

Endoscopic Management of Gallstone Ileus with Laser and Mechanical Lithotripsy

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Gallstone ileus is an uncommon complication of cholelithiasis. It accounts for less than 1–4% of all small bowel obstructions [1]. The condition involves the passage of a gallstone into the gastrointestinal tract through a biliary-enteric fistula, often resulting in obstruction at the ileum or, less commonly, the duodenum. This condition is known as Bouveret syndrome [1]. Management can be surgical (gastrotomy, intra-gastric laparoscopy, pyloromyotomy, duodenotomy, enterotomy) or endoscopic (removal with nets/baskets, electrohydraulic lithotripsy [EHL], extracorporeal shockwave lithotripsy [ESWL]). Endoscopic management is preferred due to its lower morbidity and mortality rates [2,3].

PATIENT DESCRIPTION

A 60-year-old female patient with a history of peptic ulcer disease (no prior endoscopy) was admitted to our hospital emergency department

(ED) with epigastric pain for a week, which exacerbate after eating. Four days prior to her admission, she started to have nausea and bilious emesis. This event was her first presentation of any biliary disease.

On admission to the ED, the patient was hemodynamically stable and exhibited epigastric tenderness and repeated bilious emesis, even in the ED. Laboratory findings were significant for a mildly elevated C-reactive protein of 18.75 mg/L (normal range 0–0.5 mg/dl), with otherwise normal blood counts and biochemistry. An abdominal computed tomography (CT) revealed a distended stomach, pneumobilia, and a large gallstone (4.6 × 3.2 cm) impacted in the third part of the duodenum [Figure 1], consistent with gallstone ileus secondary to a cholecystoduodenal fistula.

INTERVENTIONS

Initially, the conservative management was initiated with intravenous fluids, proton pump inhibitors, and nasogastric tube decompression. Following multidisciplinary discussion, considering her young age and hemodynamic stability, we decided on an endoscopic solution including a combination of laser and mechani-

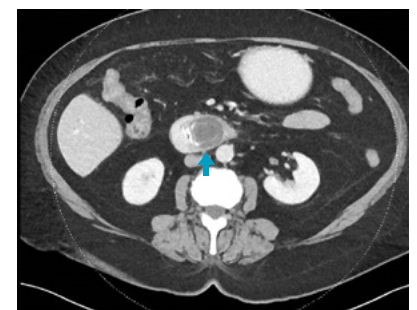
cal lithotripsy to remove the impacted stone.

FIRST PROCEDURE

The procedure was performed in the operating theater under general anesthesia. Endoscopic examination with a standard gastroscope confirmed a large impacted stone in the second and third parts of the duodenum, with evidence of a deep duodenal ulcer, consistent with fistulous connection to the gallbladder.

Partial fragmentation of the stone was performed using a 550-micron holmium laser fiber (Cyber Ho Hol-

Figure 1. Abdominal computerized tomography revealed a distended stomach, pneumobilia, and a large gallstone (4.6 × 3.2 cm) impacted in the third part of the duodenum



mium 150W, Quanta Systems™, Italy) Residual fragments were extracted using an endoscopic retrieval basket and snare. Two clips were applied to seal a suspected duodenal microperforation. Due to the long procedure time of 270 minutes and because of the suspected perforation, we decided to terminate the procedure.

An abdominal CT scan with intravenous and oral contrast was performed to rule out duodenal perforation and to assure the stone had not migrated deeper into the jejunum, which would negate repeat endoscopic intervention. The scan revealed residual stone fragments in the third part of the duodenum with mild duodenal wall thickening and surrounding fatty stranding without evidence of perforation, free air, or extraluminal fluid extravasation. No evidence of air in the intrahepatic bile ducts was seen.

SECOND PROCEDURE (3 DAYS AFTER THE FIRST PROCEDURE)

Under general anesthetic repeat endoscopic examination with a standard gastroscope was performed in the operating theatre. The stone was successfully fragmented using laser lithotripsy, followed by mechanical lithotripsy to extract larger fragments. Final endoscopic inspection (including the third and fourth part of the duodenum) showed a clear duodenal lumen without significant ulceration or perforation. This procedure took 155 minutes.

Postoperatively, the patient resumed oral intake without complications and passed bowel movements. As no residual stones were seen in the follow-up CT, we decided not to perform a colonoscopy to inspect the rest of the bowel. The patient was discharged in good condition on post-procedural day 5/2.

In accordance with common practice, a cholecystectomy and the repair of the cholecysto-enteric fistula 4–6 weeks after the first intervention was advised to the patient. However, she declined.

COMMENT

Gallstone ileus presents a diagnostic challenge due to its rarity and non-specific symptoms. While Rigler's triad (pneumobilia, small bowel obstruction, and ectopic gallstone) is highly specific, it is not always evident. CT imaging is the diagnostic modality of choice, as in this case.

Endoscopic management has emerged as a safer alternative to surgery, particularly for high-risk patients. Our case demonstrates the utility of lithotripsy for large, impacted stones. Despite the prolonged procedure time (270 minutes and 155 minutes, respectively), this approach effectively avoided the morbidity associated with surgical intervention.

Due to the rarity of Bouveret syndrome and the wide variation in surgical techniques and patient-specific considerations, operative duration is not well standardized in the literature. Nonetheless, reports from individual cases and small case series have indicated that surgical interventions generally last between 1.5 and 3 hours. The length of the procedure largely depends on the complexity of the presentation, the operative approach (open versus laparoscopic), and whether additional procedures, such as cholecystectomy or repair of a biliary enteric fistula are required [4].

Endoscopic management of Bouveret syndrome is associated with a lower risk of peri-procedural morbidity and mortality compared to surgery, particularly among elderly patients with significant co-morbidities,

but it has a lower success rate and specific complications. The main complications of endoscopic therapy include mucosal injury, bleeding, perforation, and, distal gallstone ileus due to migration of stone fragments after incomplete lithotripsy or extraction attempts. This symptom sometimes requires surgical intervention due to gallstone ileus. Other complications are generally less severe than those seen with surgery.

Surgical treatment may be either primary or required following failed endoscopic attempts. Surgical interventions include open or laparoscopic enterolithotomy, with or without fistula repair, and cholecystectomy. They carry a higher risk of major complications, including surgical site infection, intra-abdominal abscess, postoperative ileus, anastomotic leak, and cardiopulmonary events, especially in the elderly and those with co-morbidities [4]. Reported complication rates can reach 12–30% in older series, though more recent data suggest a lower complication rate [4].

The endoscopic management of Bouveret syndrome with laser and mechanical lithotripsy has been studied and practiced and showed promising success rate [5]. The benefit of using laser lithotripsy is precise targeting of energy onto the stone with minimal tissue injury. Mechanical lithotripsy is recommended for stones that are unable to be removed simply with an endoscopic basket as an adjunct to crush the stone prior to extraction. Limitations of this technic include multiple procedures may be needed to ensure clearance of the stone, there is still a need for surgery even after successful endoscopic removal to complete cholecystectomy and fistula takedown, and the limited control of intraprocedural complications, including: perforation and bleeding.

OTHER TECHNIQUES

Other endoscopic options have been described, including only endoscopic removal with nets/baskets and EHL. In addition to intracorporal techniques, ESWL has also been reported [3]. Surgical options consist of open gastrotomy, pylorotomy, or duodenotomy [2] at or immediately proximal to the site of obstruction. In the case of a distal duodenal impacted gallstone or a gallstone that has migrated into the proximal jejunum, an enterotomy distal to the ligament of Trietz may be utilized for stone removal. As accepted in other cases of gallstone ileus, also in Bouveret syndrome, in which the gallstone obstructs the duodenum, the remainder of the small intestine should be examined to ensure there are no other potential large enteric stones that may result in post-operative obstruction.

A combined surgical and endoscopic management is also acceptable

in cases when the gallstone is located in an area that may be difficult to access during open surgery. An intragastric laparoscopy, in which an impacted duodenal gallstone was manipulated into the stomach, fragmented, and extracted have been also described [4].

The minimally invasive laparoscopic approach to treatment should be considered as the preferred treatment in patients with Bouveret syndrome provided the equipment and expertise is available.

CONCLUSIONS

Our case underscores the importance of considering a multidisciplinary approach in managing gallstone ileus. Endoscopic lithotripsy, while technically challenging, offers a minimally invasive and effective option for carefully selected patients. Early intervention and careful monitoring are essential for favorable outcomes.

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**Some people with great virtues are disagreeable,
while others with great vices are delightful.**

Francois de La Rochefoucauld (François VI, Duc de La Rochefoucauld, Prince de Marcillac)
1680–1613)), French author of maxims and memoirs

Capsule

Activity-dependent adaptive deep brain stimulation improves gait in Parkinson's disease

Scafa and co-authors developed an activity-dependent adaptive deep brain stimulation (aDBS) system that continuously monitors neural signals associated with movement and automatically adjusts stimulation intensity during walking. The researchers investigated whether this physiologically driven approach could improve gait performance compared with standard continuous DBS. The adaptive system successfully synchronized stimulation with patient moment-to-moment neural activity and produced significant improvements in gait quality. Patients experienced fewer freezing episodes, smoother gait initiation, increased walking stability, and

improved overall mobility. Importantly, stimulation was delivered only when required, reducing total stimulation time while maintaining or enhancing therapeutic benefit. The system was well tolerated, and no unexpected safety concerns were identified. These findings suggest that tailoring stimulation according to real-time brain activity can more effectively address the dynamic motor deficits characteristic of Parkinson's disease than fixed stimulation paradigms.

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