

Endoscopic ultrasound-guided cholecystostomy for resection of gallbladder polyps with lumen-apposing metal stent

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Abstract

Laparoscopic cholecystectomy is the routine method to treat gallbladder polyps. Nowadays, endoscopic ultrasound (EUS)-guided cholecystostomy as a bridge for per-oral transmural endoscopic resection of gallbladder polyps is introduced because preservation of gallbladder is increasingly getting attention. The aim of our study was to evaluate the approach in the treatment of patients with gallbladder polyps and symptomatic gallstones.

EUS-guided cholecystostomy with the placement of a lumen-apposing metal stent (LAMS) was performed for those patients with accompanying gallbladder polyps and symptomatic gallstones. Several days after the cholecystostomy with LAMS, a gastroscope was introduced into the gallbladder to remove gallbladder polyps.

All patients were successfully performed with the procedures of EUS-guided cholecystoduodenostomy (n=3) or cholecystogastrostomy (n=1) and endoscopic resection of gallbladder polyps. One patient experienced severe peritonitis. During the follow-up at 3 months, 1 patient was performed with laparoscopic cholecystectomy because ultrasonography examination showed the reappeared gallstones. No stone recurrence was found in other patients. During the follow-up of 3 to 15 months, no polyp recurrence was found in all the patients.

The approach is novel for performing EUS-guided gallbladder fistulization, which can subsequently allow procedures of per-oral transmural endoscopic resection of gallbladder polyps to avoid cholecystectomy in the patients with gallbladder polyps and gallstones. However, further studies are needed before clinical recommendation because of the complications and stone recurrence.

Abbreviations: ECE-LAMS = electrocautery-enhanced LAMS, EUS = endoscopic ultrasound, LAMS = lumen-apposing metal stent, LC = laparoscopic cholecystectomy, US = ultrasonography.

Keywords: cholecystostomy, endoscopic ultrasound, gallbladder polyp, metal stent

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Yonghua Shen, Jun Cao, and Xiaoliang Zhou contributed equally.

The authors declare that they have no competing interests.

The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

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1. Introduction

Gallbladder polyp is common in the global population, which could reach to approximately 9.5% of the overall prevalence.^[1] To treat gallbladder polyps, laparoscopic cholecystectomy (LC) is the recommendatory approach. However, it is not appropriate to remove all gallbladder polyps in consideration of low malignant potential of most polyps and related risks associated with the surgery.^[2] In a way, cholecystectomy is still widely used when gallbladder polyps are combined with symptomatic gallstones.

Nowadays, preservation of cholecyst has been increasingly getting attention with awareness of the various complications of cholecystectomy and the significance of gallbladder function.^[3–5] With the development of endoscopic ultrasound (EUS)-guided transmural cholecystostomy using lumen-apposing metal stent (LAMS), per-oral transmural endoscopic resection of gallbladder polyps was introduced.^[6] Through this pathway, endoscopic resection of gallbladder polyps with gallbladder preservation becomes possible. However, the clinical data were extremely limited.

For the patients with gallbladder polyps and symptomatic gallstones simultaneously, we performed EUS-guided transmural cholecystostomy as a bridge for per-oral endoscopic resection of gallbladder polyps. The novel method preserved gallbladder and avoided surgical complications, which could potentially become a promising selection to remove gallbladder polyps.

2. Methods

2.1. Patients

A retrospective review of patients treated with EUS-guided cholecystostomy and per-oral transmural endoscopic resection of gallbladder polyps in our endoscopy center was performed. The study was approved by the local research ethics committee. All patients provided informed consent for this procedure. Inclusion criteria were as follows: all patients were accompanied by symptomatic gallstones and gallbladder polyps, which were diagnosed by ultrasonography (US); the cholecyst was considered functional by US, when volume decreased 30% or more after consuming a fatty meal; and patients were unfit for LC or had strong desire to preserve the cholecyst. Exclusion criteria were the obstruction of cholecystic duct, thickening of cholecyst wall, cholecyst atrophy, and coagulopathy. The characteristics of all patients who underwent the procedure were collected.

2.2. EUS-guided cholecystostomy

Two expert endoscopists completed the EUS-guided cholecystostomy and per-oral transmural endoscopic therapy, which were performed under sedation with intravenous remifentanyl and propofol. The gallbladder was observed with longitudinal echoendoscope (UCT260; Olympus Medical, Tokyo, Japan) at the antrum or duodenal bulb. Then, 3 methods were prepared for preference. First, a 19-gauge needle (Wilson-Cook Medic, Winston-Salem, NC, USA) was applied to puncture the gallbladder. A stiff 0.035-inch guidewire (Boston Scientific, Natick, Massachusetts, USA) was subsequently advanced

through the needle. The tract was dilated with cystotome and balloon successively. LAMS (Micro-Tech, Nanjing CO. Ltd. China) was then advanced over the guidewire. Second, a 19-gauge needle was applied to puncture the gallbladder and a 0.035-inch guidewire was then advanced through the needle to allow insertion of an electrocautery-enhanced LAMS (ECE-LAMS) (Micro-Tech, Nanjing CO. Ltd. China). Third, ECE-LAMS was directly used to puncture the gallbladder by the electrocautery tip after endoscopic nasogallbladder drainage through duodenal papilla, which facilitated the process by extraction of the bile and injection of saline solution in gallbladder through the drainage tube.

After LAMS was advanced into cholecyst, the distal end of LAMS was released under EUS and fluoroscope guidance. Gentle traction was used to make cholecyst wall close to the gastric wall or duodenal wall. The proximal flange of LAMS was subsequently deployed under endoscopic and fluoroscope surveillance with EUS assistance. Before the procedure, every patient was administered antibiotics intravenously.

2.3. Per-oral transmural endoscopic resection of gallbladder polyps

Several days after the EUS-guided cholecystostomy, a gastroscope (GIF-H260, Olympus Medical, Tokyo, Japan) was introduced into the cholecyst from the fistula after the LAMS was removed. Then, the gallbladder polyps were resected with biopsy forceps or snare after the gallstones were removed. The fistula was closed by hemostatic clips after cholecystogastrostomy. The whole process is shown in Figure 1.

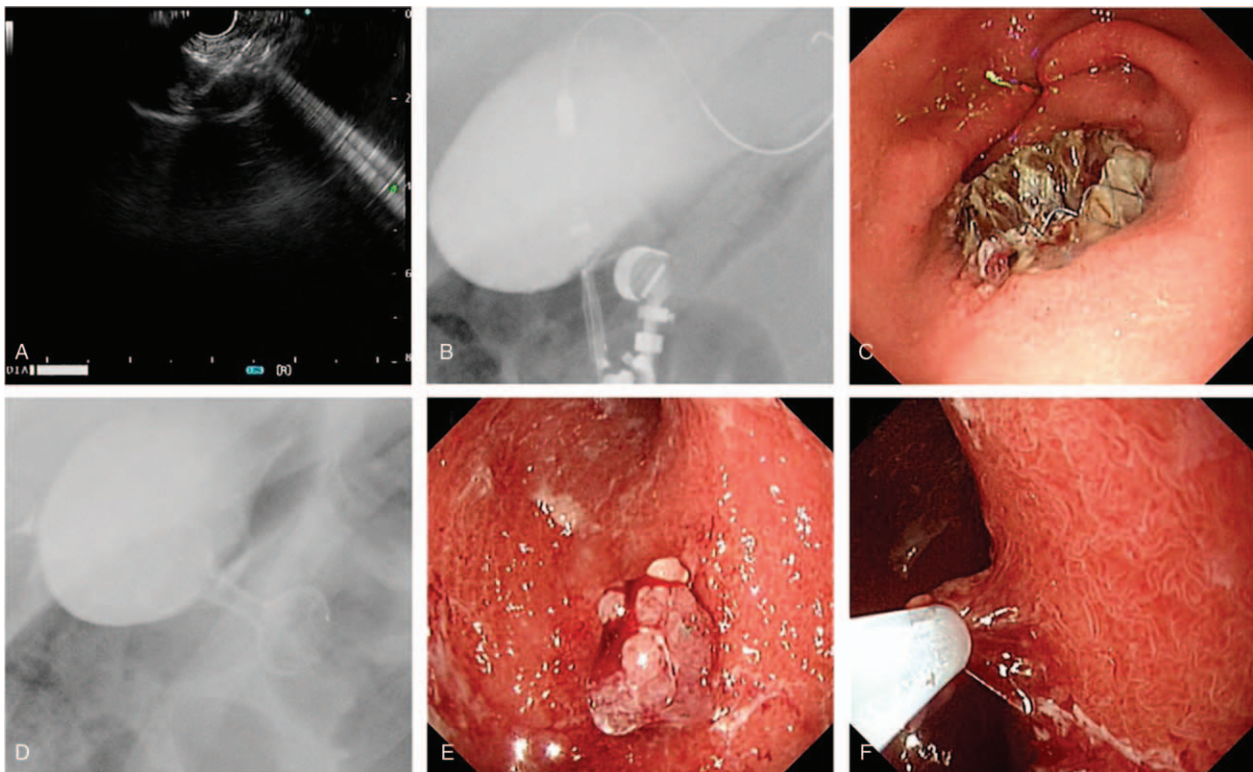


Figure 1. The whole procedure from endoscopic ultrasound-guided cholecystostomy to endoscopic resection of gallbladder polyps. (A) Endoscopic ultrasound-guided gallbladder puncture with echo-tip needle; (B) X-ray image of stent insertion by the electrocautery tip; (C) Endoscopic view of the released stent; (D) X-ray image of the released stent; (E) Endoscopic view of the gallbladder polyp; (F) Endoscopic view of the gallbladder polyp resection with snare.

Table 1**The characteristics of the patients.**

Patient	Gender	Age, yr	Number of polyps	Maximal diameter of polyps, mm	Symptoms			Follow-up, mo
					Abdominal pain	Jaundice	Fever	
1	Male	43	1	6	Yes	No	No	3
2	Female	61	2	4	Yes	Yes	No	15
3	Female	46	1	8	Yes	No	No	13
4	Female	48	1	10	Yes	No	No	6

2.4. Follow up

After the procedure, follow-up was performed at 3, 6, and 12 months in the first year and every 12 months from the second year. Clinical symptoms and US examination were investigated. The function of cholecyst was evaluated by comparing the variation of cholecyst volume between fasting and high-fat diet. A reduction greater than 30% was considered as functional.

3. Results

The clinical data of patients are summarized in Table 1. Four patients with gallbladder polyps and symptomatic gallstones treated at Nanjing Drum Tower Hospital between April 2018 and July 2019 were enrolled in this study, including 1 male and 3 females with age ranging from 43 to 61 years. The gallbladder polyps were multiple in 1 patient and single in 3 patients. The largest polyp diameter was about 10mm, and the largest gallstone diameter was about 12mm. All gallbladder polyps have short pedicles. The diagnoses of gallbladder polyps and gallstones were confirmed by US and endoscopic imaging. One patient combined with common bile duct stones who showed mild jaundice was performed with ERCP.

All patients were successfully performed with the procedures of EUS-guided cholecystostomy (Table 2). Cholecystoduodenostomy was performed in 3 patients and cholecystogastrostomy in 1 patient. The time of EUS-guided cholecystostomy was ranging from 3.3 to 14.6 minutes. One patient experienced severe peritonitis and complained of abdominal pain and fever, who was recovered after administering of imipenem for 4 days. Another 2 patients experienced mild abdominal pain following the cholecystostomy procedure. No signs of bleeding were observed. After the procedure, patients resumed a liquid diet within 1 to 4 days.

All patients were also successfully performed with endoscopic resection of gallbladder polyps (Table 3). The LAMS was removed in all patients before the per-oral transmural endoscopic therapy. The LAMS duration was ranging from 3 to 14 days. No patient underwent dilation of the fistula. Two patients showed complete stone removal spontaneously before the per-oral endoscopic therapy, and the remaining patients turned into stone-free after this procedure. Smaller gallbladder polyps in 2 patients were removed by biopsy forceps, otherwise we used snares for electric resection. The pathologies of the polyps included adenomatous, hyperplastic, and cholesterol polyp. The fistula was subsequently closed with clips in the patient with cholecystogastrostomy, while other patients with cholecystoduodenostomy were not performed with this procedure. After 2 to 4 days of hospital stay, all patients recovered without any complications, such as bleeding, infection, or peritonitis.

During the follow-up at 3 months, 1 patient was performed with LC because US examination showed the reappeared gallstones. No stone recurrence was found in other patients. The contractile response of gallbladder was evaluated by abdominal US after the procedure, which revealed functional gallbladder. During the follow-up of 3 to 15 months, no polyp recurrence was found in all the patients. There was no evident discomfort in the patients during the follow-up period.

4. Discussion

Generally, LC is recommended for gallbladder polyps greater than 10mm because of the malignant potential.^[7] On the contrary, regular US follow-up is usually used for gallbladder polyps less than 10mm. We performed EUS-guided transmural cholecystostomy and per-oral endoscopic resection of gallbladder polyps eliminating malignant possibility based on preoperative examinations. In addition, small gallbladder polyps do not need the procedure. Therefore, we performed the procedure only in gallbladder polyps combined with symptomatic gallstones. The postoperative pathology was all benign. The biggest polyp is adenoma with malignant potential. We used biopsy forceps and snares to remove the polyps, which could not ensure complete removal of lesions. Thus, close follow-up is still needed. Whether the larger gallbladder polyps can be removed by this procedure, and whether other techniques are better, are needed to be further studied.

We used various methods of gallbladder puncture in this study and there was a case of severe peritonitis. The patient was just using the traditional method of gallbladder puncture, which experienced the steps of fine-needle aspiration needle, guidewire,

Table 2**Characteristics of endoscopic ultrasound-guided cholecystostomy.**

Mean procedure time, min	7.9
Puncture method	
Needle, guidewire, cystotome, balloon, LAMS	1
Needle, guidewire, ECE-LAMS	2
Only ECE-LAMS	1
Puncture location	
Antrum	1
Duodenal bulb	3
Successful operation	4/4
Fever	1/4
Bleeding	0/4
Severe peritonitis	1/4
Abdominal pain	3/4
Stent displacement	0/4

ECE-LAMS = electrocautery-enhanced LAMS, LAMS = lumen-apposing metal stent.

Table 3
Characteristics of per-oral transmural endoscopic resection of gallbladder polyps.

Stent duration, d	7 (3–14)
Stent removal	4/4
Dilation of the fistula	0/4
Stone-free with one procedure	4/4
Stone residual	0/4
Polyp resection method	
Biopsy forceps	2
Snare	2
Close fistula	1/4
Complications	0/4

and tract dilation. The risk of complications would rise along with the increase of operation steps. The ECE-LAMS was directly advanced along the guidewire to reduce the operation steps and the occurrence of complications avoiding multiple accessory exchanges described with previous techniques.^[8,9] Moreover, retrograde gallbladder cannulation to extract bile and inject normal saline was first performed, which allowed easier 1-step puncture with ECE-LAMS and alleviated peritonitis. However, choledocholithiasis was generally required on this occasion, which made its wide application to be limited.

We closed the fistula after the operation of the puncture site in the antrum to prevent food from entering the biliary system, while the fistula in the duodenal bulb was not closed. According to our experience, the food is easy to enter the fistula in gastric antrum, but not in the duodenal bulb, which may be related to the anatomical structure. Unfortunately, we did not use gastroscope to observe the closure of the fistula, but the patients did not have any discomfort after feeding. Up to now, there is no conclusion about the maintenance time of the LAMS. It is generally considered that the stent should be maintained for 1 to 2 weeks. In 2 of our patients, the maintenance time was only 3 and 4 days, and there was no gastrointestinal fistula, so the maintenance time may be further shortened, which helps to reduce the hospital stay. But this needs to be confirmed by further case studies. In addition, there was gallstones recurrence of one patient in a short period. We should avoid to crush the stones into fragments and carefully inspect the gallbladder to discover submucosal stones.

In summary, our preliminary study demonstrated the procedure of EUS-guided gallbladder polyp resection and gallstones

removal to avoid cholecystectomy. The current limited data showed the method could be successfully implemented. However, we need to be alert to the complications and recurrence of gallstones. Therefore, more studies in large population are still needed for clinical practice guidance.

Author contributions

YL, YL Y, and LW contributed to conception and design of this study and have been involved in revising the manuscript critically. SZ and JL contributed to analysis and interpretation of data. YH S, JC, and XL Z contributed to the study design, analysis of data, and drafting this manuscript. GF X and XP Z contributed to the acquisition of data. YL Y contributed to critically revising the manuscript and interpretation of data. All authors read and approved the final version of the manuscript.

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