Commentary

EUS-guided gallbladder drainage *vs.* percutaneous gallbladder drainage

Aaron Justin Small, Shayan Irani
Division of Gastroenterology and Hepatology, Virginia Mason Medical Center, Seattle, WA 98101, USA

INTRODUCTION

Acute cholecystitis can result in severe infection and inflammatory response if left untreated. Cholecystectomy is the gold standard definitive therapy for most. However, in those patients who are poor operative candidates, decompression can be achieved by nonsurgical measures. Percutaneous transhepatic-gallbladder drainage (PT-GBD) has been the temporizing drainage modality for many years, functioning as a bridge to elective cholecystectomy [Figure 1]. While this external approach can be technically easy to perform, certain patient factors preclude its feasibility. There are also several disadvantages for percutaneous cholecystostomy tubes and the subsequent management of the catheters left in place. Internal drainage of the gallbladder, either by transpapillary drainage through ERCP or by EUS-guided transmural drainage, has several advantages over the percutaneous approach. EUS-guided transmural gallbladder drainage (EUS-GBD) is proving to be a safe, effective, and durable option. For this review, we will discuss the comparative advantages and disadvantages of EUS-GBD to PT-GBD and briefly discuss ERCP transpapillary cystic duct stenting also germane to patients in whom surgical gallbladder removal is considered too high risk or as a temporizing measure.

THE PROBLEM

As the life expectancy of humans is becoming greater with the advancement of medical care, the incidence of hospital admissions for acute cholecystitis is rising, and with that, as are the costs from associated prolonged hospital stays.[1] In addition, older patients have more comorbidities that increase the surgical risks. Laparoscopic cholecystectomy is globally one of the most common surgeries, but morbidity can be as high as 50% in high-risk individuals.[2] Yet, if acute cholecystitis is left untreated, readmission rates are high, and patients can become gravely ill from gallbladder rupture, sepsis, and multiorgan failure.[3,4] Conservative measures including broad-spectrum antibiotics and intravenous fluids can lead to a high rate of recurrence, up to 29% within the 1st year, and is associated with increased mortality following hospital discharge.[3,5] As such, decompression of the obstructed or static gallbladder for management of an unresolved infection is preferable. Furthermore, early drainage (within 7 days)

Access this article online

Quick Response Code:

Website: www.eusjournal.com

DOI: 10.4103/eus.eus_8_18

How to cite this article: Small AJ, Irani S. EUS-guided gallbladder drainage *vs.* percutaneous gallbladder drainage. Endosc Ultrasound 2018;7:89-92.

Address for correspondence
Dr. Shayan Irani, Division of Gastroenterology and Hepatology, Virginia Mason Medical Center, 1100 Ninth Avenue, C3-GAS, Seattle, WA 98101, USA. E-mail: shayan.irani@virginiamason.org
Received: 2017-09-06; **Accepted:** 2018-03-05; **Published online:** 2018-04-16

has been associated with fewer immediate complications, shorter hospitalizations, and less frequent recurrence.[2]

EUS-GUIDED GALLBLADDER DRAINAGE

Transmural GBD under EUS guidance requires interventional endoscopic expertise. If cholecystectomy is not a safe option, EUS-GBD can serve as monotherapy for calculus and acalculous cholecystitis. These patients are often critically ill, necessitating urgent drainage, yet may be unable or unwilling to undergo percutaneous drainage.

EUS-GBD has been performed using plastic stents and unflanged covered self-expandable metal stents (SEMSs), predating the advent of lumen opposing metal stents (LAMSs). LAMS have since streamlined the delivery for successful deployment and improved outcomes for EUS-GBD. Although there are three commercially available LAMS (partially covered BONA-AL stent (Standard Sci-Tech, Seoul, Korea), fully covered NAGI stent (Taewoong-Medical, Seoul, Korea) and the Axios stent (Boston Scientific, Natick, MA, USA), most of the studies to date have involved the Axios stent. LAMS has a large diameter, short length, and flared ends, all of which are properties ideal for close approximation of an extraluminal collection or in this case, gallbladder apposition with the stomach or duodenum.

EUS drainage using LAMS has become fascicle now that the Axios catheter-based delivery involves a cautery tip that allows direct puncture through the gallbladder wall without the need for a fine-needle aspiration needle, needle knife nor balloon dilator to form the initial tract. Additional details on the stepwise technical aspects of LAMS placement are described elsewhere and depicted in Figure 2.[6-8]

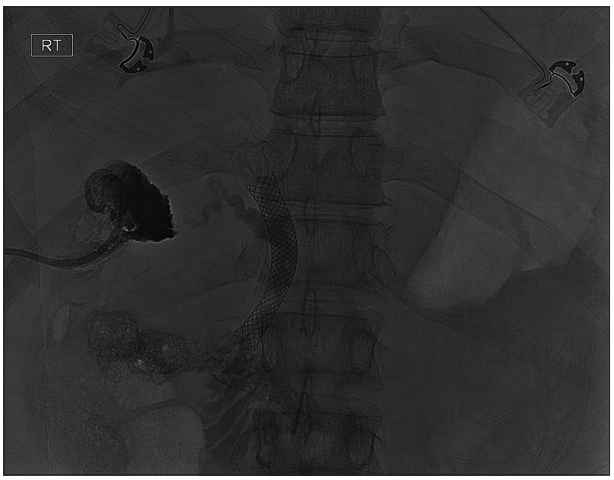

Figure 1. Fluoroscopic view of an 8 Fr locking pigtail drain placed percutaneously into the gallbladder in a patient with cholecystitis from a metal biliary stent causing cystic duct occlusion

The safety and efficacy of EUS-GBD have been reported in several pooled analyses with technical and clinical success rates as high as 97% and 99%, respectively, when including all stent types (plastic, SEMS, and LAMS).[9-12] The relatively high adverse event rate of 8% was largely driven by early occlusion of plastic stents and high migration rates of covered SEMS that can result in bile leaks.[13] Data on EUS drainage using LAMS alone, have similar high efficacy with fewer complications reported in most series than that seen with plastic stents and SEMS.[14] For this reason, notwithstanding the quicker procedural duration, LAMS have become the stent of choice for experts performing EUS-GBD. Still, EUS-GBD should not be performed in certain nonoperative patients such as those with a ruptured gallbladder, unable to be sedated safely for the endoscopy, untreated ascites, or may undergo cholecystectomy in the future.

EUS-GALLBLADDER DRAINAGE *VS.* PERCUTANEOUS TRANSHEPATIC BILIARY DRAINAGE

Percutaneous cholecystostomy tubes have been the nonsurgical method of choice for gallbladder decompression for many decades. Despite the

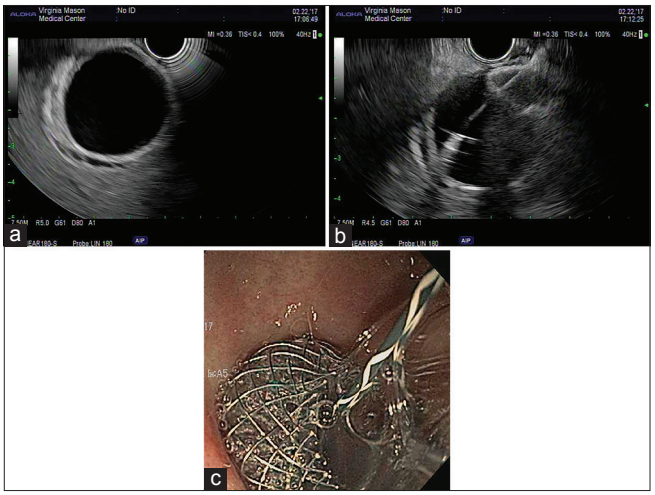

Figure 2. (a) Thick gallbladder wall and pericholecystic fluid in a patient with acute cholecystitis. (b) 10 mm × 10 mm lumen apposing metal stent with its flange opened and pulled back in the gallbladder. (c) Endoscopic view of the lumen apposing metal stent deployed to create a cholecysto-gastrostomy

technical ease of placement using transabdominal ultrasound, a few prohibitive factors for transhepatic external drainage include perihepatic ascites, intervening loops of bowel, coagulopathy or need to resume anticoagulation, concern for nonadherence, particularly if the drain dislodges, and patient refusal/preference. The size of the percutaneous catheter ranges from 6 to 10 French (Fr) and can often occlude or become dislodged which requires repeat procedures [Figure 2].[15] Furthermore, the puncture and transhepatic tract traverse the cutaneous and musculoskeletal layers which can result in discomfort to the patient that can persist while the drain remains in place. Cellulitis, hematoma formation, nerve impingement, peritonitis, and rarely, a nonhealing cholecystocutaneous fistula have been reported complications to indwelling percutaneous drains that remain in for long periods.[16] As such, internal GBD may obviate these undesired adverse events, especially in patients needing durable palliative drainage.

A few landmarks studies have compared transgastric or transduodenal EUS drainage to percutaneous transhepatic biliary drainage (PTBD) for nonsurgical therapy of acute cholecystitis.[7,17-20] These case-matched cohort studies reported comparable high rates of technical success (up to 98%) and clinical success (up to 96%) for EUS-GBD with LAMS and PTBD.[7,17,19,21] More alarming, a study by Teoh *et al.* found a significantly higher frequency of severe adverse events (75% *vs.* 24%, $P < 0.001$) in the PTBD group compared to EUS-GBD.[17] Tube dislodgement, catheter occlusion, recurrent cholecystitis, wound infection, bile leak, or acute cholangitis occurred in 71% of the PTBD group resulting in unexpected hospital admissions as opposed to only 7% of the EUS-GBD patients ($P < 0.001$). Tyberg *et al.* had similar results with a higher need for reintervention in the PTBD group compared to EUS-GBD (28% *vs.* 10%, $P < 0.001$), despite nearly half of the EUS-GBD group having cholecystitis from an underlying malignancy (48% *vs.* 12%, $P < 0.001$), arguably representing a sicker "higher risk" cohort.[19]

Shorter hospital stays, less need for repeat interventions, and a trend toward less adverse events were affirmed in a recent multicenter, international study.[7] PTBD was shown to be less durable, often requiring multiple reinterventions (mean of 2–3 sessions) in the same patient, whereas only a few of the EUS-GBD patients required a single revision, if any. The additional benefit of less postprocedural pain was also apparent in the EUS-GBD group (median pain scale of 2.5 *vs.* 6.5 out of 10, $P < 0.001$).

While the advantages for endoscopic drainage seem obvious, EUS-GBD does require anesthesia support, frequently performed under general anesthesia, in a patient population that is already considered critically ill (Class 3 cholecystitis, ASA ≥4).[7,22,23] Moreover, EUS-GBD can take slightly longer to perform than PTBD, although this may be negligible after the initial learning curve.[7] PTBD may be preferred in preoperative candidates if there is a possibility that the patient will clinically improve and be optimized for a later cholecystectomy.

Given the novelty of EUS-GBD, longitudinal follow-up is limited; however, medium-term follow-up with LAMS left in up to 1 year suggests an acceptable safety profile with low migration rates and sustained stent patency.[7,21,24]

EUS-GALLBLADDER DRAINAGE *VS.* ERCP TRANSPAPILLARY STENTING

Endoscopic GBD was first reported three decades ago.[25] This entailed selective stenting across the cystic duct at the time of ERCP. Since that time, others have demonstrated a high technical success (as high as 96%) and clinical success (88%).[26,27] The adverse events were reported to be as low as 6%. However, it is important to emphasize that these outcomes were performed by highly experienced tertiary centers. Cystic duct stenting can be especially challenging depending on the cystic duct's tortuosity, angulation at the take-off, a multitude of valves of Heister, and its small diameter which can be compounded if there is an obstructing stone, neoplasm, or metal stent occluding the cystic duct or gallbladder neck. On the contrary, gallbladder access is often easier under EUS guidance, particularly with the cautery enhanced Axios. Transmural EUS-GBD allows for a larger diameter stent to be placed when comparing the 10- or 15-mm diameter of LAMS to that of the most commonly used 7 Fr plastic biliary stent (range 4 Fr [~1.5 mm] to 10 Fr [~3–4 mm]). Still, the formation of a cholecysto-enteric fistula could complicate a subsequent cholecystectomy if planned after recovery from cholecystitis. For this reason, ERCP transpapillary stenting may be better suited as a temporizing measure, or if an ERCP is already being performed for other reasons (*i.e.*, concomitant cholangitis or common bile duct obstruction). Transpapillary stenting is also more appropriate for patients with ascites given the high risk of bile leak and the inability to form

a mature fistula in this setting. There are no comparative studies to date, evaluating the two approaches; a level three case-matched observational studies to investigate the above anecdotal merits and pitfalls of the two approaches is warranted.

CONCLUSION

EUS-guided GBD is a viable alternative for patients with cholecystitis needing nonsurgical drainage. Transmural placement of LAMSs can permit permanent drainage with minimal adverse events and has several reported advantages over percutaneous cholecystostomy tubes. EUS internal GBD should be reserved for poor operative candidates and performed by highly experienced therapeutic echoendosonographers until additional evidence is accrued.

Financial support and sponsorship
Nil.

Conflicts of interest
Aaron Small is a consultant for Boston Scientific. Shayan Irani is a consultant for Boston Scientific, with remittance to clinic.

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. Frazee RC, Nagorney DM, Micha P Jr. Acute acalculous cholecystitis. *Mayo Clin Proc* 1989;64:163-7.
3. de Mestral C, Rotstein OD, Laupacis A, *et al.* A population-based analysis of the clinical course of 10,304 patients with acute cholecystitis, discharged without cholecystectomy. *J Trauma Acute Care Surg* 2013;74:26-30.
4. Hasan MK, Itoi T, Varadarajulu S. Endoscopic management of acute cholecystitis. *Gastrointest Endosc Clin N Am* 2013;23:453-9.
5. Thistle JL, Cleary PA, Lachin JM, *et al.* The natural history of cholelithiasis: The national cooperative gallstone study. *Ann Intern Med* 1984;101:171-5.
6. Irani S, Baron TH, Grimm IS, *et al.* EUS-guided gallbladder drainage with a lumen-apposing metal stent (with video). *Gastrointest Endosc* 2015;82:1110-5.
7. 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.
8. Itoi T, Itokawa F, Kurihara T. Endoscopic ultrasonography-guided gallbladder drainage: Actual technical presentations and review of the literature (with videos). J *Hepatobiliary Pancreat Sci* 2011;18:282-6.
9. Baron TH, Grimm IS, Swanstrom LL. Interventional approaches to gallbladder disease. *N Engl J Med* 2015;373:357-65.
10. Law R, Baron TH. Endoscopic ultrasound-guided biliary interventions: An update on recent developments. *Curr Opin Gastroenterol* 2016;32:232-7.
11. Widmer J, Alvarez P, Sharaiha RZ, *et al.* Endoscopic gallbladder drainage for acute cholecystitis. *Clin Endosc* 2015;48:411-20.
12. 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.
13. Peñas-Herrero I, de la Serna-Higuera C, Perez-Miranda M. Endoscopic ultrasound-guided gallbladder drainage for the management of acute cholecystitis (with video). *J Hepatobiliary Pancreat Sci* 2015;22:35-43.
14. 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.
15. Bagla P, Sarria JC, Riall TS. Management of acute cholecystitis. *Curr Opin Infect Dis* 2016;29:508-13.
16. Mizrahi I, Mazeh H, Yuval JB, *et al.* Perioperative outcomes of delayed laparoscopic cholecystectomy for acute calculous cholecystitis with and without percutaneous cholecystostomy. *Surgery* 2015;158:728-35.
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. 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.
19. Tyberg A, Saumoy M, Sequeiros EV, et al. EUS-guided versus percutaneous transhepatic gallbladder drainage: Isn't it time to convert? *J Clin Gastroenterol* 2018;52: 79-84.
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. 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.
22. Choi JH, Lee SS. Endoscopic ultrasonography-guided gallbladder drainage for acute cholecystitis: From evidence to practice. *Dig Endosc* 2015;27:1-7.
23. Hirota M, Takada T, Kawarada Y, *et al.* Diagnostic criteria and severity assessment of acute cholecystitis: Tokyo guidelines. *J Hepatobiliary Pancreat Surg* 2007;14:78-82.
24. Inoue T, Okumura F, Kachi K, *et al.* Long-term outcomes of endoscopic gallbladder stenting in high-risk surgical patients with calculous cholecystitis (with videos). *Gastrointest Endosc* 2016;83:905-13.
25. Kozarek RA. Selective cannulation of the cystic duct at time of ERCP. *J Clin Gastroenterol* 1984;6:37-40.
26. Itoi T, Coelho-Prabhu N, Baron TH. Endoscopic gallbladder drainage for management of acute cholecystitis. *Gastrointest Endosc* 2010;71:1038-45.
27. Feretis C, Apostolidis N, Mallas E, *et al.* Endoscopic drainage of acute obstructive cholecystitis in patients with increased operative risk. *Endoscopy* 1993;25:392-5.