Endoscopic Ultrasound-Guided Gallbladder Drainage: Current Perspectives

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Introduction

- Surgical cholecystectomy is the gold standard of treatment for acute cholecystitis (AC)
- Laparoscopic cholecystectomy should be the first approach to be taken into account regardless of the degree of severity,
However, in high-risk surgical patients, such as in case of
- fragile patients
- or patients with advanced malignancy or severe organ failure or poor performance status,
- the morbidity and mortality rates remain high.
Indeed, less invasive treatment is required and
- percutaneous trans-hepatic gallbladder drainage (PTGBD)
- is considered the standard nonsurgical option in fragile patients.
Introduction

- endoscopic gallbladder drainage could be considered a possible alternative approach
- especially when the procedure is performed by skilled endoscopists in high-volume institutes.
Introduction

- The two widely accepted endoscopic techniques are
- the endoscopic transpapillary gallbladder drainage (ETGBD)
- and the transmural endoscopic ultrasound-guided gallbladder drainage (EUS-GBD)
gallbladder drainage in patients with acute cholecystitis (AC); (A) percutaneous transhepatic gallbladder drainage (PTGBD); (B) endoscopic transpapillary gallbladder drainage (ETGBD); (C) endoscopic ultrasound-guided gallbladder drainage (EUS-GBD) with electrocautery lumen-apposing metal stent (EC-LAMS)
Introduction

- EUS-GBD, since the first case reports published in medical literature in 2007
- even more attractive by the introduction of the lumen-apposing metal stent (LAMS) specifically designed for interventional EUS.
Introduction

- The purpose of this review is to provide an update on the latest available evidence in the medical literature regarding the EUS-GBD in patients with AC.
Acute cholecystitis (AC) with distended gallbladder, stones, mucosal hyper-enhancement and pericholecystic fluid noted on computed tomography (CT) scan
EUS-GBD is now considered a well-established alternative treatment to surgery in case of AC.

Originally, due to the absence of specifically designed stents for EUS-GBD, a variety of plastic stents (straight, single, and double pigtail) and self-expandable metal stents (SEMS) have been used.
One of the first prospective studies was the pilot one published in 2010: eight patients with AC and unsuitable candidates for cholecystectomy underwent an EUS-guided cholecystoenterostomy with the single-step placement of a 7F double-pigtail plastic stent.

Technical and clinical success were achieved in all patients, with three (37.5%) adverse events (AE) reported.

During follow-up periods (median 186 days) no recurrence of cholecystitis occurred.
With regard to SEMS, one of the first and most important studies was the one carried out by Choi et al in 2014.

EUS-GBD with SEMS placement was technically and clinically successful in 62/63 patients.

During the study, a total of 7 (11.2%) AE were reported, including duodenal perforation, self-limiting pneumoperitoneum, distal stent migration and cholecystitis due to stent occlusion.

Approximately 96% of the patients had no recurrence of AC during follow-up.
With the aim of overcoming the high rates of AE, modified stents with flared ends and LAMS have been firstly studied and then introduced in the clinical practice.
Fig. 24.4 Endoscopic ultrasonography specific stents. (A) Lumen-apposing stents. (B) Half-covered self-expandable metallic stents. (C) Fully covered self-expandable metal stent with antimigratory flaps.
In 2016 Anderloni et al published a systematic review and pooled analysis with the intention to evaluate the outcomes of the different types of stents.

With regard to plastic stents, pooled technical and clinical success rates were 100% with an AE frequency of 18.2% (pneumo-peritoneum, bile leakage, and bile peritonitis and stent migration).
EUS-GBD - SEMS

- Pooled technical and clinical success rates obtained using SEMS were 98.6% and 94.4%, respectively,
- with a pooled AE rate of 12.3% (pneumoperitoneum, duodenal perforation, stent migration and worsening of cholecystitis due to stent occlusion).
EUS-GBD- partially covered versus fully covered

- Analyzing the results of the different types of metal stents (partially covered versus fully covered)
- The authors have found that the clinical success rate was significantly greater for the former compared to the latter (98% vs 70%).
- Moreover, AE occurred more commonly in the fully covered group, although the difference did not reach statistical significance.
Lastly, the pooled technical and clinical success rates for LAMS were 91.5% and 90.1%, respectively, with lower AE frequency (9.9%).
In more recent years, Jain et al published a systematic review of 189 patients who underwent EUS-GBD by LAMS for AC.

Technical and clinical success rate reported was 95.2% and 96.7%, respectively.

Furthermore, they observed a small risk of recurrent cholecystitis (5.1%), gastrointestinal bleeding (2.6%) and stent migration (1.1%).
In particular, researchers highlighted a reduced stent deployment time when an electrocautery enhanced LAMS (EC-LAMS) was used, compared to procedures with a non-cautery LAMS (3.1 min vs 7.7 min).

Investigators concluded that EUS-GBD using LAMS could be considered a safe and efficacious alternative in AC but it must be performed by skilled endoscopists in high-volume centers.
The procedure can be performed with the patient under conscious sedation or general anesthesia, in an endoscopic room with all fluoroscopic equipment's.

As the first step, a linear echoendoscope is advanced into the distal gastric tantrum or duodenal bulb in order to identify the target.

A diagnostic EUS in order to locate vessels and other structures surrounding
Technical Aspects of EUS- GBD

- However, the best site to puncture has not been defined yet
  - trans-gastric
  - trans-duodenal approaches to EUS-GBD,
Technical Aspects of EUS- GBD

- the authors reported no significant difference in technical success, clinical success based on the puncture site.
- Endoscopists can choose the site they prefer to use for puncture.
Duodenum is less mobile than the stomach, resulting in a less technically challenging procedure and with a decreased risk of stent migration or dislodgment.

Furthermore, in the duodenal bulb, the risk of stent occlusion by food is lower than in the trans-gastric approach.
On the other hand, the reasons that favour trans-gastric access are

- to obtain a simpler target, as gallbladder body represents a larger entry site,
- and to have less important consequences in case of AE, because stomach has an easier surgical access than duodenal bulb.
Technical Aspects of EUS- GBD

- After selecting the best entry point, a standard 19-gauge needle is used to puncture the gastric antrum or the duodenal bulb to access the gallbladder using real-time ultrasound and color Doppler imaging.
- Next, a contrast medium is injected to obtain fluoroscopic images of the biliary tree.
- A standard biliary guide wire is then coiled into the gallbladder lumen.
At this point, the newly created tract must then be dilated over the guide wire using a balloon dilator or cystotome. Subsequently, a preloaded stent is then advanced over the guide wire.

The distal flange of the stent is first deployed into the gallbladder under ultra-sonographic or fluoroscopic guidance.

Then, the proximal flange of the stent is deployed into the duodenum or the stomach, thereby performing cholecystoenterostomy or cholecystogastrostomy, respectively.
The optimal positioning of the stent can be confirmed endoscopically or fluoroscopically.

If an EC-LAMS (Hot-Axios, Boston Scientific, Marlborough, MA, USA) is being used, the puncture site, dilation of the tract and stent deployment can all be performed simultaneously, thereby decreasing the procedure time.
In patients who are not surgical candidates, PTGBD has been traditionally considered the treatment of choice for draining the gallbladder. Indeed, the technical success of PTGBD is high, approximately 95%, and the procedure could be easily carried out. However, clinical success range from 56% to 100% and the rate of AE could reach 14%, including bleeding, pneumothorax, biliary peritonitis, and premature catheter removal or dislodgement. Nevertheless, the external catheter requires continuous care and additionally could be associated with pain, discomfort and cosmetic disfigurement. Furthermore, up to 33% of patients could develop recurrent cholecystitis after catheter removal.
Endoscopic Transpapillary Gallbladder Drainage (ETGBD)

- The transpapillary approach was first reported in 1990 and could be carried out with standard ERCP techniques;
- It ensures physiological drainage of the biliary tract without the need of transmural injury;
- However, cannulation of the cystic duct in patients with AC can be challenging.
- In addition, this technique carries all the ERCP-related complications such as bleeding, perforation and post-ERCP pancreatitis.
ETGBD

- One of the largest studies (194 patients) that assessed ETGBD outcomes was published in 2010.
- Technical success rate and clinical success rate of 81% and 75%, respectively, with an AE rate of 3.6%.
- AE including, two patients suffered from mild pancreatitis and two---cholestasis.
- During the follow-up period, late AE including distal migration, cholangitis, and recurrent biliary pain.
- Median stent patency was 760 days.
EUS-GBD versus PTGBD

- Taking in account that PTGBD may reduce
  - the patient’s quality of life due to the presence of external drainage
  - as it lengthens the mean hospital stay often due to the need for re-intervention,
  - in addition to an increased incidence of AE,
- EUS-GBD may be preferable, especially for patients who are less likely to undergo future surgical treatment.
PTGBD convert to EUS-GBD

- Interestingly, recently assessed the clinical efficacy and safety of EUS-GBD replacement of previously placed PTGBD, in a multicenter retrospective study.
- On the basis of these data, in patients where drainage needs to be maintained PTGBD could be converted to EUS-GBD.
Fluoroscopic view of a conversion procedure, from percutaneous trans-hepatic gallbladder drainage (PTGBD) to endoscopic ultrasound-guided gallbladder drainage (EUS-GBD) with the positioned electrocautery lumen apposing metal stent (EC-LAMS) into the gallbladder lumen.
EUS-GBD versus ETGBD

- recently conducted a retrospective study on 172 patients, 76 who underwent EUS-GBD drainage and 96 who were treated transpapillary, comparing the different outcomes of the techniques under examination.
  - technical success rate (99.3% vs 86.6%, P < 0.01)
  - and clinical success rate (99.3% vs 86%, p < 0.01)
- In addition, the procedure-related AE rate (7.1% vs 19.3%, p = 0.02),
- the EUS-GBD showed a significantly better safety profile.
EUS-GBD versus ETGBD

- In the EUS-GBD group, the AE including pneumo-peritoneum, duodenal perforation, and recurrent biliary pain
- while in the ETGBD AE including post-ERCP pancreatitis and recurrent biliary pain. Also, cholecystitis or cholangitis recurrence, in long term follow up
- EUS-GBD showed better results (3.2% vs 12.4%) when compared to ETGBD drainage.
EUS-GBD versus ETGBD

- The authors concluded that in patients with AC who are not candidates for surgery, EUS-GBD represents a more appropriate treatment compared to the transpapillary approach.
- ETGBD can still be considered in patients with choledocholithiasis, as it allows concomitant stone removal and physiologic drainage without the creation of a fistula.
Long-Term Outcomes of EUS-GBD

- Taken together, these data propose EUS-GBD as a valuable safe and efficient procedure also in the long-term follow-up, reducing the risk of further biliary events for fragile patients who do not undergo cholecystectomy, carrying low rates of AE.
EUS-GBD
Malignant Distal Biliary Obstruction

- In consideration of the excellent results obtained in fragile patients with AC, new possible indications for the EUS-GBD are currently being explored;
- one of the most interesting is the biliary decompression in malignant distal biliary obstruction when current endoscopic methods fail or are not feasible.
- ERCP is the treatment of choice for treating malignant obstructive jaundice. However, ERCP can fail due to the presence of surgically altered anatomy, duodenal obstruction, indwelling enteral stents, or periampullary tumor infiltration.
Malignant Distal Biliary Obstruction

- In these cases, EUS-guided bile duct drainage (EUS-BD) represents an alternative biliary drainage method and its use is increasingly taken into consideration.

- Nevertheless, in some cases, neither of the two opportunities are feasible. EUS-GBD may be a suitable rescue alternative to treat malignant distal biliary obstruction when both ERCP and EUS-BD failed.
Traditionally, the gallbladder is known to remain a difficult organ to assess using the endoscope.

- **EUS-GB access using a LAMS followed by gallstones removal and gallbladder polypectomy**

- **Routine peroral cholecystoscopy after large-diameter LAMS placement was successfully completed in the 93.1% and has allowed complete gallstone clearance in 88% of patients, using irrigation, suction, basket and laser lithotripsy.**
Gallbladder Interventions

- Authors conclude that per-oral cholecystoscopy is a feasible and safe procedure for advanced endoscopic evaluation and interventions,
- representing an unexplored land in the treatment of gallbladder pathologies.