Original Article

Feasibility of conversion of percutaneous cholecystostomy to internal transmural endoscopic ultrasound-guided gallbladder drainage

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Abstract

Background/Aim: Percutaneous cholecystostomy [percutaneous transhepatic gallbladder drainage (PTGBD)] is the treatment of choice in surgically unfit patients with acute cholecystitis. However, PTGBD tube removal after symptoms resolution results in 41–46% recurrence. This study aims to demonstrate the feasibility of the conversion of PTGBD to transmural endoscopic ultrasound-guided gallbladder drainage (EUS-GBD) using plastic stents in patients unfit for cholecystectomy.

Patients and Methods: Patients who underwent internal transmural EUS-GBD as a conversion from PTGBD were reviewed. EUS-GBD was performed after the improvement of cholecystitis due to recurrent cholecystitis and PTGBD intolerance. One or two 7-Fr double pigtail plastic stent insertion with or without temporary endoscopic naso-gallbladder drainage (ENGBD) insertion was performed.

Results: Six patients (age 61–88), with three cases of acute cholecystitis after metallic biliary stenting and three cases of calculus cholecystitis, who underwent PTGBD were included. EUS-GBD was performed 10–63 days after PTGBD, using one plastic stent in five cases, two stents in one case, with temporary ENGBD in two cases. The technical success and clinical success were achieved and the PTGBD tubes were subsequently removed in all patients. All ENGBD tubes were removed within 5 days after insertion. Bile leak with peritonitis was demonstrated in one case, which was treated conservatively. No recurrent cholecystitis was seen during 3–26 months of follow-up.

Conclusion: The conversion of percutaneous cholecystostomy to internal transmural EUS-GBD with plastic stents is feasible for patients unfit for cholecystectomy. However, more studies are still needed to confirm the results.

Keywords: Cholecystitis, endoscopic ultrasound, gallbladder drainage, percutaneous cholecystostomy

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INTRODUCTION

Acute cholecystitis is one of the common problems encountered in clinical practice. The main treatment of acute cholecystitis included antibiotics, supportive care, and biliary drainage.[1] According to the Tokyo guideline,[2] percutaneous transhepatic gallbladder drainage (PTGBD) is the recommended treatment for surgically unfit patients with acute cholecystitis. In cases with calculous cholecystitis, 41–46% of patients developed recurrent symptoms following the PTGBD tubes removal after resolution of cholecystitis.[3,4] Moreover, acute cholecystitis may occur as a complication after the endoscopic placement of self-expandable metal stent (SEMS) as a palliation for unresectable malignant biliary obstruction.[5,6] In such cases, long-term PTGBD may be required due to permanently obstructed cystic duct by the tumor or the stent, which causes significant morbidities,[3] which may in turn adversely affect the patients' quality of life.

The transmural endoscopic ultrasound-guided gallbladder drainage (EUS-GBD) is an alternative method for gallbladder drainage, which showed comparable effectiveness but less invasiveness in one randomized controlled study compared with PTGBD.[7] Formerly, plastic stent or naso-cystic tube was used, but recently, SEMS, especially lumen-apposing metal stent (LAMS) has become more popular.[8-10] The role of EUS-guided transmural drainage is not only useful as the primary drainage but also as the conversion to internal drainage as we previously reported the feasibility of EUS-guided biliary drainage as a conversion method from endoscopic transpapillary naso-biliary drainage.[11] In the same way, there was a report of the conversion from percutaneous to internal gallbladder drainage using LAMS.[12] However, despite LAMS's effectiveness in the prevention of bile leakage, it has several drawbacks, especially regarding cost. On the contrary, the role of transmural EUS-GBD using plastic stents has been reported but there has been no study of its role as the conversion of PTGBD. This study aims to demonstrate the feasibility of the conversion of percutaneous cholecystostomy to transmural EUS-GBD using plastic stents.

PATIENTS AND METHODS

We performed a multicenter, retrospective case review of all patients who received the EUS-GBD with plastic stents as a conversion from the PTGBD for acute cholecystitis from September 2011 to September 2016. Totally, six patients from three different hospitals were included. The cause of acute cholecystitis was cystic duct obstruction after the placement of SEMS for malignant biliary obstruction in three patients and calculus cholecystitis in the other three patients. All patients were considered poor surgical candidates (American Society of Anesthesiologists Physical Status Classification Class 3) and received PTGBD prior to the EUS-GBD procedure. EUS-GBD as a conversion from PTGBD was considered in first two patients due to recurrent cholecystitis following capping of the PTGBD tube after the resolution of acute cholecystitis. In the other four cases, EUS-GBD was considered due to poor surgical candidacy and intolerance to PTGBD tube insertion. Written informed consent regarding the endoscopic procedure was taken in every patient prior to the EUS-GBD. The duration between the PTGBD insertion and the EUS-GBD ranged from 11 to 63 days (median 19 days). The baseline characteristics as well as the comorbidities were presented in Table 1.

Procedure

The EUS-GBD was performed by experienced endoscopists in one university hospital and two general hospitals. The patients were given conscious sedation with intravenous diazepam and pethidine hydrochloride. The curvilinear echoendoscopes used for the procedures were EG 530 UT2, 580UT (Fujifilm Corp., Tokyo, Japan) and GF-UCT240-AL5, GF-UCT260 (Olympus Medical System, Tokyo, Japan) with the EU-ME1, EU-ME2; (Olympus Medical Systems), or SU-8000 or SU-1 (Fujifilm Corp.) as the ultrasound apparatuses.

Table 1: Baseline characteristics

Patient	Age	Gender	Initial disease	Etiology of cholecystitis	Other gallbladder disease	External drainage tube dwelling time before the internal drainage (days)
1	70	Male	Hilar cholangiocarcinoma	After uncovered SEMS* placement	Gallstone	11
2	61	Male	Colonic carcinoma with hilar lymph node metastasis	After uncovered SEMS* placement	None	19
3	65	Male	Cirrhosis with Hepatocellular carcinoma	Calculus cholecystitis	Gallstone	63
4	82	Female	Mid CBD† cholangiocarcinoma	Calculus cholecystitis	Gallstone	10
5	84	Female	Cystic duct carcinoma	After uncovered SEMS* placement	Gallstone	44
6	88	Female	Dementia	Calculus cholecystitis (with history of DIC in last episode)	Gallstone	21

*SEMS: Self-expandable metallic stent; †CBD=Common bile duct

After the echoendoscope insertion, the contrast diluted with saline was injected through the PTGBD tube to guide the puncture site. The gallbladder was accessed by EUS under both the fluoroscopic image and the EUS image. After additional injection of saline to enlarge the gallbladder lumen, the gallbladder was punctured using 19G fine-needle aspiration (Echotip Ultra, Cook, Medical Bloomington, Indiana, USA; Expect Flex, Boston Scientific, Natick Massachusetts, USA; or SonoTip Pro Control, MediGlobe, Rosenheim, Germany) either from the duodenum bulb or the gastric antrum with EUS in the pushing scope position. The puncture of the gallbladder was confirmed by contrast injection on fluoroscopy. After the puncture of the gallbladder, a 0.025-inch guidewire (VisiGlide, Olympus Medial, or Revowave, Piolax Medical, Tokyo, Japan) was inserted through the needle and coiled inside the gallbladder lumen. The fistula was dilated using the 7-Fr biliary bougie dilator (Soehendra biliary dilation catheter, Cook Medical, Bloomington, Indiana, USA), 6-Fr coaxial electric cautery (Cysto-gastro-set, ENDO-FLEX, Voerde, Germany), or the tapered tip balloon dilator (Ren, Kaneka Medix Corp., Osaka, Japan) depending on the availability of equipment and operator's decision. In cases where more than one plastic stents insertion was planned, the second 0.035-inch guidewire was inserted through the UNEVEN double-lumen cannula (Piolax Medical Devices Inc., Kanagawa, Japan). The tract was further dilated using the 4 or 6 mm balloon dilator (Hurricane, Boston Scientific, MA, Natick, Massachusetts, USA) depending on the equipment available in the institute. Subsequently, one or two double-pigtail plastic stents were inserted. In two cases, pigtail naso-cystic tube was temporarily inserted together with one double-pigtail plastic stent. The EUS-GBD procedure and the computed tomography (CT) scan after the procedure are demonstrated in Figures 1 and 2, respectively.

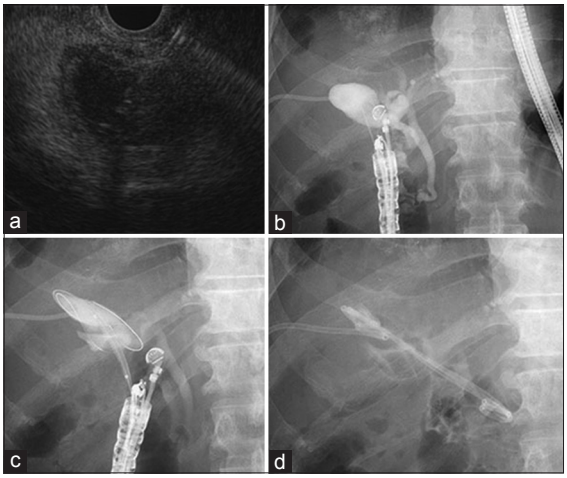

Figure 1: The thickened gallbladder was punctured under the EUS (a) and fluoroscopic guidance (b). The guidewire was coiled inside the gallbladder and the cholecysto-enteric fistula was created (c). In this case, two double-pigtail plastic stents were inserted (d)

RESULTS

The EUS-GBD using plastic stents was 100% technically successful. The PTGBD tubes were removed in all patients within 2–72 days (median 13 days) after the internal drainage. The maturity of the PTGBD fistulous tract was routinely checked by tract imaging before PTGBD tube removal. In one patient with cirrhosis (patient number 3), the PTGBD insertion was kept for more than 2 months after EUS-GBD due to poorly formed fistulous tract,[13] but the tube was accidentally misplaced. So we decided to insert another endoscopic naso-cystic tube via the puncture site while removing the PTGBD to minimize bile leakage. The naso-cystic tube was removed 5 days later and the patient was event-free afterwards. In the other two patients that received naso-cystic tube insertion along with the plastic stent, the naso-cystic tube was removed within 5 days after the EUS-GBD procedure. The procedure and the complication of EUS-GBD are demonstrated in Table 2.

In the first two patients, the plastic stents were spontaneously dislodged. However, both patients did not experience any recurrence of cholecystitis or related complications until death (8 months and 18 months later) from the underlying malignancy. For the remaining four patients, none of them experienced recurrent cholecystitis during the follow-up period ranging from 3 months to 2 years.

DISCUSSION

In patients with moderate severity of acute cholecystitis, either cholecystectomy in experienced hand or early

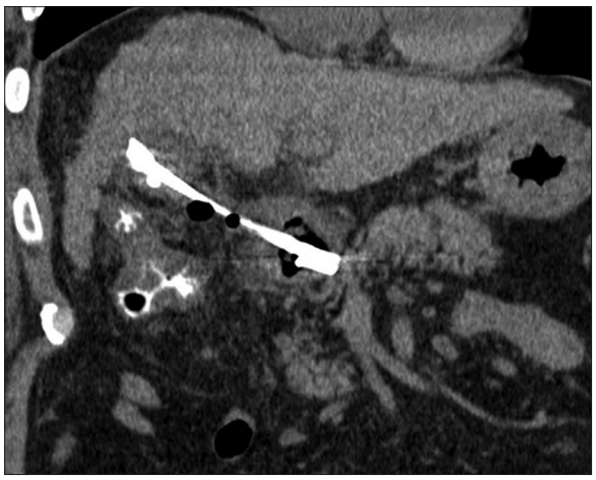

Figure 2: The CT performed after the EUS-GBD procedure showed proper placement of EUS-GBD plastic stent with no evidence of bile leakage or local complication

Table 2: The procedure description and the complications of EUS-GBD

Patient	Procedure time (minutes)	Puncture site	Dilator devices	Stent (s)	External drainage tube dwelling time after the internal drainage (days)	Early complication and treatment	Duration of follow-up (months)
1	45	Stomach	Bougie dilator, 7-Fr Soehendra followed by 4 mm balloon dilator	7 Fr 4 cm double-pigtail	14	None	8
2	30	Duodenal bulb	6-Fr Cautery dilator followed by 4 mm balloon dilator	7-Fr 2 cm double-pigtail	37	None	18
3	27	Duodenal bulb	6-Fr Cautery dilator followed by 4 mm balloon dilator	7-Fr 7 cm double-pigtail* 2 stents	72	None	25
4	43	Duodenal bulb	6-Fr Cautery dilator followed by 4 mm balloon dilator	7-Fr 10 cm double-pigtail, 7-Fr pigtail ENBD‡ (temporary)	2	None	8
5	45	Duodenal bulb	6-Fr Cautery dilator followed by 6 mm balloon dilator	7-Fr 10 cm double-pigtail	11	Peritonitis, conservative treatment	8
6	55	Duodenal bulb	4 mm Tapered tip balloon	7-Fr 4 cm double-pigtail, 5-Fr pigtail ENBD	5	None	3

‡ENBD: Endoscopic nasobiliary drainage, *Two 7-Fr 7 cm double-pigtail stents

gallbladder drainage is recommended.[1] PTGBD is the standard method for nonoperative gallbladder drainage, especially in surgically unfit patients. However, the removal of the PTGBD tube requires the maturity of the fistula tract, which requires approximately 2 weeks to form.[14] In most patients who received PTGBD, further treatment such as surgery could be performed after the resolution of the acute cholecystitis. As the cases with indication for long-term drainage are not common and among three hospitals enrolled in our study, only six cases were experienced during the 5-year period. However, patients who are surgically unfit usually have several comorbidities, or have hepatopancreatobiliary malignancy undergoing chemotherapy, where another episode of recurrent cholecystitis may be fatal or affect the course of treatment for underlying malignancy. In such patients, long-term drainage may be necessary, but placing long-term PTGBD may cause morbidities, such as patient discomfort and tube dislodgement. In such cases, the internalization of the PTGBD is perhaps another good alternative to improve their quality of life while reducing the chance of recurrent cholecystitis. However, the EUS-GBD-related procedure risk should still be considered over the risk of placing long-term PTGBD, especially in patients with very short expected survival. As a result, this technique might benefit mostly in patients unfit for surgery but still candidate for other medical treatment.

In recent years, endoscopic gallbladder drainage has an increasing role as the primary drainage procedure. The Internal drainage could be performed by plastic stents, or metallic stents, either by transpapillary[15] or transmural approach. The role of EUS-GBD as the primary drainage method for acute cholecystitis has been reported in many series but its role as a conversion from PTGBD has been limited. In the study by Law,[12] EUS-GBD was performed as the internalization of PTGBD using LAMS in seven patients. Despite the simplicity of LAMS insertion, initial stent dislodgement or LAMS deployment in extraluminal location was seen in 71% of patients, which necessitated additional metal stent or plastic stents insertion during the first session. Additional endoscopic sessions for LAMS removal and replacement by plastic stents were necessary in three cases. Moreover, LAMS is expensive, and not widely available in Japan. On the contrary, although the EUS-GBD using plastic stents is technically more difficult, stent exchange was not necessary. Our longest duration of follow-up was more than 2 years without any recurrent cholecystitis or stent-related complication.

During the usual EUS-guided transmural drainage, the main complication is the leakage of bile juice during and after the EUS-guided transmural drainage. By using the conversion technique, the adverse effect of bile leakage could be minimized as the infected bile juice is drained via the external drainage tube and replaced with normal saline by tube flushing. However, the conversion is technically more difficult because of thickened gallbladder wall and insufficient gallbladder expansion with low tension despite the administration of saline through the PTGBD tube. Moreover, after the initial puncture, the guidewire coiling is much more difficult in the contracted gallbladder. Dilation of the fistula after the puncture was the most difficult step using the bougie dilator but will become easier using the cautery dilator. As a result, we injected the diluted contrast through the PTGBD not only to aid the visualization of the gallbladder by fluoroscopy but also to temporarily increase gallbladder distention to ease the puncture. Despite technical difficulty, the success rate of this technique was 100%, which can improve the patients' quality of life.

In our series, although the EUS-GBD stent was spontaneously dislodged in two patients, they did not experience any

recurrence of cholecystitis. Although the formation of internal fistula after stent displacement was not confirmed, the EUS-GBD might play a role in the prevention of recurrence of cholecystitis, long enough for their life expectancy. In one patient, bile leak and peritonitis was observed after the EUS-GBD. In this case, the 6-mm balloon dilation was used before the placement of a single 7-Fr stent. This creates a larger gap between stent and the dilated fistulous tract when compared to other cases. In one patient with cirrhosis, the PTGBD fistulous tract was not formed due to poor tissue healing and poor nutrition, which are the common problems encountered in surgically unfit patients. In this case, we temporarily inserted the naso-cystic tube to improve the gallbladder drainage after the PTGBD removal and bile leak was not observed after PTGBD removal.

Our study demonstrates the feasibility of EUS-GBD using the plastic stents for the internalization of PTGBD, which could improve the patient's quality of life. The advantages of using plastic stent included long-term durability without the need for stent exchange or additional procedure, and lower cost. However, there are still some limitations. First, the number of cases was limited as patients who need long-term PTGBD that indicated for the internalization are not so common. Secondly, the EUS-GBD procedures were not performed under the same method and equipment. The procedure itself is more complicated, and has a higher risk of bile leak compared to those using the LAMS. Even so, the technical success rate was 100% using the different equipment. However, more studies with a more uniform procedure, as well as longer time of follow-up are still needed to confirm the results of this technique.

CONCLUSION

In summary, we demonstrate the feasibility of the conversion of percutaneous cholecystostomy to internal transmural gallbladder drainage using endoscopic ultrasound-guided plastic stents insertion.

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None.

Conflicts of interest
There are no conflicts of interest.

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