

Flexible transgastric endoscopic liver cyst fenestration

A feasibility study in humans (with video)

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Abstract

There is no clinical report on the use of natural orifice transluminal endoscopic surgery (NOTES) for the management of patients with large liver cysts.

This study aims to evaluate the feasibility and safety of NOTES for liver cyst fenestration in humans using a currently available technique.

From February 2009 to June 2010, 4 cases of transgastric endoscopic liver cyst fenestration were performed; in which 3 cases received NOTES only, while 1 case received additional laparoscopic assistance.

Mean time to endoscopically locate the liver cyst was 16 minutes (5–22 minutes). Cysts that were present in the left lobe or on the liver surface were easier to locate endoscopically. Transgastric endoscopic liver cyst fenestration was successful in all patients. The use of an occlusion balloon helped in the endoscopic clipping of the gastrotomy incision. Mean operative time was 101.3 minutes (range, 90–112 minutes), and there were no intra- or postoperative complications including infections. All patients recovered well after the surgery, with only minor postoperative throat pain. There was no recurrence at a mean follow-up of 12 months (range, 6–48 months).

Small sample size.

It may be technically feasible and safe to perform transgastric endoscopic liver cyst fenestration in humans with no recurrence at follow up.

Abbreviation: NOTES = natural orifice transluminal endoscopic surgery.

Keywords: endoscopic, human, liver cyst, NOTES, therapy

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1. Introduction

Technological advancements in endoscopic and laparoscopic surgery have led to the development of natural orifice transluminal endoscopic surgery (NOTES).^[1–6] However, the technique of NOTES in humans remains at its evolutionary stage.^[5–9]

Laparoscopic liver cyst fenestration has been recognized as one of the standard methods of treatment for nonparasitic hepatic cysts.^[10,11] Based on our previous experience with transgastric peritoneoscopy,^[12] we conducted this study to explore the technical feasibility and safety of flexible transgastric endoscopic liver cyst fenestration in human subjects.

2. Patients and methods

Preoperative preparation

- CT and EUS imaging (Fig. 1A and B).
- Fasting for 12 hours before the procedure.
- An intravenous dose of a broad-spectrum antibiotic (cephalosporins) was given within 1 hour of the procedure.

2.1. NOTES procedure

The procedures were performed under general anesthesia with endotracheal intubation in the operating room. The patient was placed in the Trendelenburg position. An overtube

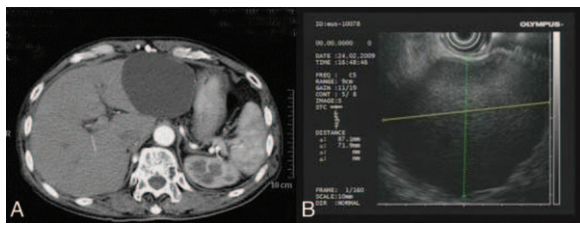


Figure 1. Preparation CT (A); preparation EUS (B).

(diameter: 1.8 cm) was inserted into the esophagus with the help of an upper GI scope (GIFQ260; Olympus, Tokyo, Japan). Gastric contents were suctioned and sent for bacteriological culture. The esophagus and stomach were washed with 1000 mL of physiological saline and suctioned. Nebulized povidone iodine solution was sprayed from the overtube into the esophagus and stomach, and suctioned. A separate clean disinfected forward-viewing double-channel endoscope (GIF-2TQ260M; Olympus) was used to perform the NOTES procedure.

The peritoneal cavity was accessed through gastrotomy, which was created on the anterior wall of the body of the stomach. A standard double lumen needle-knife (HPC-3; COOK, Ireland, Limerick) was used to make the initial full-thickness puncture through the gastric wall, followed by the passage of a guidewire (Jagwire 5658; Boston Scientific, Natick, MA) into the peritoneal cavity. The gastrotomy incision was dilated with a graded dilation balloon (CRE wire guided balloon dilatation catheter [16-18-20] Boston Scientific) over the guide wire (Fig. 2A). The endoscope was advanced through the gastrotomy into the peritoneal cavity. Pneumoperitoneum was maintained using an air pump (UCR Olympus) and by insufflating carbon dioxide through the air/water channel of the endoscope.

Under direct visual control, the endoscope was manipulated to the right side of the abdominal cavity to locate and identify the liver cyst (Fig. 2B). The cyst wall was cut open using a pair of electric biopsy forceps (FD-1L-1; Olympus) and a diathermy snare (SD-6L-1; Olympus) (Fig. 2C–E). A part of the cyst capsule was resected using the snare, removed through the scope channel, and sent for histological evaluation (Video 1, <http://links.lww.com/MD/B464>).

Laparoscopic assistance was used if required to safely complete the procedure. After completing the liver cyst fenestration, the double-channel endoscope was withdrawn back into stomach and the guidewire was left across the gastrotomy incision. A 20 mm occlusion balloon (Boston Scientific) was advanced through the gastrotomy over the guidewire into the peritoneal cavity, fully inflated, and pulled back against the stomach wall to block the gastrotomy. The incision was closed by applying 5-7 hemoclips (HX-610-135L; Olympus) through the second scope channel (Fig. 2F and G). Then, the balloon was deflated and removed after complete closure of the gastrotomy incision, and the endoscope was withdrawn from the patient. A nasogastric tube was inserted to provide gastric decompression and prevent leakage (Video 2, <http://links.lww.com/MD/B465>).

Postoperatively, patients were monitored in the intensive care unit for 12 hours. Antibiotic prophylaxis was continued for another 24 hours. Patients were allowed to have a clear liquid diet at 24 hours and a regular diet at 48 hours after the procedure. Patients were discharged on postoperative day 7 after a repeat upper endoscopy to check for healing of the gastric incision (Fig. 2H). All patients were followed up regularly to look for postoperative complications and recurrence.

This study was approved by the Ethics Committee of Changhai Hospital. Informed consent was obtained from each patient.

3. Results

From February 2009 to June 2010, 4 patients underwent the NOTES procedure (males: 3, female: 1). Mean age of these patients was 62 years (range, 38–82 years). All patients had complaints of right hypochondriac pain and abdominal distension. Cyst details are provided in Table 1. In 3 patients, liver cyst fenestration was performed using NOTES alone. In these patients, a single gastrointestinal scope was used. In 1 patient, laparoscopic assistance was required due to the inadequate exposure of the cyst, as it was located in segment VIII. For laparoscopic assistance, a 5-mm trocar was inserted into the left upper abdomen and a 12-mm trocar was inserted in the supra umbilical area using a standard technique. A peritoneoscopic-guided liver biopsy was also performed for this patient.

All gastric incisions were successfully performed without any major complications. There was only minor bleeding from the

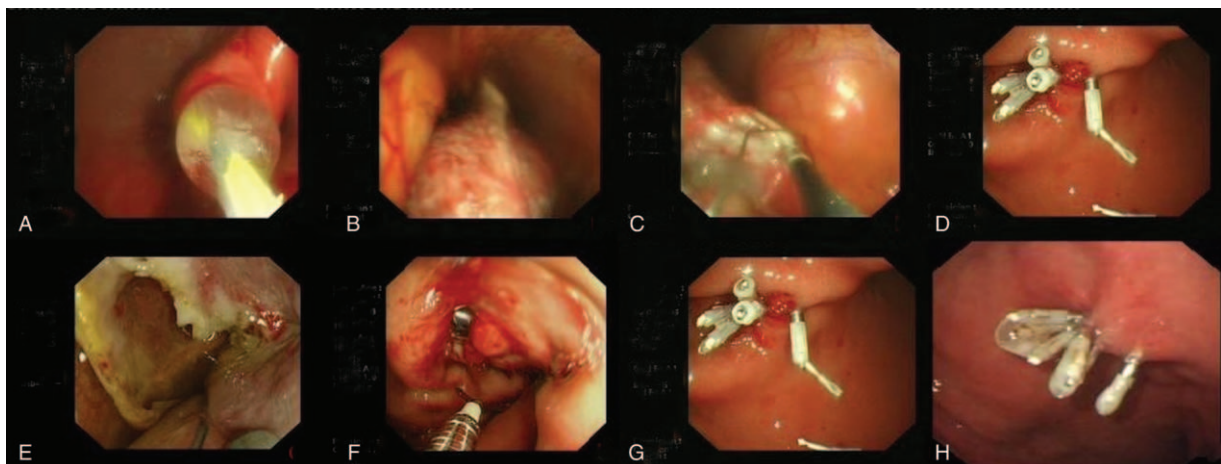


Figure 2. Incision dilation (A); liver cyst (B); cut open using electric biopsy forceps and snare (C and D); liver cyst fenestration forceps and snare (E); incision closed assisted by balloon (F); incision closed using clips (G); EGD reviewed incision after 7 days postoperation (H).

Table 1**Results of liver cyst fenestration.**

Case	Gender	Age	Site*	Size, cm	Operation	Insertion time	Searching cyst time	Procedure time
1	M	82	Segment II	9.5 × 7.1	NOTES	22	1	98
2	F	42	Segment II	9.2 × 8.5	NOTES	17	3	112
3	M	53	Segment VIII	10.5 × 11.2	N+L	20	26	105
4	M	56	Segment VI	8.4 × 12.3	NOTES	5	15	90

* Couinaud liver segment (II=left posterolateral segment, VI=right posteroinferior segment, VIII=right anterosuperior segment), N+L=NOTES and laparoscopy.

Table 2**Results of bacteriological cultures of gastric content before and after disinfection.**

Case	Before disinfection	After disinfection
1	No growth	No growth
2	Kocuria kristinae	No growth
3	Microcycclus	No growth
4	No growth	No growth

incision site in 1 patient, which resolved spontaneously. There was no injury to adjacent structures or internal organs. The culture of the gastric content was negative after saline lavage and treatment with povidone iodine (Table 2).

Using the CRE balloon, the gastric incision was dilated up to 16 mm in 1 patient and up to 20 mm in remaining 3 patients. Scope advancement in the peritoneal cavity was facilitated by having the assistant palpate the abdominal wall and identify anatomical landmarks after the abdomen was distended. With experience, time taken to locate the cyst was reduced from 22 minutes in the first patient to 5 minutes in the last patient (Table 1).

All patients made an uneventful recovery. All patients had mild throat pain, which was resolved 2 days after the operation. One patient who required laparoscopic assistance had mild abdominal pain in the postoperative period. After a mean follow up of 12 months (6 months to 4 years), no patient developed relapse.

4. Discussion

This is the first reported human study that used NOTES for liver cyst fenestration. Our results have shown that transgastric endoscopic peritoneoscopy and liver cyst fenestration is feasible in humans using the described technique. In this study, we attempted to resolve technical issues related to the use of NOTES in managing liver cysts.

The most significant problem with the transgastric route is to locate and expose the liver cyst. We used external finger palpation on the abdominal wall and anatomical landmarks to guide scope orientation and in maneuvering within the peritoneal cavity.^[13] Despite these anatomical landmarks, orientation within the abdominal cavity was very different between flexible endoscopy and laparoscopy.

Conventional flexible endoscopic instruments are not designed for NOTES, because this endoscopic procedure is a 1-handed operation performed by a single operator. In this study, we revealed that electric biopsy forceps and diathermy snare can be safely used to perform liver cyst fenestration.

In our study, we found that the balloon assisted closure of the gastrotomy with clips was effective. This method had several advantages. Firstly, traction on the balloon turned the circular gastric incision into a linear incision, making it easier to apply the clips. Secondly, traction on the inflated balloon blocked the incision and prevented gas leakage. Thirdly, the balloon inverted the gastric incision and promoted healing. Finally, the incision was stabilized by the inflated balloon, making it easy to apply the clips.

In this pilot study, we demonstrated that transgastric flexible endoscopic liver cyst fenestration in humans may be technically feasible, safe, and effective. Future multicenter studies with a larger sample size are required to confirm the findings of this study. In addition, more refinement in endoscopic technology and techniques are required to perform complex cases without compromising safety.

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