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Review Article

Endoscopic Gallbladder Drainage for Acute Calculus Cholecystitis: Review Article

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Abstract: Endoscopic gallbladder drainage is performed for high-risk patients with acute calculus cholecystitis who are not fit to undergo a cholecystectomy. Endoscopic transpapillary gallbladder drainage and endoscopic ultrasound-guided gallbladder drainage are the two procedures performed. Both procedures require specialized training and equipment, and the most common complications include perforation, bleeding, and stent migration. In this review, we will investigate the role that endoscopic transpapillary gallbladder drainage and endoscopic ultrasound gallbladder drainage play in the management of acute calculus cholecystitis in high-risk patients who would not undergo a cholecystectomy. We will also review the indications and complications of these procedures and compare them with percutaneous cholecystostomy in the management of acute calculus cholecystitis.

Keywords: "Acute calculus cholecystitis"," Gallbladder drainage. Endoscopic Transpapillary Gallbladder Drainage"," Endoscopic Ultrasound Gallbladder Drainage."," Endoscopic Drainage", and "Tokyo Guidelines".

INTRODUCTION

Acute Calculus cholecystitis is the most common complication of gallstone disease and accounts for 20% of patients who present with symptomatic cholelithiasis. The clinical presentation is about upper abdominal pain with nausea and vomiting. On abdominal examination, Murphy's sign will be positive, while laboratory investigations will reveal leukocytosis, and ultrasonography will reveal inflammation of the gallbladder wall with pericholecystic fluid collection and the presence of gallstones (Costanzo *et al*., 2023; Strasberg, 2008). The management of acute calculus cholecystitis is conservative treatment with intravenous fluids and antibiotics, with laparoscopic cholecystectomy being the definitive treatment. Laparoscopic cholecystectomy is performed as an early or delayed procedure. Gallbladder drainage is indicated for high-risk patients who are not fit for surgery, and it is used as a bridging procedure to stabilize them and perform a laparoscopic cholecystectomy later. Gallbladder drainage can be divided into percutaneous cholecystostomy and endoscopic gallbladder drainage. Endoscopic gallbladder drainage can be divided into endoscopic transpapillary gallbladder drainage and endoscopic ultrasound gallbladder drainage (Kuhlenschmidt *et al*., 2021; Mou *et al*., 2019; Troncone *et al*., 2024).

Endoscopic management of acute calculus cholecystitis is indicated for high-risk patients who will require permanent drainage and may never undergo laparoscopic cholecystectomy due to their risk factors and co-morbidities. The two endoscopic treatments are the transpapillary drainage of the gallbladder via an endoscopic retrograde cholangiopancreatography, with the placement of a stent or via nasobiliary drainage, and the endoscopic ultrasound gallbladder drainage via a transluminal route(Bozic *et al*., 2024; Hasan *et al*., 2013; Higa & Irani, 2019; Itoi *et al*., 2010).The 2020 World Society of Emergency Surgery(WSES) guidelines for the management of acute calculus cholecystitis have recommended endoscopic gallbladder drainage as an alternative for high-risk patients who cannot undergo cholecystectomy or percutaneous cholecystostomy, in high-volume centers, and it should be performed by an experienced endoscopist(Pisano *et al.,* 2020).The Tokyo Guidelines of 2013 and 2018 have recommended

gallbladder drainage for patients with grade 3 acute cholecystitis, with the endoscopic drainage with either endoscopic transpapillary gallbladder drainage or endoscopic ultrasound gallbladder stenting being used based on the patient's background and the decision of the endoscopist(Mori *et al*., 2018; Okamoto *et al.,* 2018; Tsuyuguchi *et al*., 2013).

The management of high-risk patients with acute cholecystitis has seen the introduction of gallbladder drainage. Percutaneous gallbladder drainage is the most common first-line therapy, and endoscopic drainage is considered an alternative. The endoscopic gallbladder drainage procedures include the endoscopic transpapillary gallbladder drainage and the endoscopic ultrasound gallbladder stenting. We will investigate the various endoscopic gallbladder drainage procedures that are done, including the success rates, complication rates, and long-term outcomes. We conducted a literature review using PUBMED, Cochrane database of clinical reviews, and Google Scholar, looking for clinical trials, observational studies, cohort studies, systematic reviews, and meta-analyses from 1985 to 2025. We used the following keywords: “Acute calculus cholecystitis”, “Gallbladder drainage”, “Endoscopic Transpapillary Gallbladder Drainage”, “endoscopic drainage “,” High-risk patients”,” Tokyo Guidelines and “Endoscopic Ultrasound Gallbladder drainage”. All articles were in the English language only. Further articles were obtained by manual cross-referencing of the literature. Case reports and studies with fewer than 10 patients and editorials were excluded. Adult male and female patients were included in this study, and pediatric patients were excluded.

DISCUSSION

Endoscopic Transpapillary Gallbladder Drainage

Endoscopic transpapillary gallbladder drainage is a procedure where an endoscopic retrograde cholangiopancreatography is performed, and after cannulation of the common bile duct, the cystic duct is cannulated, and a double pigtail stent or a nasobiliary drain is inserted, which allows drainage of the cystic duct and common bile duct and hence internal drainage of the gallbladder(Saumoy *et al*., 2021; Sobani *et al.,* 2021; Widmer *et al*., 2015)A retrospective study by Kim *et al.,* examined endoscopic transpapillary gallbladder drainage in patients with acute calculus cholecystitis who were unfit for cholecystectomy. A total of 171 patients were included in this study, and the technical and clinical success rates were 90.6% and 91%, respectively. The adverse effects rate was 12.2%, with acute pancreatitis being the most common complication (Kim *et al*., 2020).

Maruta *et al*., conducted a retrospective study to examine factors affecting the technical success rate of endoscopic transpapillary gallbladder drainage for acute calculus cholecystitis. A total of 323 patents were included in this study, and the presence of stone in the cystic duct, dilated common bile duct, and the direction of the cystic duct were factors that could affect the success rate of this procedure (Maruta *et al*., 2020).Hirakawa *et al.,* looked at the factors predicting technical failure of endoscopic transpapillary gallbladder drainage for acute calculus cholecystitis. A retrospective study was conducted on 182 patients, and the direction of the cystic duct and a spiral-like course of the cystic duct were factors that could lead to difficult cannulation and the risk of bile duct injury (Hirakawa *et al.,* 2024).

Endoscopic transpapillary gallbladder drainage was compared to percutaneous cholecystostomy in acute cholecystitis by Ali *et al.,* In this retrospective study, 3360 patients were included,in this study, 1612 patients underwent percutaneous cholecystostomy, and 1713 patients underwent endoscopic transpapillary gallbladder drainage. There were no differences in morbidity and length of hospital stay between the procedures, but endoscopic transpapillary gallbladder drainage was associated with a lower mortality rate than percutaneous cholecystostomy (Ali *et al*., 2023).Lino *et al*., also compared the efficacy of both percutaneous cholecystostomy with endoscopic transpapillary gallbladder drainage in acute calculus cholecystitis. A total of 75 patients were included in this study, and endoscopic transpapillary gallbladder drainage was associated with a reduced length of hospital stay, with comparable morbidity and mortality to percutaneous cholecystostomy (Iino *et al.,* 2018).

A meta-analysis on the safety and efficacy of endoscopic transpapillary gallbladder drainage in acute cholecystitis was conducted by Jandura *et al*., A total of 21 studies with 1307 patients were included in this study, and the pooled technical success rate and clinical success rate were 82.6% and 92.4%, respectively. The complication rate and recurrence rates were 8.8% and 1.4%, respectively. This study showed that endoscopic transpapillary gallbladder drainage was a safe and effective treatment option for patients with acute cholecystitis who were not fit to undergo a cholecystectomy (Jandura & Puli, 2021). A systematic review and meta-analysis on the efficacy of endoscopic transpapillary gallbladder drainage and stenting in high-risk patients with acute calculus cholecystitis was conducted by Malik *et al*., A total of 7 studies with 335 patients were included in this study, and the clinical and technical success rates were 91.3% and 92.8%, respectively, and the complication rate was 5.4%. This study showed that endoscopic transpapillary gallbladder drainage was effective in the management of acute cholecystitis in high-risk patients (Malik *et al*., 2023).

Endoscopic Ultrasound Gallbladder Drainage

Endoscopic ultrasound gallbladder drainage is another endoscopic procedure that is used for internal drainage of the gallbladder in patients with acute calculus cholecystitis who are not fit for surgery and when conversion to long-term internal drainage is required. The procedure involves the placement of an endoscope

into the stomach, and the position of the gallbladder is assessed by ultrasound on the endoscope. The antrum of the stomach or the duodenal bulbs are a common site for puncture with aspiration of bile, and a cholecystogram is then performed. A guidewire is subsequently inserted, and the tract is dilated, followed by the insertion of a pigtail stent. Self-expanding metallic stents can also be used to establish drainage of the bile from the gallbladder (Choi & Lee, 2015; Fok *et al*., 2024; Fugazza *et al*., 2020; Rimbaş *et al.,* 2023).The long-term outcomes of endoscopic ultrasound gallbladder drainage in high-risk patients with acute calculus cholecystitis were assessed by Moreno *et al*., A total of 50 patients who had undergone endoscopic ultrasound gallbladder drainage were followed up to 3 years, and the complication rates at 1,2 and 3 years were 18%,20% and 23%, respectively. The recurrence rate was at 4%, while the stent migration rate was at 14%, and there were no mortalities (Martinez-Moreno *et al*., 2023).

The efficacy and safety of endoscopic ultrasound-guided gallbladder drainage as a bridge to surgery for patients with acute calculus cholecystitis were assessed by Ishii *et al*., A total of 35 patients had undergone endoscopic ultrasound gallbladder drainage, and post-procedure morbidity was seen in 11.4% of cases(Ishii *et al*., 2023).Another retrospective study on the long-term results of endoscopic ultrasound-guided gallbladder drainage, which was conducted by Ahmed *et al*., also had a technical and clinical success rate of 100% and 92.3%(Ahmed, Ogura, *et al*., 2018).An international randomized controlled multicenter superiority trial (DRAC1) comparing endoscopic ultrasound gallbladder drainage and percutaneous cholecystostomy in high-risk patients with acute cholecystitis was conducted by Teoh *et al*., A total of 80 patients were randomized to 40 who underwent endoscopic ultrasound-guided drainage and 40 who underwent percutaneous cholecystostomy. Endoscopic ultrasound-guided drainage was associated with a better 1-year adverse outcome rate (25.6%vs77.5%), readmission rate (15.4%vs50%), and recurrent cholecystitis rate (2.6%vs 24%). The technical and clinical success rates were similar between the two groups. This study showed that endoscopic ultrasound gallbladder drainage had better outcomes than percutaneous cholecystostomy (Teoh *et al*., 2020).

A meta-analysis of outcomes of endoscopic ultrasound-guided gallbladder drainage versus percutaneous cholecystostomy for the management of acute cholecystitis was conducted by Ahmed *et al*., A total of 5 studies with 495 patients were included in this study, and there were no differences in the technical and clinical success rate between the procedures, with percutaneous cholecystostomy being associated with a higher reintervention rate(Ahmed, Rogers, *et al*., 2018).A systematic review and meta-analysis comparing endoscopic ultrasound-guided gallbladder drainage and percutaneous cholecystostomy for acute cholecystitis was conducted by Boregowda *et al.,* A total of 11 studies with 1136 patients were included in this study, of which 477 underwent endoscopic ultrasound gallbladder drainage, and 698 underwent percutaneous cholecystostomy. Endoscopic ultrasound gallbladder drainage was associated with a better technical success rate, reduced reintervention, and adverse effect rates than percutaneous cholecystostomy(Boregowda *et al*., 2023).Another systematic review and meta-analysis comparing endoscopic ultrasound-guided gallbladder drainage and percutaneous cholecystostomy was conducted by Luk *et al*., A total of 5 studies with 495 patients were included in this study, and endoscopic ultrasound gallbladder drainage was associated with a lower post-procedure morbidity, reduced length of hospital stay, and reduced reintervention when compared with percutaneous cholecystostomy(Luk *et al*., 2019).

A systematic review and meta-analysis comparing endoscopic ultrasound-guided gallbladder drainage, endoscopic transpapillary gallbladder drainage, and percutaneous cholecystostomy in high-risk patients with acute cholecystitis was conducted by Mohan *et al*., A total of 72 studies with 15,131 patients were included, with 1223 undergoing endoscopic ultrasound-guided gallbladder drainage, 557 undergoing endoscopic transpapillary gallbladder drainage, and 13,351 undergoing percutaneous cholecystostomy. The technical and clinical success rate for endoscopic ultrasound gallbladder drainage were 95.3% and 96.7%, for endoscopic transpapillary gallbladder drainage were 83% and 88.1%, and for percutaneous cholecystostomy was 98.7% and 87.3%, respectively. The complication rates were comparable between the groups, and this study showed that endoscopic ultrasound gallbladder drainage had the best clinical success rate for the management of high-risk acute cholecystitis patients (Mohan *et al*., 2020). A systematic review and meta-analysis comparing endoscopic ultrasound gallbladder drainage and endoscopic transpapillary gallbladder drainage in high-risk surgical patients with acute cholecystitis was conducted by Krishnamoorthi *et al*., A total of 5 studies with 857 patients were included in this study, with 259 undergoing endoscopic ultrasound gallbladder drainage and 598 undergoing endoscopic transpapillary gallbladder drainage, and endoscopic ultrasound gallbladder drainage was associated with a higher technical and clinical success rate(Krishnamoorthi *et al*., 2020).

A systematic review and network meta-analysis comparing all three methods of gallbladder drainage in acute cholecystitis was conducted by Hu *et al*., A total of 17 studies with 2254 patients were included in this study, and endoscopic ultrasound gallbladder drainage and percutaneous cholecystostomy were associated with better technical and clinical success rates than endoscopic transpapillary gallbladder drainage. Endoscopic ultrasound gallbladder drainage was also associated with the least number of adverse events. This study concluded that endoscopic ultrasound gallbladder

drainage is the best drainage procedure if the expertise is available (Hu *et al*., 2026).

Table I

Outcome	EUS-GBD (endoscopic ultrasound Gallbladder drainage)	ET-GBD (Endoscopic Transpapillary Gallbladder drainage)	Sources
Technical Success	Higher technical success compared with transpapillary drainage (OR 3.91; 95% CI 1.52–10.09). Superior to ET-GBD in pooled analyses.	Lower technical success compared with EUS-GBD (OR 3.91, favoring EUS). Technical success -83%.	Hu 2026, Mohan 2020
Clinical Success	Higher clinical success (OR 4.59; 95% CI 1.84–11.46). Clinical success -96.7%.[6]	Lower clinical success; pooled clinical success -88.1%.	Hu 2026, Mohan 2020
Adverse Events	Similar Adverse Events rate to Et-GBD	Comparable Adverse Events rates to EUS-GBD.	Hu 2026, Mohan 2020
Recurrence Rate	Lower recurrence (OR 0.17; 95% CI 0.06–0.52).	Higher recurrence than EUS-GBD.	Hu 2026
Reintervention Rate	Lower reintervention rate compared to other modalities.	Generally higher need for reintervention when compared with EUS-GBD.	Boregowda 2023
Mortality	Comparable to other modalities.	ET-GBD is associated with the lowest mortality in some network analyses.	Boregowda 2023, Krishnamoorthi 2020
Guideline/Expert Commentary	Recommended in centers with advanced EUS expertise and shown to decrease adverse events and reintervention.	Considered effective but technically more challenging (cystic duct access required).	Krishnamoorthi 2020

Table comparing endoscopic ultrasound gallbladder drainage and endoscopic transpapillary gallbladder drainage in high-risk patients with acute calculus cholecystitis.

CONCLUSION

The endoscopic gallbladder drainage is an internal drainage of the gallbladder and is performed as an endoscopic transpapillary gallbladder drainage or an endoscopic ultrasound gallbladder drainage. Both procedures are highly specialized endoscopic procedures that require training and specialized equipment. Endoscopic gallbladder drainage is indicated for high-risk surgical patients with acute calculus cholecystitis who would not undergo cholecystectomy. They have the advantage of no external drainage tubes and are well tolerated by patients. Endoscopic ultrasound gallbladder drainage with the insertion of a metallic stent is slowly emerging as the most popular endoscopic gallbladder drainage. Endoscopic gallbladder drainage should be considered an option for high-risk surgical patients where placement of a percutaneous cholecystostomy may lead to complications and difficulty in maintenance of the tube.

Conflict of Interest: There is no conflict of interest.

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