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Single-incision laparoscopic surgery for gallstone ileus: An alternative surgical procedure

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ABSTRACT

INTRODUCTION: Gallstone ileus (GI) results from the passage of a stone through a cholecystoenteric fistula, subsequently causing a bowel obstruction. The ideal treatment procedure for GI remains controversial.
PRESENTATION OF CASE: A 63-year-old female was admitted to our hospital following persistent nausea and vomiting for 7 days. Computed tomography revealed a partially calcified 4-cm circular object in the jejunum, and the proximal intestine was dilated, with concomitant pneumobilia. Based on the preoperative diagnosis of GI, enterotomy with stone extraction by single-incision laparoscopic surgery (SILS) was performed. The patient's postoperative course was uneventful, and the cholecystoduodenal fistula closed spontaneously 4 months after the surgery.
DISCUSSION: Recent studies have reported that enterotomy with stone extraction alone is associated with better outcomes than with more invasive techniques. This case also suggests that enterotomy with stone extraction alone and careful postoperative follow-up is feasible for the management of GI. Although the use of laparoscopy in the management of GI has been described previously, laparoscopic surgery has not been widely performed, and SILS is not generally performed. When only this less demanding procedure is required, laparoscopic surgery, including SILS, can be a viable option.
CONCLUSION: SILS can be an alternative surgical procedure for the management of GI.

1. Introduction

Gallstone ileus (GI) is a mechanical bowel obstruction caused by intra-luminal intestinal occlusion by biliary calculi.[1,2] This condition occurs when an inflamed gallbladder adheres to the adjacent bowel, forming a biliary-enteric fistula, which can permit gallstones to enter the gastrointestinal tract.[3] The fistula is usually located between the gallbladder and duodenum.[4,5] Small stones, particularly if they are <2–3 cm, pass uneventfully through the gastrointestinal tract; however, larger stones can cause mechanical bowel obstruction, and require intervention.[6] The cornerstone of GI management is surgery, and enterotomy with stone extraction should be performed to relieve the obstruction.[7] There is debate among the limited number of reported cases whether the cholecystoenteric fistula should be repaired.[3,7,8] Although no definitive conclusions have been reached, recent reports suggest that combined fistula closure and cholecystectomy at the time of the initial procedure are not generally recommended, particularly for high risk patients.[4,7,9,10]

Recently, single-incision laparoscopic surgery (SILS) has become a popular procedure, linking the standard laparoscopic surgery with diverse procedures such as cholecystectomy, colectomy, and appendectomy.[11,12] Although the use of laparoscopy in the management of GI has been described previously,[13,14] laparoscopic surgery has not been widely performed,[7] and SILS is not generally used.

2. Presentation of case

A 63-year-old female was admitted to our hospital with a 7-day history of nausea and vomiting. She denied abdominal pain; however, she was unable to tolerate oral food or liquid. She had a past medical history of depression but no history of gallstone disease. On admission, her cardiopulmonary function was stable and there was no elevation in body temperature. On physical examination, the patient was obese with a body mass index of 32.5. Abdominal tenderness and distension were absent. Laboratory data indicated

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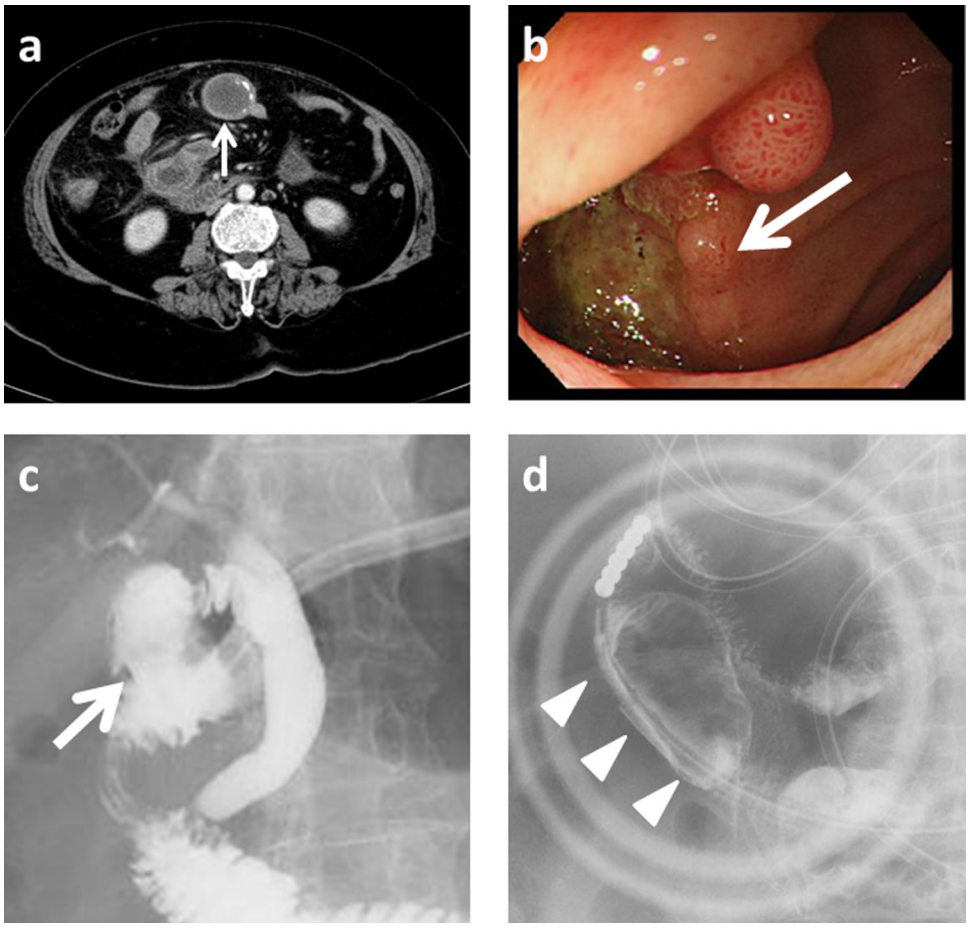

Fig. 1. Preoperative images. (a) Computed tomography showing a partially calcified 4-cm circular object in the jejunum (arrow). The proximal duodenum and stomach are dilated, and pneumobilia is also present. (b) Gastroduodenal endoscopy showing the orifice of the cholecystoduodenal fistula (arrow) at the posterior wall of the duodenal bulb. (c) Hypotonic duodenography. The cystic duct, common bile duct, and intra-hepatic bile duct are identifiable via the cholecystoduodenal fistula (arrow). (d) Contrast study by the long nasal tube demonstrating a 6-cm gallstone as a filling defect in the ileum (arrow heads).

an elevated white cell count of 23,250 cells/μL; total bilirubin, 2.0 mg/dL; aspartate aminotransferase, 47 IU/L; alanine aminotransferase, 45 IU/L; creatine phosphokinase, 1140 IU/L; blood urea nitrogen, 61.8 mg/dL; and creatinine, 8.2 mg/dL. The remaining laboratory data were almost within normal limits. Computed tomography revealed a partially calcified 4-cm circular object in the jejunum (Fig. 1a). The proximal duodenum and stomach were dilated, and pneumobilia was also observed. Gastroduodenal endoscopy revealed the orifice of a cholecystoduodenal fistula on the posterior wall of the duodenal bulb (Fig. 1b). Hypotonic duodenography revealed that the cystic duct, common bile duct, and intra-hepatic bile duct communicated with the cholecystoduodenal fistula (Fig. 1c). A definitive diagnosis of GI was made on the basis of these findings. A long nasal tube was inserted for decompression of intestinal contents, and intra-venous infusion was performed for dehydration. A contrast study using the long nasal tube revealed a 6-cm gallstone creating a filling defect in the ileum (Fig. 1d). Elective surgery was performed on Day 12 after admission.

A 3.5-cm vertical incision was made at the umbilicus where Alexis Wound Retractor (Applied Medical, Rancho Santa Margarita, CA, USA) was inserted and covered by a sterile surgical glove. Three 5-mm trocars, two of which were used for laparoscopic instruments and one for a 5-mm rigid scope, were introduced through the finger of the surgical glove (Fig. 2). Under an induced pneumoperitoneum at 8 mm Hg, intra-abdominal observation revealed that the omentum and mesentery of the transverse colon were tightly adhered to the gallbladder and duodenum, prohibiting

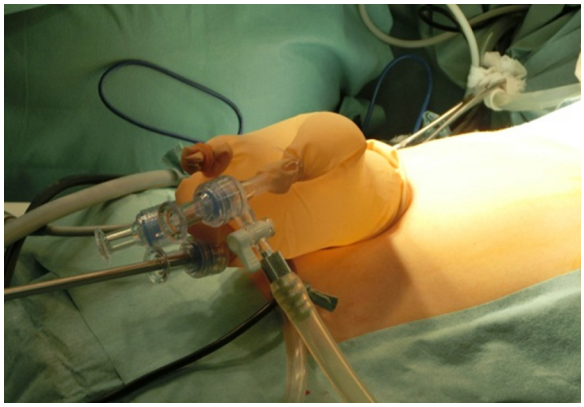

Fig. 2. Photograph showing the single-incision laparoscopic surgery. An Alexis Wound Retractor (Applied Medical, Rancho Santa Margarita, CA, USA) is inserted into the incision at the umbilicus and covered by a sterile surgical glove. Three 5-mm trocars are introduced through the finger of the glove.

further observation. The calculus in the ileum was identified at the tip of the long nasal tube (Fig. 3a). Hypermobility of the large calculus in the ileum made eventration of the small bowel with the calculus via a comparatively small umbilical incision difficult. Therefore, we clamped the small bowel on both sides of the calculus with removable intestinal clamps for stabilization (Fig. 3b). Subsequently, the small bowel with the calculus was extracted

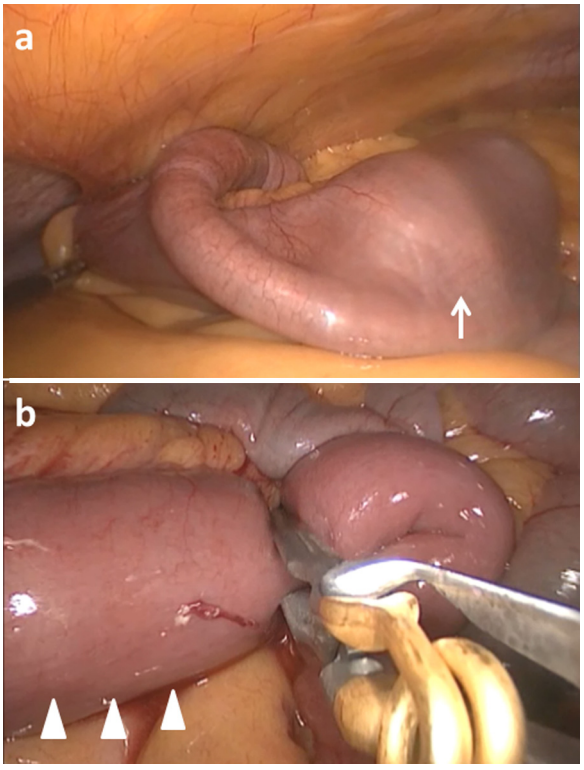

Fig. 3. Laparoscopic intraoperative findings and procedure. (a) The calculus in the ileum is identified at the tip of the long nasal tube (arrow). (b) Hypermobility of the large calculus in the ileum makes eventration of the small bowel with the calculus via a comparatively small umbilical incision difficult. Therefore, we clamp the small bowel on both sides of the calculus (arrow heads) with removable intestinal clamps for stabilization.

from the peritoneal cavity, and an extracorporeal enterolithotomy was performed through the incision (Fig. 4a). The extracted stone measured 5.5 cm in length (Fig. 4b), and the surgical duration was 96 min with minimal blood loss.

Postoperatively, the patient recovered uneventfully and was discharged on postoperative Day 12. Spontaneous closure of the cholecystoduodenal fistula was documented by gastroduodenal endoscopy 4 months after the surgery (Fig. 5). At 9 months postoperatively, the patient was well and had experienced no recurrence of calculi.

3. Discussion

GI is caused by the passage of a stone through a cholecystoenteric fistula, subsequently causing a bowel obstruction. This

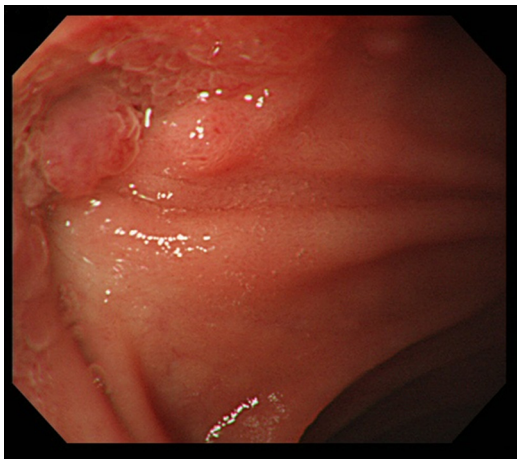

Fig. 5. Gastroduodenal endoscopy revealing spontaneous closure of the cholecystoduodenal fistula 4 months after the surgery.

disease is extremely rare and its incidence has been reported as 0.1–5.0% of mechanical bowel obstructions.[1–10] Intervention with stone extraction or disruption is recommended to relieve the obstruction.[7] Although endoscopic treatment for gallstone ileus has been described previously, successful cases are rare, and the majority of cases reported involved a surgical procedure.[10] Therefore, surgery is considered to be the standard procedure for the management of GI. Until recently, debate existed about whether and when the cholecystoenteric fistula should be approached.[3,7,8] Surgical options include the following: (1) enterolithotomy alone; (2) enterolithotomy, cholecystectomy, and fistula repair during the initial procedure (one-stage surgery); and (3) enterolithotomy with cholecystectomy later (two-stage surgery). Recent studies have reported that enterotomy with stone extraction alone is associated with better outcomes than with more invasive techniques.[4,7] Spontaneous closure of the cholecystoenteric fistula after removal of the offending stone has been reported,[9] which also occurred in our patient. This case demonstrated that enterotomy with stone extraction alone at the time of the initial procedure with careful postoperative follow-up may be adequate therapy. In agreement with previous reports,[4,7] fistula closure and cholecystectomy are suggested to be performed electively in select patients who do not undergo spontaneous closure of the fistula, which results in several problems such as cholangitis.

Previous reports state that the most common complication associated with GI is acute renal failure, resulting in high mortality rates.[7] Because this patient was also in severe acute renal failure at the time of admission, we chose elective surgery after treatment for this comorbidity. We judged that the renal failure in this patient

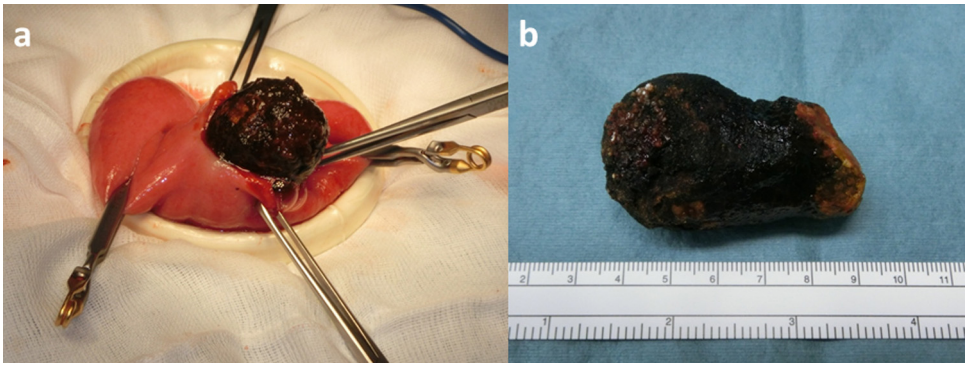

Fig. 4. Operative photographs. (a) The small bowel with the calculus is extracted from the peritoneal cavity. An extracorporeal enterolithotomy is performed through the incision. (b) The extracted stone measures 5.5 cm in length.

reflected elevated white cell count as well as high levels of blood urea nitrogen and creatinine. These values improved to within normal limits after treatment with intravenous fluids. Therefore, we were able to perform elective surgery safely in this case; however, when bowel necrosis or perforation caused by a firmly impacted stone is suspected, emergency surgery should be performed, even with such comorbidities.

Although it has been reported that the site of obstruction in GI is usually the terminal ileum,[7,10] the obstructing stone in this patient was located in the jejunum at the time of admission. Relatively small stones may initially lodge at the ileocecal valve without lodging at the jejunum; however, because the size of the stone in this patient was relatively large, it might have caused mucosal irritation resulting in muscle contraction leading to temporary lodging in the jejunum. Intra-abdominal observation at the time of operation revealed that the stone was located in the ileum. Peristalsis might have pushed the stone to the ileum; however, because of the size of this stone, it might not have passed through the ileocecal valve, making surgery unavoidable.

Although the use of laparoscopy in the management of GI has been described previously and was shown to have a lower incidence of major complications,[13,14] laparoscopic surgery has not been widely performed. Halabi et al.[7] reported that laparoscopy was attempted in only 10% of patients in the United States for the treatment of GI. They also reported a high conversion rate to laparotomy of 53%. However, cholecystectomy with fistula closure at the time of the initial procedure was attempted several times in the patients who were converted to laparotomy in their study. Compared with the difficulty of fistula closure and cholecystectomy with severe inflammation, enterotomy with stone extraction alone is a simple procedure. Therefore, when only this less demanding procedure is required, laparoscopic surgery, including SILS, can be a viable option.

SILS, which was performed safely in our patient, is a rapidly developing technique that may represent the future of laparoscopic surgery. Enterotomy with stone extraction for GI requires the following simple tasks: (1) seeking and discovering the stone; (2) extraction of the small bowel with the stone from the peritoneal cavity; and (3) completion of an extracorporeal enterolithotomy through the incision. Compared with the stomach or colorectum, the small bowel is easier to handle and can be extracted easily through a small incision at the umbilicus because it is not fixed to the retroperitoneum or any other organ.[12] Therefore, enterotomy with stone extraction is likely to become an attractive alternative SILS procedure. Because the dilated small bowel caused by obstruction disturbs the laparoscopic view, a laparoscopic approach is appropriate in the absence of severe gastrointestinal distention. Therefore, we routinely insert the long nasal tube before laparoscopic surgery when bowel obstruction is evident preoperatively, and in our case, preoperative decompression performed via the long nasal tube made the SILS procedure safe and uncomplicated. It is important to note that multiple stones can occur in up to 25% of patients with GI,[15] and multiple stones missed during surgery were reported to cause recurrence of bowel obstruction.[16,17] When there is a possibility of multiple stones, surgeons should perform careful intra-abdominal observation, and should not hesitate to add one or more ports or to convert to open surgery.

Generally, devices such as the SILS Port (Covidien, Norwalk, CT, USA), which allows simultaneous multiple instrument insertion, are used for SILS because they make the procedure easier and more efficient.[18] However, we performed the SILS procedure with the Alexis Wound Retractor and a sterile surgical glove. Compared with procedures that use the SILS Port, our procedure has the benefit of a lower cost. However, a drawback of our procedure may be a lack of port stability, because a rubber surgical glove cannot provide stabilization. Furthermore, because there is no fulcrum for the laparoscopic forceps and scope, this procedure tends to allow interference between instruments, and difficulty in instrument insertion through the incision may occur. Movement of the scope often results in inadvertent movement of an adjacent instrument, which can make surgical tasks very difficult. However, simple tasks, such as enterotomy with stone extraction alone, can be performed with this technique without difficulty.

4. Conclusion

This report describes the case of a patient successfully treated for GI by enterotomy with stone extraction alone using the SILS procedure with subsequent spontaneous closure of a cholecystoduodenal fistula. Enterotomy with stone extraction alone at the time of the initial procedure with careful postoperative follow-up is feasible. Thus, SILS can be an acceptable alternative procedure for the management of GI.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Conflict of interest

The authors have no disclosures or conflicts of interest related to this manuscript.

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None.

Ethical approval

This is not a research study which requires ethical approval. So, there is no ethical approval.

Author contributions

Yusuke Watanabe drafted the manuscript, and was attending physician of the presented patient. Junkichi Takemoto was attending physician of the presented patient. Eiji Miyatake supervised the study, and was attending physician of the presented patient. Jun Kawata, Keigo Ohzono, Hiroyuki Suzuki, Masaaki Inoue, Toshiyuki Ishimitsu, Junichi Yoshida, Masahiro Shinohara supervised the study. Chihiro Nakahara acted as complete supervisor.

Key learning points

- Enterotomy with stone extraction alone and careful postoperative follow-up is feasible for the management of GI.
- When only this less demanding procedure is required, laparoscopic surgery, including SILS, can be a viable option.

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