Development of EUS-guided gallbladder drainage and current indications

Takao Itoi, Takayoshi Tsuchiya, Atsushi Sofuni, Reina Tanaka, Ryosuke Tonozuka, Mitsuyoshi Honjo, Shuntaro Mukai, Mitsuru Fujita, Kenjiro Yamamoto, Yasutsugu Asai, Takashi Kurosawa, Shingo Tachibana, Yuichi Nagakawa

Departments of Gastroenterology and Hepatology and 1Gastrointestinal and Pediatric Surgery, Tokyo Medical University, Tokyo, Japan

Acute calculous and non-calculous cholecystitis is one of the most common intra-abdominal infections. Although the imaging diagnosis of acute cholecystitis (AC) is not complicated, the determination of AC severity leading to the selection of treatment, conservative therapy, gallbladder drainage, and surgical cholecystectomy is still controversial even with the latest data analyses based on the Tokyo Guidelines 2013.\(^1,2\) However, the mortality and morbidity rates from cholecystectomy in high-risk patients remain high. Moreover, surgical cholecystectomy cannot always be performed for several reasons (e.g., few surgery-related staff particularly at night). Thus, such patients have been treated using temporary therapy regimens such as percutaneous transhepatic interventions and endoscopic transpapillary interventions;\(^3,4\) although, no obvious discrepancy in the outcome has been found between the two interventions.\(^5\) In 2007, Baron and Topazian introduced EUS-guided gallbladder drainage (EUS-GBD) using a double pigtail stent as a new technique.\(^6\) Thereafter, studies on EUS-GBD using dedicated metal stents were published by Jang et al. in 2011\(^7\) and Itoi et al. in 2012.\(^8\) Since then, several studies and case series on EUS-GBD using metal stents have been published.\(^9-11\)

Although EUS-GBD has become widely used among skilled endosonographers, endoscopic transpapillary gallbladder drainage (ETGBD) is commonly performed by skilled ERCP endoscopists. In their study involving a meta-analysis and systematic review, Khan et al. showed that the technical and clinical success rates of EUS-GBD were superior to those of ETGBD.\(^12\) Theoretically, a large target and a short access route allow EUS-GBD to have a high success rate. However, it is interesting to note that EUS-GBD using a plastic stent or a naso-gallbladder drainage catheter more likely has adverse events than EUS-GBD using a metal stent.\(^13\) In contrast, newly developed bi-flanged lumen-apposing metal stents with diameters ranging from 10 mm to 15 mm enable the effective drainage of gallbladder content and afford less stent migration. Thus, if the single-step stent delivery system could be used, EUS-GBD appears to be the most effective and...
The present indications of EUS-GBD are shown in Table 1. To date, patients who have undergone EUS-GBD have been described by most reports as noncandidates for surgery owing to their critical illness. What then is the possibility of conducting EUS-GBD in those who are candidates for surgery? EUS-GBD appears to be a potential alternative to surgical intervention because it allows not only gallbladder drainage but also stone removal from the gallbladder. However, the recurrence of stones and cholecystitis may be inevitable as long as the gallbladder is present. Once the gallbladder is completely removed surgically, there should be no recurrence of cholecystitis theoretically. Thus, surgical intervention should be the gold standard therapy in noncritically ill patients with AC being a safe and reliable procedure.

Recently, a bridge to surgery in the form of preoperative biliary drainage has attracted attention. Surgical interventions are not always possible because of the unavailability of surgeons or the medical staff. In such a case, percutaneous transhepatic drainage or endoscopic transpapillary drainage has been preoperatively performed for AC treatment. Theoretically, transpapillary interventions by ERCP may have few obstacles during the operation because of the transluminal approach. For percutaneous interventions, some obstacles such as difficulty in removing the gallbladder wall attached to the liver side may be experienced during the operation. However, most surgeons do not object to performing cholecystectomy after percutaneous transhepatic interventions. They indicate that there is no discrepancy in the difficulty of removing the gallbladder wall from the liver between the anastomotic site and the liver (gallbladder) bed. In EUS-GBD, however, the anastomotic site is in the GI tract (duodenal or gastric wall), and this can be an obstacle to removing the gallbladder wall and closing the anastomotic site in the GI tract wall. The difficulty of the operation is still controversial. However, if the number of EUS-GBD cases continues to increase as one of the preoperative gallbladder drainage therapies, the intraoperative management of the anastomotic site should be established in the near future.

The conversion of percutaneous transhepatic gallbladder drainage (PTGBD) to EUS-GBD is preferable for patients because the PTGBD tube involves external drainage and is troublesome in daily life. In contrast, EUS-GBD involves internal drainage and is cosmetically and functionally better than PTGBD. Technically, although the gallbladder does not show distention except in the predrainage status, the PTGBD tube enables saline injection to distend the gallbladder. Furthermore, even if EUS-GBD fails, PTGBD works well as a safety route.

Although PTGBD and ETGBD have been used for the treatment of AC patients, they are not always successful because of anatomical and technical issues. EUS-GBD may be useful for such patients in hospitals with EUS expertise as salvage therapy.

For the last indication, EUS-GBD can be used as an alternative to failed EUS-guided biliary drainage (EUS-BD). At present, EUS-BD is performed worldwide in case of failed ERCP, and dedicated devices for EUS-BD have been developed. However, EUS-BD is not always successful because of anatomical and technical issues. If the gallbladder has a connection with the proximal bile duct via the cystic duct, the gallbladder may be able to contribute to the biliary decompression as a salvage drainage route. We first suggested that EUS-GBD is a possible alternative to failed EUS-BD. Notably, the gallbladder stent showed no occlusion during 14 months until the patient's death caused by the primary pancreatic cancer. Imai et al. also reported the usefulness of EUS-GBD as an alternative to failed EUS-BD.

In conclusion, EUS-GBD appears to be a promising drainage technique for the treatment of acute cholecystitis because of its effectiveness and safety. More high-quality studies are necessary for the future to emphasize the superiority of EUS-GBD over other gallbladder drainages.
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