—Review Article—

Outcomes and limitations in EUS-guided gallbladder drainage

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ABSTRACT

EUS-guided gallbladder drainage (EUS-GBD) is gaining popularity as an option for drainage of the gallbladder in patients suffering from acute cholecystitis but at high risk for cholecystectomy. It allows internal drainage of the gallbladder and avoidance of the external tube as used in percutaneous cholecystostomy (PT-GBD). It may also provide additional benefits, including reduced re-admissions and re-interventions. In this chapter, we review the indications and outcomes of EUS-GBD. Furthermore, the follow-up management of patients that received EUS-GBD would be outlined.

Key words: Acute cholecystitis, EUS-guided gallbladder drainage, malignant biliary obstruction, percutaneous cholecystostomy

INTRODUCTION

Acute cholecystitis is increasing in frequency with an aging population.[1] Laparoscopic cholecystectomy is the gold standard in the treatment of the condition.[2] However, with an elderly population, frequently, they are also suffering from multiple comorbidities that render them at high-risk for cholecystectomy. Then, percutaneous cholecystostomy gallbladder drainage (PT-GBD) may be needed for drainage of the gallbladder. However, the presence of an external tube is frequently cumbersome for care as they are prone to leak, obstruction, and dislodgement.[3-5] The advent of endoscopic gallbladder provides an alternative to external drainage of the gallbladder and avoidance of an external drainage tube. Endoscopic GBD can be performed with either transpapillary GBD or EUS-guided transmural GBD. When compared, EUS-GBD is associated with higher technical and clinical success and lower risk of adverse events (AE). Hence, the procedure is increasing in popularity as the procedure of choice for the treatment of acute cholecystitis in high-risk patients. In the paper, an in-depth review of EUS-GBD would be provided.

Indications for EUS-guided gallbladder drainage

The most common indication of EUS-GBD is in patients suffering from acute cholecystitis but are at high risk for cholecystectomy.[2] EUS-GBD should be avoided in patients with suspected gallbladder perforation or necrosis. In case of doubt, a computed tomography should be performed to assess the vascularity of the

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gallbladder and to rule out peroration. The second indication of EUS-GBD is to convert the long-term percutaneous cholecystostomy to internal drainage.[6] Care should be taken when performing EUS-GBD in this group of patients. First, the gallbladder is frequently contracted and difficult to distend. This results in a small-sized target for drainage. The presence of a cholecystostomy can allow injection of saline or contrast to help with distension of the gallbladder. Second, the gallbladder wall may be thickened and more difficult to puncture. Finally, the presence of a large gallstone may make EUS-GBD more difficult as there is limited space for stent deployment. The third indication for EUS-GBD is to achieve drainage of malignant biliary obstruction in patients with failed ERCP and EUS-guided biliary drainage.[7,8] The principle of this procedure is similar to the principle of a surgical cholecystojejunostomy, and successful drainage depends on a patent cystic duct. In a retrospective study assessing the incidence of patent cystic ducts on cholangiograms performed by ERCP in patients with MBO, only 50% of the patients had a patent hepatocystic junction.[9] In addition, results from multiple surgical series on cholecystojejunostomy demonstrated that the overall rate of recurrent biliary obstruction of 8%–48%.[10-12] Thus, in patients with failed ERCP, EUS-guided biliary drainage should still be the first option, and in cases where EUS-guided biliary drainage (EUS-BD) is not possible, then EUS-GBD can be considered.

Outcomes of EUS-guided gallbladder drainage

EUS-gallbladder drainage for acute cholecystitis

EUS-GBD is associated with high technical and clinical success rates ranging from 90% to 98.7% and 89% to 98.4%, respectively.[13-16] AEs are infrequent and ranges from 4.8% to 22%. These include bleeding, recurrent cholecystitis, stent migration, and occlusion. Five studies have compared EUS-GBD to PT-GBD in patients with acute cholecystitis.[17-21] Three studies used lumen apposing stents (LAMS), one study used fully covered self-expandable biliary metal stents (FCSEMS) and the other studies used a naso-gallbladder drain as a method of drainage prior to cholecystectomy.

Comparing EUS-GBD and PT-GBD, all studies reported comparable technical (95.2%–100% *vs.* 96.6%–100%) and clinical success rates (86.7%–96.7% *vs.* 85.8%–97.7%), respectively. Jang *et al.* compared EUS-GBD with a naso-gallbladder drain and PT-GBD as temporary drainage prior to cholecystectomy.[21] They reported similar AE rate (6.7% *vs.* 3.4%, respectively) but significantly lower median postprocedure pain score after EUS-GBD (1 *vs.* 5; P <.001). Teoh *et al.* reported significantly lower 1-year AE rates (32.2% *vs.* 74.6%, $P < 0.001$) and readmission rates for re-intervention (6.8% *vs.* 71.2%, $P < 0.001$) in the EUS-GBD group.[17] The majority of AE in PT-GBD group were due to tube related problems including leak, obstruction, or infection. This resulted in a significantly higher re-admission and re-intervention rates in two studies. In the other two studies, similar 30-day AE rates were noted but lower re-intervention rates were again noted in the EUS-GBD group. Irani *et al.* also reported lower postprocedural pain scores in the EUS-GBD group.

EUS-guided gallbladder drainage for the conversion of percutaneous cholecystostomy

The outcomes of EUS-GBD in this group of patients are less well reported. Only outcomes from two studies are available.[6,22] Law *et al.* reported outcomes in seven patients. The technical success rate was 100%, but two patients required additional placement of an FCSEMS due to misdeployment of the LAMS. No AE occurred after a median follow-up of 2.5 months. Cholecystostomy tubes were removed in all patients. In the other study, six patients had EUS-GBD performed with plastic stents. Technical and clinical success was achieved in all patients. However, one patient suffered from bile leak and peritonitis.

EUS-guided gallbladder drainage for drainage of malignant biliary obstruction

Again, the outcomes of EUS-GBD for this indication less well reported and only described in two studies.[7,8] Imai *et al.* performed EUS-GBD when ERCP failed, and EUS-BD was not possible. An FCSEMS was used for drainage. They reported technical success, functional success, AE, and stent dysfunction rates of 100%, 91.7%, 16.7%, and 8.3%, respectively. Two patients suffered from early AE due to peritonitis in one and another due to stent dysfunction from entrapment of the cystic duct by the growing tumor. In the other study, nine patients received EUS-GBD after failed ERCP and EUS-guided rendezvous.[8] The technical, clinical, and AE rates were 100%, 77.8%, and 0%, respectively. One patient required percutaneous biliary drainage as liver functions did not improve after EUS-GBD. Another had recurrent biliary obstruction 7 months after EUS-GBD.

Outcomes of meta-analysis

Several pooled analyses of case series and meta-analysis on EUS-GBD have been reported recently.[23-27] Three

of these studies were pooled analysis on EUS-GBD using LAMS only and the other included the use of plastic stents, self-expandable metallic stent (SEMS), and LAMS. One meta-analysis compared the outcomes of EUS-GBD to PT-GBD. Klava reported the outcomes of EUS-GBD with LAMS in 233 patients.[23] The pooled proportion of technical success was 93.86% (95% confidence interval [CI] = 90.56–96.49) and clinical success was 92.48% (95% CI = 88.9–95.42). Overall complication rate was 18.31% (95% CI = 13.49–23.68) and stent-related complication rate was 8.16% (95% CI = 4.03–14.96). The pooled proportion for perforation was 6.71% (95% CI 3.65–10.6), and recurrent cholangitis/cholecystitis was noted in 4.05% (95% CI = 1.64–7.48). Anderloni reported the outcomes of EUS-GBD using plastic stents, SEMS, and LAMS in 166 patients.[27] The technical success rate was 100% using plastic stents, 98.6% using SEMS, and 91.5% using LAMS. The clinical success rate was 100%, 94.4%, and 90.1% for plastic stents, SEMS, and LAMS, respectively. The frequency of AE was 18.2% using plastic stents, 12.3% using SEMS, and 9.9% using LAMS. Both studies concluded that EUS-GBD was feasible, safe, and effective.

In a meta-analysis comparing EUS-GBD with PT-GBD, five studies comprising 495 patients were selected for analysis.[24] There were no differences in technical or clinical success rates between the two groups on pooled meta-analysis. EUS-GBD had significantly lower postprocedural pain scores (mean difference - 3.0, 95% CI - 2.3–3.6, $P < 0.001$, on a 10-point pain scale). There were no statistically significant differences in procedure complications between groups. Re-intervention rates were significantly higher in the PT-GBD group (odds ratio 4.3, 95% CI 2.0–9.3, $P < 0.001$).

Thus, the above studies suggest that EUS-GBD is associated with high technical and clinical success rates with low AE. When compared to PT-GBD, EUS-GBD may reduce AE and re-interventions. The results of a completed randomized study (NCT02212717) performed by the authors comparing EUS-GBD *vs.* PT-GBD are eagerly awaited to confirm the benefits of EUS-GBD over PT-GBD.

The management of patients after EUS-guided gallbladder drainage

There are two options for management in patients that have received EUS-GBD for acute cholecystitis. In those frail and old patients who do not want a second endoscopy, permanent stenting could be a potential option. Choi *et al.* reported the long-term outcomes with EUS-GBD.[13] Late AE occurred in four patients (7.1%) including asymptomatic distal stent migration (two patients), and acute cholecystitis due to stent occlusion (two patients). Two patients with an occluded stent were successfully treated endoscopically. A total of 54 patients (96.4%) had no recurrence of acute cholecystitis during the follow-up. The median stent patency time was 458 days for the 28 patients who were alive at the study end. The cumulative stent patency rate was 86% at 3 years.

In our institution, we prefer to perform a peroral cholecystoscopy at 4 weeks after EUS-GBD. The aim is for complete stone clearance and to replace the LAMS with a 7Fr double pigtail plastic stent. The presence of large diameter stent also allows endoscopic access and interventions to the gallbladder.[28,29] We reported the outcomes of 29 cholecystoscopies that were performed in 25 patients. The success rate was 93.1%. Magnifying endoscopy was performed in 10 patients, confocal endomicroscopy and EUS in 1 patient, and endocytoscopy in another patient. Fourteen patients (56%) had spontaneous stone passage. Eleven patients (44%) had residual gallstones on cholecystoscopy, and removed in 8. Overall stone clearance rate was 88% after a mean (standard deviation) number of 1.25 (0.46) sessions of cholecystoscopy.

CONCLUSION

EUS-GBD is a safe and effective procedure for the treatment of acute cholecystitis in patients that are at high-risk for cholecystectomy. It also opens up new windows for endoscopic intervention to the gallbladder that was previously impossible. Data from large scale randomized studies are eagerly awaited to confirm the efficacy of the procedure.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Wadhwa V, Jobanputra Y, Garg SK, *et al.* Nationwide trends of hospital admissions for acute cholecystitis in the United States. *Gastroenterol Rep (Oxf)* 2017;5:36-42.

2. Mori Y, Itoi T, Baron TH, *et al.* Tokyo guidelines 2018: Management strategies for gallbladder drainage in patients with acute cholecystitis (with videos). *J Hepatobiliary Pancreat Sci* 2018;25:87-95.
3. Chang YR, Ahn YJ, Jang JY, *et al.* Percutaneous cholecystostomy for acute cholecystitis in patients with high comorbidity and re-evaluation of treatment efficacy. *Surgery* 2014;155:615-22.
4. Cull JD, Velasco JM, Czubak A, *et al.* Management of acute cholecystitis: Prevalence of percutaneous cholecystostomy and delayed cholecystectomy in the elderly. *J Gastrointest Surg* 2014;18:328-33.
5. Davis CA, Landercasper J, Gundersen LH, *et al.* Effective use of percutaneous cholecystostomy in high-risk surgical patients: Techniques, tube management, and results. *Arch Surg* 1999;134:727-31.
6. Law R, Grimm IS, Stavas JM, *et al.* Conversion of percutaneous cholecystostomy to internal transmural gallbladder drainage using an endoscopic ultrasound-guided, lumen-apposing metal stent. *Clin Gastroenterol Hepatol* 2016;14:476-80.
7. Imai H, Kitano M, Omoto S, *et al.* EUS-guided gallbladder drainage for rescue treatment of malignant distal biliary obstruction after unsuccessful ERCP. *Gastrointest Endosc* 2016;84:147-51.
8. Chang JI, Dong E, Kwok KK. Endoscopic ultrasound-guided transmural gallbladder drainage in malignant obstruction using a novel lumen-apposing stent: A case series (with video). *Endosc Int Open* 2019;7:E655-61.
9. Tarnasky PR, England RE, Lail LM, *et al.* Cystic duct patency in malignant obstructive jaundice. An ERCP-based study relevant to the role of laparoscopic cholecystojejunostomy. *Ann Surg* 1995;221:265-71.
10. Eastman MC, Kune GA. The objectives of palliative surgery in pancreas cancer: A retrospective study of 73 cases. *Aust N Z J Surg* 1980;50:462-4.
11. Watanapa P, Williamson RC. Surgical palliation for pancreatic cancer: Developments during the past two decades. *Br J Surg* 1992;79:8-20.
12. Gough IR, Mumme G. Biliary and duodenal bypass for carcinoma of the head of the pancreas. *J Surg Oncol* 1984;26:282-4.
13. Choi JH, Lee SS, Choi JH, *et al.* Long-term outcomes after endoscopic ultrasonography-guided gallbladder drainage for acute cholecystitis. *Endoscopy* 2014;46:656-61.
14. Walter D, Teoh AY, Itoi T, *et al.* EUS-guided gall bladder drainage with a lumen-apposing metal stent: A prospective long-term evaluation. *Gut* 2016;65:6-8.
15. Kahaleh M, Perez-Miranda M, Artifon EL, *et al.* International collaborative study on EUS-guided gallbladder drainage: Are we ready for prime time? *Dig Liver Dis* 2016;48:1054-7.
16. Dollhopf M, Larghi A, Will U, *et al.* EUS-guided gallbladder drainage in patients with acute cholecystitis and high surgical risk using an electrocautery-enhanced lumen-apposing metal stent device. *Gastrointest Endosc* 2017;86:636-43.
17. Teoh AY, Serna C, Penas I, *et al.* Endoscopic ultrasound-guided gallbladder drainage reduces adverse events compared with percutaneous cholecystostomy in patients who are unfit for cholecystectomy. *Endoscopy* 2017;49:130-8.
18. Tyberg A, Saumoy M, Sequeiros EV, *et al.* EUS-guided *versus* percutaneous gallbladder drainage: Isn't it time to convert? *J Clin Gastroenterol* 2018;52:79-84.
19. Irani S, Ngamruengphong S, Teoh A, *et al.* Similar efficacies of endoscopic ultrasound gallbladder drainage with a lumen-apposing metal stent *versus* percutaneous transhepatic gallbladder drainage for acute cholecystitis. *Clin Gastroenterol Hepatol* 2017;15:738-45.
20. Choi JH, Kim HW, Lee JC, *et al.* Percutaneous transhepatic *versus* EUS-guided gallbladder drainage for malignant cystic duct obstruction. *Gastrointest Endosc* 2017;85:357-64.
21. Jang JW, Lee SS, Song TJ, *et al.* Endoscopic ultrasound-guided transmural and percutaneous transhepatic gallbladder drainage are comparable for acute cholecystitis. *Gastroenterology* 2012;142:805-11.
22. Chantarojanasiri T, Matsubara S, Isayama H, *et al.* Feasibility of conversion of percutaneous cholecystostomy to internal transmural endoscopic ultrasound-guided gallbladder drainage. *Saudi J Gastroenterol* 2017;23:318-22.
23. Kalva NR, Vanar V, Forcione D, *et al.* Efficacy and safety of lumen apposing self-expandable metal stents for EUS guided cholecystostomy: A meta-analysis and systematic review. *Can J Gastroenterol Hepatol* 2018;2018:7070961.
24. Ahmed O, Rogers AC, Bolger JC, *et al.* Meta-analysis of outcomes of endoscopic ultrasound-guided gallbladder drainage *versus* percutaneous cholecystostomy for the management of acute cholecystitis. *Surg Endosc* 2018;32:1627-35.
25. Jain D, Bhandari BS, Agrawal N, *et al.* Endoscopic ultrasound-guided gallbladder drainage using a lumen-apposing metal stent for acute cholecystitis: A systematic review. *Clin Endosc* 2018;51:450-62.
26. Manta R, Mutignani M, Galloro G, *et al.* Endoscopic ultrasound-guided gallbladder drainage for acute cholecystitis with a lumen-apposing metal stent: A systematic review of case series. *Eur J Gastroenterol Hepatol* 2018;30:695-8.
27. Anderloni A, Buda A, Vieceli F, *et al.* Endoscopic ultrasound-guided transmural stenting for gallbladder drainage in high-risk patients with acute cholecystitis: A systematic review and pooled analysis. *Surg Endosc* 2016;30:5200-8.
28. Chan SM, Teoh AY, Yip HC, *et al.* Feasibility of per-oral cholecystoscopy and advanced gallbladder interventions after EUS-guided gallbladder stenting (with video). *Gastrointest Endosc* 2017;85:1225-32.
29. Teoh AY, Chan AW, Chiu PW, *et al. In vivo* appearances of gallbladder carcinoma under magnifying endoscopy and probe-based confocal laser endomicroscopy after endosonographic gallbladder drainage. *Endoscopy* 2014;46 Suppl 1:E13-4.