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## Minimally invasive treatment of gallstone ileus

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Gallstone ileus, a rare complication of cholelithiasis (about 1%–3% of all intestinal ileus cases), is characterized by mechanical obstruction of the gastrointestinal tract caused by a dislodged gallstone (typically >2 cm in size) migrating from the gallbladder via a cholecystoenteric fistula. Bouveret syndrome, a variant of gallstone ileus, refers to gastric outlet obstruction caused by the gallstone entering the duodenum via a bilioduodenal fistula [1]. The literature on Bouveret syndrome is scarce, and thus far, there are no uniform treatment guidelines [2]. This report presents a case of Bouveret syndrome successfully managed with endoscopic surgery.

In November 2020, a 75-year-old female with a history of chronic cholecystitis presented to the Surgical Department of Wolski Hospital, Warsaw, Poland, with a 4-day history of upper abdominal pain, vomiting, and retention of gases and stool. Laboratory tests revealed the following results: leucocyte count =  $21 \times 10^9/\text{L}$  (reference:  $4.5\text{--}11 \times 10^9/\text{L}$ ); C-

reactive protein = 224.67 nmol/L (reference: <47.6 nmol/L); potassium = 2.8 mmol/L (reference: 3.5–5.1 mmol/L); creatinine = 386.4  $\mu$ mol/L (reference: 50.4–98.15  $\mu$ mol/L). Abdominal computed tomography (CT) revealed a dilated stomach filled with gas and fluid, a distended gallbladder with a thickened wall, a gas-filled common bile duct 10 mm in diameter, and a 3-cm gallstone stuck in the duodenal bulb (Figure 1A, B). Accordingly, we decided on endoscopic removal of the gallstone under general anesthesia. Initially, we intended to crush the stone with a lithotripter, although the forcible stone extraction may have caused duodenal wall rupture; however, we could not access the gallstone using this approach (Figure 1C). Eventually, the stone was removed with an endoscopic basket, crushed in the gastric lumen, and extracted piece by piece via the esophagus (Figure 1D). The procedure took 70 minutes (Figure 1E). In the following days, the ileus symptoms disappeared, and the laboratory results returned to normal.

Since Bouveret syndrome presents with nonspecific symptoms, such as abdominal pain, nausea, vomiting, and biliary colic [3], a history of chronic cholecystitis may help raise suspicion. CT is the diagnostic tool of choice; the characteristic radiologic sign, Rigler's triad (pneumobilia, gastrointestinal tract obstruction, and ectopic localization of gallstone), is crucial for diagnosis [4]. Surgery is the treatment of choice for gallstone ileus; it is aimed at removing the ectopic intestinal gallstone and closing the fistula. Endoscopic extraction is feasible in the case of a duodenal stone [5]. Based on our patient's advanced age, comorbidities, and wasting caused by the prolonged ileus, we decided on endoscopic gallstone removal and refrained from fistula repair, although a persisting fistula may cause retrograde cholecystitis and increase the risk of gallbladder cancer. Magnetic resonance imaging was used to visualize the biliary fistula and exclude residual cholelithiasis (Figure 1F). During the 40-month follow-up period, our patient did not develop any symptoms suggestive of a persistent fistula. Therefore, endoscopic treatment without fistula closure may

be preferred over high-risk open surgery in elderly and high-risk patients owing to their shorter life expectancy, which is associated with a low risk of cholelithiasis recurrence and neoplastic transformation.

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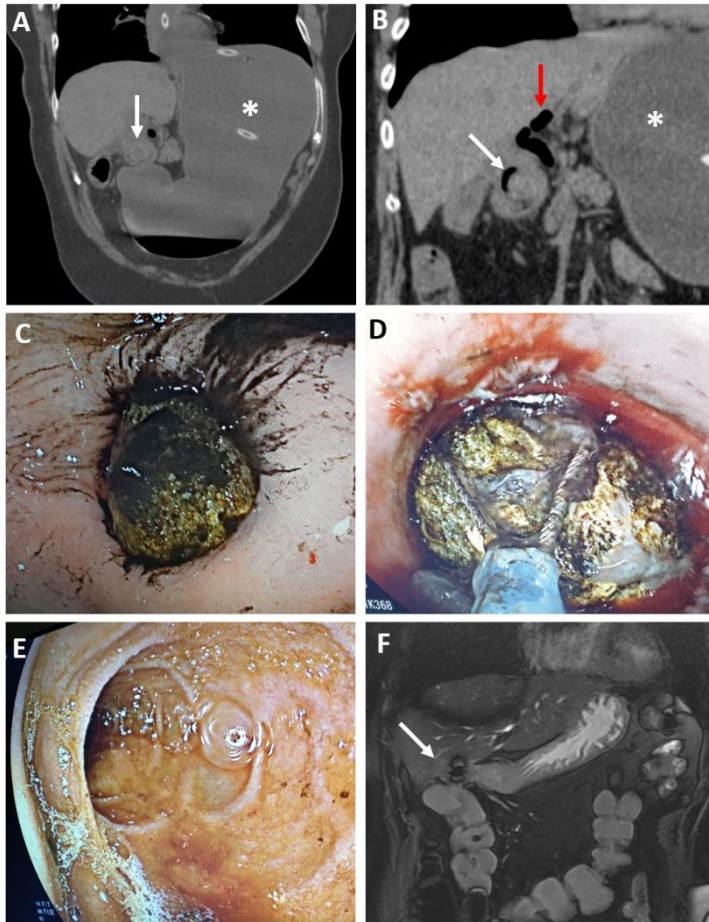
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**Figure 1** A – Frontal plane abdominal computed tomography scan showing a dilated stomach (asterisk) and the gallstone stuck in the duodenal bulb (white arrow); B – frontal plane abdominal computed tomography scan showing dilated bile ducts with pneumobilia (red arrow), dilated stomach (asterisk), and the gallstone stuck in the duodenal bulb (white arrow); C – endoscopic picture of gallstone stuck in the pylorus; D – endoscopic picture of gallstone captured in the Dormia basket; E – endoscopic picture of patent duodenal bulb after the gallstone removal; F – frontal plane magnetic resonance imaging scan of the patient's abdomen showing the bilioduodenal fistula (white arrow)

**Short title:** Bouveret syndrome