

Review Article

# Acute cholecystitis grade II–III: Early cholecystectomy vs percutaneous drainage

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## Abstract

Acute cholecystitis is a common inflammatory condition that requires timely diagnosis and appropriate management to prevent complications. Its diagnosis is based on the integration of clinical signs, laboratory findings, and imaging studies, while severity stratification according to the Tokyo Guidelines plays a central role in guiding treatment decisions. Grade II disease is characterized by significant local inflammation, whereas Grade III involves organ dysfunction and is associated with worse clinical outcomes. The pathophysiology begins with cystic duct obstruction, leading to bile stasis, bacterial infection, and progressive inflammation that may result in ischemia, necrosis, and systemic involvement. Early laparoscopic cholecystectomy is considered the gold standard treatment, particularly in Grade II and selected stabilized Grade III patients, as it provides definitive source control, reduces recurrence, and shortens hospital stay. Despite its benefits, the procedure may be technically challenging in inflamed fields and carries a risk of complications, especially in critically ill patients. Percutaneous cholecystostomy represents an important alternative in patients with high surgical risk or hemodynamic instability. It is primarily used as a bridging strategy to stabilize patients before delayed surgery, although it may serve as definitive management in non-operable

individuals. However, this approach is associated with higher recurrence rates, need for reintervention, and increased mortality when compared to early surgery. Comparative evidence consistently favors early cholecystectomy in terms of mortality, hospital stay, and long-term outcomes, although patient heterogeneity requires individualized decision-making. Risk stratification tools, assessment of frailty, and evaluation of organ dysfunction are essential to guide treatment selection. Emerging techniques such as endoscopic ultrasound-guided drainage offer promising alternatives, while current evidence underscores the need for standardized protocols and further research to optimize management strategies in moderate to severe acute cholecystitis.

## Key words

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Acute cholecystitis, laparoscopic cholecystectomy, percutaneous cholecystostomy, severity stratification, gallbladder drainage, surgical timing.

## Introduction

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Acute cholecystitis represents a common clinical condition with significant implications for both emergency and surgical care, primarily due to its potential to progress toward severe complications and recurrence when not managed in a timely and effective manner [1]. In this context, the Tokyo Guidelines 2018 establish laparoscopic cholecystectomy as the standard of care, highlighting the importance of early intervention as a key strategy to reduce complication rates and improve clinical outcomes. This recommendation underscores the central role of prompt and definitive management in the natural history of the disease [2].

The clinical burden becomes more pronounced in cases classified as Grade II–III acute cholecystitis, where morbidity and mortality rates are significantly increased, particularly among high-risk patients who may not be suitable candidates for immediate surgical intervention [3]. In such scenarios, alternative strategies such as percutaneous transhepatic gallbladder drainage have been widely utilized. However, evidence suggests that this approach is associated with higher mortality rates when compared to emergency cholecystectomy, raising important concerns regarding its role as a primary therapeutic option. These findings highlight the complexity of managing moderate to severe disease, especially in vulnerable populations [4].

Within this framework, early and adequate source control remains a cornerstone of treatment. Early laparoscopic cholecystectomy is widely regarded as the optimal therapeutic approach, particularly when performed within the first 72 hours following diagnosis, as it is associated with a reduction in complications and improved recovery. Nevertheless, in patients who are not suitable for immediate surgery due to clinical instability or comorbid conditions, gallbladder drainage - either percutaneous or endoscopic - serves as a necessary temporizing measure aimed at controlling infection and stabilizing the patient [1].

Consequently, a persistent debate remains between definitive surgical management and temporizing drainage strategies. Although laparoscopic cholecystectomy continues to be the gold standard, percutaneous transhepatic gallbladder drainage is frequently considered in high-risk patients despite its association with increased morbidity and mortality compared to emergency cholecystectomy [4, 5]. In parallel, emerging techniques such as endoscopic ultrasound-guided gallbladder drainage have demonstrated promising results, including lower rates of adverse events and shorter hospital stays, positioning this modality as a potentially favorable alternative [1]. Furthermore, evidence from systematic reviews and meta-analyses consistently indicates that cholecystectomy is associated with superior outcomes, including reduced mortality and lower readmission rates,

when compared to percutaneous cholecystostomy [6].

The objective of this review is to compare early laparoscopic cholecystectomy and percutaneous gallbladder drainage in Grade II–III acute cholecystitis, evaluating their indications and outcomes to guide evidence-based clinical decision-making.

## Methodology

This manuscript was developed as a structured narrative review aimed at providing an updated and clinically integrated analysis of the management of moderate to severe acute cholecystitis (Grade II–III), with particular emphasis on the comparative role of early laparoscopic cholecystectomy and percutaneous gallbladder drainage. The review was conducted in accordance with the SANRA (Scale for the Assessment of Narrative Review Articles) framework and followed a predefined methodological protocol established prior to literature screening. Given the clinical heterogeneity of patients with Grade II–III acute cholecystitis, including variability in comorbidity burden, physiological reserve, and severity of organ dysfunction, a narrative interpretative synthesis was selected over quantitative pooling to integrate surgical, interventional, and critical care perspectives into a coherent and clinically applicable framework. Special attention was given to risk stratification, timing of intervention, comparative outcomes, and the role of drainage as either a bridge to surgery or definitive therapy. The objective was to provide a structured synthesis capable of supporting individualized, evidence-based decision-making in complex clinical scenarios.

A comprehensive literature search was conducted in PubMed, Scopus, and Web of Science, including peer-reviewed articles published in English or Spanish between January 2020 and March 2026. The final search was performed in March 2026. This timeframe was selected to capture contemporary advances in minimally

invasive surgery, interventional radiology techniques, endoscopic gallbladder drainage, and updated guideline recommendations. Foundational studies were incorporated when necessary to contextualize pathophysiological mechanisms or historical evolution of management strategies. The search strategy combined MeSH and free-text terms using Boolean operators related to acute cholecystitis, Tokyo Guidelines, Grade II cholecystitis, Grade III cholecystitis, laparoscopic cholecystectomy, early cholecystectomy, emergency cholecystectomy, percutaneous cholecystostomy, percutaneous transhepatic gallbladder drainage, endoscopic gallbladder drainage, and clinical outcomes. Searches were conducted in titles and abstracts as well as indexed subject headings to maximize sensitivity.

The initial search yielded 199 records. After removal of duplicates, 118 articles remained for title and abstract screening. Of these, 88 underwent full-text evaluation, and 42 studies were included in the final synthesis. Selection was performed independently by two authors, with disagreements resolved through discussion and consensus. Exclusion criteria comprised non-peer-reviewed publications, isolated case reports, editorials without outcome data, purely technical descriptions without clinical outcomes, redundant datasets, and studies not directly addressing comparative outcomes, indications, or timing of cholecystectomy or gallbladder drainage in moderate to severe acute cholecystitis.

Eligible studies included randomized controlled trials, large observational cohorts, systematic reviews, meta-analyses, expert consensus statements, and contemporary international guidelines from surgical, gastroenterological, and emergency medicine societies. Priority was assigned to multicenter studies, investigations with clearly defined severity grading according to the Tokyo Guidelines, and research evaluating outcomes such as mortality, morbidity, length of hospital stay, need for reintervention, and

recurrence rates. Extracted variables included study design, patient population and risk profile, severity grade, intervention type (early cholecystectomy versus drainage), timing of intervention, clinical outcomes, complications, and follow-up duration. Methodological quality and internal validity were assessed narratively, considering risk of bias, sample size, heterogeneity of populations, and consistency of outcome definitions. In cases of conflicting evidence, greater interpretative weight was assigned to higher-level evidence and guideline-supported recommendations.

Reference lists of included studies were manually screened to identify additional relevant publications. Given its narrative design, this review is subject to potential selection bias and does not provide pooled quantitative estimates. Artificial intelligence–based tools were used exclusively to assist in literature organization and structural coherence, whereas critical appraisal, synthesis, and final interpretation were conducted independently by the authors to preserve methodological rigor.

### **Diagnostic Criteria and Severity Stratification**

The diagnosis of acute cholecystitis is based on the integration of clinical, laboratory, and imaging findings, which together allow for a structured and reliable identification of the disease. At the clinical level, local signs such as Murphy’s sign and right upper quadrant pain represent key indicators, often serving as the initial cues that prompt further diagnostic evaluation [7]. These findings, when combined with evidence of systemic inflammation, strengthen the diagnostic suspicion. In this context, the presence of fever, leukocytosis, and elevated inflammatory markers supports the diagnosis, with a leukocyte count greater than  $18,000/\text{mm}^3$  being particularly relevant for identifying cases of moderate severity [8]. Complementing these clinical and laboratory features, imaging plays a fundamental role, with ultrasound being the preferred initial modality

due to its high specificity and moderate sensitivity. This technique is especially useful for detecting gallstones, gallbladder wall thickening, and pericholecystic fluid, while computed tomography and magnetic resonance imaging provide additional detail in more complex or uncertain cases [9, 10, 11].

Beyond diagnosis, severity stratification constitutes a critical step in the clinical evaluation of acute cholecystitis. Grade II, or moderate disease, is characterized by marked local inflammation, leukocytosis exceeding  $18,000/\text{mm}^3$ , and a symptom duration longer than 72 hours, reflecting a more advanced stage that often requires urgent intervention [8]. In contrast, Grade III, or severe disease, is defined by the presence of organ dysfunction, including cardiovascular, respiratory, renal, hepatic, neurological, or hematologic impairment, and represents a clinical scenario that demands immediate and aggressive management to prevent further deterioration. This stratification not only reflects the extent of disease progression but also directly influences therapeutic decision-making [12].

In this regard, the clinical relevance of severity grading, particularly as established by the Tokyo Guidelines, lies in its ability to guide treatment selection and prioritize management strategies. For example, patients with Grade II acute cholecystitis are often candidates for early laparoscopic cholecystectomy, whereas those with Grade III disease may require initial stabilization with antibiotics and percutaneous cholecystostomy prior to definitive surgical intervention [13, 14]. Furthermore, these guidelines facilitate the prioritization of surgical urgency and contribute to more efficient resource allocation, which is especially important in healthcare settings with limited access to operating rooms or specialized care [15].

However, despite their clinical utility, the application of the Tokyo Guidelines in real-world practice is subject to variability.

Adherence may be influenced by factors such as patient comorbidities, prolonged symptom duration, and the presence of acute renal dysfunction, all of which can lead to deviations from recommended management pathways [14]. Additionally, while the guidelines demonstrate high sensitivity for detecting acute inflammation, their relatively low specificity when compared to final pathological findings may result in over-treatment in certain cases [15]. In specific populations, such as super-elderly patients, the guidelines can still be safely applied; however, careful clinical assessment remains essential to avoid underestimating perioperative risks and to ensure appropriate individualized management [8].

### **Pathophysiology and Clinical Progression**

The pathophysiology of acute cholecystitis begins with obstruction of the cystic duct, which constitutes the primary event leading to bile stasis and increased intraluminal pressure, thereby creating the conditions necessary for the development of inflammation [1]. As bile becomes stagnant, it serves as a favorable medium for bacterial proliferation, resulting in secondary infection and amplification of the inflammatory response [12]. With ongoing inflammation, vascular compromise may occur, leading to ischemia and subsequent necrosis of the gallbladder wall, which can further progress to gangrene or perforation if not promptly addressed [3, 16]. In more advanced stages, this localized inflammatory process may extend beyond the gallbladder, triggering a systemic inflammatory response that significantly increases the risk of sepsis and clinical deterioration [12].

These pathophysiological mechanisms manifest differently depending on disease severity, particularly when comparing Grade II and Grade III acute cholecystitis. Grade III disease is characterized by a more intense inflammatory response and a substantially higher risk of severe complications, including gangrene and perforation, in contrast to Grade II cases. This

increased severity is reflected in clinical outcomes, as patients with Grade III cholecystitis exhibit higher mortality rates and lower success rates with interventions such as percutaneous transhepatic gallbladder drainage when compared to those with moderate disease. These differences underscore the importance of early recognition and appropriate stratification of disease severity [3].

The impact of delayed or inadequate intervention further accentuates the progression of the disease and its associated risks. Early laparoscopic cholecystectomy is recommended within the first 72 hours following diagnosis, as timely intervention is associated with a reduction in complications and improved outcomes, whereas delays have been linked to increased morbidity and mortality [1, 17]. Although percutaneous transhepatic gallbladder drainage may serve as a bridging strategy in selected patients, its use as a definitive treatment in severe cases has been associated with higher mortality, particularly in Grade III disease [3, 18]. In contrast, a proactive approach with emergency laparoscopic cholecystectomy in high-volume centers has demonstrated safety and effectiveness even in severe presentations, contributing to lower rates of conversion to open surgery and a reduction in complications [19].

### **Early Laparoscopic Cholecystectomy**

Early laparoscopic cholecystectomy is defined as the performance of surgical intervention within 72 hours of hospital admission, although an extended window of up to 7 days may be considered acceptable in selected cases depending on clinical circumstances [20, 21]. This approach has been consistently associated with shorter hospital stays and reduced healthcare costs when compared to delayed surgical management, reinforcing its role as a preferred strategy in appropriate patients [22].

A central component of safe laparoscopic cholecystectomy is the achievement of the critical view of safety, which is crucial for

preventing bile duct injuries, most commonly resulting from misidentification of anatomical structures [20]. When this view cannot be safely obtained due to severe inflammation or distorted anatomy, dissection strategies should be modified to minimize risk, including avoidance of the hepatocystic triangle and the adoption of alternative techniques. In such scenarios, bailout strategies become particularly relevant. Subtotal cholecystectomy and the fundus-first approach represent viable alternatives when standard dissection is unsafe, allowing for completion of the procedure while reducing the risk of major complications. Although subtotal cholecystectomy has been associated with fewer complications compared to conversion to open surgery, it carries an increased risk of postoperative bile leakage [20, 23].

The indications for early laparoscopic cholecystectomy are well established in patients with Grade II acute cholecystitis and extend to selected cases of Grade III disease, provided that patients are hemodynamically stabilized and that adequate surgical expertise is available. In this context, the decision to proceed with early surgery should be individualized, considering patient-specific factors such as comorbidities and overall physiological status [20, 22]. When appropriately applied, early laparoscopic cholecystectomy offers significant clinical advantages, including definitive source control, which reduces the risk of recurrent cholecystitis and hospital readmissions. Additionally, it has been associated with shorter overall hospital stays and improved postoperative quality of life when compared to delayed surgical approaches [20, 22, 24].

Despite these benefits, the procedure is not without limitations. The presence of intense inflammation and altered anatomy increases the technical difficulty of the operation, which in turn elevates the risk of conversion to open surgery and complications such as bile duct injury and intraoperative bleeding. Nevertheless, even in these challenging scenarios, early

laparoscopic cholecystectomy has demonstrated a low rate of bailout procedures and is considered a safe and effective option when performed by experienced surgical teams [18, 26].

### **Percutaneous Cholecystostomy**

Percutaneous cholecystostomy can be performed through different technical approaches, each with specific advantages and limitations that influence procedural selection. The transhepatic approach involves catheter insertion through the liver parenchyma, which may reduce the risk of bile leakage by providing a more stable tract; however, it is technically more demanding and may increase the risk of bleeding complications. In contrast, the transperitoneal approach avoids traversing the liver, potentially reducing bleeding risk, although it may be associated with a higher likelihood of bile leakage and peritoneal contamination [27].

The indications for percutaneous cholecystostomy are primarily centered on patients with elevated surgical risk or clinical instability. Individuals classified as American Society of Anesthesiologists (ASA) III–IV are frequently considered candidates due to their increased risk of perioperative complications. Similarly, the procedure is indicated in patients with hemodynamic instability or organ failure, particularly those requiring intensive care support, in whom immediate surgical intervention may be associated with significant morbidity and mortality [28]. In this context, percutaneous cholecystostomy also serves as a bridge to surgery, allowing for clinical stabilization and optimization prior to delayed cholecystectomy [13].

From a clinical perspective, percutaneous cholecystostomy fulfills both temporary and, in selected cases, definitive therapeutic roles. As a bridging strategy, it enables initial control of infection and inflammation, facilitating subsequent delayed cholecystectomy, which has been associated with improved outcomes

compared to its use as a standalone treatment. Conversely, in patients deemed non-operable, it may be employed as definitive management; however, this approach has been linked to higher mortality rates compared to patients who ultimately undergo surgical intervention [28, 29]. Additionally, the procedure carries inherent limitations, including catheter-related complications such as dislodgment and obstruction, as well as recurrence of cholecystitis. Furthermore, incomplete source control may lead to persistent infection and an increased likelihood of hospital readmissions [4, 30].

When considering comparative effectiveness, alternative and definitive treatment strategies demonstrate important differences in outcomes. Endoscopic ultrasound-guided gallbladder drainage has emerged as a promising modality, showing superior results compared to percutaneous cholecystostomy, including lower complication rates and reduced need for repeat interventions [31, 32]. Moreover, emergency cholecystectomy has been associated with lower postoperative mortality and shorter hospital stays compared to percutaneous drainage, suggesting that surgical management may remain preferable even in certain high-risk populations when feasible [4].

### **Comparative Evidence and Outcomes**

Comparative evidence evaluating early laparoscopic cholecystectomy and percutaneous transhepatic gallbladder drainage demonstrates important differences in clinical outcomes, particularly in terms of mortality and morbidity. Early laparoscopic cholecystectomy has been associated with lower mortality rates, with meta-analytic data reporting a significantly higher mortality risk in patients managed with percutaneous drainage, with a hazard ratio of 3.68, despite the latter being a less invasive approach. However, this survival benefit must be interpreted alongside the procedural risks of surgery, as early laparoscopic cholecystectomy is associated with a higher incidence of

complications, including bile duct injury and postoperative adverse events, particularly in critically ill patients admitted to intensive care units [4, 18].

In addition to differences in mortality, length of hospital stay represents a key outcome in the comparison of these strategies. Patients undergoing early laparoscopic cholecystectomy generally experience shorter hospitalizations, whereas those treated with percutaneous transhepatic gallbladder drainage often require prolonged stays due to the need for subsequent interventions and ongoing management [4, 6]. Within the spectrum of drainage techniques, endoscopic ultrasound-guided gallbladder drainage has demonstrated advantages over percutaneous approaches, including shorter hospital stays and fewer adverse events, supporting its role as a preferable alternative when available [2, 31].

The need for definitive treatment further distinguishes these approaches. Early laparoscopic cholecystectomy provides definitive source control, thereby reducing the risk of recurrence and minimizing the need for additional interventions [6]. In contrast, percutaneous transhepatic gallbladder drainage, while effective in controlling acute inflammation, frequently necessitates further procedures, such as interval cholecystectomy, to prevent recurrence and achieve definitive management [2, 34].

From an economic perspective, although early laparoscopic cholecystectomy involves higher initial costs related to surgical intervention, it may be more cost-effective over time due to reduced readmission rates and a lower need for additional procedures [6]. Conversely, drainage strategies, including both percutaneous and endoscopic approaches, while less invasive initially, may result in increased overall healthcare utilization due to the need for ongoing management, potential complications, and repeated interventions [2, 31].

The interpretation of these findings must consider the heterogeneity of patient populations, as individual factors such as comorbidities, physiological reserve, and surgical risk play a decisive role in determining outcomes [4, 18]. In this context, endoscopic ultrasound-guided gallbladder drainage is emerging as a favorable non-surgical alternative for high-risk patients, offering lower complication rates and improved long-term outcomes compared to percutaneous drainage, thereby expanding the therapeutic options available for this complex group of patients [31, 33].

### **Risk Stratification and Patient Selection**

Risk stratification in acute cholecystitis is based on a comprehensive assessment that integrates clinical status, comorbidities, and physiological reserve through validated tools. The American Society of Anesthesiologists classification is widely used to evaluate preoperative physical status and predict surgical risk, with lower scores generally identifying patients who are more suitable candidates for early laparoscopic cholecystectomy [13, 24]. In parallel, the Charlson Comorbidity Index provides an estimate of the burden of chronic disease, where higher scores are associated with an increased likelihood of postoperative complications and may favor less invasive approaches such as percutaneous drainage. In critically ill patients, the Acute Physiology and Chronic Health Evaluation II score is particularly useful for assessing disease severity and predicting outcomes, especially in identifying those who may not tolerate surgical intervention [17].

Beyond these scoring systems, the evaluation of frailty and functional reserve represents a key component in clinical decision-making. Frailty has been consistently associated with higher rates of postoperative complications and mortality following cholecystectomy, suggesting that percutaneous drainage may represent a safer alternative in this population [34]. Additionally, distinguishing between reversible and irreversible organ dysfunction is essential, as

patients with reversible conditions may benefit from early surgical management, whereas those with irreversible dysfunction may require alternative strategies [4].

Within this context, specific clinical criteria can guide the selection of therapeutic approach. Hemodynamic stability is a fundamental requirement for early laparoscopic cholecystectomy, as stable patients have demonstrated lower mortality and morbidity compared to those undergoing delayed intervention [4, 18]. Likewise, patients with well-controlled comorbidities, including chronic conditions such as heart failure, are more likely to tolerate surgery and achieve favorable outcomes [35]. In contrast, the presence of severe sepsis or multiorgan failure favors the use of percutaneous drainage due to the elevated surgical risk [4]. This approach is also particularly relevant in patients with poor physiological reserve, such as elderly or frail individuals, in whom less invasive management may reduce procedural risk [23, 34].

The integration of these variables has led to the development of individualized, patient-centered decision models that aim to optimize management strategies. Tools such as the Chole-risk score and CHOLE-POSSUM incorporate clinical, physiological, and operative parameters to stratify patients into risk categories, thereby guiding the choice between early surgical intervention and alternative treatments [17].

### **Timing and Sequential Management Strategies**

The management of acute cholecystitis may follow either an immediate surgical approach or a staged strategy, depending on patient condition and operative risk. Immediate laparoscopic cholecystectomy is generally preferred in patients who can tolerate surgery, as it has been associated with lower mortality and readmission rates when compared with percutaneous cholecystostomy alone. In contrast, staged management is often reserved for high-risk

patients who are not suitable candidates for immediate operative intervention. In these cases, percutaneous cholecystostomy serves as a bridging measure that provides temporary decompression, symptom relief, and clinical stabilization [6, 13].

Within this staged approach, the timing of interval laparoscopic cholecystectomy after percutaneous cholecystostomy remains a subject of ongoing debate. Some studies suggest that performing cholecystectomy within 4 to 8 weeks after drainage may represent an optimal balance between minimizing complications and reducing the need for additional biliary interventions [36]. However, other evidence has shown no significant difference in outcomes between earlier procedures performed within 30 days and later interventions carried out after 30 days [32]. In addition, the optimal interval may also be influenced by pathological findings, with some data indicating that a 9- to 10-week delay may be more appropriate for specific pathological profiles [37].

Catheter management is another relevant component of staged treatment, as the duration of catheter placement may influence clinical outcomes. Prolonged catheterization beyond one month has been associated with increased risks of pancreatitis and jaundice, which highlights the importance of timely reassessment [38]. In general, catheter removal is considered when symptoms have resolved and there is no evidence of persistent infection. Alongside drainage, antibiotic therapy remains a central aspect of management, particularly after percutaneous cholecystostomy, and its duration is usually guided by clinical response with the aim of preventing recurrent infection [13].

Close monitoring of the patient's clinical response is essential in order to detect potential failure of drainage and determine the appropriate time to proceed toward definitive treatment. Persistent symptoms, ongoing fever, and abnormal laboratory markers of infection are

important indicators of inadequate drainage or unresolved disease. Accordingly, the transition from temporizing management with percutaneous cholecystostomy to definitive laparoscopic cholecystectomy depends on clinical stabilization, resolution of acute inflammatory findings, and a careful reassessment of surgical readiness considering comorbidities and overall patient status [13, 39, 40].

### **Guidelines, Controversies, and Future Directions**

Current guidelines and recommendations provide a structured framework for the management of acute cholecystitis, particularly in moderate and severe cases. For Grade II disease, the Tokyo Guidelines recommend early laparoscopic cholecystectomy as the preferred treatment, emphasizing its safety and efficacy regardless of symptom duration [19, 41]. This recommendation is supported by evidence demonstrating that early intervention is associated with shorter hospital stays and fewer complications when compared to delayed cholecystectomy [18]. In contrast, for patients with Grade III acute cholecystitis who present with clinical instability, percutaneous cholecystostomy is recommended as a bridging strategy, allowing for initial control of infection and stabilization prior to definitive surgical management [12, 13].

Despite these recommendations, several areas of controversy persist in clinical practice. One of the main points of debate is the role of percutaneous drainage as a definitive therapy. Although it is considered a viable option in high-risk patients, its long-term effectiveness remains uncertain, and some studies suggest that it should be reserved for patients who do not respond to conservative treatment or who are not candidates for immediate surgery [13, 18]. Another unresolved issue concerns the optimal timing of surgery following patient stabilization. While early surgical intervention is generally favored, the precise timing remains variable and is often

influenced by patient condition and institutional protocols [25, 41].

In parallel with these challenges, emerging alternatives and technological advances are expanding the therapeutic landscape. Endoscopic ultrasound-guided gallbladder drainage has emerged as a minimally invasive option for patients with high surgical risk, demonstrating high success rates and low incidence of adverse events, which supports its use in selected cases [17]. Additionally, advances in minimally invasive surgery, such as the use of intraoperative indocyanine green cholangiography, are improving surgical precision and contributing to a reduction in complications, particularly in complex cases [19].

Given the heterogeneity of patient populations and treatment approaches, there is a growing consensus on the need for standardized management protocols and high-quality clinical trials to better define optimal strategies in severe acute cholecystitis. This includes further evaluation of emerging techniques and refinement of surgical timing to improve clinical outcomes and ensure more consistent, evidence-based care [17, 42].

## Conclusions

The management of acute cholecystitis Grade II–III relies on accurate diagnostic integration and severity stratification, as these directly determine therapeutic pathways. The combination of clinical signs, laboratory findings, and imaging allows reliable diagnosis, while the Tokyo Guidelines enable differentiation between moderate and severe disease, guiding decisions toward early laparoscopic cholecystectomy in Grade II and staged or supportive approaches in unstable Grade III patients.

Early laparoscopic cholecystectomy remains the most effective definitive treatment, providing superior outcomes in terms of mortality, recurrence, hospital stay, and long-term cost-

effectiveness compared to percutaneous drainage. Although technically more demanding and associated with procedural risks, it ensures definitive source control, whereas percutaneous cholecystostomy is primarily a temporizing strategy with higher rates of recurrence, reintervention, and mortality when used as definitive management.

Optimal management requires individualized, risk-adapted decision-making that integrates clinical severity, comorbidities, physiological reserve, and timing of intervention. In this context, percutaneous drainage plays a critical role in unstable or high-risk patients, while emerging techniques such as endoscopic ultrasound-guided drainage expand therapeutic options. Nevertheless, variability in practice and ongoing controversies highlight the need for standardized protocols and further high-quality evidence to refine treatment strategies in severe acute cholecystitis.

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