EUS-guided gallbladder drainage vs. percutaneous gallbladder drainage

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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)
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.\(^{[6-8]}\)

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

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**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.

**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.
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More 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 \( \geq 4 \)).\textsuperscript{[7,22,23]} Moreover, EUS-GBD can take slightly longer to perform than PTBD, although this may be negligible after the initial learning curve.\textsuperscript{[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.\textsuperscript{[7,21,24]}

**EUS-GALLBLADDER DRAINAGE VS. ERCP TRANSPAPILLARY STENTING**

Endoscopic GBD was first reported three decades ago.\textsuperscript{[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%),\textsuperscript{[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 [\( \sim 1.5 \text{ mm} \)] to 10 Fr [\( \sim 3–4 \text{ mm} \)]). Still, the formation of a choledocho-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.

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

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