Jurnal Kesehatan, Sains, dan Teknologi (JAKASAKTI)
Vol. 5 No. 2 August 2026
Available online at https://jurnal.undhirabali.ac.id/index.php/jakasakti/index

Research Article e-ISSN: 2963-0940

Acute Cholecystitis Current Evidence on Diagnosis Severity Assessment and Therapeutic Management

Muhammad Iqbal Daniswara[1*], Esha Hawayani[2], Lalu Maji'urrizki Muharzami[3], I Putu Reza Wedangga[4]

[1,2,3,4]Medical Student, Faculty of Medicine and Health Sciences, University of Mataram, Indonesia

(*) Corresponding Author: iqbaldswara2507@gmail.com

Article info

Keywords:
acute cholecystitis, diagnosis, severity assessment, laparoscopic cholecystectomy, gallbladder drainage

Abstract

This narrative review aimed to synthesize current evidence on the diagnosis, severity assessment, and management of acute cholecystitis, with emphasis on contemporary imaging strategies, early laparoscopic cholecystectomy, and alternative interventions for patients with increased operative risk. Literature was searched through PubMed/MEDLINE and Google Scholar for publications from August 2016 to August 2026 using combinations of terms related to acute cholecystitis, ultrasonography, computed tomography, magnetic resonance imaging, hepatobiliary scintigraphy, Tokyo Guidelines, severity grading, laparoscopic cholecystectomy, early cholecystectomy, gallbladder drainage, and percutaneous or endoscopic drainage. The reviewed evidence indicates that ultrasonography remains an important initial imaging modality, although its diagnostic sensitivity is moderate and may vary according to clinical and operator-related factors. Computed tomography, magnetic resonance imaging, and hepatobiliary scintigraphy provide complementary diagnostic information when ultrasonography is inconclusive or complications are suspected. Severity assessment supports clinical risk stratification but should be interpreted together with comorbidities, physiological status, and operative risk. Early laparoscopic cholecystectomy remains the principal definitive treatment for suitable surgical candidates and is associated with shorter hospitalization without a clear increase in major postoperative complications. For patients at increased operative risk or unsuitable for immediate surgery, gallbladder drainage provides an alternative source-control strategy, with endoscopic ultrasound-guided drainage representing an increasingly supported option in experienced centers. Overall, management should be individualized according to disease severity, patient risk, anatomical considerations, and available expertise.

INTRODUCTION

Acute cholecystitis (AC) is one of the most common acute biliary disorders and represents an important cause of emergency surgical admission. Most cases are associated with gallstone disease, which affects a substantial proportion of the global population and continues to impose considerable clinical and healthcare burdens. A recent systematic review and meta-analysis involving more than 32 million participants estimated the global prevalence of gallstones at approximately 6.1%, with higher prevalence observed among

women and older individuals (Wang *et al*., 2024). AC develops predominantly when gallstone obstruction of the cystic duct leads to gallbladder distension, inflammation, and, in some cases, secondary infection or ischemic complications (Mencarini *et al*., 2024). In emergency care, AC may account for up to 9% of hospital admissions related to acute abdominal pain, emphasizing the importance of prompt recognition and appropriate management (Wilson *et al*., 2024).

The diagnosis of AC requires integration of clinical manifestations, systemic inflammatory findings, and imaging because no single clinical or laboratory parameter is sufficiently reliable to establish the diagnosis in all patients. The Tokyo Guidelines incorporate local signs of inflammation, systemic inflammatory responses, and characteristic imaging findings into the diagnostic framework for AC (Okamoto *et al*., 2018). Ultrasonography remains an important initial imaging modality because it can demonstrate gallstones, gallbladder wall thickening, pericholecystic fluid, gallbladder distension, and a sonographic Murphy sign (Khan *et al*., 2026). However, its diagnostic performance varies among studies; a systematic review and meta-analysis of 40 studies involving 8,652 patients reported pooled sensitivity and specificity of 71% and 85%, respectively (Huang *et al*., 2023). Comparative evidence also indicates that computed tomography may provide higher sensitivity than ultrasonography in selected patients, whereas magnetic resonance imaging and hepatobiliary scintigraphy may provide additional diagnostic information when initial imaging is inconclusive (Childs *et al*., 2024).

Beyond establishing the diagnosis, assessment of disease severity is essential because the clinical course of AC ranges from uncomplicated inflammation to severe disease accompanied by systemic organ dysfunction. The Tokyo Guidelines classify AC into Grade I, Grade II, and Grade III according to the extent of local inflammation and the presence of organ dysfunction, providing a framework for estimating disease severity and guiding treatment decisions (Okamoto *et al*., 2018). Subsequent validation studies have demonstrated that higher severity grades are associated with clinically relevant outcomes, including increased mortality, longer hospital stays, greater difficulty during cholecystectomy, and higher healthcare costs (Okamoto *et al*., 2018). However, severity grading should not be considered in isolation when determining management. Patient-related factors, including age, comorbidities, physiological condition, and overall operative risk, may also influence treatment selection and perioperative decision-making, particularly among patients with severe or complicated AC (Fugazzola *et al*., 2024).

Management of AC has increasingly shifted toward early definitive treatment, with laparoscopic cholecystectomy serving as the principal therapeutic strategy for patients who are suitable surgical candidates. The World Society of Emergency Surgery recommends early laparoscopic cholecystectomy whenever feasible, including in selected elderly and high-risk patients, while emphasizing that patients who are genuinely unsuitable for surgery require alternative strategies (Pisano *et al*., 2020). Evidence from recent randomized controlled trials further supports early laparoscopic cholecystectomy, with a 2026 meta-analysis of 21 randomized trials involving 1,731 patients demonstrating a significantly shorter total hospital stay without significant differences in conversion to open surgery, common bile duct injury, or overall postoperative complications compared with delayed surgery (Khan *et al*., 2026). Nevertheless, the optimal strategy for patients with severe physiological impairment or very high operative risk remains more complex, and gallbladder drainage, including percutaneous and endoscopic approaches, may have a role in selected patients (Fugazzola *et al*., 2024).

Despite established diagnostic criteria and advances in surgical management, several clinical uncertainties remain in the management of AC. Variability in the diagnostic performance of imaging modalities may complicate evaluation when clinical findings are

equivocal, while severity grading alone may not fully capture the heterogeneity of operative risk among individual patients (Huang *et al*., 2023). In addition, the management of high-risk patients, the selection of patients who may benefit from gallbladder drainage, and the integration of surgical and endoscopic interventions continue to represent areas of evolving evidence (Fugazzola *et al*., 2024). Recent literature therefore supports the need for an integrated synthesis that considers diagnosis, severity assessment, and therapeutic decision-making within the contemporary clinical spectrum of AC (Mencarini *et al*., 2024). This narrative review aims to synthesize current evidence regarding the diagnosis, severity assessment, and therapeutic management of acute cholecystitis, with particular emphasis on contemporary diagnostic strategies, severity-based clinical decision-making, early laparoscopic cholecystectomy, and alternative interventions for patients who are not suitable for immediate surgery.

METHODS

This narrative review examined current evidence on the diagnosis, severity assessment, and management of acute cholecystitis, with particular emphasis on contemporary imaging strategies, severity-based clinical decision-making, early laparoscopic cholecystectomy, and alternative interventions for patients with increased operative risk. PubMed/MEDLINE and Google Scholar were searched for English-language publications published from August 2016 to August 2026, with the final search conducted in August 2026. Search terms included *acute cholecystitis*, *acute calculous cholecystitis*, *cholecystitis diagnosis*, *ultrasonography*, *computed tomography*, *magnetic resonance imaging*, *hepatobiliary scintigraphy*, *Tokyo Guidelines*, *severity grading*, *laparoscopic cholecystectomy*, *early cholecystectomy*, *gallbladder drainage*, *percutaneous cholecystostomy*, and *endoscopic gallbladder drainage*. Reference lists of relevant publications were additionally screened to identify important studies that may not have been retrieved through the primary database search. Earlier publications were retained when they provided landmark evidence, established diagnostic criteria, or foundational recommendations that remained clinically relevant.

Eligible publications included randomized controlled trials, observational studies, diagnostic accuracy studies, systematic reviews and meta-analyses, narrative reviews, clinical practice guidelines, consensus statements, and relevant clinical or public health publications addressing the diagnosis, severity assessment, treatment, outcomes, or clinical decision-making in acute cholecystitis. Studies were excluded when they were unrelated to the objectives of the review, focused primarily on chronic cholecystitis or other biliary conditions without relevant data on acute cholecystitis, lacked sufficient clinical information, or were duplicate publications. Publications involving both calculous and acalculous acute cholecystitis were considered when their findings were relevant to the clinical questions addressed in this review. Titles and abstracts were screened for relevance, followed by full-text assessment of potentially relevant publications. Particular attention was given to evidence concerning diagnostic accuracy, severity classification, timing of surgery, perioperative outcomes, and management strategies for patients who were considered unsuitable for immediate surgery.

The selected evidence was synthesized narratively according to the major clinical domains of acute cholecystitis, including diagnostic evaluation, imaging performance, severity assessment, early laparoscopic cholecystectomy, and gallbladder drainage or other alternative interventions. Findings were compared across study designs and patient populations to identify areas of consistency, variation, and uncertainty in contemporary

clinical management. Differences in diagnostic performance, treatment timing, operative risk, and reported clinical outcomes were considered during interpretation, together with limitations related to study heterogeneity, retrospective designs, differences in guideline recommendations, and variations in healthcare settings. No formal systematic-review registration, quantitative meta-analysis, or statistical pooling was performed because the objective was to provide a clinically oriented narrative synthesis of the current evidence.

RESULTS AND DISCUSSION

Results

The literature review identified studies addressing the diagnosis, imaging evaluation, severity assessment, surgical timing, and alternative management of acute cholecystitis. The selected studies included systematic reviews and meta-analyses, observational studies, diagnostic accuracy studies, clinical reviews, and randomized controlled trials published between 2023 and 2026. The reviewed evidence mainly evaluated the diagnostic performance of ultrasonography and other imaging modalities, the relationship between severity classification and clinical findings, early versus delayed laparoscopic cholecystectomy, and gallbladder drainage in high-risk patients (Huang *et al*., 2023; Park *et al*., 2023; Mencarini *et al*., 2024; Fugazzola *et al*., 2024).

The diagnostic studies reported variable performance across imaging modalities. Ultrasonography demonstrated moderate sensitivity with relatively high specificity, while computed tomography, magnetic resonance imaging, and hepatobiliary scintigraphy provided additional diagnostic information in selected patients (Huang *et al*., 2023; Childs *et al*., 2024; Oliveira *et al*., 2024; Wilson *et al*., 2024). Other studies evaluated severity classification and treatment strategies, including early laparoscopic cholecystectomy and gallbladder drainage procedures in patients at increased operative risk (Park *et al*., 2023; Cirocchi *et al*., 2023; Khan *et al*., 2026). The characteristics and principal findings of the selected studies are summarized in Table 1.

Table 1. Selected Studies on the Diagnosis and Management of Acute Cholecystitis

Author, year	Study design	Population	Main focus	Main finding
Boregowda *et al*., 2023	Systematic review and meta-analysis	11 studies; 1,136 patients	EUS-guided versus percutaneous gallbladder drainage	EUS-guided drainage showed higher technical success, fewer adverse events, and fewer reinterventions than percutaneous drainage.
Cirocchi *et al*., 2023	Systematic review and meta-analysis	17 studies; 783,672 patients	High-risk acute cholecystitis	Percutaneous gallbladder drainage did not demonstrate lower morbidity compared with emergency cholecystectomy.
Huang *et al*., 2023	Systematic review and meta-analysis	40 studies; 8,652 patients	Diagnostic performance of ultrasonography	Ultrasonography had pooled sensitivity of 71% and specificity of 85% for acute cholecystitis.
Joyce *et al*., 2023	Scoping review	46 studies involving	Point-of-care ultrasonography	POCUS demonstrated variable diagnostic accuracy across studies evaluating acute cholecystitis.

Author, year	Study design	Population	Main focus	Main finding
		adults evaluated with POCUS		
Park *et al*., 2023	Retrospective observational study	217 patients undergoing cholecystectomy	Severity grading and pathological findings	Grade III disease was associated with greater inflammatory and organ dysfunction-related laboratory abnormalities, while histopathological severity did not differ significantly between grades.
Tyberg *et al*., 2023	Multicenter observational study	139 patients with acute cholecystitis	EUS-guided versus percutaneous drainage	EUS-guided drainage was associated with shorter symptom resolution, hospital stay, and interval to cholecystectomy.
Chavan *et al*., 2024	Multicenter retrospective study	29 patients	EUS-guided gallbladder drainage	Technical success was 96.55% and clinical success was 82.75%.
Childs *et al*., 2024	Systematic review and meta-analysis	Comparative imaging studies	Ultrasound, CT, MRI, and hepatobiliary scintigraphy	Different imaging modalities demonstrated variable diagnostic performance, with complementary roles in suspected acute cholecystitis.
Fugazzola *et al*., 2024	Clinical review	International literature	Diagnosis and treatment	Early laparoscopic cholecystectomy was identified as the principal treatment for appropriate surgical candidates, with drainage considered in selected high-risk patients.
Mencarini *et al*., 2024	Narrative review	International literature	Diagnosis and treatment	Diagnosis required integration of clinical, laboratory, and imaging findings, while treatment selection depended on disease severity and patient characteristics.
Oliveira *et al*., 2024	Systematic review and meta-analysis	64 studies	CT versus ultrasound	CT and ultrasound demonstrated comparable overall diagnostic performance, with sensitivity of 83.9% and 79.0%, respectively, in head-to-head comparisons.
Wilson *et al*., 2024	Systematic review and meta-analysis	10 studies; 2,356 patients	Emergency physician-performed POCUS	POCUS showed pooled sensitivity of 70.9% and specificity of 94.4% for acute cholecystitis.

Author, year	Study design	Population	Main focus	Main finding
Pawa *et al*., 2025	Propensity-score-matched observational study	114 high-risk patients	EUS-guided versus percutaneous drainage	EUS-guided drainage had similar technical success and was associated with fewer procedures and complications.
Hu *et al*., 2026	Systematic review and network meta-analysis	17 trials; 2,254 patients	Gallbladder drainage techniques	EUS-guided and percutaneous drainage demonstrated different technical and clinical success profiles compared with transpapillary drainage.
Khan *et al*., 2026	Meta-analysis of randomized controlled trials	21 RCTs; 1,731 patients	Early versus delayed laparoscopic cholecystectomy	Early laparoscopic cholecystectomy reduced total hospital stay without significant differences in conversion to open surgery, common bile duct injury, or overall postoperative complications.

The selected studies primarily addressed four areas: diagnostic imaging, severity assessment, timing of laparoscopic cholecystectomy, and gallbladder drainage in high-risk patients. Diagnostic studies evaluated ultrasonography, POCUS, CT, MRI, and hepatobiliary scintigraphy, while therapeutic studies compared early surgery with delayed intervention and evaluated different gallbladder drainage techniques.

Discussion

The findings of this narrative review indicate that contemporary management of acute cholecystitis depends on the integration of diagnostic imaging, severity assessment, timing of definitive surgery, and selection of alternative drainage strategies for patients who are not suitable for immediate cholecystectomy. Recent evidence does not support relying on a single diagnostic modality or a single severity parameter, because the clinical presentation and performance of imaging techniques vary between patients and clinical settings. Ultrasonography remains an important first-line investigation because of its accessibility and ability to demonstrate gallstones and inflammatory changes, but its diagnostic sensitivity is not sufficient to exclude acute cholecystitis in every patient. Comparative evidence has shown that CT may provide similar or somewhat higher sensitivity in selected populations, whereas hepatobiliary scintigraphy and MRI may offer additional diagnostic information when conventional imaging is inconclusive (Childs *et al.*, 2024; de Oliveira *et al.*, 2024). This supports a diagnostic strategy in which imaging findings are interpreted together with clinical manifestations and laboratory abnormalities rather than being considered independently (Mencarini *et al.*, 2024).

Diagnostic Imaging and the Role of Ultrasonography

The results of this review reinforce the central role of ultrasonography while also demonstrating its diagnostic limitations. Childs *et al.* (2024) reported pooled sensitivity and specificity of 69% and 79%, respectively, for ultrasonography, compared with higher sensitivity for cholescintigraphy and MRI. However, the relatively high performance of

alternative modalities does not necessarily mean that they should replace ultrasonography as the initial examination. Ultrasonography is widely available, does not involve ionizing radiation, can be performed rapidly, and provides direct assessment of gallstones, gallbladder wall thickening, distension, and pericholecystic findings. These practical advantages remain particularly relevant in emergency settings where rapid assessment is required (Mencarini *et al.*, 2024). Point-of-care ultrasonography may further facilitate early assessment, although Wilson *et al.* (2024) found a pooled sensitivity of 70.9% and specificity of 94.4%, indicating that a positive examination may be useful for supporting the diagnosis but that a negative examination cannot reliably exclude disease (Wilson *et al.*, 2024).

The apparent differences between imaging studies should also be interpreted in relation to study design and reference standards. The meta-analysis by Childs *et al.* (2024) included studies with substantial variation in disease prevalence, while de Oliveira *et al.* (2024) specifically evaluated head-to-head comparisons between CT and ultrasonography. In the latter analysis, CT showed a pooled sensitivity of 83.9% compared with 79.0% for ultrasonography, while specificity was similar between the two modalities. Importantly, sequential use of both modalities changed clinical management in only a minority of cases, suggesting that routinely performing both examinations may not be necessary for every patient. Thus, the selection of additional imaging should be determined by the clinical probability of acute cholecystitis, the findings of the initial examination, alternative diagnoses under consideration, and local availability rather than by a fixed requirement to perform multiple imaging studies (de Oliveira *et al.*, 2024).

The role of imaging also extends beyond confirmation of acute cholecystitis because radiological findings can contribute to treatment planning and assessment of complications. CT may be particularly useful when perforation, abscess formation, emphysematous changes, or alternative intra-abdominal pathology is suspected, whereas MRI and hepatobiliary scintigraphy may be useful in selected diagnostically challenging cases. However, the available evidence remains heterogeneous because imaging accuracy is influenced by disease prevalence, operator experience, diagnostic criteria, and the reference standard used in individual studies (Childs *et al.*, 2024). The relatively high specificity reported for emergency physician-performed POCUS further suggests that operator-performed ultrasound can contribute meaningfully to early decision-making when adequate training is available. Therefore, the practical value of imaging lies not simply in identifying an abnormal gallbladder but in selecting the most appropriate subsequent diagnostic or therapeutic pathway for the individual patient (Wilson *et al.*, 2024).

Severity Assessment and Clinical Decision-Making

Severity assessment represents an important component of acute cholecystitis management because the severity category influences the urgency of intervention and the need for additional supportive or drainage procedures. The Tokyo Guidelines provide a structured framework based on local inflammation, systemic inflammatory response, and organ dysfunction. Nevertheless, the relationship between guideline-defined severity and the actual pathological extent of gallbladder inflammation is not absolute. Park *et al.* (2023) found that patients classified as Grade III had greater abnormalities in inflammatory and organ-function parameters and higher rates of positive blood and bile cultures, but the histopathological extent of gallbladder inflammation did not significantly differ between severity grades (Wilson *et al.*, 2024). This finding indicates that clinical severity grading

captures systemic physiological burden more effectively than it necessarily reflects the microscopic extent of local gallbladder inflammation (Childs *et al.*, 2024).

This distinction is clinically important because treatment decisions should not be based solely on the assumption that a higher clinical grade represents proportionally greater local tissue destruction. The increased inflammatory markers, renal dysfunction, bilirubin abnormalities, thrombocytopenia, and microbiological positivity observed in Grade III disease suggest that systemic involvement and physiological reserve are highly relevant to risk assessment (Park *et al.*, 2023). Contemporary reviews similarly emphasize that treatment selection should incorporate disease severity together with age, comorbidities, surgical risk, and the presence of complications (Mencarini *et al.*, 2024). Fugazzola *et al.* (2024) likewise describe early laparoscopic cholecystectomy as the principal treatment for suitable patients while recognizing that high-risk patients may require individualized alternatives. Consequently, severity grading should function as one component of clinical decision-making rather than as an isolated determinant of management (Fugazzola *et al.*, 2024).

Early Laparoscopic Cholecystectomy

The evidence reviewed supports early laparoscopic cholecystectomy as the principal definitive treatment for patients with acute cholecystitis who are suitable surgical candidates. The rationale extends beyond removal of the inflamed gallbladder because early surgery can shorten the overall treatment course and prevent recurrent biliary events during a period of conservative management. Fugazzola *et al.* (2024) summarized contemporary guideline-based management and identified early laparoscopic cholecystectomy as the preferred treatment for acute calculous cholecystitis. Similarly, Mencarini *et al.* (2024) emphasized that definitive surgical treatment should be performed promptly when clinically appropriate rather than routinely postponing surgery. The recent meta-analysis by Khan *et al.* (2026), which included 21 randomized controlled trials involving 1,731 patients, further demonstrated that early laparoscopic cholecystectomy reduced total hospital stay by approximately 3.5 days compared with delayed surgery (Khan *et al.*, 2026).

The findings of Khan *et al.* (2026) also provide an important nuance regarding surgical timing. Early surgery was not associated with significant differences in conversion to open surgery, common bile duct injury, operative time, or overall postoperative complications, although intraoperative complications were more frequent. These intraoperative events were predominantly minor technical complications and did not translate into increased overall postoperative morbidity (Khan *et al.*, 2026). This distinction is important because concern regarding technically more difficult surgery during the acute inflammatory period has historically contributed to delayed intervention. Current evidence suggests that, when adequate surgical expertise and perioperative resources are available, early intervention can reduce hospitalization without producing a corresponding increase in major postoperative morbidity. Therefore, postponement should generally be based on specific patient or institutional considerations rather than on the presence of acute inflammation alone (Fugazzola *et al.*, 2024).

The timing of surgery should nevertheless remain individualized. Patients with substantial organ dysfunction, severe comorbidity, unstable physiological status, or inadequate perioperative resources may not be immediately suitable for laparoscopic cholecystectomy. In these circumstances, initial stabilization and source control may be

required before definitive treatment is reconsidered. The distinction between a patient who is technically operable and one who is physiologically unsuitable for surgery is particularly relevant in older patients and those with substantial comorbidity (Mencarini *et al.*, 2024). Thus, the evidence supporting early surgery should not be interpreted as a requirement to operate immediately on every patient, but rather as support for early definitive management when the patient's clinical condition and available resources permit it (Fugazzola *et al.*, 2024).

Management of High-Risk Patients and Gallbladder Drainage

The management of patients who are unsuitable for immediate surgery remains one of the major areas of clinical uncertainty. Percutaneous gallbladder drainage has traditionally provided a means of achieving source control without general anesthesia and major surgery. However, the evidence does not demonstrate that percutaneous drainage should routinely replace emergency cholecystectomy in high-risk patients who remain suitable for operative management. Cirocchi *et al.* (2023), in a systematic review and meta-analysis of 17 studies involving more than 783,000 patients, found that percutaneous gallbladder drainage did not show lower morbidity compared with emergency cholecystectomy, although the analysis was characterized by substantial heterogeneity. These findings are consistent with contemporary reviews emphasizing that drainage should generally be considered in selected patients rather than used as a universal substitute for definitive surgery (Fugazzola *et al.*, 2024; Mencarini *et al.*, 2024).

At the same time, advances in endoscopic intervention have expanded the options available to patients with high operative risk. Boregowda *et al.* (2023) reported that EUS-guided gallbladder drainage was associated with higher technical success, fewer adverse events, and fewer reinterventions than percutaneous gallbladder drainage, although clinical success and mortality were not significantly different. Tyberg *et al.* (2023) further demonstrated that patients who underwent EUS-guided drainage before subsequent cholecystectomy had shorter symptom-resolution time, shorter hospital stay, and shorter operative time than patients who received percutaneous drainage. These findings suggest that EUS-guided drainage can provide effective initial source control while preserving the possibility of subsequent definitive cholecystectomy (Tyberg *et al.*, 2023).

More recent evidence strengthens the potential role of EUS-guided drainage but also illustrates why procedural expertise and patient selection remain important. Pawa *et al.* (2025) compared EUS-guided and percutaneous drainage in a propensity-score-matched cohort of high-risk surgical patients and found similar technical success, while EUS-guided drainage was associated with fewer procedures and fewer complications. In a multicenter study, Chavan *et al.* (2024) reported technical and clinical success rates of 96.55% and 82.75%, respectively, although adverse events occurred in approximately one-quarter of patients. These results indicate that EUS-guided drainage is technically feasible and potentially beneficial, but it is not a universally available procedure and its outcomes depend on operator experience, anatomical suitability, and access to advanced endoscopy (Chavan *et al.*, 2024).

The 2026 network meta-analysis by Hu *et al.* further demonstrates that the choice of drainage technique involves different strengths and limitations. Across 17 trials involving 2,254 patients, EUS-guided and percutaneous drainage showed higher technical and clinical success than endoscopic transpapillary drainage, while procedure-related adverse events did not differ significantly among the three approaches. The authors

concluded that endoscopic drainage is particularly relevant in centers with advanced endoscopic expertise, whereas percutaneous drainage remains an important alternative when such expertise is unavailable (Hu *et al.*, 2026). These findings support a resource-sensitive strategy rather than a single universal drainage method. In practice, the selection of drainage should consider surgical risk, anatomical factors, local expertise, availability of interventional endoscopy, anticipated need for subsequent cholecystectomy, and the patient's overall clinical trajectory (Tyberg *et al.*, 2023).

Relationship Between Drainage and Definitive Treatment

An important consideration is whether gallbladder drainage should be regarded as definitive treatment or as a bridge to subsequent cholecystectomy. The evidence suggests that this distinction should depend on the patient's long-term operative candidacy. Cirocchi *et al.* (2023) did not demonstrate a morbidity advantage for percutaneous drainage as definitive treatment compared with emergency cholecystectomy, while Fugazzola *et al.* (2024) emphasize that drainage is particularly relevant when immediate surgery is not appropriate. Conversely, patients whose physiological condition improves after initial drainage may subsequently become suitable for definitive laparoscopic cholecystectomy. Tyberg *et al.* (2023) demonstrated that EUS-guided drainage did not preclude later cholecystectomy and was associated with favorable perioperative parameters compared with percutaneous drainage (Tyberg *et al.*, 2023).

This distinction has practical implications for treatment planning. A patient who is temporarily unsuitable for surgery because of acute physiological instability may require drainage as a bridge, whereas a patient with persistent prohibitive surgical risk may require long-term nonoperative management. EUS-guided drainage may be particularly useful in the latter group because it avoids an external drainage catheter and may reduce the need for repeated procedures. Pawa *et al.* (2025) observed fewer procedures and complications among patients treated with EUS-guided drainage, while Hu *et al.* (2026) demonstrated favorable clinical and technical outcomes for EUS-guided drainage in high-risk populations. However, these findings should not be interpreted as evidence that EUS-guided drainage universally replaces cholecystectomy because the available studies are predominantly observational or comparative nonrandomized studies and involve specialized centers (Pawa *et al.*, 2025).

Integration of Diagnosis, Severity, and Treatment

Taken together, the evidence suggests that acute cholecystitis management should be understood as a continuum from diagnosis to severity assessment and definitive source control. Imaging provides diagnostic confirmation and identifies complications, whereas severity assessment helps estimate systemic risk and guide treatment intensity. Neither component should be interpreted independently. The moderate sensitivity of ultrasonography means that a negative examination does not necessarily exclude disease, particularly when clinical suspicion remains high (Childs *et al.*, 2024; Wilson *et al.*, 2024). Similarly, the limitations of pathological correlation with Tokyo Guideline severity categories indicate that severity grading is more useful for assessing physiological burden and treatment risk than for predicting the exact extent of local gallbladder inflammation (Park *et al.*, 2023).

The therapeutic pathway should subsequently be determined according to surgical suitability. For appropriate candidates, early laparoscopic cholecystectomy provides

definitive source control and is associated with shorter hospitalization without a clear increase in major postoperative morbidity (Khan *et al.*, 2026). For patients in whom immediate surgery is unsuitable, gallbladder drainage provides an alternative means of controlling the acute inflammatory process, with EUS-guided drainage becoming increasingly relevant in centers with advanced endoscopic capabilities (Pawa *et al.*, 2025; Hu *et al.*, 2026). This framework emphasizes that management should be individualized according to the interaction between disease severity, physiological reserve, operative risk, available expertise, and the expected role of definitive surgery (Hu *et al.*, 2026).

Limitations of the Current Evidence

Several limitations should be considered when interpreting the findings of this narrative review. First, the diagnostic literature demonstrates considerable heterogeneity in reference standards, disease prevalence, imaging protocols, and operator expertise. Childs *et al.* (2024) reported substantial variation in disease prevalence among included studies, while the comparison by de Oliveira *et al.* (2024) showed that estimates differed according to whether studies directly compared CT and ultrasonography. These methodological differences limit direct comparison of pooled diagnostic estimates across studies. Second, evidence concerning high-risk patients is particularly heterogeneous because many studies are retrospective and involve specialized tertiary centers, which may limit generalizability to hospitals without advanced endoscopic services (Pawa *et al.*, 2025; Chavan *et al.*, 2024).

The evidence concerning drainage techniques also requires cautious interpretation because procedural expertise can substantially influence outcomes. EUS-guided drainage requires advanced endoscopic skills and appropriate equipment, while percutaneous drainage may remain more accessible in many healthcare systems (Hu *et al.*, 2026). In addition, comparisons between drainage techniques may be affected by differences in patient selection, comorbidity burden, institutional experience, and subsequent treatment strategies. Cirocchi *et al.* (2023) reported very high heterogeneity in their analysis of high-risk patients, illustrating the difficulty of drawing universal conclusions from observational evidence. Therefore, the current literature supports broad principles of management but does not establish a single drainage strategy that is optimal for every high-risk patient (Khan *et al.*, 2026).

CONCLUSION

Acute cholecystitis requires an integrated strategy that combines clinical assessment, appropriate imaging, severity evaluation, and individualized treatment selection. Ultrasonography remains an important initial imaging modality, while CT, MRI, and hepatobiliary scintigraphy provide complementary information when the diagnosis remains uncertain or complications are suspected. Severity assessment is useful for identifying systemic involvement and estimating clinical risk, but should be interpreted together with comorbidities, physiological status, and operative factors. Early laparoscopic cholecystectomy remains the principal definitive treatment for patients who are suitable surgical candidates and is associated with shorter hospitalization without a clear increase in major postoperative complications. For patients who are unsuitable for immediate surgery, gallbladder drainage provides an important source-control option, with EUS-guided drainage increasingly supported as an alternative to percutaneous drainage in

centers with appropriate expertise. Overall, treatment decisions should be individualized according to disease severity, surgical risk, anatomical considerations, and available resources. Further prospective studies are needed to refine risk stratification and establish the optimal role of different drainage strategies in high-risk patients.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to all individuals and academic institutions who provided support during the preparation of this narrative review. The authors also acknowledge the contribution of the scientific literature and clinical evidence that provided the basis for the development of this review.

REFERENCES

Boregowda, U., Chen, M., & Saligram, S. (2023). Endoscopic ultrasound-guided gallbladder drainage versus percutaneous gallbladder drainage for acute cholecystitis: A systematic review and meta-analysis. *Diagnostics, 13*(4), 657. https://doi.org/10.3390/diagnostics13040657

Chavan, R., Singla, V., Sundaram, S., Zanwar, S., Shah, C., Sud, S., Singh, P., Gandhi, C., Bhatt, P., Goel, A., & Rajput, S. (2024). Outcomes of endoscopic ultrasound-guided gallbladder drainage: A multicenter study from India (with video). *Indian Journal of Gastroenterology, 43*(6), 1184–1193. https://doi.org/10.1007/s12664-024-01614-1

Childs, D. D., Lalwani, N., Craven, T., Arif, H., Morgan, M., Anderson, M., & Fulcher, A. S. (2024). A meta-analysis of the performance of ultrasound, hepatobiliary scintigraphy, CT and MRI in the diagnosis of acute cholecystitis. *Abdominal Radiology, 49*(2), 384–398. https://doi.org/10.1007/s00261-023-04059-w

Cirocchi, R., Amato, L., Ungania, S., Buononato, M., Tebala, G. D., Cirillo, B., Avenia, S., Cozza, V., Costa, G., Davies, R. J., Sapienza, P., Coccolini, F., Mingoli, A., Chiarugi, M., & Brachini, G. (2023). Management of acute cholecystitis in high-risk patients: Percutaneous gallbladder drainage as a definitive treatment vs. emergency cholecystectomy—Systematic review and meta-analysis. *Journal of Clinical Medicine, 12*(15), 4903. https://doi.org/10.3390/jcm12154903

Fugazzola, P., Podda, M., Tian, B. W. C., Cobianchi, L., Ansaloni, L., & Catena, F. (2024). Clinical update on acute cholecystitis and biliary pancreatitis: Between certainties and grey areas. *eClinicalMedicine, 77*, 102880. https://doi.org/10.1016/j.eclinm.2024.102880

Hu, L., Xu, Y., Wang, A., Qiao, Y., & Dai, Q. (2026). Comparison of three gallbladder drainage methods for acute cholecystitis: A systematic review with network meta-analysis. *ANZ Journal of Surgery, 96*(3), 412–421. https://doi.org/10.1111/ans.70438

Huang, S.-S., Lin, K.-W., Liu, K.-L., Wu, Y.-M., Lien, W.-C., & Wang, H.-P. (2023). Diagnostic performance of ultrasound in acute cholecystitis: A systematic review and meta-analysis. *World Journal of Emergency Surgery, 18*, 54. https://doi.org/10.1186/s13017-023-00524-5

Joyce, A., Snelling, P. J., Elsayed, T., & Keijzers, G. (2023). Point-of-care ultrasound to diagnose acute cholecystitis in the emergency department: A scoping review. *Australasian Journal of Ultrasound in Medicine, 27*(1), 26–41. https://doi.org/10.1002/ajum.12371

Khan, Q. I., Baig, H., Khan, M., Naz, S., & Lucocq, J. (2026). The optimal timing of laparoscopic cholecystectomy for acute cholecystitis according to symptom onset

and patient admission: A meta-analysis of randomised controlled trials. *Surgical Endoscopy, 40*(5), 3641–3657. https://doi.org/10.1007/s00464-026-12779-5

Mencarini, L., Vestito, A., Zagari, R. M., & Montagnani, M. (2024). The diagnosis and treatment of acute cholecystitis: A comprehensive narrative review for a practical approach. *Journal of Clinical Medicine, 13*(9), 2695. https://doi.org/10.3390/jcm13092695

Okamoto, K., Suzuki, K., Takada, T., Strasberg, S. M., Asbun, H. J., Endo, I., Iwashita, Y., Hibi, T., Pitt, H. A., Umezawa, A., Asai, K., Han, H.-S., Hwang, T.-L., Huang, W. S., Tanabe, M., Tokumura, H., Mori, Y., Yoon, Y.-S., Miura, F., ... Yamamoto, M. (2018). Tokyo Guidelines 2018: Diagnostic criteria and severity grading of acute cholecystitis (with videos). *Journal of Hepato-Biliary-Pancreatic Sciences, 25*(1), 41–54. https://doi.org/10.1002/jhbp.515

Park, T. Y., Do, J. H., Oh, H.-C., Choi, Y. S., Lee, S. E., Kang, H., & Hong, S. A. (2023). Relationship between the Tokyo Guidelines and pathological severity in acute cholecystitis. *Journal of Personalized Medicine, 13*(9), 1335. https://doi.org/10.3390/jpm13091335

Pisano, M., Allievi, N., Gurusamy, K., Borzellino, G., Cimbanassi, S., Boerna, D., Coccolini, F., Tufo, A., Di Martino, M., Leung, J., Sartelli, M., Ceresoli, M., Maier, R. V., Poiasina, E., De Angelis, N., Magnone, S., Fugazzola, P., Paolillo, C., Coimbra, R., ... Ansaloni, L. (2020). 2020 World Society of Emergency Surgery updated guidelines for the diagnosis and treatment of acute calculus cholecystitis. *World Journal of Emergency Surgery, 15*, 61. https://doi.org/10.1186/s13017-020-00336-x

Pawa, R., Koutlas, N., Cecil, A., Dorrell, R., Russell, G., & Pawa, S. (2025). EUS-guided gallbladder drainage versus percutaneous gallbladder drainage in high-risk patients with acute cholecystitis: A propensity score-matched analysis. *Therapeutic Advances in Gastroenterology, 18*(), https://doi.org/10.1177/17562848251375376

Tyberg, A., Duarte-Chavez, R., Shahid, H. M., Sarkar, A., Simon, A., Shah-Khan, S. M., Gaidhane, M., Mohammad, T. F., Nosher, J., Wise, S. S., Needham, V., Kheng, M., Lajin, M., Sojitra, B., Wey, B., Dorwat, S., Raina, H., Ansari, J., Gandhi, A., Bapaye, A., ... Kahaleh, M. (2023). Endoscopic ultrasound-guided gallbladder drainage versus percutaneous drainage in patients with acute cholecystitis undergoing elective cholecystectomy. *Clinical and Translational Gastroenterology, 14*(6). https://doi.org/10.14309/ctg.0000000000000593

Wang, X., Yu, W., Jiang, G., Li, H., Li, S., Xie, L., Bai, X., Cui, P., Chen, Q., Lou, Y., Zou, L., Li, S., Zhou, Z., Zhang, C., Sun, P., & Mao, M. (2024). Global epidemiology of gallstones in the 21st century: A systematic review and meta-analysis. *Clinical Gastroenterology and Hepatology, 22*(8), 1586–1595. https://doi.org/10.1016/j.cgh.2024.01.051

Wilson, S. J., Thavanathan, R., Cheng, W., Stuart, J., Kim, D. J., Glen, P., Duigenan, S., Shorr, R., Woo, M. Y., & Perry, J. J. (2024). Test characteristics of emergency medicine-performed point-of-care ultrasound for the diagnosis of acute cholecystitis: A systematic review and meta-analysis. *Annals of Emergency Medicine, 83*(3), 235–246. https://doi.org/10.1016/j.annemergmed.2023.09.005