



Review

# Technical Evolution, Clinical Application, and Outcomes of Endoscopic Transpapillary Gallbladder Drainage in Acute Cholecystitis: A Review

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## Abstract

**Background:** Acute cholecystitis (AC) is a common inflammatory disease of the gallbladder. Although laparoscopic cholecystectomy remains the standard treatment, gallbladder drainage may be required in patients who are unsuitable for early surgery. Endoscopic transpapillary gallbladder drainage (ETGBD), including endoscopic nasogallbladder drainage (ENGBD) and endoscopic gallbladder stenting (EGBS), has increasingly been used as a minimally invasive internal drainage approach. **Aims:** This review aims to clarify the role of ETGBD in AC by integrating stepwise technical failure analysis with a practical selection framework among other drainage techniques. **Methods:** This narrative review was conducted through a structured literature search of PubMed, Embase, Web of Science, and the Cochrane Library up to 30 April 2026. **Results:** ETGBD preserves native gallbladder anatomy and may have specific value in selected patients, particularly when gallbladder preservation is desirable or concomitant endoscopic retrograde cholangiopancreatography (ERCP) is indicated. Recent technical developments, including cholangioscopy and advanced drainage devices, may support procedural planning and clinical management in selected difficult cases. Compared with percutaneous transhepatic gallbladder drainage (PTGBD) or endoscopic ultrasound-guided gallbladder drainage (EUS-GBD), ETGBD should be regarded as a complementary option rather than a universal substitute, and its application remains limited by variable technical success, cystic duct anatomy, operator expertise, and center experience. However, ETGBD may also be combined with other techniques, providing additional options in selected complex clinical scenarios. **Conclusions:** Adequately powered multicenter comparative studies with standardized outcome definitions are needed to clarify the optimal role, safety, recurrence risk, and long-term stent management of ETGBD.

**Keywords:** acute cholecystitis; endoscopic retrograde cholangiopancreatography; gallbladder disease; gallbladder drainage; transpapillary; endoscopic transpapillary gallbladder drainage; endoscopic nasogallbladder drainage; endoscopic gallbladder stenting; percutaneous transhepatic gallbladder drainage; endoscopic ultrasound-guided gallbladder drainage

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## 1. Background

Acute cholecystitis (AC) is a common and potentially severe acute abdominal disorder characterized by gallbladder inflammation, which may progress to life-threatening complications if not promptly managed [1]. Laparoscopic cholecystectomy (LC) remains the standard treatment for symptomatic cholelithiasis and acute calculous cholecystitis. However, in patients with organ dysfunction, substantial comorbidities, frailty, or unacceptable anesthetic risk, LC may be associated with increased perioperative morbidity and mortality [2,3].

The 2018 Tokyo Guidelines (TG18) recommend early laparoscopic cholecystectomy (LC) for patients who can tolerate surgery, whereas patients who do not meet the criteria for early LC should receive initial medical treatment and/or gallbladder drainage according to disease severity, response to initial treatment, and surgical risk [4]. For Grade I–II AC, drainage may be considered when the Charlson Comorbidity Index (CCI) and the American Society of Anesthesiologists physical status classification (ASA-PS) suggest that the patient cannot safely withstand early surgery, or when Grade II disease does not respond adequately to initial medical treatment. For Grade III AC, early LC is reserved for highly selected patients with favorable organ system failure, no negative predictive factors, acceptable CCI and ASA-PS scores, and treatment in an advanced center. Otherwise, intensive medical treatment and organ support should be prioritized, and gallbladder drainage should be considered. The intended role of drainage should be defined before treatment. In patients who are not suitable for early LC because of poor general condition, organ dysfunction, uncontrolled sepsis, or anesthesiologic contraindications, gallbladder drainage may be used as initial treatment [2]. When these factors are potentially reversible, delayed LC may be considered after the patient's overall condition has improved and perioperative risk has decreased. By contrast, long-term or definitive drainage may be considered in patients who remain unsuitable for surgery despite clinical stabilization, particularly those with persistent severe comorbidities, advanced frailty, or unacceptable anesthetic risk [2,5].

Percutaneous transhepatic gallbladder drainage (PTGBD) is a first-line alternative to surgery with a technical success rate over 95%. However, it is unsuitable for patients with bleeding tendencies, massive ascites, or inaccessible anatomical locations. Its external drainage catheter can cause discomfort, limiting long-term use [6]. Endoscopic drainage techniques, including ETGBD and EUS-GBD, are increasingly used. Endoscopic ultrasound (EUS)-guided gallbladder drainage (EUS-GBD) enables direct gallbladder access via transgastric or transduodenal lumen-apposing metal stent (LAMS) placement. Its efficacy is comparable to PTGBD, but widespread adoption remains limited by device availability and the need for advanced EUS and endoscopic retrograde cholangiopancreatography (ERCP) expertise [7]. ETGBD is a drainage technique that involves the placement of a nasobiliary drainage tube or stent during ERCP [8]. One of its key advantages is the use of a natural drainage route, which preserves the normal gastrointestinal anatomy. Studies have reported that ETGBD can be effective across all severity levels of acute cholecystitis [9,10]. Recent studies suggest that ETGBD can achieve technical success rates of approximately 80–95%; however, lower rates within the 60–80% range have also been reported, likely reflecting differences in technical approach, clinical factors, and study scale [11–16]. Unlike EUS-GBD, ETGBD primarily requires ERCP expertise, though its broader application is still constrained by procedural difficulties, operator experience, and clinical factors [17,18]. Ongoing research continues to refine ETGBD equipment and procedural techniques [10,19–21]. Given its inherent diversity and flexibility, ETGBD may have clinical value as a complementary option for selected patients with gallbladder disease. The current ETGBD literature is heterogeneous, with evidence spanning technical feasibility, device innovation, comparative outcomes, and long-term stent management. Because

much of this evidence remains retrospective and operator-dependent, the findings should be interpreted with consideration of selection bias, referral bias, and center-expertise effects. Although the existing literature has provided valuable insights into gallbladder drainage strategies, the specific technical evolution and practical positioning of ETGBD still require further systematic integration. This review is organized around two interrelated themes. First, it provides a stepwise analysis of ETGBD procedural difficulty and technical failure, incorporating recent advances in endoscopic techniques, accessory devices, dedicated stents, and long-term EGBS management. Second, it develops a practical selection framework among ETGBD, PTGBD, and EUS-GBD for patients with acute cholecystitis who are unsuitable for early cholecystectomy, with particular attention to concomitant ERCP indications, cystic duct accessibility, future interval cholecystectomy, and the intended role of drainage as either a bridge to surgery or definitive treatment. By integrating procedural details with clinical decision making, this review aims to clarify the specific role and practical positioning of ETGBD in the management of acute cholecystitis.

## 2. Literature Search Strategy and Study Selection

For this review, we performed a literature search in PubMed, Embase, Web of Science, and the Cochrane Library, with the final search performed on 30 April 2026. The following search terms were used: (“acute cholecystitis” OR “gallbladder drainage” OR “endoscopic transpapillary gallbladder drainage” OR “ETGBD” OR “endoscopic nasogallbladder drainage” OR “ENGBD” OR “endoscopic gallbladder stenting” OR “EGBS” OR “transpapillary gallbladder stenting” OR “percutaneous gallbladder drainage” OR “PTGBD” OR “percutaneous cholecystostomy” OR “endoscopic ultrasound-guided gallbladder drainage” OR “EUS-GBD” OR “cholangioscopy” OR “SpyGlass” OR “cystic duct” OR “gallbladder stent” OR “lumen-apposing metal stent”). All retrieved articles were screened by the authors before exclusion.

We included studies that met the following criteria: (1) studies related to ETGBD, ENGBD, EGBS, PTGBD, or EUS-GBD for acute cholecystitis; (2) studies reporting clinical outcomes, technical outcomes, adverse events, recurrence, long-term stent management, device innovation, procedural troubleshooting, or comparative outcomes; and (3) case reports or technical feasibility reports describing novel ETGBD-related devices, rescue techniques, or uncommon technical scenarios. We excluded (1) articles unrelated to acute cholecystitis or gallbladder drainage; (2) articles without gallbladder intervention; (3) articles lacking relevant clinical or technical information; (4) duplicate studies; (5) articles judged irrelevant after title, abstract, and full-text screening; and (6) non-English articles. Disagreements between the two authors were discussed, and a third author was consulted for resolution when necessary.

The included original studies were summarized in evidence tables. Guidelines, systematic reviews, meta-analyses, and selected background articles were used to support the discussion of disease management, patient selection, safety, and long-term outcomes, but were not necessarily included in the evidence tables. Because this article is a narrative review, no formal meta-analysis or risk-of-bias assessment was performed.

## 3. Classification of ETGBD

In 1984, Kozarek et al. [8] first proposed cystic duct (CD) cannulation via ERCP for the evaluation and treatment of gallbladder disease. Subsequent studies established the clinical feasibility of ETGBD [22–25]. ETGBD includes endoscopic nasogallbladder drainage (ENGBD) and endoscopic gallbladder stenting (EGBS). ENGBD uses a nasobiliary catheter for drainage, allowing for external irrigation and multiple cholecystographies, but carries risks of dislodgment and discomfort. EGBS employs internal drainage with a

double-pigtail catheter, reducing discomfort but limiting repeated rinsing and monitoring [26,27]. ENGBD is preferred for active decompression or close monitoring, while EGBS suits internal drainage and longer-term management [28]. Additionally, patient preference should also be considered after discussion of the benefits and limitations of each approach. The technical and clinical aspects of ETGBD continue to be actively investigated, and representative studies are summarized in Table 1. Detailed evidence extraction for ETGBD-related studies is provided in Supplementary Table S1.

**Table 1.** Patient and study characteristics of ETGBD.

| Author               | Year | Format        | Scale       | Country | Disease                                                              | Patients | Drainage Procedure | Drainage Device                                                             | Technical Success                                   | Clinical Success                          | Adverse Events                                | Recurrence/Late Outcomes             | Follow-Up Duration                       | Technology Application                                                                                                                     |
|----------------------|------|---------------|-------------|---------|----------------------------------------------------------------------|----------|--------------------|-----------------------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------|-----------------------------------------------|--------------------------------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Kaloo et al. [24]    | 1994 | Retrospective | Unicenter   | USA     | Symptomatic gallbladder diseases                                     | 4        | EGBS               | Nasobiliary pigtail catheter                                                | 100% (4/4)                                          | 100% (4/4)                                | 0% (0/4)                                      | 0% (0/4)                             | 11–17 mo                                 | Divide the nasobiliary pigtail catheter with laser after successful placement, and leave a length of 1 to 2 cm projecting from the papilla |
| Toyota et al. [29]   | 2006 | Retrospective | Unicenter   | Japan   | Acute cholecystitis                                                  | 22       | ENGBD              | Nasobiliary drainage tube                                                   | 81.8% (18/22)                                       |                                           | 0% (0/18)                                     |                                      |                                          | Perform ENGBD with LC                                                                                                                      |
| Shin et al. [30]     | 2012 | Retrospective | Unicenter   | Korea   | Acute cholecystitis combined with cholangitis or choledocholithiasis | 8        | ENGBD              | Nasobiliary pigtail catheter                                                | 87.5% (7/8)                                         | 75.0% (6/8)                               | 12.5% (1/8)                                   |                                      | Median 103.5 d (10–315)                  | Perform ENGBD with the assistance of Spyglass                                                                                              |
| Widmer et al. [31]   | 2015 | Prospective   | Multicenter | USA     | Acute cholecystitis                                                  | 139      | EGBS               | Double-pigtail stent                                                        | 91% (117/128)                                       | 92% (128/139)                             | 8% (11/139)                                   |                                      | Mean 32 mo (1–87)                        | Perform EGBS or perform EUS-GBS after unsuccessful EGBS                                                                                    |
| Hatanaka et al. [32] | 2016 | Retrospective | Unicenter   | Japan   | Acute cholecystitis                                                  | 22       | EGBS               | Double-pigtail stent                                                        | 77.2% (17/22)                                       | 100% (17/17)                              | 0% (0/22)                                     | 15.7% (3/19)                         | Median 229 d (14–880)                    | Perform gallbladder drainage with a nasobiliary drainage tube and replace the tube with a stent                                            |
| Doi et al. [33]      | 2018 | Prospective   | Multicenter | Japan   | Acute cholecystitis                                                  | 40       | EGBS               | Nasobiliary drainage tube                                                   | 75.0% (30/40)                                       | 96.6% (29/30)                             | 5.0% (2/40)                                   | 0% (0/40)                            | Median 42 d (12–138) to surgery          | Perform gallbladder drainage with a nasobiliary drainage tube and replace the tube with a stent                                            |
| Nakahara et al. [34] | 2019 | Retrospective | Unicenter   | Japan   | Acute cholecystitis                                                  | 70       | EGBS               | Stent with tip of a three-dimensional spiral-shaped structure/Pigtail stent | 100% (70/70)                                        | 100% (23/23) novel; 95.7% (45/47) control | 17.4% (4/23) novel; 57.4% (27/47) control     | 0% (0/23) novel; 8.5% (4/47) control | 120 ± 143 d novel; 162 ± 252 d control   | Novel gallbladder stent                                                                                                                    |
| Sagami et al. [35]   | 2020 | Retrospective | Unicenter   | Japan   | Acute cholecystitis                                                  | 100      | EGBS               | Pigtail stent                                                               | 76.0% (32/42) without IDUS; 92.0% (46/50) with IDUS | 96.0% (79/82) overall                     | 0% (0/42) without IDUS; 6.0% (3/50) with IDUS | 3.7% (3/82) early; 7.3% (6/82) late  | Mean 176 d (55–337) for late dysfunction | Perform ETGBD with or without IDUS                                                                                                         |

|                      |      |               |             |          |                                                                         |     |            |                                            |                                                   |                                         |                                        |                                 |                                                                                                                                                               |
|----------------------|------|---------------|-------------|----------|-------------------------------------------------------------------------|-----|------------|--------------------------------------------|---------------------------------------------------|-----------------------------------------|----------------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nakahara et al. [36] | 2020 | Retrospective | Unicenter   | Japan    | Acute cholecystitis after biliary self-expandable metal stent placement | 12  | ENGBD/EGBS | Nasobiliary drainage tube/Pigtail stent    | 83.3% (10/12)                                     | 90.0% (9/10)                            | 16.7% (2/12)                           |                                 | Remove or retain the SEMS before the ETGBD                                                                                                                    |
| Ridtitid et al. [37] | 2020 | Retrospective | Unicenter   | Thailand | Acute cholecystitis                                                     | 104 | EGBS       | Double-pig-tail stent                      | 53% (55/104) fluoro alone; 75% (78/104) after SOC | 100% (78/78)                            | 2% (1/41) SOC; 11% (7/63) fluoro       | 7% (3/41) SOC; 4% (3/63) fluoro | Median 57 d (1–2405)<br>Perform EGBS/perform additional SOC-assisted EGBS after unsuccessful EGBS                                                             |
| Kim et al. [38]      | 2020 | Retrospective | Unicenter   | Korea    | Acute calculous cholecystitis                                           | 171 | ENGBD/EGBS | Nasobiliary drainage tube/Pigtail stent    | 90.6% (155/171)                                   | 90.1% (154/171)                         | early 7.6% (13/171); late 4.7% (8/171) | 1.4% (1/70)                     | Mean 495.8 d (43–1117)<br>SpyDS-assisted CD cannulation<br>high-risk EGBS                                                                                     |
| Maruta et al. [39]   | 2020 | Retrospective | Multicenter | Japan    | Acute cholecystitis                                                     | 323 | EGBS       | Nasobiliary drainage tube                  | 72.8% (235/323)                                   | 96.2% (226/235)                         | 5.9% (19/323)                          |                                 | Perform gallbladder lavage with a nasobiliary drainage tube, then cut the tube to optimal length and place as a stent                                         |
| Sagami et al. [40]   | 2020 | Retrospective | Multicenter | Japan    | Acute cholecystitis receiving antithrombotic therapy                    | 130 | EGBS       | Pigtail stent                              | 84.3% (70/83) ATT; 89.4% (42/47) non-ATT          | 97.1% (68/70) ATT; 100% (42/42) non-ATT | Early 3.1% (4/130); late 1.8% (2/110)  | 10.9% (12/110)                  | 12-mo patency                                                                                                                                                 |
| Sobani et al. [41]   | 2021 | Retrospective | Unicenter   | USA      | Acute cholecystitis                                                     | 21  | EGBS       | Two gallbladder stents                     | 100% (21/21)                                      | 100% (21/21)                            | 9.52% (2/21)                           | 4.76% (1/21)                    | Mean 471.74 ± 345.64 d; median 341 d<br>Dual gallbladder stenting                                                                                             |
| Maruta et al. [42]   | 2021 | Retrospective | Multicenter | Japan    | Acute cholecystitis                                                     | 71  | EGBS       | Nasobiliary drainage tube                  | 78.9% (56/71)                                     | 94.6% (53/56)                           | Early 4.2% (3/71); late 5.0% (2/40)    | 5.0% (2/40)                     | Median 375 d (IQR 155–710.2)<br>EGBS<br>Perform gallbladder lavage with a nasobiliary drainage tube, then cut the tube to optimal length and place as a stent |
| Sato et al. [43]     | 2021 | Retrospective | Unicenter   | Japan    | Acute cholecystitis                                                     | 145 | ENGBD/EGBS | Plastic stent or nasobiliary drainage tube | 87.6% (127/145)                                   |                                         | 11.0% (16/145) CD injury               |                                 |                                                                                                                                                               |
| Takano et al. [44]   | 2021 | Case report   |             | Japan    | Acute cholecystitis with Billroth-II reconstruction                     | 1   | EGBS       | IYO-stent                                  | 100% (1/1)                                        | 100% (1/1)                              | 0% (0/1)                               | 0% (0/1)                        | 6 mo<br>Single-balloon enteroscopy-assisted ETGBD                                                                                                             |
| Storm et al. [45]    | 2021 | Retrospective | Unicenter   | USA      | Acute cholecystitis                                                     | 51  | EGBS       | Pigtail stent                              | 96.1% (49/51)                                     | 100% (49/49)                            | 5.9% (3/51)                            | 4.1% (2/49)                     | Mean 453 d (18–1879)<br>Perform EGBS with 1 or 2 stents                                                                                                       |

|                       |      |               |             |       |                                                                                  |     |            |                                               |                                            |                                                                                 |                                                                            |                                                                  |                                                                                                                    |                                                                                                                   |
|-----------------------|------|---------------|-------------|-------|----------------------------------------------------------------------------------|-----|------------|-----------------------------------------------|--------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Takano et al. [46]    | 2022 | Retrospective | Unicenter   | Japan | Acute cholecystitis                                                              | 11  | EGBS       | IYO-stent                                     | 91% (10/11)                                | 91% (10/11)                                                                     | Early 9.1% (1/11); late 20.0% (2/10)                                       | 0% (0/10)                                                        | Median 312 d (109–742)                                                                                             | IYO-stent permanent drainage                                                                                      |
| Nakahara et al. [47]  | 2022 | Retrospective | Unicenter   | Japan | Acute cholecystitis                                                              | 249 | ENGBD/EGBS | Nasobiliary drainage tube/Plastic stent       | 43.5% (10/23) CDP; 91.2% (206/226) non-CDP | 87.0% (20/23) CDP; 90.7% (205/226) non-CDP                                      | CDP 9.2% (23/249); ERCP-related AE 5.6% (14/249)                           |                                                                  |                                                                                                                    |                                                                                                                   |
| Takahashi et al. [48] | 2022 | Retrospective | Unicenter   | Japan | Acute cholecystitis                                                              | 20  | EGBS       | Nasobiliary drainage tube/Pigtail stent       |                                            | 92.3% (12/13) cut ENGBD tube stent; 100% (7/7) ready-made double-pig-tail stent | 7.7% (1/13) cut ENGBD tube stent; 0% (0/7) ready-made double-pigtail stent |                                                                  | Median observation: 273 d (IQR 28–1579) cut ENGBD tube stent; 628 d (IQR 389–1070) ready-made double-pigtail stent | Measure and cut the pig-tail ENGBD tube and place the newly created stent/place a ready-made double-pigtail stent |
| Maruta et al. [49]    | 2022 | Retrospective | Multicenter | Japan | Acute cholecystitis                                                              | 21  | EGBS       | Nasobiliary drainage tube                     | 90.5% (19/21)                              | 100% (19/19)                                                                    | Procedural 9.5% (2/21); late 4.7% (1/21)                                   | 0% (0/19)                                                        | Median 61 d (19–103) to surgery                                                                                    | Cut the ENGBD tube with a loop cutter in conjunction with surgical scissors inside the stomach                    |
| Ban et al. [50]       | 2023 | Case report   |             | Japan | Acute cholecystitis with cholelithiasis and choledocholithiasis                  | 1   | EGBS       | Drilling dilator/Double-pigtail plastic stent | 100% (1/1)                                 |                                                                                 |                                                                            |                                                                  |                                                                                                                    | Aid plastic stent delivery with a screw tip stent retriever                                                       |
| Sato et al. [51]      | 2023 | Retrospective | Unicenter   | Japan | Acute cholecystitis                                                              | 242 | ENGBD/EGBS | Plastic stent or nasobiliary drainage tube    | 86.8% (210/242)                            | 92.9% (195/210)                                                                 | 9.9% (24/242) CD injury; 5.0% (12/242) ERCP-related AEs                    |                                                                  |                                                                                                                    |                                                                                                                   |
| Ishii et al. [52]     | 2023 | Retrospective | Unicenter   | Japan | Cholecystitis after covered metal stent placement for distal biliary obstruction | 32  | EGBS       | Double-pig-tail plastic stent                 | 75.0% (24/32)                              |                                                                                 | EGBS-related AE 9.4% (3/32)                                                | Post-CSEMS AC incidence 4.2% (1/24) EGBS; 21.4% (56/262) no EGBS | Median 175 d                                                                                                       | Place prophylactic endoscopic gallbladder stent before the CSEMS deployment                                       |
| Inoue et al. [12]     | 2023 | Prospective   | Unicenter   | Japan | Acute calculous cholecystitis                                                    | 83  | EGBS       | Single-pigtail stent                          | 80.7% (67/83)                              | 98.5% (66/67)                                                                   | Early 3.6% (3/83); overall late 10.6% (7/66)                               | 4.5% (3/66)                                                      | Median 603 d (IQR 404–1314)                                                                                        | Perform endoscopic gallbladder inside-stenting with lavage and aspiration                                         |

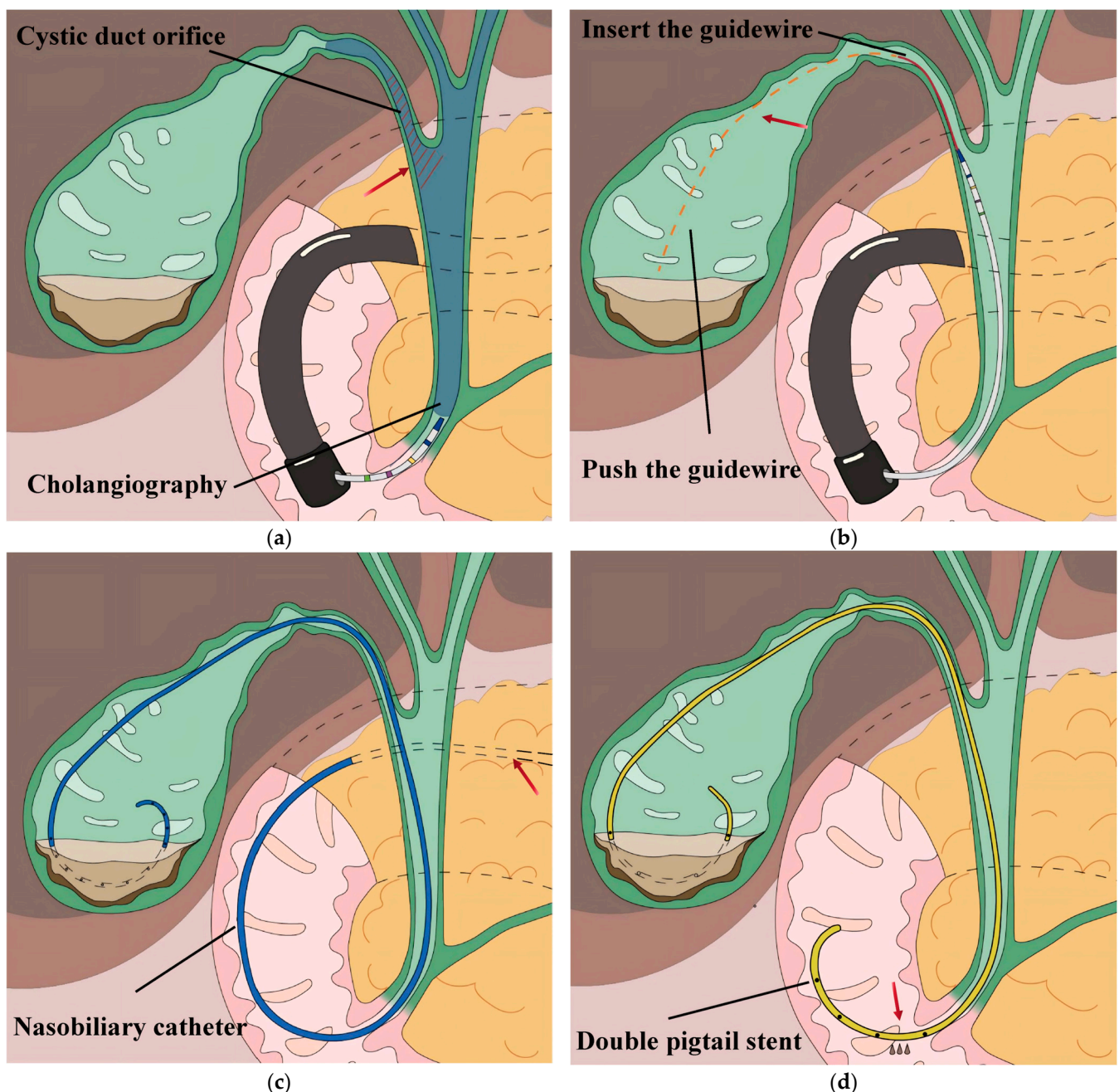
|                      |      |               |             |       |                                                                           |     |            |                                                                       |                                                  |                                                  |                                                                                                          |                                           |                                                                   |                                                                                                |
|----------------------|------|---------------|-------------|-------|---------------------------------------------------------------------------|-----|------------|-----------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Koizumi et al. [53]  | 2023 | Case report   |             | Japan | Acute cholecystitis                                                       | 2   | ENGBD/EGBS | Nasobiliary drainage tube/Pigtail stent                               | 100% (2/2)                                       |                                                  |                                                                                                          |                                           |                                                                   | Place the tube or stent through the outer sheath into the fundus of the gallbladder            |
| Yoshida et al. [21]  | 2023 | Retrospective | Unicenter   | Japan | Acute cholecystitis                                                       | 115 | ENGBD/EGBS | Three-pillar: cholangioscopy, flexible guide-wire, 3-Fr microcatheter | 72.0% (36/50) classical; 96.9% (63/65) strategic | 91.7% (33/36) classical; 93.7% (59/63) strategic | 12.0% (6/50) classical; 10.8% (7/65) strategic                                                           |                                           |                                                                   | Strategic ETGBD/classical ETGBD                                                                |
| Maruta et al. [54]   | 2023 | Retrospective | Multicenter | Japan | Acute cholecystitis                                                       | 122 | EGBS       | Nasobiliary drainage tube                                             | 78.6% (96/122) ENGBD; 91.1% (31/34) cutting      | 96.8% (93/96) ENGBD improvement                  | Early 3.2% (4/122); cutting procedure AE 8.8% (3/34); late AE 6.4% (2/31) cutting, 33.3% (12/36) removal | 6.4% (2/31) cutting; 11.1% (4/36) removal | Median waiting 58 d (IQR 43–80) cutting; 33 d (IQR 14–78) removal | Cut the ENGBD tube with a loop cutter in conjunction with surgical scissors inside the stomach |
| Hirakawa et al. [19] | 2024 | Retrospective | Unicenter   | Japan | Acute cholecystitis                                                       | 182 | ENGBD/EGBS | Nasobiliary drainage tube/Double-pigtail stent                        | 84.6% (154/182)                                  | 96.1% (148/154)                                  | 11.0% (20/182)                                                                                           |                                           |                                                                   |                                                                                                |
| Noda et al. [55]     | 2024 | Case report   |             | Japan | Acute cholecystitis and cholangitis                                       | 1   | EGBS       | Drilling dilator/Plastic stent                                        | 100% (1/1)                                       |                                                  | 0% (0/1)                                                                                                 |                                           |                                                                   | Insert a novel drill-type dilator and perform EGBS                                             |
| Suzuki et al. [10]   | 2024 | Retrospective | Unicenter   | Japan | Acute cholecystitis                                                       | 71  | ENGBD      | Nasobiliary drainage tube                                             | 85.9% (61/71)                                    | 93.4% (57/61)                                    | 11.3% (8/71)                                                                                             |                                           |                                                                   | Place the nasobiliary catheter or cut the tube within the stomach                              |
| Niiya et al. [20]    | 2024 | Retrospective | Unicenter   | Japan | Acute cholecystitis                                                       | 35  | EGBS       | Plastic stent                                                         | 77.1% (27/35)                                    |                                                  | Early 11.4% (4/35); late 3.7% (1/27)                                                                     | 3.7% (1/27)                               | Median 123 d (20–1435)                                            | Perform EGBS after PTGBD placement                                                             |
| Ishikawa et al. [56] | 2025 | Case report   |             | Japan | Acute cholecystitis                                                       | 1   | EGBS       | Novel rotatable sphincterotome/IYO stent                              | 100% (1/1)                                       | 100% (1/1)                                       | 0% (0/1)                                                                                                 |                                           |                                                                   | Rotatable sphincterotome for difficult caudal cystic duct cannulation                          |
| Cooper et al. [57]   | 2025 | Retrospective | Unicenter   | USA   | Symptomatic cholelithiasis/biliary disease in decompensated liver disease | 55  | EGBS       | Pigtail stent                                                         | 94.5% (52/55)                                    | 92.3% (48/52)                                    | 7.7% (4/52) 30-d AE; 1.9% (1/52) 30-d mortality                                                          | 7.7% (4/52) at 6 mo                       | Median 361 d (IQR 117–766)                                        |                                                                                                |
| Goda et al. [58]     | 2025 | Case report   |             | Japan | Acute cholecystitis                                                       | 1   | ENGBD      | Rotatable Engetsu                                                     | 100% (1/1)                                       | 100% (1/1)                                       | 0% (0/1)                                                                                                 |                                           |                                                                   | Rotatable catheter for difficult stricture alignment and guidewire passage                     |

|                      |      |               |           |       |                     |    | catheter/Na-sobiliary drainage tube |                                                        |               |                                           |                                      |                                                   |            |
|----------------------|------|---------------|-----------|-------|---------------------|----|-------------------------------------|--------------------------------------------------------|---------------|-------------------------------------------|--------------------------------------|---------------------------------------------------|------------|
| Kuraishi et al. [59] | 2025 | Case report   |           | Japan | Acute cholecystitis | 1  | EGBS                                | Pigtail stent                                          | 100% (1/1)    |                                           |                                      | Loop cutter-assisted over-the-wire stent exchange |            |
| Nakahara et al. [60] | 2026 | Retrospective | Unicenter | Japan | Acute cholecystitis | 24 | EGBS                                | Novel plastic stent with an integrated delivery system | 95.8% (23/24) | 94.7% (18/19) EGBS; 90.0% (18/20) overall | Early 4.2% (1/24); late 10.0% (2/20) | 0% (0/20)                                         | Mean 211 d |

Abbreviations: AC, acute cholecystitis; AE, adverse event; AEs, adverse events; ATT, antithrombotic therapy; CD, cystic duct; CDP, cystic duct perforation; CSEMS, covered self-expandable metal stent; EGBS, endoscopic gallbladder stenting; ENGBD, endoscopic nasogallbladder drainage; ETGBD, endoscopic transpapillary gallbladder drainage; ERCP, endoscopic retrograde cholangiopancreatography; EUS-GBS, endoscopic ultrasound-guided gallbladder stenting; IDUS, intraductal ultrasonography; IQR, interquartile range; LC, laparoscopic cholecystectomy; PTGBD, percutaneous transhepatic gallbladder drainage; SEMS, self-expandable metal stent; SOC, single-operator cholangioscopy; SpyDS, SpyGlass Direct Visualization System; d, days; mo, months; y, years.

#### 4. Procedure and Technical Considerations of ETGBD

The ETGBD process involves four key steps: Step 1, cannulating the bile duct; Step 2, inserting a guidewire (GW) into the CD; Step 3, advancing the GW into the gallbladder; Step 4, placing a nasobiliary catheter or stent (Figure 1). Rather than serving as a simple procedural description, this four-step classification provides a practical framework for procedural planning and troubleshooting. It helps localize the point at which technical difficulty occurs, distinguish anatomical barriers from limitations of device or operation, and guide the timely use of adjunctive techniques or alternative drainage strategies. The technical objective, common failure signals, and potential adjunctive strategies for each step are summarized in Table 2.



**Figure 1.** Key steps of the ETGBD process. Black solid and dashed lines indicate superficial and deeper structures, respectively. The blue region represents the cholangiographic area, the red shaded region highlights the cystic duct orifice, and the orange dashed lines indicate the expected

device position. (a) Cannulate the bile duct and identify the cystic duct orifice; (b) insert a guidewire across the cystic duct takeoff and push it into the gallbladder; (c) place a pigtail nasobiliary catheter and withdraw the endoscope; (d) place a double-pigtail transpapillary stent and withdraw the endoscope. Red arrows highlight the key procedural points and the drainage route.

**Table 2.** Practical interpretation of the four-step classification for ETGBD.

| Step   | Main Technical Objective                                                    | Common Signals of Difficulty or Failure                                                                                                            | Potential Adjunctive or Rescue Strategies                                                                                                                                     |
|--------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | Identify the cystic duct orifice and define the biliary–cystic duct anatomy | Poor cystic duct opacification, non-visualization of the cystic duct, or unclear cystic duct takeoff                                               | Repeat cholangiography, balloon-occlusion cholangiography, intraductal ultrasonography, cholangioscopy-assisted identification, or PTGBD-assisted staged approach             |
| Step 2 | Obtain guidewire access into the cystic duct                                | Failure to enter the cystic duct due to steep takeoff angle, tortuosity, stenosis, stone impaction, or unfavorable cystic duct orientation         | Hydrophilic or smaller-caliber guidewire, rotatable catheter, balloon-occlusion method, cholangioscopy-assisted cannulation                                                   |
| Step 3 | Advance and stabilize the guidewire within the gallbladder                  | Loss of guidewire support, looped guidewire formation, inability to cross true obstruction, or failure to achieve stable gallbladder access        | Microcatheter assistance, double-guidewire technique, balloon catheter straightening, cholangioscopy-guided passage, or alternative drainage if obstruction cannot be crossed |
| Step 4 | Deliver and maintain the drainage catheter or stent                         | Failed device advancement, mismatch in stent length or shape, inadequate guidewire support, early migration, occlusion, or recurrent cholecystitis | Appropriate stent selection, dedicated gallbladder stents, dilators or delivery-assist devices, dual-stent placement, staged stent exchange, or alternative drainage          |

Abbreviations: ETGBD, endoscopic transpapillary gallbladder drainage; PTGBD, percutaneous transhepatic gallbladder drainage.

A primary challenge in Step 1 is visualizing the CD on cholangiography, as severe cholecystitis may obscure both the gallbladder and CD, making cannulation difficult [61]. Limited visualization of the CD increases guidewire failure risk in Steps 2–3, particularly with tortuous anatomy, steep angles, stones, or strictures [19].

Intraductal ultrasonography (IDUS) can assist ETGBD when CD visualization is poor. The use of IDUS was associated with a higher technical success rate, from 76% to 92%, with manageable complications [35]. Pre-procedural PTGBD may facilitate subsequent ETGBD in selected patients by decompressing the inflamed gallbladder and improving cystic duct visualization. Niiya et al. reported that, after PTGBD placement, cystic duct visualization was achieved in 97.1% of patients and subsequent EGBS was successful in 77.1% [20]. In addition, PTGBD-*rendezvous* rescue has been described after unsuccessful initial EGBS, suggesting that PTGBD may serve not only as temporary decompression but also as a bridge to transpapillary internal drainage in selected cases [32,62]. Therefore, this staged strategy may be considered according to the clinical context when direct ETGBD is technically difficult or when PTGBD has already been performed.

Cholangioscopy, such as the SpyGlass Direct Visualization System (SpyDS), may provide high-definition visualization of the CD and may facilitate ERCP procedures [63]. In a single-center retrospective observational study, Ridditid et al. attempted conventional EGBS in 104 patients and subsequently performed cholangioscopy-assisted ETGBD in 41 patients after technical failure, increasing the overall technical success rate from 53% to 75% without an apparent increase in AEs or recurrence [37]. Another single-center retrospective study by Yoshida et al. reported similar findings [64]. In an earlier small retrospective series, Shin et al. showed that SpyDS identified cystic duct orifices missed on cholangiography in eight patients, with an 88% technical success rate and a 75% clinical

success rate [30]. More recently, Hamamura et al. described a low-cost cholangioscopic method that identified the CD bifurcation when cholangiography was insufficient in a case report [65].

Step 2 can be challenging due to convoluted or stenotic CDs. Commonly used GWs are 0.035-inch and 0.025-inch; smaller or hydrophilic GWs may be needed. Anatomical factors such as proximal and caudal branches, right cranial orientation, and spiral CD shape predict technical failure [19,39]. Suzuki et al. [10] reported that the success rate of ETGBD was significantly higher in patients with a straight or single-bend CD (97.5%) compared to those with two or more bends (71.0%). Sato et al. [51] identified CD injury during the procedure as an independent predictor of failure. Interestingly, Sato et al. [43] subsequently evaluated the accuracy of preoperative CT and MRCP for identifying cystic duct direction and location before ETGBD. The accuracy rates of CT were 58% to 79%, while the accuracy rates of MRCP were 58% to 68%. As a result, the preoperative evaluation of the anatomical structure of the CD is relatively limited.

The balloon occlusion technique is frequently employed to insert a GW into the CD takeoff [66]. This method involves inflation of the occlusion balloon proximal to the CD origin, and subsequent GW advancement into the CD. Additionally, balloon occlusion may serve a dual purpose by creating a sealed compartment within the bile duct lumen, which may improve contrast agent administration during cholangiography [67].

In this step, cholangioscopy helps guide the guidewire through the cystic duct into the gallbladder [68]. The cholangioscope can stabilize the GW at the CD orifice and help negotiate the takeoff angle, facilitating deeper advancement into the CD. Additionally, cholangioscopy may also help identify and clear intraductal obstruction [69].

For calculous cholecystitis, proper sphincterotomy may facilitate GW insertion and can be performed alongside treating common bile duct stones [70]. However, incorrect sphincterotomy may drain bile from the common bile duct, obstructing the duct opening and complicating catheter or GW access to the gallbladder. Takenaka et al. [71] successfully used a loop-forming GW to dislodge gallstones in the CD, creating space for a nasobiliary tube insertion. Taken together, ETGBD success is strongly anatomy-dependent, and pre-procedural imaging alone may not reliably predict real-time cannulation difficulty.

Step 3 failure usually reflects either true CD obstruction or loss of GW support, both of which prevent smooth entry into the gallbladder. CD obstruction can be caused by gallbladder wall thickening due to inflammation, or by CD stones or tumors leading to bile duct dilation. A single-center retrospective study involving 11 patients suggested that shorter gallbladder short-axis length and thinner gallbladder wall thickness may be associated with higher procedural success [72]. The authors of a prospective single-center study of 27 patients further identified gallbladder wall thickness as a predictor of ENGBD procedural difficulty [73]. In a multicenter retrospective study involving 323 patients, Maruta et al. reported a technical success rate of 72.8% and found that cystic duct stones, common bile duct dilation, and cystic duct orientation were associated with technical failure [39]. By contrast, recent case reports have described rotatable catheters or sphincterotomes as rescue tools for selected difficult anatomy, including localized adenomyomatosis, caudal cystic duct branching, or steep angulation [56,58].

A looped GW in the CD often results from anatomical variations, which can hinder stent placement. Straightening the looped GW is a key technical challenge. In a single-center retrospective comparative study, Yoshida et al. applied a three-pillar strategy combining cholangioscopy, a flex-type guidewire, and a 3-Fr microcatheter to address Step 3 challenges. The flexible tip of the guidewire facilitated navigation through tortuous cystic ducts, while the slim 3-Fr microcatheter improved guidewire operability and helped overcome cystic duct obstruction. Compared with classical ETGBD, strategic ETGBD achieved

a higher technical success rate (96.9% vs. 72.0%), with similar clinical success (93.7% vs. 91.7%) and adverse event (AE) rates (10.8% vs. 12.0%) [21]. Case reports by Jimbo et al. and Nakahara et al. further suggested that a small-caliber intraductal balloon catheter or a double-guidewire method may help straighten and stabilize a looped guidewire [74,75].

Step 4 involves the placement of a nasobiliary catheter or stent. ENGBD uses 5–7 F pigtail tubes, allowing fluid analysis to guide treatment [76,77]. Pus or blood in the drainage fluid may indicate ongoing infection or bleeding, and saline irrigation may help maintain drainage. For EGBS, the 7 F to 10 F double-pigtail stent is commonly used, but mismatches in stent length, hardness, or shape can lead to migration or cholecystitis recurrence.

Current research on ETGBD devices mainly focuses on improving stent drainage, reducing migration, and facilitating delivery across difficult cystic ducts. Dedicated gallbladder stents have mostly been evaluated in small observational studies. In a single-center retrospective comparative study, the GBest-N stent, which has a three-dimensional spiral tip and side holes, achieved a technical success rate of 100%, comparable to that of conventional stents, while reducing the rate of late adverse events (4.3% vs. 40.4%) and showing no migration, compared with a migration rate of 31.9% for conventional stents [34]. The IYO-stent, another spiral-shaped stent with multiple side holes, achieved technical and clinical success rates of 91% in a small single-center retrospective case series of permanent ETGBD, with no recurrence reported [46]. From a technical perspective, helical or spiral stent designs may help reduce migration, while a smaller 5 F diameter may facilitate insertion in patients with cystic duct stones or complex cystic duct anatomy. Multiple side holes may also improve bile drainage and reduce bile accumulation, thereby lowering the risk of stent occlusion. However, the non-integrated design of some dedicated stents may limit procedural flexibility and warrants further refinement before broader adoption [44].

In contrast, although several device improvements have not yet been evaluated in clinical studies and have only been described in case reports or technical feasibility reports, they may still provide useful technical insight and reference value. Ban et al. reported the use of a screw-tip stent retriever that also functioned as a dilator to overcome inner sheath obstruction within the cystic duct [50]. A tapered endoscopic sheath may assist stent placement into the gallbladder fundus when strictures are difficult to traverse [53]. For complex anatomy or recurrent cholecystitis, over-the-wire stent exchange using a loop cutter may facilitate stent replacement while maintaining access [59]. Drill-type dilators may expand the cystic duct and facilitate safer EGBS placement when device delivery is difficult [55]. Although these reports do not establish general superiority, they illustrate preliminary technical approaches for procedural challenges.

Because smaller transpapillary plastic stents may be prone to occlusion, dual stent placement has been explored to improve drainage durability. In a retrospective case series, Sobani et al. reported the feasibility of dual gallbladder stenting in 21 non-surgical candidates, with both technical and clinical success rates reaching 100%, and recurrent cholecystitis occurring in 1 patient [41]. In their retrospective study, Storm et al. further found that the long-term success rate was higher with dual stent placement than with single stent placement (100% vs. 89%), and that recurrence after single-stent therapy or elective stent removal could be managed by repeat ERCP with the placement of two side-by-side stents [45]. In a multicenter retrospective comparative study, Amin et al. also reported comparable outcomes between dual-stent ETGBD and EUS-GBD, suggesting that dual-stent ETGBD may reduce the recurrence concern associated with single-stent ETGBD [78]. This approach has been proposed to reduce stent occlusion risk and dilate the cystic duct, and index placement of both stents may reduce the need for a second ERCP.

However, in cases of severe inflammation or edema, dual stents may aggravate the condition; delaying placement of the second stent for several weeks may help mitigate this issue.

Variation in duodenal papilla–gallbladder distance affects stent selection. Using cut ENGBD tubes as stents may facilitate conversion from initial ENGBD to EGBS after inflammation improves [33,48]. However, this strategy generally requires an additional ERCP, which increases procedural burden, although it may simplify subsequent management in selected patients, and this strategy has also been used successfully in patients undergoing elective cholecystectomy. Several multicenter studies have evaluated the effectiveness of this strategy. For example, Doi et al. [33] achieved a 75% technical success rate with no late adverse events in 40 cholecystitis patients using cut ENGBD tubes as EGBS. Similarly, Maruta et al. [49] reported a 90.5% technical and 100% clinical success rate in 21 acute cholecystitis patients. A subsequent study comparing ENGBD-to-EGBS conversion with simple ENGBD removal as preoperative management found lower late AE rates in the conversion group (6.4% vs. 33.3%) [54]. ENGBD tube cutting can be challenging, and using a loop cutter or external marking may reduce migration risk. In their retrospective comparative study, Takahashi et al. [48] found comparable success rates between cut ENGBD tubes and ready-made stents (92% vs. 100%), highlighting their practicality.

Overall, technical failure of ETGBD may occur at any point in the above procedural sequence. Anatomical factors are usually the primary limitation. The AGA Clinical Practice Update noted that cystic duct occlusion caused by tumors, stones, or uncovered metal biliary stents is a major reason for technical failure of ETGBD [5,79]. Severe inflammation or edema, tortuosity, stenosis, and cystic duct stones may also contribute to failure of cystic duct identification, guidewire advancement, or stent delivery [10,19,39]. In practice, anatomical factors may compromise several procedural steps rather than a single isolated maneuver. Second, technical failure is closely related to operator experience and procedural decision. Even when the cystic duct is identified, successful ETGBD still depends on appropriate guidewire selection, catheter orientation, maintenance of guidewire support, avoidance of cystic duct injury, timely use of rescue techniques, and proper application of adjunctive methods such as intraductal ultrasonography and cholangioscopy-assisted cannulation [35,63–66]. These adjunctive techniques should be applied selectively according to anatomical difficulty and available expertise, rather than as fixed procedural steps. Third, device limitations may affect both technical success and long-term outcomes. Conventional drainage devices are not always able to accommodate individual anatomical variations and clinical needs. Mismatches in device length, stiffness, diameter, shape, or side-hole position may hinder stent delivery, promote migration or occlusion, and contribute to recurrent cholecystitis [34,46]. This explains why recent device development has focused on improving trackability, facilitating delivery across the cystic duct, reducing migration, maintaining drainage, and simplifying long-term stent management [50,55,60]. Therefore, when ETGBD is considered, the possibility of technical failure should be anticipated, and rescue strategies such as cholangioscopy-assisted cannulation, PTGBD-assisted rendezvous, or alternative drainage should be considered when appropriate.

## 5. Safety of ETGBD

Safety issues related to ETGBD should be considered during both patient selection and follow-up. Because ETGBD is performed through ERCP, ERCP-related adverse events may include post-ERCP pancreatitis, cholangitis, post-sphincterotomy bleeding, and duodenal or periampullary perforation. ETGBD-related adverse events mainly arise from cystic duct manipulation and stent placement, including cystic duct injury or perforation, bile leakage, stent migration, and stent occlusion. When stent exchange or removal is

required, repeat ERCP may further increase procedural burden and expose patients to additional ERCP-related risks. According to the American Society for Gastrointestinal Endoscopy (ASGE) symposium, ETGBD-related AEs are generally mild and rarely require extended hospitalization [80–82].

Post-ERCP pancreatitis and cholangitis are important ERCP-related AEs after ETGBD. Kim et al. [38] retrospectively reviewed 171 patients with acute calculous cholecystitis. Early AEs, defined as events within 2 weeks after ETGBD, included post-ERCP pancreatitis in nine patients (5.2%) which improved with conservative management or endoscopic hemostasis. Delayed AEs, defined as events occurring more than 2 weeks after ETGBD, included stent migration in one patient (0.6%), recurrent acute calculous cholecystitis in one patient (0.6%), and acute cholangitis in six patients (3.5%). These six cholangitis cases occurred in the high-surgical-risk ETGBD subgroup at 150–399 days after the procedure and were successfully managed by ERCP. Inoue et al. [12] prospectively evaluated endoscopic gallbladder inside-stenting combined with lavage and aspiration in 83 poor surgical candidates with acute calculous cholecystitis. Among early AEs, post-ERCP pancreatitis occurred in two patients (2.4%). During a median follow-up of 603 days, late cholangitis occurred in 3 of 66 patients included in the long-term outcome analysis and was treated by stent removal followed by bile duct stent placement. These findings suggest that adequate gallbladder and biliary drainage, careful papillary manipulation, and timely ERCP-based management of suspected stent dysfunction may help reduce or manage these events.

Bleeding may occur during ETGBD, particularly when endoscopic sphincterotomy is performed or when patients are receiving antithrombotic therapy. In their multicenter study involving 130 cholecystitis patients who were divided into antithrombotic therapy (ATT) and non-ATT groups, Sagami et al. [40] found no significant difference in bleeding complications between the two groups. The ATT group had technical and clinical success rates of 84.3% and 97.1%, respectively, while the non-ATT group achieved 89.4% and 100%, with no bleeding incidents in either group. These findings suggest that ETGBD may be a reasonable option for patients receiving antithrombotic therapy.

Cystic duct injury, perforation, and bile leakage are relatively specific concerns during ETGBD because the guidewire, cannula, catheter, or stent must pass through the cystic duct [77]. Nakahara et al. [47] conducted a retrospective study of 23 cystic duct perforation (CDP) patients during ETGBD, reporting a 43.5% technical success rate and an 87.0% clinical success rate, with 90.7% clinical success in non-CDP cases. No significant differences in clinical success or AE rates were observed between CDP and non-CDP groups. The study highlighted that CDP caused by GWs had a higher technical success rate (53.5%) compared to cannula-induced CDP (25.0%), likely due to the wider perforation caused by cannulas, leading to GW dislocation. In cases of failed ETGBD after CDP, rescue management included bile duct drainage during the same ERCP session, PTGBD, EUS-GBD, surgery, conservative treatment, or repeat ETGBD. Sato et al. [51] similarly reported cystic duct injury in 24 of 242 patients (10%) undergoing ETGBD for acute cholecystitis, with no bile peritonitis observed; cystic duct injury was the only independent predictor of technical failure. These findings suggest that forced advancement of the guidewire or cannula should be avoided, and suspected cystic duct injury or perforation should prompt careful cholangiographic assessment, close monitoring during hospitalization, and timely rescue drainage when bile leakage or inadequate gallbladder decompression is suspected [62,83].

Stent dysfunction, including migration and occlusion, remains a concern during long-term EGBS because it may lead to recurrent cholecystitis, cholangitis, or repeat intervention. Stent migration may occur as gallbladder swelling subsides after inflammation improves, whereas occlusion may result from viscous bile, sludge, food reflux, or duodenobiliary reflux [84]. In pooled analyses, stent occlusion, stent migration, and recurrent

cholecystitis occurred in 0.39%, 1.30%, and 1.48% of cases, respectively, although these outcomes may vary with patient population, stent type, and follow-up duration [85]. Dedicated stents such as the GBest-N stent, IYO-stent, and integrated delivery plastic stent may help reduce migration, improve drainage, or facilitate placement, but their role should be considered in relation to long-term follow-up data [34,46,60].

Recurrent cholecystitis is a common late clinical issue after gallbladder drainage and is mainly related to persistent gallstones, cystic duct obstruction, incomplete gallbladder decompression, and stent-related dysfunction [86]. A meta-analysis reported an overall recurrence rate of approximately 1.5% after ETGBD, whereas recurrence during long-term EGBS has shown a wider range of approximately 5.0–19.2% [87,88]. In patients initially managed with ENGBD, conversion to EGBS has been associated with a lower recurrence rate than simple tube removal (5.0% vs. 16.0%). Therefore, recurrence after ETGBD should be assessed in relation to cystic duct patency, stent function, and the intended role of drainage. In addition, repeat ERCP may be required for ENGBD-to-EGBS conversion, stent exchange or removal, or staged placement of additional gallbladder stents. Even when not counted as independent AEs, these procedures may increase the procedural burden and re-expose patients to ERCP-related risks [33,41,48,49,54]. Therefore, the need for additional ERCP should be considered when evaluating the long-term safety and practicality of ETGBD.

## 6. Comparison of ETGBD with Other Drainage Methods

### 6.1. Comparison with Percutaneous Transhepatic Gallbladder Drainage

Although PTGBD is effective, it may be unsuitable in patients with ascites or coagulopathy and often causes discomfort. ETGBD is technically more demanding but may offer internal drainage with comparable efficacy, shorter hospitalization, and fewer complications in selected patients [89] (Table 3). Single-center retrospective studies reported that ETGBD could achieve clinical outcomes comparable to PTGBD and might be associated with shorter hospitalization in selected patients [89,90]. A multicenter study further reported similar or more favorable short-term clinical outcomes for endoscopic drainage compared with percutaneous drainage [91]. In a prospective randomized study, Mu et al. observed more favorable perioperative outcomes with ENGBD than with PTGBD, including abdominal drainage tube placement rates, gallbladder pathology, and bleeding [92]. Furthermore, a large-scale analysis by Ali et al. also suggested that ETGBD was associated with significantly lower 30-day inpatient mortality than PTGBD [93]. Therefore, ETGBD should not be viewed as a universal replacement for PTGBD, but rather as an internal drainage option with specific advantages in patients with suitable anatomy and in those expected to undergo subsequent cholecystectomy.

**Table 3.** Clinical comparison of gallbladder drainage strategies for acute cholecystitis.

| Drainage Method | Author            | Year | Format        | Scale        | Country | Disease                       | Patients | Drainage Procedure                        | Drainage Device                                              | Technical Success | Clinical Success | Adverse Events                                 | Recurrence/Late Outcomes | Recurrence Definition/Group          | Follow-Up Duration     |
|-----------------|-------------------|------|---------------|--------------|---------|-------------------------------|----------|-------------------------------------------|--------------------------------------------------------------|-------------------|------------------|------------------------------------------------|--------------------------|--------------------------------------|------------------------|
| ETGBD vs. PC    | Inoue et al. [62] | 2016 | Retrospective | Uni-center   | Japan   | Acute calculous cholecystitis | 35       | EGBS                                      | Plastic stent                                                | 82.9% (29/35)     |                  | Procedure 2.9% (1/35); late non-AC 9.1% (3/33) | 0% (0/33)                | Recurrent cholecystitis; EGBS group  | Median 473 d (13–1095) |
|                 |                   |      |               |              |         |                               | 29       | PTGBD- rendezvous method with second EGBS | Pigtail tube                                                 | 100% (29/29)      |                  | Late non-AC 6.9% (2/29)                        | 17.2% (5/29)             | Recurrent cholecystitis; PTGBD group | Median 485 d (30–1873) |
|                 | Itoi et al. [91]  | 2017 | Retrospective | Multi-center | Japan   | Acute cholecystitis           | 330      | ENGBD/EGBS                                | Single-pigtail nasogallbladder catheter/Double-pigtail stent |                   | 89.2% (207/232)  | 8.2% (27/330)                                  |                          |                                      |                        |
|                 |                   |      |               |              |         |                               | 266      | PTGBD                                     | Pigtail catheter                                             |                   | 85.7% (191/223)  | 5.6% (15/266)                                  |                          |                                      |                        |
|                 |                   |      |               |              |         |                               | 64       | PTGBA                                     | Aspiration needle with optional saline lavage                |                   | 96.2% (50/52)    | 1.6% (1/64)                                    |                          |                                      |                        |
|                 | Iino et al. [90]  | 2018 | Retrospective | Uni-center   | Japan   | Acute cholecystitis           | 43       | ENGBD/EGBS                                | Nasobiliary drainage tube/Double-pigtail stent               | 77.0% (33/43)     |                  | 9.3% (4/43)                                    |                          |                                      |                        |
|                 |                   |      |               |              |         |                               | 42       | PTGBD                                     | Pigtail catheter                                             | 100% (42/42)      |                  | 4.8% (2/42)                                    |                          |                                      |                        |

|                   |      |                |              |       |                               |     |       |                                                |                 |                 |                                                                                           |                                           |                                                                                           |                                                                         |
|-------------------|------|----------------|--------------|-------|-------------------------------|-----|-------|------------------------------------------------|-----------------|-----------------|-------------------------------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Kaura et al. [89] | 2020 | Retro-spective | Uni-center   | USA   | Acute cholecystitis           | 57  | EGBS  | Double-pigtail plastic stent                   | 91.2% (52/57)   |                 | Unplanned repeat intervention 7.7% (4/52); postoperative complications 30.8% (16/52)      | Clinical failure/recurrent AC 7.7% (4/52) | Clinical failure and recurrence of cholecystitis; ERGD successful patients                | Median 61 d (IQR 32–98) from drainage to cholecystectomy                |
|                   |      |                |              |       |                               | 140 | PC    | Pigtail catheter                               | 100% (140/140)  |                 | Unplanned repeat intervention 16.4% (23/140); post-operative complications 47.1% (66/140) |                                           | AC recurrence not separately reported; unplanned repeats were drain blockage/dislodgement | Median 72 d (IQR 51–109) from drainage to cholecystectomy               |
| Mu et al. [92]    | 2021 | Pro-spective   | Uni-center   | China | Acute cholecystitis           | 11  | ENGBD | Nasobiliary drainage tube/Double-pigtail stent | 90.9% (10/11)   | 100% (11/11)    | Peri-drainage 9.1% (1/11); peri-cholecystectomy 0% (0/11)                                 | 9.1% (1/11)                               | Recurrent cholecystitis; randomized group                                                 | Bridge to cholecystectomy 2–3 mo; follow-up ≥3 mo after cholecystectomy |
|                   |      |                |              |       |                               | 11  | PTGBD | Pigtail catheter                               | 100% (11/11)    | 100% (11/11)    | Peri-drainage 27.3% (3/11); peri-cholecystectomy 0% (0/11)                                | 0% (0/11)                                 | Recurrent cholecystitis; randomized group                                                 | Bridge to cholecystectomy 2–3 mo; follow-up ≥3 mo after cholecystectomy |
| Inoue et al. [94] | 2023 | Retro-spective | Multi-center | Japan | Acute calculous cholecystitis | 297 | EGBS  | Double-pigtail stent/Single-pigtail stent      | 75.4% (224/297) | 96.9% (217/224) | Early 7.7% (23/297); late non-AC symptomatic 19.6% (31/158); overall late 25.9% (41/158)  | 6.3% (10/158)                             | Recurrent cholecystitis; long-term EGBS patients                                          | Mean 1115.5 d (SD 729.2)                                                |

|                          |                     |      |                         |                |                             |     |         |                                 |                    |                    |                                                                                                                 |                                                                                                                             |                                                                                                            |                             |
|--------------------------|---------------------|------|-------------------------|----------------|-----------------------------|-----|---------|---------------------------------|--------------------|--------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------|
|                          |                     |      |                         |                |                             | 231 | PTGBD   | Pigtail catheter                | 98.7%<br>(228/231) | 96.9%<br>(221/228) | Early 4.3%<br>(10/231); late<br>non-AC<br>symptomatic<br>10.8%<br>(13/120); over-<br>all late 30.0%<br>(36/120) | 19.2%<br>(23/120)                                                                                                           | Recurrent chol-<br>ecystitis; long-<br>term PTGBD<br>patients                                              | Mean 1136.2 d (SD<br>728.8) |
| ETGBD<br>vs. EUS-<br>GBD | Oh et<br>al. [95]   | 2019 | Retro-<br>spec-<br>tive | Uni-<br>center | Acute<br>cholecysti-<br>tis | 96  | EGBS    | Double-pigtail<br>plastic stent | 83.3%<br>(80/96)   | 82.3%<br>(79/96)   | Procedural<br>AE 9.4%<br>(9/96); asymp-<br>tomatic stent-<br>related AE<br>4.3% (3/69)                          | Cholecysti-<br>tis/cholangi-<br>tis recur-<br>rence 17.4%<br>(12/69); recur-<br>rent chol-<br>ecystitis<br>14.5%<br>(10/69) | Recurrent typi-<br>cal symptoms<br>with character-<br>istic imaging<br>findings; long-<br>term patients    | Mean 25.5 mo (SD<br>21.9)   |
|                          |                     |      |                         |                |                             | 83  | EUS-GBD | SEMS                            | 98.8%<br>(82/83)   | 98.8%<br>(82/83)   | Procedural<br>7.2% (6/83);<br>asymptomatic<br>stent-related<br>3.9% (3/76)                                      | Cholecysti-<br>tis/cholangi-<br>tis recur-<br>rence 3.9%<br>(3/76); recur-<br>rent chole-<br>cystitis 3.9%<br>(3/76)        | Recurrent typi-<br>cal symptoms<br>with character-<br>istic imaging<br>findings; long-<br>term patients    | Mean 18.6 mo (SD<br>21.1)   |
|                          | Higa et<br>al. [96] | 2019 | Retro-<br>spec-<br>tive | Uni-<br>center | Acute<br>cholecysti-<br>tis | 38  | EGBS    | Double-pigtail<br>stent         | 84.2%<br>(32/38)   | 76.3%<br>(29/38)   | 9.4% (3/32)                                                                                                     | 18.8% (6/32)                                                                                                                | Recurrent chol-<br>ecystitis during<br>follow-up; suc-<br>cessful transpa-<br>pillary drainage<br>patients | Median 5 mo (<1–29)         |
|                          |                     |      |                         |                |                             | 40  | EUS-GBD | LAMS                            | 97.5%<br>(39/40)   | 95.0%<br>(38/40)   | 17.9% (7/39)                                                                                                    | 2.6% (1/39)                                                                                                                 | Recurrent chol-<br>ecystitis during<br>follow-up;                                                          | Median 7 mo (<1–20)         |

|                         |      |                |              |       |                                 |    |                                                               |                                                         |                                         |                                  |                                                                                     |                                   |                                                                                   |                                                         |
|-------------------------|------|----------------|--------------|-------|---------------------------------|----|---------------------------------------------------------------|---------------------------------------------------------|-----------------------------------------|----------------------------------|-------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------|
|                         |      |                |              |       |                                 |    |                                                               |                                                         |                                         |                                  |                                                                                     | successful EUS drainage pa-tients |                                                                                   |                                                         |
| Nishi-guchi et al. [97] | 2021 | Retro-spective | Uni-center   | Japan | Acute cholecysti-tis            | 29 | EGBS with or without digital sin-gle-operator cholangio-scope | Plastic stent                                           | 89.7% (26/29) overall                   | 79.3% (23/29)                    | Procedure-re-lated 10.3% (3/29); stent-related 7.7% (2/26)                          | 15.4% (4/26)                      | Recurrent chol-ecystitis; suc-cessful ETGBD patients                              | Median follow-up re-ported as 522 d (range 43–1892)     |
|                         |      |                |              |       |                                 | 25 | EUS-GBD                                                       | FCSEMS plus double-pigtail plastic stent                | 100% (25/25)                            | 96.0% (24/25)                    | Procedure-re-lated 4.0% (1/25); stent-related 0% (0/25)                             | 0% (0/25)                         | Recurrent chol-ecystitis; EUS-GBD patients                                        | Median follow-up re-ported as 522 d (range 43–1892)     |
| Inoue et al. [98]       | 2023 | Retro-spective | Multi-center | Japan | Acute cal-culous cholecysti-tis | 90 | EGBS                                                          | Double-pigtail stent/Single-pigtail stent               | 78.9% (71/90)                           | 94.4% (67/71)                    | Early 8.9% (8/90); late non-AC symptomatic 13.4% (9/67); overall late 16.4% (11/67) | 3.0% (2/67)                       | Recurrent chol-ecystitis; clini-cal-success ETGBD pa-tients                       | Mean 689.8 d (SD 530.8) after PSM                       |
|                         |      |                |              |       |                                 | 90 | EUS-GBD                                                       | Double-pigtail plastic stent/Nasobili-ary drainage tube | 96.7% (87/90)                           | 92.0% (80/87)                    | Early 7.8% (7/90); late non-AC symptomatic 1.3% (1/80); overall late 5.0% (4/80)    | 3.8% (3/80)                       | Recurrent chol-ecystitis; clini-cal-success EUS-GBD pa-tients                     | Mean 727.6 d (SD 411.7) after PSM                       |
| Amin et al. [78]        | 2025 | Retro-spective | Multi-center | USA   | Acute cholecysti-tis            | 73 | EGBS                                                          | Dual transcystic stents                                 | ETGBD 86.3% (63/73); DSET 80.9% (51/63) | 100% (36/36) for in-dex DSET-GBD | Procedure-re-lated 0% (0/51); 30-d mortality 2.0% (1/51)                            | 5.3% (2/38)                       | Recurrent chol-ecystitis; pa-tients with non-cholecystitis death during follow-up | Minimum 6 mo; pri-mary recurrence as-sessed within 6 mo |



|                            |      |                         |                |               |                                                                                                       |    |                                                                                    |                                 |                  |                  |              |              |                                                                                                         |                                                                              |
|----------------------------|------|-------------------------|----------------|---------------|-------------------------------------------------------------------------------------------------------|----|------------------------------------------------------------------------------------|---------------------------------|------------------|------------------|--------------|--------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Ridditid<br>et al.<br>[99] | 2022 | Retro-<br>spec-<br>tive | Uni-<br>center | Thai-<br>land | Acute<br>cholecysti-<br>tis with or<br>without<br>concomi-<br>tant com-<br>mon bile<br>duct<br>stones | 93 | EGBS either<br>by fluoro-<br>scopic or<br>digital chol-<br>angioscopic<br>guidance | Double-pigtail<br>plastic stent | 74.2%<br>(69/93) | 95.7%<br>(66/69) | 10.5% (9/86) | 4.6% (4/86)  | Recurrent clini-<br>cal symptoms<br>plus imaging<br>findings of AC;<br>final EGBS-<br>group patients    | Subgroup medians 193<br>d with CBD stones and<br>197 d without CBD<br>stones |
|                            |      |                         |                |               |                                                                                                       | 22 | EUS-GBD                                                                            | LAMS/FCSEMS                     | 100%<br>(22/22)  | 100%<br>(22/22)  | 4.5% (1/22)  | 4.5% (1/22)  | Recurrent clini-<br>cal symptoms<br>plus imaging<br>findings of AC;<br>final EUS-GBD-<br>group patients | Subgroup medians 252<br>d with CBD stones and<br>390 d without CBD<br>stones |
|                            |      |                         |                |               |                                                                                                       | 35 | PC                                                                                 | Pigtail drainage<br>catheter    | 100%<br>(35/35)  | 68.6%<br>(24/35) | 0% (0/35)    | 17.1% (6/35) | Recurrent clini-<br>cal symptoms<br>plus imaging<br>findings of AC;<br>PC-group pa-<br>tients           | Subgroup medians 79<br>d with CBD stones and<br>72 d without CBD<br>stones   |

Abbreviations: AC, acute cholecystitis; AEs, adverse events; CBD, common bile duct; DSET, dual-stent endoscopic transpapillary gallbladder drainage; EGBS, endoscopic gallbladder stenting; ENGBD, endoscopic nasogallbladder drainage; ERGD, endoscopic retrograde gallbladder drainage; ETGBD, endoscopic transpapillary gallbladder drainage; EUS-GBD, endoscopic ultrasound-guided gallbladder drainage; FCSEMS, fully covered self-expandable metal stent; IQR, interquartile range; LAMS, lumen-apposing metal stent; PC, percutaneous cholecystostomy; PTGBA, percutaneous transhepatic gallbladder aspiration; PTGBD, percutaneous transhepatic gallbladder drainage; PSM, propensity score matching; SD, standard deviation; SEMS, self-expandable metal stent; TP, transpapillary; d, days; mo, months.

### 6.2. Comparison with Endoscopic Ultrasound-Guided Gallbladder Drainage

EUS-GBD, an internal fistula approach using LAMS, avoids external tubes and supports long-term stent placement [100]. Its saddle-shaped design with flared ends and wide lumen may reduce risks like migration and bile leakage [96]. Unlike EUS-GBD, ETGBD preserves the native gastrointestinal anatomy and avoids creation of a transmural fistula (Table 3). Retrospective comparative studies generally suggest that EUS-GBD achieves higher technical and clinical success rates, shorter procedure times, and lower recurrence rates than ETGBD [95,97,101,102]. However, Amin et al. reported that dual-stent ETGBD achieved outcomes comparable to EUS-GBD in a multicenter retrospective comparative study, with technical success of 86.3% vs. 87.5%, clinical success of 100% vs. 98.1%, similar AE rates (0% vs. 2.0%), and low recurrence rates (5.3% vs. 8.2%) [78]. Inoue et al. [98] found that recurrence of calculous cholecystitis and early AE rates were comparable between EUS-GBD and ETGBD, whereas late AEs, particularly non-cholecystitis events, were more frequent after ETGBD. However, EUS-GBD requires advanced therapeutic EUS expertise and dedicated devices, may increase device costs, and raises concerns regarding future cholecystectomy and LAMS placement [103,104]. Despite lower overall success rates, ETGBD may still be considered in patients with concomitant common bile duct stones because it allows simultaneous ERCP-based stone extraction, and in those scheduled for cholecystectomy because it preserves gallbladder anatomy [38]. EUS-GBD may be better suited for non-surgical candidates requiring permanent drainage [105].

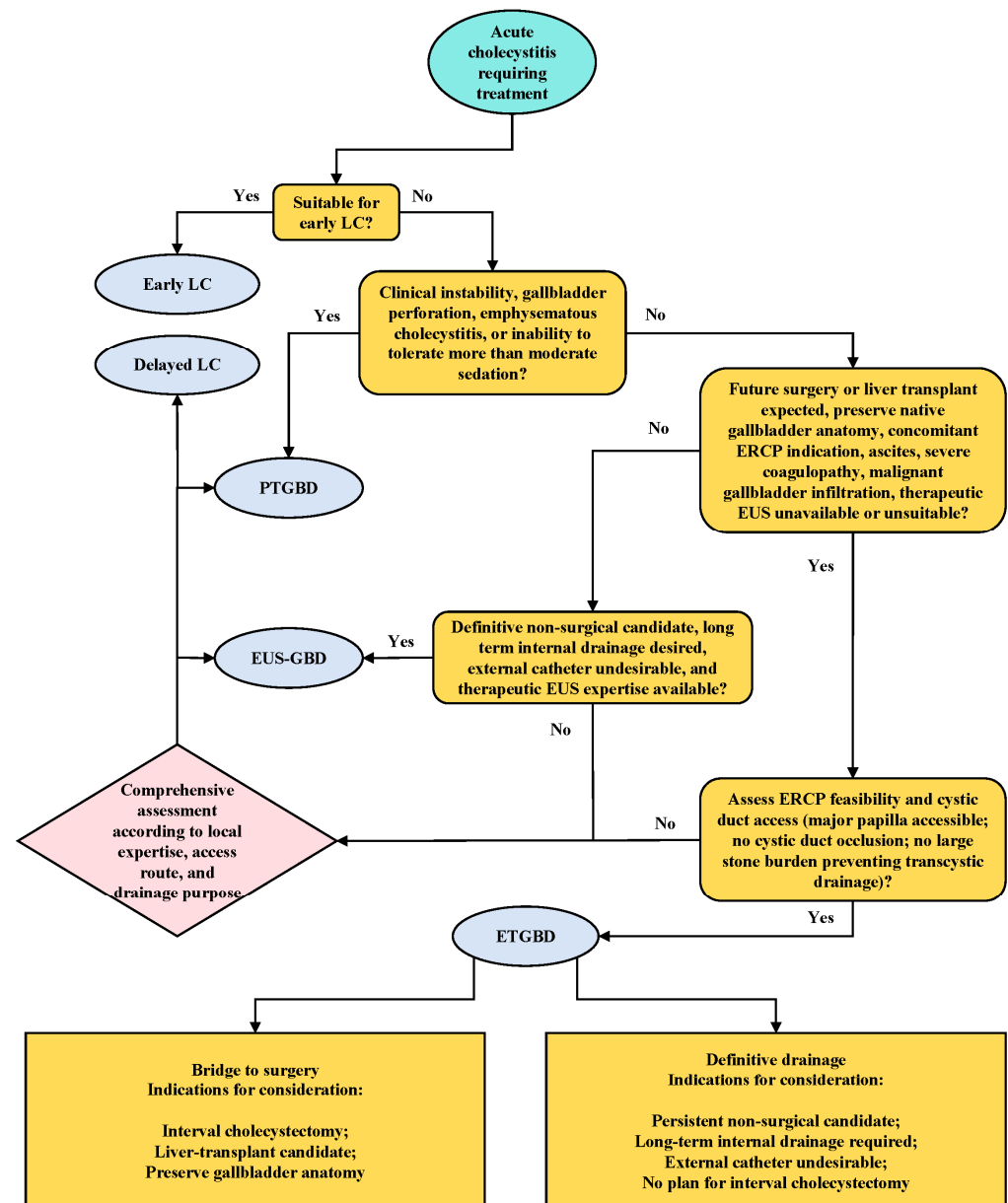
An international multicenter retrospective comparative cohort study reported that PTGBD and EUS-GBD showed higher technical (98% vs. 94%) and clinical (97% vs. 90%) success than ETGBD (88% vs. 80%), though EUS-GBD had a higher procedural AE rate, while PTGBD had more long-term AEs and more complications [82]. Ridditid et al. [99] compared PTGBD, EUS-GBD, and ETGBD in acute cholecystitis patients with or without common bile duct stones in a retrospective comparative study. For those with stones, PTGBD and EUS-GBD had similar technical success rates (100% vs. 100%), outperforming ETGBD (73.2%). Clinically, ETGBD and EUS-GBD were comparable (96.2% vs. 100%) and superior to PTGBD (87.5%). For patients without stones, PTGBD and EUS-GBD again matched technically (100% vs. 100%), exceeding ETGBD (77.3%), while ETGBD and EUS-GBD achieved higher clinical success rates than PTGBD (94.1% and 100% vs. 63.0%). From a cost-effectiveness perspective, a 3-month cost-effectiveness model suggested that ETGBD may be cost-saving compared with PTGBD (\$40,086 vs. \$53,712) and economically favored over EUS-GBD, which required an additional \$17,722 to avert 1.98 additional hospitalization days, although these findings depended on assumptions regarding hospital stay, LAMS cost, and expert-center performance [106]. Across comparative studies, ETGBD generally has lower technical success rates than PTGBD and EUS-GBD, which could be partly attributable to difficulties in identifying or traversing the cystic duct, dependence on favorable anatomy, and the need for adequate ERCP expertise. Therefore, findings from expert centers may be less applicable to broader clinical practice. Beyond general risks of gallbladder drainage, including bleeding, infection, bile leakage, perforation, and the need for additional intervention, each approach has its own limitations. PTGBD may cause discomfort from the external tube, tube dislodgement, skin infection, and difficulties with catheter care. EUS-GBD carries risks related to transmural puncture and stent placement, such as bile peritonitis, sepsis, stent migration, and stent dysfunction. ETGBD carries risks including post-ERCP pancreatitis, cholangitis, cystic duct injury, perforation, and repeat ERCP for stent exchange or removal [107]. The choice of drainage method in AC should be individualized according to clinical severity, overall surgical fitness, local expertise, and the anticipated need for future intervention. The intended role of drainage should also be defined before treatment. In patients who are temporarily

unsuitable for early LC, gallbladder drainage may serve as a bridge to delayed cholecystectomy [108]. In this setting, surgical candidacy should be reassessed after clinical improvement, resolution of sepsis or organ dysfunction, and optimization of comorbidities and anesthetic risk. By contrast, definitive drainage may be considered for patients who remain poor surgical candidates despite clinical stabilization, such as those with persistent severe comorbidities, frailty, or unacceptable anesthetic risk [2,109]. Comparative studies evaluating ETGBD against PTGBD or EUS-GBD are summarized in Table 3, and the full evidence extraction is provided in Supplementary Table S2.

### 6.3. Practical Framework for Drainage Selection

Based on the risk-stratified management principles of TG18 and the recent recommendations of the American Society for Gastrointestinal Endoscopy (ASGE) on therapeutic EUS, this framework is intended to guide the individualized management of patients with acute cholecystitis who are unsuitable for early cholecystectomy [4,110] (Figure 2). The optimal drainage strategy should be determined according to disease severity, clinical stability, surgical candidacy, anatomical feasibility, concomitant indications for ERCP, bleeding risk, sedation tolerance, local availability of interventional radiology and therapeutic EUS expertise, and the intended role of drainage as either definitive treatment or a bridge to interval cholecystectomy.

PTGBD remains an appropriate option when rapid decompression is required, when endoscopic intervention is unsafe or infeasible, or when percutaneous access is safe and readily available, particularly in patients with perforation, emphysematous or gangrenous cholecystitis, clinical instability, or poor sedation tolerance. By contrast, EUS-GBD may be considered when definitive internal drainage is required and appropriate expertise is available. The ASGE guideline suggests EUS-GBD over ETGBD in non-surgical patients, particularly when the major papilla cannot be accessed, when an indwelling metal biliary stent occludes the cystic duct, or when a large gallstone burden makes transpapillary drainage difficult [110]. ETGBD should be regarded as a complementary option rather than a universal substitute for PTGBD or EUS-GBD. It may be particularly considered when gallbladder drainage can be integrated into an already indicated ERCP procedure, such as in patients with concomitant common bile duct stones, cholangitis, or other transpapillary biliary indications. It may also be considered in patients who may subsequently undergo interval cholecystectomy, because it preserves the native anatomical structure. This patient-selection logic is supported by comparative studies. Ridditid et al. suggested that concomitant common bile duct stones should be considered in drainage selection, because they may favor an ERCP-based transpapillary approach when anatomically feasible [99]. Amin et al. adopted a pragmatic strategy in which ETGBD was attempted in patients who might later become surgical candidates, whereas EUS-GBD was selected for patients who were unlikely to undergo future cholecystectomy [78]. Together, these findings suggest that patient selection should integrate surgical candidacy, the intended role of drainage, transpapillary feasibility, concomitant ERCP indications, and local therapeutic EUS expertise. Therefore, the final choice should be based on multidisciplinary and patient-centered assessment rather than on a single universal rule.



**Figure 2.** Practical framework for drainage selection. AC, acute cholecystitis; LC, laparoscopic cholecystectomy; PTGBD, percutaneous transhepatic gallbladder drainage; ETGBD, endoscopic transpapillary gallbladder drainage; EUS-GBD, endoscopic ultrasound-guided gallbladder drainage; ERCP, endoscopic retrograde cholangiopancreatography; EUS, endoscopic ultrasound.

## 7. Combination of ETGBD and Other Technologies

ETGBD is minimally invasive and preserves anatomical structures and mucosa. Its versatility may make it useful in selected complex cases when other approaches are unsuitable or unsuccessful. Although AEs may occur, ETGBD can be considered in selected patients, with alternative drainage strategies available if technical success is not achieved.

Early LC in AC may be complicated by adhesions in Calot's triangle, increasing the risk of biliary and vascular injury. ENGBD before LC may reduce inflammation and improve cystic duct identification. Toyota et al. [29] reported no conversion to open surgery in 19 ENGBD patients, compared with 11.1% in controls. The ENGBD catheter fixation technique simplifies CD identification, enabling safer minimally invasive procedures.

Self-expanding metallic stents (SEMSs) are widely used in biliary management, including gallbladder drainage, though they may induce cholecystitis [111]. ETGBD combined with SEMS may reduce cholecystitis risk. Ishii et al. [52] reported an incidence of 4.2% with EGBS versus 21.4% in controls. Nakahara et al. [36] reported ETGBD success rates of 83.3% technical and 90% clinical post-SEMS, with 75% success in distal and 100% in perihilar ducts, without major complications. These findings suggest that ETGBD may have a potential role in selected patients with cholecystitis after SEMS placement. Innovatively, Gutkin et al. [112] employed SpyDS-assisted fully covered SEMSs for chronic cholecystitis, facilitating gallbladder drainage and stone removal, highlighting the synergy of endoscopic and stent-based approaches in complex biliary conditions.

A stepwise drainage strategy may be feasible in selected patients. Widmer et al. [31] proposed EGBS via ERCP first, followed by EUS-GBD for failures, and PTGBD if endoscopic drainage is unsuccessful. Among 128 patients, EGBS succeeded in 91%, and the remaining 11 received EUS-GBD, achieving 100% success and symptom improvement. This approach suggests technical feasibility in selected high-risk patients. Iino et al. [113] reported ENGBD followed by EGBS for perforated emphysematous cholecystitis with localized peritonitis, in which PTGBD was considered unfavorable because of potential bile leakage and poor ultrasonographic visualization caused by pericholecystic gas.

## 8. Long-Term Management Following ETGBD

Prolonged stent retention may lead to cholestasis, duodenobiliary reflux, cholangitis, and, rarely, gallbladder perforation or penetration. Therefore, indefinite stent retention may not be optimal, and scheduled exchange or removal should be considered. Permanent EGBS may reduce recurrence in high-risk patients, but optimal exchange intervals and removal timing are unclear.

Prevention of recurrent cholecystitis is a major rationale for long-term EGBS in patients who remain unsuitable for cholecystectomy. Persistent internal drainage was generally associated with lower recurrence than tube removal or observation. Inoue et al. reported no recurrent cholecystitis in 33 patients treated with long-term EGBS during a median follow-up of 473 days, whereas recurrence occurred in 5 of 29 patients (17.2%) managed by observation after percutaneous drainage tube removal [62]. Similarly, Maruta et al. reported a lower recurrence rate after permanent EGBS than after drainage tube removal, with recurrence rates of 5.0% and 16.0%, respectively, during median follow-up periods of 375 and 307 days [42]. In a larger multicenter cohort, recurrent cholecystitis occurred in 10 of 158 EGBS patients (6.3%) during a mean follow-up of 1115.5 days, compared with 23 of 120 patients (19.2%) after PTGBD tube removal [94]. Long-term EGBS may reduce the risk of recurrent cholecystitis by maintaining gallbladder drainage, preserving biliary patency, and providing a “wicking” action. However, the risk of recurrence should still be assessed in relation to patient background, stent strategy, and follow-up duration [32,57,78].

Stent-related dysfunction is another concern during long-term EGBS. Inoue et al. reported late stent-related events in 3 of 33 patients, including stent migration at 70 days and cholangitis at 21 and 440 days after treatment; all patients improved after stent exchange, and one difficult case required PTGBD-rendezvous and guidewire-assisted exchange [62]. As shown by Nakahara et al., the distal migration rate of stents was 31.9%, with migration-related recurrent cholecystitis occurring in 8.5% of patients, whereas no migration or recurrence was observed in the GBest-N group during a shorter follow-up period [34].

Reintervention may be required during long-term EGBS management, either for the treatment of late complications or for planned optimization of drainage. Recurrent cholecystitis, stent migration, and other stent-related adverse events can be managed by stent

exchange. In cases of cholangitis and other conditions, the gallbladder stent may be removed first, followed by bile duct stent placement. In technically difficult cases, PTGBD-*rendezvous* may also be required, with guidewire-assisted stent exchange [12,62]. Reintervention may also be incorporated as part of a planned long-term treatment strategy [41,78]. Storm et al. evaluated long-term transpapillary gallbladder stenting and compared single-stent and double-stent approaches. Patients with only one stent were generally advised to undergo repeat ERCP 1–2 months after the procedure for stent exchange and attempted side-by-side placement of two stents, whereas patients with two stents in place generally did not require routine stent exchange if they remained asymptomatic. In that study, the long-term success rate was higher in the double-stent group than in the single-stent group (100% vs. 89%), and no recurrent acute cholecystitis occurred while two stents were maintained in situ [45]. However, the optimal interval for stent exchange or removal requires further investigation before standardized recommendations can be made.

## 9. Conclusions

ETGBD is a technically demanding and anatomy-dependent internal drainage option for patients with acute cholecystitis who are unsuitable for early cholecystectomy. Current evidence suggests that ETGBD may have clinical value in carefully selected patients, particularly when ERCP is otherwise indicated, such as in patients with concomitant common bile duct stones or cholangitis, or when preservation of native gallbladder anatomy is desirable because interval cholecystectomy remains possible. However, its use should be balanced against its lower technical success rate compared with PTGBD or EUS-GBD, dependence on cystic duct access, need for adequate ERCP expertise, and potential ERCP-related or stent-related adverse events. Drainage selection should therefore be individualized. The available evidence remains predominantly retrospective, heterogeneous, and largely derived from experienced centers; therefore, the current conclusions should be interpreted cautiously. Adequately powered multicenter comparative studies with standardized definitions of technical success, clinical success, adverse events, recurrence, and long-term stent management are needed to clarify the optimal role of ETGBD alongside PTGBD and EUS-GBD.

**Supplementary Materials:** The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/jcm15156007/s1>, Table S1: Detailed evidence extraction of ETGBD-related studies; Table S2: Detailed evidence extraction of comparative studies involving ETGBD, PTGBD, and EUS-GBD.

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## Abbreviations

The following abbreviations are used in this manuscript:

|         |                                                   |
|---------|---------------------------------------------------|
| AC      | Acute Cholecystitis                               |
| LC      | Laparoscopic Cholecystectomy                      |
| PTGBD   | Percutaneous Transhepatic Gallbladder Drainage    |
| ETGBD   | Endoscopic Transpapillary Gallbladder Drainage    |
| EUS     | Endoscopic Ultrasound                             |
| EUS-GBD | Endoscopic Ultrasound-Guided Gallbladder Drainage |
| ERCP    | Endoscopic Retrograde Cholangiopancreatography    |
| ENGBD   | Endoscopic Nasogallbladder Drainage               |
| EGBS    | Endoscopic Gallbladder Stenting                   |
| CD      | Cystic Duct                                       |
| GW      | Guidewire                                         |
| IDUS    | Intraductal Ultrasonography                       |
| SpyDS   | SpyGlass Direct Visualization System              |
| LAMS    | Lumen-Apposing Metal Stent                        |
| SEMS    | Self-Expanding Metallic Stent                     |
| AE      | Adverse Event                                     |
| CDP     | Cystic Duct Perforation                           |
| ATT     | Antithrombotic Therapy                            |

## References

1. Gallaher, J.R.; Charles, A. Acute Cholecystitis: A Review. *JAMA* **2022**, *327*, 965–975.
2. Pisano, M.; Allievi, N.; Gurusamy, K.; Borzellino, G.; Cimbanassi, S.; Boerna, D.; Coccolini, F.; Tufo, A.; Di Martino, M.; Leung, J.; et al. 2020 World Society of Emergency Surgery updated guidelines for the diagnosis and treatment of acute calculus cholecystitis. *World J. Emerg. Surg.* **2020**, *15*, 61.
3. Mishima, K.; Fujiyama, Y.; Wakabayashi, T.; Igarashi, K.; Ozaki, T.; Honda, M.; Mori, S.; Funamizu, N.; Tsutsui, A.; Okamoto, N.; et al. Early laparoscopic cholecystectomy for acute cholecystitis following the Tokyo Guidelines 2018: A prospective single-center study of 201 consecutive cases. *Surg. Endosc.* **2023**, *37*, 6051–6061.
4. Mori, Y.; Itoi, T.; Baron, T.H.; Takada, T.; Strasberg, S.M.; Pitt, H.A.; Ukai, T.; Shikata, S.; Noguchi, Y.; Teoh, A.Y.B.; 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.
5. Irani, S.S.; Sharzei, K.; Siddiqui, U.D. AGA Clinical Practice Update on Role of EUS-Guided Gallbladder Drainage in Acute Cholecystitis: Commentary. *Clin. Gastroenterol. Hepatol.* **2023**, *21*, 1141–1147.
6. McKay, A.; Abulfaraj, M.; Lipschitz, J. Short- and long-term outcomes following percutaneous cholecystostomy for acute cholecystitis in high-risk patients. *Surg. Endosc.* **2012**, *26*, 1343–1351.
7. Hemerly, M.C.; de Moura, D.T.H.; Junior, E.S.D.M.; Proença, I.M.; Ribeiro, I.B.; Yvamoto, E.Y.; Ribas, P.H.B.V.; Sánchez-Luna, S.A.; Bernardo, W.M.; de Moura, E.G.H. Endoscopic ultrasound (EUS)-guided cholecystostomy versus percutaneous cholecystostomy (PTC) in the management of acute cholecystitis in patients unfit for surgery: A systematic review and meta-analysis. *Surg. Endosc.* **2023**, *37*, 2421–2438.
8. Kozarek, R.A. Selective cannulation of the cystic duct at time of ERCP. *J. Clin. Gastroenterol.* **1984**, *6*, 37–40.
9. Masuda, T.; Takamori, H.; Ogata, K.-I.; Ogawa, K.; Shimizu, K.; Karashima, R.; Nitta, H.; Matsumoto, K.; Okino, T.; Baba, H. The Success Rate Is Lower but Completion Rate of Laparoscopic Cholecystectomy Is higher in Endoscopic Transpapillary Gallbladder Drainage than Percutaneous Gallbladder Drainage for Acute Cholecystitis. *Surg. Laparosc. Endosc. Percutan Tech.* **2024**, *34*, 413–418.
10. Suzuki, K.; Naito, H.; Naito, E.; Sasaki, T.; Yoshikawa, Y.; Omagari, K.; Yoshitake, N.; Koike, T.; Hashimoto, T.; Tamura, A. Evaluation of the Validity of Endoscopic Transpapillary Gallbladder Drainage for Acute Cholecystitis Based on the Tokyo Guidelines 2018. *J. Clin. Gastroenterol.* **2024**, *58*, 419–425.
11. Cherng, N.; Achebe, I.; Winkie, M.; Thomann, J.; Then, E.; Marya, N.B. Approaches to Cholecystitis: Surgical, Endoscopic, and Percutaneous Management. *J. Intensive Care Med.* **2024**, *40*, 1033–1041.
12. Inoue, T.; Kitano, R.; Ibusuki, M.; Kobayashi, Y.; Ito, K.; Yoneda, M. Endoscopic gallbladder inside-stenting combined with aspirated lavage for calculous cholecystitis in poor surgical candidates: A prospective pilot study. *Sci. Rep.* **2023**, *13*, 21156.

13. Itoi, T.; Sofuni, A.; Itokawa, F.; Tsuchiya, T.; Kurihara, T.; Ishii, K.; Tsuji, S.; Ikeuchi, N.; Tsukamoto, S.; Takeuchi, M.; et al. Endoscopic transpapillary gallbladder drainage in patients with acute cholecystitis in whom percutaneous transhepatic approach is contraindicated or anatomically impossible (with video). *Gastrointest. Endosc.* **2008**, *68*, 455–460.
14. Kjaer, D.W.; Kruse, A.; Funch-Jensen, P. Endoscopic gallbladder drainage of patients with acute cholecystitis. *Endoscopy* **2007**, *39*, 304–308.
15. Mutignani, M.; Iacopini, F.; Perri, V.; Familiari, P.; Tringali, A.; Spada, C.; Ingrosso, M.; Costamagna, G. Endoscopic gallbladder drainage for acute cholecystitis: Technical and clinical results. *Endoscopy* **2009**, *41*, 539–546.
16. Ueki, T.; Maruo, T.; Igarashi, Y.; Yamamiya, A.; Tominaga, K.; Irisawa, A.; Yoshida, H.; Kamisawa, T.; Takenaka, M.; Isayama, H. Role of advanced endoscopy in the management of inflammatory digestive diseases (pancreas and biliary tract). *Dig. Endosc.* **2024**, *36*, 546–553.
17. Maekawa, S.; Nomura, R.; Murase, T.; Ann, Y.; Oeholm, M.; Harada, M. Endoscopic gallbladder stenting for acute cholecystitis: A retrospective study of 46 elderly patients aged 65 years or older. *BMC Gastroenterol.* **2013**, *13*, 65.
18. McCarthy, S.T.; Tuijios, S.; Fontana, R.J.; Rahnama-Moghadam, S.; Elmunzer, B.J.; Kwon, R.S.; Wamsteker, E.J.; Anderson, M.A.; Scheiman, J.M.; Elta, G.H.; et al. Endoscopic Transpapillary Gallbladder Stent Placement Is Safe and Effective in High-Risk Patients Without Cirrhosis. *Dig. Dis. Sci.* **2015**, *60*, 2516–2522.
19. Hirakawa, N.; Yamamoto, K.; Sofuni, A.; Tsuchiya, T.; Ishii, K.; Tanaka, R.; Tonozuka, R.; Mukai, S.; Nagai, K.; Matsunami, Y.; et al. Factors predicting technical failure of endoscopic transpapillary gallbladder drainage for acute cholecystitis. *DEN Open* **2024**, *4*, e308.
20. Niiya, F.; Tamai, N.; Yamawaki, M.; Noda, J.; Azami, T.; Takano, Y.; Nishimoto, F.; Nagahama, M. Benefits of endoscopic gallbladder stenting following percutaneous transhepatic gallbladder drainage. *World J. Gastrointest. Surg.* **2024**, *16*, 2902–2909.
21. Yoshida, M.; Naitoh, I.; Hayashi, K.; Hori, Y.; Kato, A.; Kachi, K.; Asano, G.; Sahashi, H.; Toyohara, T.; Kuno, K.; et al. Theoretical step approach with 'Three-pillar' device assistance for successful endoscopic transpapillary gallbladder drainage. *PLoS ONE* **2023**, *18*, e0281605.
22. Feretis, C.; Apostolidis, N.; Mallas, E.; Manouras, A.; Papadimitriou, J. Endoscopic drainage of acute obstructive cholecystitis in patients with increased operative risk. *Endoscopy* **1993**, *25*, 392–395.
23. Feretis, C.B.; Manouras, A.J.; Apostolidis, N.S.; Golematis, B.C. Endoscopic transpapillary drainage of gallbladder empyema. *Gastrointest. Endosc.* **1990**, *36*, 523–525.
24. Kalloo, A.N.; Thuluvath, P.J.; Pasricha, P.J. Treatment of high-risk patients with symptomatic cholelithiasis by endoscopic gallbladder stenting. *Gastrointest. Endosc.* **1994**, *40*, 608–610.
25. Tamada, K.; Seki, H.; Sato, K.; Kano, T.; Sugiyama, S.; Ichiyama, M.; Wada, S.; Ohashi, A.; Tomiyama, G.; Ueno, A.; et al. Efficacy of endoscopic retrograde cholecystoendoprosthesis (ERCCE) for cholecystitis. *Endoscopy* **1991**, *23*, 2–3.
26. Itoi, T.; Kawakami, H.; Katanuma, A.; Irisawa, A.; Sofuni, A.; Itokawa, F.; Tsuchiya, T.; Tanaka, R.; Umeda, J.; Ryozaawa, S.; et al. Endoscopic nasogallbladder tube or stent placement in acute cholecystitis: A preliminary prospective randomized trial in Japan (with videos). *Gastrointest. Endosc.* **2015**, *81*, 111–118.
27. Lee, T.H.; Park, D.H.; Lee, S.S.; Seo, D.W.; Park, S.H.; Lee, S.K.; Kim, M.H.; Kim, S.J. Outcomes of endoscopic transpapillary gallbladder stenting for symptomatic gallbladder diseases: A multicenter prospective follow-up study. *Endoscopy* **2011**, *43*, 702–708.
28. Bozic, D.; Ardalic, Z.; Mestrovic, A.; Ivisic, J.B.; Alicic, D.; Zaja, I.; Ivanovic, T.; Bozic, I.; Puljiz, Z.; Bratanic, A. Assessment of Gallbladder Drainage Methods in the Treatment of Acute Cholecystitis: A Literature Review. *Medicina* **2023**, *60*, 5.
29. Toyota, N.; Takada, T.; Amano, H.; Yoshida, M.; Miura, F.; Wada, K. Endoscopic naso-gallbladder drainage in the treatment of acute cholecystitis: Alleviates inflammation and fixes operator's aim during early laparoscopic cholecystectomy. *J. Hepatobiliary Pancreat. Surg.* **2006**, *13*, 80–85.
30. Shin, J.U.; Lee, J.K.; Kim, K.M.; Lee, K.H.; Lee, K.T. Endoscopic naso-gallbladder drainage by using cholangioscopy for acute cholecystitis combined with cholangitis or choledocholithiasis (with video). *Gastrointest. Endosc.* **2012**, *76*, 1052–1055.
31. Widmer, J.; Alvarez, P.; Sharaiha, R.Z.; Gossain, S.; Kedia, P.; Sarkaria, S.; Sethi, A.; Turner, B.G.; Millman, J.; Lieberman, M.; et al. Endoscopic Gallbladder Drainage for Acute Cholecystitis. *Clin. Endosc.* **2015**, *48*, 411–420.
32. Hatanaka, T.; Itoi, T.; Ijima, M.; Matsui, A.; Kurihara, E.; Okuno, N.; Kobatake, T.; Kakizaki, S.; Yamada, M. Efficacy and Safety of Endoscopic Gallbladder Stenting for Acute Cholecystitis in Patients with Concomitant Unresectable Cancer. *Intern. Med.* **2016**, *55*, 1411–1417.

33. Doi, S.; Yasuda, I.; Mabuchi, M.; Iwata, K.; Ando, N.; Iwashita, T.; Uemura, S.; Okuno, M.; Mukai, T.; Adachi, S.; et al. Hybrid procedure combining endoscopic gallbladder lavage and internal drainage with elective cholecystectomy for acute cholecystitis: A prospective pilot study (The BLADE study). *Dig. Endosc.* **2018**, *30*, 501–507.
34. Nakahara, K.; Michikawa, Y.; Morita, R.; Suetani, K.; Morita, N.; Sato, J.; Tsuji, K.; Ikeda, H.; Matsunaga, K.; Watanabe, T.; et al. Endoscopic transpapillary gallbladder stenting using a newly designed plastic stent for acute cholecystitis. *Endosc. Int. Open* **2019**, *7*, E1105–E1114.
35. Sagami, R.; Hayasaka, K.; Ujihara, T.; Nakahara, R.; Murakami, D.; Iwaki, T.; Suehiro, S.; Katsuyama, Y.; Harada, H.; Amano, Y. A New Technique of Endoscopic Transpapillary Gallbladder Drainage Combined with Intraductal Ultrasonography for the Treatment of Acute Cholecystitis. *Clin. Endosc.* **2020**, *53*, 221–229.
36. Nakahara, K.; Morita, R.; Michikawa, Y.; Suetani, K.; Morita, N.; Fujita, A.; Sato, J.; Igarashi, Y.; Ikeda, H.; Matsunaga, K.; et al. Endoscopic Transpapillary Gallbladder Drainage for Acute Cholecystitis After Biliary Self-Expandable Metal Stent Placement. *Surg. Laparosc. Endosc. Percutan Tech.* **2020**, *30*, 416–423.
37. Ridditid, W.; Piyachaturawat, P.; Teeratom, N.; Angsuwatcharakon, P.; Kongkam, P.; Rerknimitr, R. Single-operator peroral cholangioscopy cystic duct cannulation for transpapillary gallbladder stent placement in patients with acute cholecystitis at moderate to high surgical risk (with videos). *Gastrointest. Endosc.* **2020**, *92*, 634–644.
38. Kim, T.H.; Park, D.E.; Chon, H.K. Endoscopic transpapillary gallbladder drainage for the management of acute calculus cholecystitis patients unfit for urgent cholecystectomy. *PLoS ONE* **2020**, *15*, e0240219.
39. Maruta, A.; Iwata, K.; Iwashita, T.; Yoshida, K.; Ando, N.; Toda, K.; Mukai, T.; Shimizu, M. Factors affecting technical success of endoscopic transpapillary gallbladder drainage for acute cholecystitis. *J. Hepatobiliary Pancreat. Sci.* **2020**, *27*, 429–436.
40. Sagami, R.; Hayasaka, K.; Ujihara, T.; Nakahara, R.; Murakami, D.; Iwaki, T.; Suehiro, S.; Katsuyama, Y.; Harada, H.; Nishikiori, H.; et al. Endoscopic transpapillary gallbladder drainage for acute cholecystitis is feasible for patients receiving antithrombotic therapy. *Dig. Endosc.* **2020**, *32*, 1092–1099.
41. Sobani, Z.A.; Sánchez-Luna, S.A.; Rustagi, T. Endoscopic Transpapillary Gallbladder Drainage for Acute Cholecystitis using Two Gallbladder Stents (Dual Gallbladder Stenting). *Clin. Endosc.* **2021**, *54*, 899–902.
42. Maruta, A.; Iwashita, T.; Iwata, K.; Yoshida, K.; Uemura, S.; Mukai, T.; Yasuda, I.; Shimizu, M. Permanent endoscopic gallbladder stenting versus removal of gallbladder drainage, long-term outcomes after management of acute cholecystitis in high-risk surgical patients for cholecystectomy: Multi-center retrospective cohort study. *J. Hepatobiliary Pancreat. Sci.* **2021**, *28*, 1138–1146.
43. Sato, J.; Nakahara, K.; Michikawa, Y.; Morita, R.; Suetani, K.; Sekine, A.; Igarashi, Y.; Kobayashi, S.; Otsubo, T.; Itoh, F. The Influence of Pre-Procedural Imaging and Cystic Duct Cholangiography on Endoscopic Transpapillary Gallbladder Drainage in Acute Cholecystitis. *Diagnostics* **2021**, *11*, 1286.
44. Takano, Y.; Noda, J.; Yamawaki, M.; Azami, T.; Kobayashi, T.; Niiya, F.; Maruoka, N.; Nagahama, M. Endoscopic Transpapillary Gallbladder Drainage in a Patient with Billroth-II Reconstruction. *Intern. Med.* **2021**, *60*, 2613–2615.
45. Storm, A.C.; Vargas, E.J.; Chin, J.Y.; Chandrasekhara, V.; Abu Dayyeh, B.K.; Levy, M.J.; Martin, J.A.; Topazian, M.D.; Andrews, J.C.; Schiller, H.J.; et al. Transpapillary gallbladder stent placement for long-term therapy of acute cholecystitis. *Gastrointest. Endosc.* **2021**, *94*, 742–748.e1.
46. Takano, Y.; Noda, J.; Yamawaki, M.; Azami, T.; Kobayashi, T.; Niiya, F.; Maruoka, N.; Yamagami, T.; Nagahama, M. Permanent endoscopic transpapillary gallbladder drainage using a novel spiral stent (IYO-stent). *DEN Open* **2022**, *2*, e40.
47. Nakahara, K.; Sato, J.; Morita, R.; Michikawa, Y.; Suetani, K.; Igarashi, Y.; Sekine, A.; Kobayashi, S.; Otsubo, T.; Itoh, F. Incidence and management of cystic duct perforation during endoscopic transpapillary gallbladder drainage for acute cholecystitis. *Dig. Endosc.* **2022**, *34*, 207–214.
48. Takahashi, K.; Ohyama, H.; Ouchi, M.; Kan, M.; Nagashima, H.; Iino, Y.; Kusakabe, Y.; Okitsu, K.; Ohno, I.; Takiguchi, Y.; et al. Feasibility of a Single Pigtail Stent Made by Cutting a Nasobiliary Drainage Tube in Endoscopic Transpapillary Gallbladder Stenting for Acute Cholecystitis. *Cureus* **2022**, *14*, e25072.
49. Maruta, A.; Iwashita, T.; Yoshida, K.; Iwata, K.; Shimizu, S.; Shimizu, M. Endoscopic Internalization by Cutting the Endoscopic Transpapillary Nasogallbladder Drainage Tube in Management of Acute Cholecystitis: A Retrospective Multicenter Cohort Study. *J. Clin. Med.* **2022**, *11*, 7415.
50. Ban, T.; Kubota, Y.; Takahama, T.; Tanida, S.; Ando, T.; Joh, T. Cystic duct recanalization with a screw tip stent retriever aids plastic stent delivery in endoscopic transpapillary gallbladder drainage. *Endoscopy* **2023**, *55*, E197–E198.
51. Sato, J.; Nakahara, K.; Michikawa, Y.; Morita, R.; Suetani, K.; Sekine, A.; Igarashi, Y.; Kobayashi, S.; Otsubo, T.; Itoh, F. Clinical outcomes and predictors of technical failure of endoscopic transpapillary gallbladder drainage in acute cholecystitis. *Scand. J. Gastroenterol.* **2023**, *58*, 286–290.

52. Ishii, T.; Kin, T.; Yamazaki, H.; Hama, K.; Nakamura, R.; Iwano, K.; Ando, R.; Toyonaga, H.; Shimizu, T.; Hayashi, T.; et al. Prophylactic endoscopic gallbladder stent placement for cholecystitis after covered metal stent placement for distal biliary obstruction (with video). *Gastrointest. Endosc.* **2023**, *98*, 36–42.e1.
53. Koizumi, K.; Kubota, J.; Masuda, S. Endoscopic transpapillary gallbladder drainage using a tapered endoscopic sheath. *Dig. Endosc.* **2023**, *35*, e115–e116.
54. Maruta, A.; Iwashita, T.; Yoshida, K.; Iwata, K.; Shimizu, S.; Shimizu, M. Endoscopic internalization by cutting versus removal of the endoscopic transpapillary naso-gallbladder drainage tube in preoperative management of acute cholecystitis: A retrospective multicenter cohort study. *J. Hepatobiliary Pancreat. Sci.* **2023**, *30*, 1152–1160.
55. Noda, J.; Takano, Y.; Yamawaki, M.; Azami, T.; Niiya, F.; Nishimoto, F.; Nagahama, M. Endoscopic transpapillary gallbladder drainage using a novel drill dilator. *Endoscopy* **2024**, *56*, E433–E434.
56. Ishikawa, T.; Kumano, R.; Kawashima, H. Endoscopic transpapillary gallbladder drainage using a novel sphincterotome. *Dig. Endosc.* **2025**, *37*, 297–299.
57. Cooper, K.M.; Winkie, M.; Achebe, I.; Devuni, D.; Mehta, S. Endoscopic transpapillary gallbladder drainage is associated with favorable long-term outcomes in patients with advanced liver disease. *Endosc. Int. Open* **2025**, *13*, a24724256.
58. Goda, Y.; Irie, K.; Matsuoka, Y.; Hamaguchi, T.; Anan, H.; Suzuki, Y.; Maeda, S. Endoscopic transpapillary gallbladder drainage for localized acute cholecystitis confined by segmental adenomyomatosis using a novel rotatable sphincterotome. *Endoscopy* **2025**, *57*, E1218–E1219.
59. Kuraishi, Y.; Horiuchi, I.; Nakamura, A. Novel over-the-wire stent exchange technique with a loop cutter for endoscopic transpapillary gallbladder drainage in a complex anatomical case. *Dig. Endosc.* **2025**, *37*, 714–716.
60. Nakahara, K.; Itoi, T.; Sato, J.; Igarashi, Y.; Satta, Y.; Sekine, A.; Niwa, H.; Matsuda, Y.; Kamimukai, S.; Kobayashi, S.; et al. Novel Plastic Stent With an Integrated Delivery System for Endoscopic Transpapillary Gallbladder Stenting: A Preliminary Feasibility Study (With Video). *Dig. Endosc.* **2026**, *38*, e70053.
61. Conway, J.D.; Russo, M.W.; Shrestha, R. Endoscopic stent insertion into the gallbladder for symptomatic gallbladder disease in patients with end-stage liver disease. *Gastrointest. Endosc.* **2005**, *61*, 32–36.
62. Inoue, T.; Okumura, F.; Kachi, K.; Fukusada, S.; Iwasaki, H.; Ozeki, T.; Suzuki, Y.; Anbe, K.; Nishie, H.; Mizushima, T.; et al. Long-term outcomes of endoscopic gallbladder stenting in high-risk surgical patients with calculous cholecystitis (with videos). *Gastrointest. Endosc.* **2016**, *83*, 905–913.
63. Chi, H.; Yan, X.; Tong, W.; Tian, Q. SpyGlass guided PDT for advanced intraductal papillary mucinous neoplasm of the bile tract: A case report and literature review. *Photodiagnosis Photodyn. Ther.* **2024**, *46*, 104098.
64. Yoshida, M.; Naitoh, I.; Hayashi, K.; Jinno, N.; Hori, Y.; Natsume, M.; Kato, A.; Kachi, K.; Asano, G.; Atsuta, N.; et al. Four-Step Classification of Endoscopic Transpapillary Gallbladder Drainage and the Practical Efficacy of Cholangioscopic Assistance. *Gut Liver* **2021**, *15*, 476–485.
65. Hamamura, R.; Kobayashi, M.; Okamoto, R. Endoscopic transpapillary gallbladder drainage using a novel cholangioscope. *Dig. Endosc.* **2025**, *37*, 434–435.
66. Nakahara, K.; Michikawa, Y.; Morita, R.; Suetani, K.; Kobayashi, S.; Otsubo, T.; Itoh, F. Endoscopic transpapillary gallbladder drainage using the balloon occlusion method to advance the guidewire into the cystic duct. *Endoscopy* **2020**, *52*, E339–E341.
67. AbiMansour, J.P.; Law, R.J.; Storm, A.C.; Chandrasekhara, V. Tips and tricks for endoscopic transpapillary gallbladder drainage. *VideoGIE* **2023**, *8*, 474–477.
68. Tyberg, A.; Zerbo, S.; Kahaleh, M.; Sharaiha, R.Z. Digital cholangioscopy-assisted gallbladder drainage: Seeing is accessing. *Endoscopy* **2015**, *47* (Suppl. S1), E417.
69. Kedia, P.; Kuo, V.; Tarnasky, P. Digital cholangioscopy-assisted endoscopic gallbladder drainage. *Gastrointest. Endosc.* **2017**, *85*, 257–258.
70. Pal, P.; Ramchandani, M. Management of ERCP complications. *Best Pract. Res. Clin. Gastroenterol.* **2024**, *69*, 101897.
71. Takenaka, M.; Fukunishi, K.; Takashima, K.; Yamazaki, T.; Kudo, M. Efficacy of an easy loop-forming guidewire in endoscopic transpapillary gallbladder drainage with gallstones impacted in the cystic duct. *Endoscopy* **2022**, *54*, E1078–E1080.
72. Ogawa, O.; Yoshikumi, H.; Maruoka, N.; Hashimoto, Y.; Kishimoto, Y.; Tsunamasa, W.; Kuroki, Y.; Yasuda, H.; Endo, Y.; Inoue, K.; et al. Predicting the success of endoscopic transpapillary gallbladder drainage for patients with acute cholecystitis during pretreatment evaluation. *Can. J. Gastroenterol.* **2008**, *22*, 681–685.
73. Yane, K.; Maguchi, H.; Katanuma, A.; Takahashi, K.; Osanai, M.; Kin, T.; Takaki, R.; Matsumoto, K.; Gon, K.; Matsumori, T.; et al. Feasibility, efficacy, and predictive factors for the technical success of endoscopic nasogallbladder drainage: A prospective study. *Gut Liver* **2015**, *9*, 239–246.

74. Jimbo, H.; Asai, S.; Takeshita, K. Use of small-caliber intraductal balloon catheter for straightening the looped cystic duct during endoscopic transpapillary gallbladder drainage. *Dig. Endosc.* **2020**, *32*, e96–e97.
75. Nakahara, K.; Michikawa, Y.; Sato, J.; Igarashi, Y.; Sekine, A.; Hashimoto, H.; Kobayashi, S.; Otsubo, T.; Itoh, F. Double-guide-wire technique for endoscopic transpapillary gallbladder stenting. *J. Hepatobiliary Pancreat. Sci.* **2022**, *29*, e50–e51.
76. Troncone, E.; Amendola, R.; Moscardelli, A.; De Cristofaro, E.; De Vico, P.; Paoluzi, O.A.; Monteleone, G.; Perez-Miranda, M.; Blanco, G.D.V. Endoscopic Gallbladder Drainage: A Comprehensive Review on Indications, Techniques, and Future Perspectives. *Medicina* **2024**, *60*, 633.
77. Yang, M.J.; Yoo, B.M.; Kim, J.H.; Hwang, J.C.; Baek, N.H.; Kim, S.S.; Lim, S.G.; Shin, S.J.; Cheong, J.Y.; Lee, K.M.; et al. Endoscopic naso-gallbladder drainage versus gallbladder stenting before cholecystectomy in patients with acute cholecystitis and a high suspicion of choledocholithiasis: A prospective randomised preliminary study. *Scand. J. Gastroenterol.* **2016**, *51*, 472–478.
78. Amin, D.; Rau, P.; Cooper, K.M.; Sayegh, L.; Mostafa, N.; Achebe, I.; DeVore, Z.; Gonzalez, D.; Stephanie, S.; Zivny, J.; et al. EUS-guided gallbladder drainage vs dual stent transpapillary gallbladder drainage for management of acute cholecystitis. *Endosc. Int. Open* **2025**, *13*, a25097076.
79. Niiya, F.; Tamai, N.; Yamawaki, M.; Noda, J.; Azami, T.; Takano, Y.; Nishimoto, F.; Nagahama, M. Timing and other factors influencing shortterm outcomes of endoscopic transpapillary gallbladder drainage for acute cholecystitis: A retrospective study. *BMC Gastroenterol.* **2025**, *25*, 469.
80. Cotton, P.B.; Eisen, G.M.; Aabakken, L.; Baron, T.H.; Hutter, M.M.; Jacobson, B.C.; Mergener, K.; Nemcek, A., Jr.; Petersen, B.T.; Petrini, J.L.; et al. A lexicon for endoscopic adverse events: Report of an ASGE workshop. *Gastrointest. Endosc.* **2010**, *71*, 446–454.
81. Khan, M.A.; Atiq, O.; Kubiliun, N.; Ali, B.; Kamal, F.; Nollan, R.; Ismail, M.K.; Tombazzi, C.; Kahaleh, M.; Baron, T.H. Efficacy and safety of endoscopic gallbladder drainage in acute cholecystitis: Is it better than percutaneous gallbladder drainage? *Gastrointest. Endosc.* **2017**, *85*, 76–87.e3.
82. Siddiqui, A.; Kunda, R.; Tyberg, A.; Arain, M.A.; Noor, A.; Mumtaz, T.; Iqbal, U.; Loren, D.E.; Kowalski, T.E.; Adler, D.G.; et al. Three-way comparative study of endoscopic ultrasound-guided transmural gallbladder drainage using lumen-apposing metal stents versus endoscopic transpapillary drainage versus percutaneous cholecystostomy for gallbladder drainage in high-risk surgical patients with acute cholecystitis: Clinical outcomes and success in an International, Multicenter Study. *Surg. Endosc.* **2019**, *33*, 1260–1270.
83. Kawakami, Y.; Suzuki, K.; Akahonai, M.; Miyake, T.; Taniguchi, M.; Nakase, H. Successful treatment with endoscopic transpapillary drainage for gallbladder perforation associated with steroid treatment for interstitial pneumonia (with video). *JGH Open* **2020**, *4*, 1233–1235.
84. Yane, K.; Katanuma, A.; Maguchi, H. Late onset pancreatitis 6 months after endoscopic transpapillary gallbladder stenting for acute cholecystitis. *Dig. Endosc.* **2014**, *26*, 494–495.
85. Manudhane, A.P.; Leupold, M.D.; Shah, H.W.; Shah, R.; Han, S.Y.; Lee, P.J.; Burlen, J.J.; Papachristou, G.I.; Krishna, S.G. A Review on Endoscopic Management of Acute Cholecystitis: Endoscopic Ultrasound-Guided Gallbladder Drainage and Endoscopic Transpapillary Gallbladder Drainage. *Medicina* **2024**, *60*, 212.
86. Maruta, A.; Iwashita, T.; Yoshida, K.; Shimizu, S.; Shimizu, M. Endoscopic management of acute cholecystitis in high-risk surgical patients: A comprehensive review article. *DEN Open* **2026**, *6*, e70133.
87. Inoue, T.; Yoshida, M.; Suzuki, Y.; Kitano, R.; Okumura, F.; Naitoh, I. Long-Term Outcomes of Endoscopic Gallbladder Drainage for Cholecystitis in Poor Surgical Candidates: An Updated Comprehensive Review. *J. Clin. Med.* **2021**, *10*, 4842.
88. Jandura, D.M.; Puli, S.R. Efficacy and safety of endoscopic transpapillary gallbladder drainage in acute cholecystitis: An updated meta-analysis. *World J. Gastrointest. Endosc.* **2021**, *13*, 345–355.
89. Kaura, K.; Bazerbachi, F.; Sawas, T.; Levy, M.J.; Martin, J.A.; Storm, A.C.; Wise, K.B.; Reisenauer, C.J.; Abu Dayyeh, B.K.; Topazian, M.D.; et al. Surgical outcomes of ERCP-guided transpapillary gallbladder drainage versus percutaneous cholecystostomy as bridging therapies for acute cholecystitis followed by interval cholecystectomy. *HPB* **2020**, *22*, 996–1003.
90. Iino, C.; Shimoyama, T.; Igarashi, T.; Aihara, T.; Ishii, K.; Sakamoto, J.; Tono, H.; Fukuda, S. Comparable efficacy of endoscopic transpapillary gallbladder drainage and percutaneous transhepatic gallbladder drainage in acute cholecystitis. *Endosc. Int. Open* **2018**, *6*, E594–E601.
91. Itoi, T.; Takada, T.; Hwang, T.; Endo, I.; Akazawa, K.; Miura, F.; Chen, M.; Jan, Y.; Ker, C.; Wang, H.; et al. Percutaneous and endoscopic gallbladder drainage for acute cholecystitis: International multicenter comparative study using propensity score-matched analysis. *J. Hepatobiliary Pancreat. Sci.* **2017**, *24*, 362–368.
92. Mu, P.; Lin, Y.; Zhang, X.; Lu, Y.; Yang, M.; Da, Z.; Gao, L.; Mi, N.; Li, T.; Liu, Y.; et al. The evaluation of ENGBD versus PTGBD in high-risk acute cholecystitis: A single-center prospective randomized controlled trial. *EClinicalMedicine* **2021**, *31*, 100668.

93. Ali, H.; Shamooun, S.; Bolick, N.L.; Manickam, S.; Sattar, U.; Poola, S.; Mudireddy, P. Outcomes of endoscopic retrograde cholangiopancreatography-guided gallbladder drainage compared to percutaneous cholecystostomy in acute cholecystitis. *Ann. Hepatobiliary Pancreat. Surg.* **2023**, *27*, 56–62.
94. Inoue, T.; Suzuki, Y.; Yoshida, M.; Naitoh, I.; Okumura, F.; Kitano, R.; Haneda, K.; Hayashi, K.; Yoneda, M. Long-Term Impact of Endoscopic Gallbladder Stenting for Calculous Cholecystitis in Poor Surgical Candidates: A Multi-center Comparative Study. *Dig. Dis. Sci.* **2023**, *68*, 1529–1538.
95. Oh, D.; Song, T.J.; Cho, D.H.; Park, D.H.; Seo, D.-W.; Lee, S.K.; Kim, M.-H.; Lee, S.S. EUS-guided cholecystostomy versus endoscopic transpapillary cholecystostomy for acute cholecystitis in high-risk surgical patients. *Gastrointest. Endosc.* **2019**, *89*, 289–298.
96. Higa, J.T.; Sahar, N.; Kozarek, R.A.; La Selva, D.; Larsen, M.C.; Gan, S.-I.; Ross, A.S.; Irani, S.S. EUS-guided gallbladder drainage with a lumen-apposing metal stent versus endoscopic transpapillary gallbladder drainage for the treatment of acute cholecystitis (with videos). *Gastrointest. Endosc.* **2019**, *90*, 483–492.
97. Nishiguchi, K.; Ogura, T.; Okuda, A.; Ueno, S.; Nishioka, N.; Yamada, M.; Matsuno, J.; Ueshima, K.; Yamamoto, Y.; Higuchi, K. Endoscopic gallbladder drainage for acute cholecystitis with high-risk surgical patients between transduodenal and transpapillary stenting. *Endosc. Ultrasound* **2021**, *10*, 448–454.
98. Inoue, T.; Yoshida, M.; Suzuki, Y.; Kitano, R.; Urakabe, K.; Haneda, K.; Okumura, F.; Naitoh, I. Comparison of the long-term outcomes of EUS-guided gallbladder drainage and endoscopic transpapillary gallbladder drainage for calculous cholecystitis in poor surgical candidates: A multicenter propensity score-matched analysis. *Gastrointest. Endosc.* **2023**, *98*, 362–370.
99. Ridditid, W.; Luangsukrer, T.; Piyachaturawat, P.; Teeratorn, N.; Angsuwatcharakon, P.; Kongkam, P.; Rerknimitr, R. Ultimate outcomes of three modalities for non-surgical gallbladder drainage in acute cholecystitis with or without concomitant common bile duct stones. *Ann. Hepatobiliary Pancreat. Surg.* **2022**, *26*, 104–112.
100. Chan, S.M.; Teoh, A.Y.B. Endoscopic Ultrasonography-Guided Gallbladder Drainage. *Gastrointest. Endosc. Clin. N Am.* **2024**, *34*, 523–535.
101. Cucchetti, A.; Binda, C.; Dajti, E.; Sbrancia, M.; Ercolani, G.; Fabbri, C. Trial sequential analysis of EUS-guided gallbladder drainage versus percutaneous cholecystostomy in patients with acute cholecystitis. *Gastrointest. Endosc.* **2022**, *95*, 399–406.
102. Fugazza, A.; Andreozzi, M.; De Marco, A.; Da Rio, L.; Colombo, M.; Spadaccini, M.; Carrara, S.; Giacchetto, M.; Sharma, M.; Craviotto, V.; et al. Endoscopy Ultrasound-Guided Biliary Drainage Using Lumen Apposing Metal Stent in Malignant Biliary Obstruction. *Diagnostics* **2023**, *13*, 2788.
103. Fugazza, A.; Khalaf, K.; Pawlak, K.M.; Spadaccini, M.; Colombo, M.; Andreozzi, M.; Giacchetto, M.; Carrara, S.; Ferrari, C.; Binda, C.; et al. Use of endoscopic ultrasound-guided gallbladder drainage as a rescue approach in cases of unsuccessful biliary drainage. *World J. Gastroenterol.* **2024**, *30*, 70–78.
104. Rımbaş, M.; Tripodi, G.; Rizzatti, G.; Larghi, A. Endoscopic ultrasound in the management of acute cholecystitis: Practical review. *Dig. Endosc.* **2023**, *35*, 809–818.
105. Chavan, R.; Singla, V.; Sundaram, S.; Zanwar, S.; Shah, C.; Sud, S.; Singh, P.; Gandhi, C.; Bhatt, P.; Goel, A.; et al. Outcomes of endoscopic ultrasound-guided gallbladder drainage: A multicenter study from India (with video). *Indian J. Gastroenterol.* **2024**, *43*, 1184–1193.
106. Corral, J.E.; Das, A.; Kröner, P.T.; Gomez, V.; Wallace, M.B. Cost effectiveness of endoscopic gallbladder drainage to treat acute cholecystitis in poor surgical candidates. *Surg. Endosc.* **2019**, *33*, 3567–3577.
107. Hayat, U.; Al Shabeeb, R.; Perez, P.; Hensien, J.; Dwivedi, A.; Sakhawat, U.; Ahmad, O.; Haseeb, M.; Siddiqui, A.A.; Adler, D.G. Safety and adverse events of EUS-guided gallbladder drainage using lumen-apposing metal stents and percutaneous cholecystostomy tubes: A systematic review and meta-analysis. *Gastrointest. Endosc.* **2024**, *99*, 444–448.e1.
108. Katsura, M.; Matsushima, K.; Kato, T.; Bent, C.I.; Kubota, T.; Kubota, T.; Ie, M. Interval cholecystectomy following drainage procedures for acute cholecystitis: Percutaneous transhepatic vs endoscopic transpapillary gallbladder drainage. *J. Gastrointest. Surg.* **2024**, *28*, 1912–1914.
109. Loozen, C.S.; van Santvoort, H.C.; van Duijvendijk, P.; Besselink, M.G.; Gouma, D.J.; Nieuwenhuijzen, G.A.; Kelder, J.C.; Donkervoort, S.C.; van Geloven, A.A.; Kruijt, P.M.; et al. Laparoscopic cholecystectomy versus percutaneous catheter drainage for acute cholecystitis in high risk patients (CHOCOLATE): Multicentre randomised clinical trial. *BMJ* **2018**, *363*, k3965.
110. Pawa, S.; Marya, N.B.; Thiruvengadam, N.R.; Ngamruengphong, S.; Baron, T.H.; Teoh, A.Y.B.; Bent, C.K.; Abidi, W.; Alipour, O.; Amateau, S.K.; et al. American Society for Gastrointestinal Endoscopy guideline on the role of therapeutic EUS in the management of biliary tract disorders: Summary and recommendations. *Gastrointest. Endosc.* **2024**, *100*, 967–979.

111. Singh, S.; Kumar, V.C.S.; Aswath, G.; Khan, H.M.A.; Sapkota, B.; Vinayek, R.; Dutta, S.; Dahiya, D.S.; Inamdar, S.; Mohan, B.P.; et al. Indirect comparison of various lumen-apposing metal stents for EUS-guided biliary and gallbladder drainage: A systematic review and meta-analysis. *Gastrointest. Endosc.* **2024**, *100*, 829–839.e3.
112. Gutkin, E.; Hussain, S.A.; Kim, S.H. The Successful Treatment of Chronic Cholecystitis with SpyGlass Cholangioscopy-Assisted Gallbladder Drainage and Irrigation through Self-Expandable Metal Stents. *Gut Liver* **2012**, *6*, 136–138.
113. Iino, C.; Shimoyama, T.; Igarashi, T.; Aihara, T.; Ishii, K.; Sakamoto, J.; Tono, H.; Fukuda, S. Perforated emphysematous cholecystitis managed by endoscopic transpapillary gallbladder drainage. *Clin. J. Gastroenterol.* **2017**, *10*, 388–391.

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