple gallstones can generally be extracted through a single incision freeing the intestines and moving smaller gallstones to larger ones. In case of sigmoid obstruction, resection that removes gallstones and underlying stenosis has been recommended [12].

The main long-standing controversy in biliary ileum management is whether surgery should be performed simultaneously with relief of bowel obstruction (one-stage procedure) or later (two-stage procedure).

In 1922, Pybus successfully extracted a limestone blocking the ileum, closed the duodenal fistula, and drained the gallbladder after removing two additional gallstones from it. In 1929, Holz extracted a limestone at the sigmoid level, and after removing a second limestone in the duodenum, he closed the gallbladder fistula and removed the gallbladder. The author recommended this procedure for patients in satisfactory general conditions. In 1957, Welch successfully performed a one-stage surgery in a patient who was well prepared after recurrent intestinal gallstone obstruction. The authors suggested the feasibility of the operation under optimal conditions. In 1965, Berliner et al. [70] reported three similarly managed and mentioned cases that when the patient is adequately hydrated with restored serum electrolytes, it does not represent an operational risk and a one-stage surgical procedure should be considered. The authors recommend considering the one-step procedure in selected cases. The incidence of recurrence commonly cited is 2–5%, but a recurrence of up to 8% has also been reported after only enterolithotomy; half of these new onset events occurred within 30 days [71]. It should be considered that relapse rates of 17–33% have also been reported [12, 72, 73].

The possibility of recurrent cholecystitis and acute cholangitis [12, 70] in patients with unrepaired gallbladder fistulas or retained gallbladder has been highlighted. Acute cholangitis has been reported in 11% of patients with cholecystoduodenal fistula and in 60% with gallbladder colic fistula [12, 52, 53, 67, 68]. With a one-stage procedure, further events related to gallstones are avoided [18].

A potential long-term complication of biliary enteric fistula could be gallbladder cancer. Bossart et al. [74] found an incidence of 15% of gallbladder carcinoma in 57 patients undergoing surgery for these fistulas, compared with 0.8% among all patients with cholecystectomy.

On the other hand, simple enterolithotomy has long been associated with lower mortality [13]. It should be taken into account that the severity of each case affects the outcome of a particular surgical procedure and that mortality is not an absolute consequence of the surgical procedure itself. In the Clavien et al.'s [12] report, when patients were comparable in terms of age, concomitant disease, and APACHE II score, operational mortality and morbidity rates were not significantly different.

In 2003, Doko et al. [75] reported a series of 30 patients with morbidity of 27.3% in patients undergoing enterolithotomy alone and 61.1% for a one-stage procedure. Mortality was 9% after enterolithotomy and 10.5% after a one-stage procedure. The American Society of Anesthesiologists (ASA) scores were similar between the two groups, but operating times were significantly longer for the one-step procedure. Urgent fistula repair was significantly associated with postoperative complications. The authors concluded that enterolithotomy is the procedure of choice, with a one-stage procedure reserved for patients with acute cholecystitis, gallbladder gangrene, or residual gallstones [12].

In 2008, Riaz et al. [76] reported their retrospective experience with 10 patients diagnosed with bileous ileus. The choice of surgical procedure was largely determined by the patient's clinical condition. Five patients underwent enterolithotomy only (group 1), while the remaining five patients underwent cholecystectomy and fistula repair (group 2). In group 1, all patients were hypertensive and diabetic. All patients were hemodynamically unstable, with metabolic acidosis and prerenal azotemia. The ASA score was III or higher in all patients. In group 2, only two patients were hypertensive and all were hemodynamically stable at presentation with an ASA score of II. There was no operational mortality in both groups.

Many patients with biliary ileus are elderly, with comorbidities, in poor general conditions and have a delayed diagnosis, which leads to dehydration, shock, sepsis, or peritonitis. Relief of gastrointestinal obstruction with simple enterolithotomy is the safest procedure for these patients [19, 21].

At laparotomy, examination and careful palpation of the entire intestine, gallbladder, and extrahepatic bile duct is recommended in order to rule out gallstones, bile loss, abscesses, or necrosis [1, 2, 9, 14, 18, 77]. Cholecystectomy and fistula repair reduce the need for reoperation and the incidence of complications related to the persistence of the fistula, including recurrent ileus, cholecystitis, or cholangitis, but are justified only in selected patients who are adequately stabilized in good general condition, with good reserve cardiorespiratory and metabolic, and are able to withstand a more prolonged operation, unless it has been clearly demonstrated that gallstones do not remain in the gallbladder [10, 12, 21, 67, 78, 79].

According to several authors, enterolytictomy alone is the best option for most patients with biliary ileus. The one-step procedure should only be offered to highly selected patients with absolute indications for biliary surgery at the time of presentation and who have been adequately reanimated [6, 7, 13, 21, 29, 31, 52, 53, 67].

The demonstration of gallstones, the appearance of symptoms, or a persistent cholecystointeric fistula indicates the need for cholecystectomy, closure of the fistula, and exploration of the common duct [18]. It has been pointed out that delayed cholecystectomy as a second procedure is clearly justified only in cases of persistence of symptoms [13, 21]. Cholecystectomy and fistula closure are recommended 4–6 weeks later [7, 13, 29, 80]. A 2.94% mortality rate has been reported in this group of patients [25].

4. Morbidity

The most common postoperative complication was wound infection. In 1961, Raiford [5] observed an overall wound infection rate of 75%. Localized peritonitis, respiratory complications, phlebitis, and recurrent obstruction due to residual gallstones and cholangitis have also been observed. Wound infection continues to be the most common complication, with rates of 27 and 42.5%, as reported by Clavien et al. [12] and Rodríguez Hermosa et al. [19], respectively. Several authors have reported no significant differences in postoperative complications between patients treated with enterolithotomy or enterolithotomy, cholecystectomy, and closure of fistulas [12, 21, 67, 80]. The least common complications were wound dehiscence, cardiopulmonary and vascular complications, sepsis, intestinal and biliary fistulas, and urinary tract infections [12, 21, 80].

5. Mortality

Biliary ileum is predominantly a geriatric disease and as many as 80–90% of patients have concomitant medical diseases. Hypertension, diabetes, congestive heart failure, chronic lung disease, and anemia are the most common comorbidities [25]. These associated conditions must be taken into consideration, as they can influence the results of the treatment [1].

Mortality rates were reported up to 44% in the late 1800s, while in the first half of the twentieth century, these rates remained between 40 and 50% [14, 22]. In the 1990s, significant reductions in mortality were observed at 15–18%, at current rates of less than 7% [13, 25]. In particular, simple enterolithotomy has long been associated with a mortality of 11.7% compared to 16.9% for the one-stage procedure (enterolithotomy plus cholecystectomy and fistula closure) [13]. As described by Kirchmayr et al. [79], four main reasons could be responsible for the high number of lethal courses. First of all, the biliary ileum is a disease of the elderly. Second, concomitant diseases such as cardiorespiratory diseases and/or diabetes mellitus are frequent. Third, due to uncommon symptoms, the diagnosis is difficult and an average delay of 4 days from the start of symptoms to hospitalization is reported. Fourth, postoperative recovery is also hampered; age-related complications such as pneumonia or heart failure are more frequent than complications associated with surgery.

The authors noted that fistula closure, performed during the initial procedure, was independently associated with a higher mortality rate than enterolithotomy alone. When intestinal resection was indicated, it was also associated with a higher mortality rate than with enterolithotomy alone. However, if you consider the fact that intestinal resection is not exactly an option but a requirement due to the conditions of the intestinal segment, the mortality for those patients who underwent enterolithotomy alone or intestinal resection is actually 6.53%.

6. Conclusions

Biliary ileum or gastrointestinal obstruction from gallstones accounts for less than 1% of cases of gastrointestinal obstruction, with a higher frequency among the elderly. Computed tomography has proven to be the most accurate diagnostic modality, but validation of diagnostic criteria is required. Surgical relief of the obstruction is the cornerstone of the treatment. Given the high incidence of comorbidity in these patients, a good judgment is needed in the choice of the

surgical procedure. Enterolithotomy remains the mainstay of surgical treatment. A one-stage cholecystectomy and fistula repair are justified only in selected patients in good general condition and adequately stabilized preoperatively. Two-stage surgery is an option for patients with persistent symptoms after an enterolithotomy. Extensive prospective studies of laparoscopic and endoscopic guided procedures are planned.

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