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ACUTE CHOLANGITIS: DIAGNOSIS, SEVERITY STRATIFICATION, AND THERAPEUTIC MANAGEMENT

COLANGITE AGUDA: DIAGNÓSTICO, ESTRATIFICAÇÃO DE GRAVIDADE E MANEJO TERAPÊUTICO

COLANGITIS AGUDA: DIAGNÓSTICO, ESTRATIFICACIÓN DE LA GRAVEDAD Y MANEJO TERAPÉUTICO

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ABSTRACT

Acute cholangitis is a biliary infection that usually develops when obstruction raises intraductal pressure and permits bacterial translocation into the systemic circulation. Because deterioration can be rapid, diagnosis, severity assessment, antimicrobial therapy, resuscitation, and biliary decompression must be coordinated rather than performed as isolated sequential steps. This narrative review examines current evidence for diagnosis, Tokyo Guidelines 2018 severity grading, imaging, microbiological assessment, empirical antibiotics, timing and modality of drainage, and definitive treatment. PubMed/MEDLINE and major society guidelines were reviewed through September 2026, prioritizing guidelines, systematic reviews, randomized trials, multicenter cohorts, and diagnostic validation studies. The Tokyo Guidelines 2018 define suspected disease by systemic inflammation combined with cholestasis or biliary imaging abnormalities, and definite disease by the presence of all three domains. Organ dysfunction defines severe cholangitis, whereas any two of five prognostic variables define moderate disease. Transabdominal ultrasonography is generally the initial imaging examination; computed tomography, magnetic resonance cholangiopancreatography, or endoscopic ultrasonography are selected according to diagnostic uncertainty, suspected cause, and clinical stability. Blood cultures should be obtained without delaying treatment, and bile should be cultured during drainage when feasible. Endoscopic retrograde cholangiopancreatography is the preferred drainage route. Evidence consistently supports avoiding decompression delays beyond 48 hours, while septic shock or worsening organ dysfunction warrants drainage as soon as resuscitation allows, often within 12 hours. After successful source control, four days of antibiotics were noninferior to eight days in a randomized trial, although shorter courses require careful

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selection. Effective care therefore depends on repeated severity assessment, early source control, antibiotic stewardship, and definitive correction of stones, strictures, malignant obstruction, or dysfunctional stents.

Keywords: Cholangitis. Biliary Obstruction. Cholangiopancreatography. Endoscopic Retrograde. Sepsis.

RESUMO

A colangite aguda é uma infecção biliar que geralmente se desenvolve quando uma obstrução aumenta a pressão intraductal e permite a translocação bacteriana para a circulação sistêmica. Como a deterioração clínica pode ser rápida, o diagnóstico, a avaliação da gravidade, a terapia antimicrobiana, a ressuscitação e a descompressão biliar devem ser coordenados, em vez de realizados como etapas sequenciais isoladas. Esta revisão narrativa examina as evidências atuais sobre diagnóstico, classificação de gravidade pelas Diretrizes de Tóquio de 2018 (Tokyo Guidelines 2018), exames de imagem, avaliação microbiológica, antibioticoterapia empírica, momento e modalidade de drenagem e tratamento definitivo. As bases PubMed/MEDLINE e as diretrizes das principais sociedades médicas foram consultadas até setembro de 2026, priorizando-se diretrizes, revisões sistemáticas, ensaios clínicos randomizados, coortes multicêntricas e estudos de validação diagnóstica. As Diretrizes de Tóquio de 2018 definem a suspeita da doença pela presença de inflamação sistêmica combinada com colestase ou alterações em exames de imagem das vias biliares, e a doença confirmada pela presença de todos esses três critérios. A disfunção orgânica define a colangite grave, enquanto a presença de quaisquer duas de cinco variáveis prognósticas define a doença moderada. A ultrassonografia transabdominal é, geralmente, o exame de imagem inicial; a tomografia computadorizada, a colangiopancreatografia por ressonância magnética ou a ecoendoscopia são selecionadas com base na incerteza diagnóstica, na causa suspeita e na estabilidade clínica. Hemoculturas devem ser coletadas sem atrasar o tratamento, e a cultura da bile deve ser realizada durante a drenagem, sempre que possível. A colangiopancreatografia retrógrada endoscópica é a via de drenagem preferencial. As evidências corroboram consistentemente a necessidade de evitar atrasos na descompressão superiores a 48 horas; por outro lado, a presença de choque séptico ou o agravamento da disfunção orgânica indicam a necessidade de drenagem assim que a ressuscitação permitir, frequentemente dentro de um prazo de 12 horas. Após o controle bem-sucedido do foco infeccioso, um ciclo de quatro dias de antibióticos mostrou-se não inferior a um ciclo de oito dias em um ensaio clínico randomizado, embora ciclos mais curtos exijam uma seleção criteriosa dos pacientes. Portanto, uma assistência eficaz depende da avaliação contínua da gravidade, do controle precoce do foco infeccioso, do uso racional de antibióticos e da correção definitiva de cálculos, estenoses, obstruções malignas ou disfunções de stents.

Palavras-chave: Colangite. Obstrução Biliar. Colangiopancreatografia Retrógrada Endoscópica. Sepse.

RESUMEN

La colangitis aguda es una infección biliar que suele desarrollarse cuando una obstrucción aumenta la presión intraductal y permite la translocación bacteriana hacia la circulación sistémica. Dado que el deterioro puede ser rápido, el diagnóstico, la evaluación de la gravedad, la terapia antimicrobiana, la reanimación y la descompresión biliar deben coordinarse en lugar de realizarse como pasos secuenciales aislados. Esta revisión narrativa

examina la evidencia actual sobre el diagnóstico, la clasificación de gravedad de las Guías de Tokio 2018, las pruebas de imagen, la evaluación microbiológica, los antibióticos empíricos, el momento y la modalidad del drenaje, y el tratamiento definitivo. Se revisaron PubMed/MEDLINE y las principales guías de sociedades científicas hasta septiembre de 2026, priorizando guías, revisiones sistemáticas, ensayos aleatorizados, cohortes multicéntricas y estudios de validación diagnóstica. Las Guías de Tokio 2018 definen la enfermedad sospechada mediante inflamación sistémica combinada con colestasis o anomalías en las pruebas de imagen biliares, y la enfermedad confirmada mediante la presencia de los tres criterios. La disfunción orgánica define la colangitis grave, mientras que la presencia de dos de cinco variables pronósticas define la enfermedad moderada. La ecografía transabdominal es generalmente la prueba de imagen inicial; la tomografía computarizada, la colangiopancreatografía por resonancia magnética o la ecoendoscopia se seleccionan según la incertidumbre diagnóstica, la causa sospechada y la estabilidad clínica. Se deben obtener hemocultivos sin retrasar el tratamiento y cultivar la bilis durante el drenaje cuando sea factible. La colangiopancreatografía retrógrada endoscópica es la vía de drenaje preferida. La evidencia respalda consistentemente evitar retrasos en la descompresión superiores a 48 horas, mientras que el choque séptico o el empeoramiento de la disfunción orgánica justifican el drenaje tan pronto como la reanimación lo permita, a menudo dentro de las primeras 12 horas. Tras un control eficaz del foco infeccioso, un ciclo de antibióticos de cuatro días resultó no inferior a uno de ocho días en un ensayo aleatorizado, aunque los ciclos más cortos requieren una selección cuidadosa. Por tanto, una atención eficaz depende de la evaluación repetida de la gravedad, el control precoz del foco, el uso racional de antibióticos y la corrección definitiva de cálculos, estenosis, obstrucciones malignas o prótesis disfuncionales.

Palabras clave: Colangitis. Obstrucción Biliar. Colangiopancreatografía Retrógrada Endoscópica. Sepsis.

1 INTRODUCTION

Acute cholangitis is an infection of the biliary system that most often arises when mechanical obstruction and microbial contamination coexist. Obstruction increases intraductal pressure, weakens the normal barrier against reflux, and promotes cholangiovenous and cholangiolymphatic spread. Once bacteria or bacterial products reach the systemic circulation, a localized biliary infection may progress to sepsis, shock, and multiple-organ dysfunction.[1]

The disease is clinically heterogeneous. Choledocholithiasis remains a major cause, but malignant obstruction, benign postoperative or inflammatory strictures, occluded biliary stents, bilioenteric anastomoses, hepatolithiasis, and complications after transplantation are increasingly encountered. The underlying anatomy affects diagnostic yield, microbiology, the feasibility of complete drainage, and the likelihood of recurrence.[1,2]

The classical combination of fever, right upper-quadrant pain, and jaundice is useful when present but cannot safely exclude disease when incomplete. Modern practice therefore relies on the Tokyo Guidelines 2018 (TG18), which integrate systemic inflammation, cholestasis, and imaging evidence of biliary obstruction or its cause. The same framework grades severity and links the grade to monitoring, organ support, and urgency of drainage.[2]

Treatment must address both components of the syndrome. Antibiotics suppress bloodstream and biliary infection, whereas decompression corrects the pressure and obstruction that sustain infection. A patient may transiently improve after antimicrobial therapy yet relapse or deteriorate if the obstructed system remains inadequately drained. Conversely, drainage without adequate resuscitation and antimicrobial coverage may expose an unstable patient to procedural complications.[2,3]

Several practical questions remain unsettled. Guidelines differ in the exact time window for drainage, observational studies are vulnerable to confounding by indication, and antibiotic-duration trials apply mainly to patients with successful source control. The appropriate procedure also depends on hemodynamic stability, coagulation, location of obstruction, prior surgery, local expertise, and whether definitive treatment can be completed safely during the index intervention.[3]

2 OBJECTIVES

The primary objective was to review the diagnosis, TG18 severity stratification, and therapeutic management of acute cholangitis. Secondary objectives were to examine the role

of laboratory tests and imaging, summarize microbiological and antimicrobial principles, compare endoscopic and rescue drainage strategies, evaluate the evidence on drainage timing and antibiotic duration, and define measures that reduce recurrent biliary events.

3 METHODS

A structured narrative review was performed using PubMed/MEDLINE and the official publications of the Japanese Society of Hepato-Biliary-Pancreatic Surgery, the American Society for Gastrointestinal Endoscopy (ASGE), the European Society for Gastrointestinal Endoscopy (ESGE), the Infectious Diseases Society of America (IDSA), and the Surviving Sepsis Campaign. The search was updated through September 2026.

Search concepts included acute cholangitis, biliary sepsis, Tokyo Guidelines, diagnosis, severity, ultrasonography, computed tomography, magnetic resonance cholangiopancreatography, endoscopic retrograde cholangiopancreatography (ERCP), percutaneous drainage, endoscopic-ultrasound-guided biliary drainage, antibiotics, source control, and cholecystectomy. Reference lists of major guidelines and systematic reviews were screened for additional studies.

Priority was given to evidence-based guidelines, diagnostic validation studies, randomized clinical trials, systematic reviews, meta-analyses, and large observational cohorts in adults. Studies were retained when they informed diagnostic accuracy, severity classification, organ failure, mortality, drainage route or timing, antimicrobial selection or duration, recurrence, or definitive management. Pediatric-only studies, isolated case reports, and chronic cholangitis without an acute episode were not used in the central synthesis.

Data were organized by study design, population, intervention or comparison, outcomes, and principal limitations. Particular attention was paid to retrospective definition of time zero, incomplete adjustment for severity, overlap among administrative datasets, heterogeneous etiologies, adequacy of source control, and exclusion of unstable or immunocompromised patients from short-course antibiotic studies. No original meta-analysis was performed.

4 RESULTS AND DISCUSSION

Thirty principal publications were used to construct the clinical synthesis. They included international guidelines, diagnostic studies, randomized trials, observational cohorts,

and meta-analyses. Table 1 summarizes the population or evidence base, central outcomes, and the interpretation used in this review.[1-3]

Table 1

Principal publications informing the diagnosis, severity assessment, and management of acute cholangitis

Reference	Population / Intervention / Comparison	Outcomes	Main conclusions
Sokal et al., 2019[1]	Narrative review of acute cholangitis diagnosis and management.	Pathophysiology, microbiology, diagnostic approach, and treatment.	Obstruction and infection must be treated together; clinical context determines antimicrobial breadth and drainage strategy.
Kiriyama et al., 2018[2]	TG18 evidence review and international consensus.	Diagnostic criteria and severity grading.	Systemic inflammation, cholestasis, and imaging provide an operational diagnosis; organ dysfunction defines Grade III disease.
Miura et al., 2018[3]	TG18 management flowchart.	Initial stabilization and grade-directed drainage.	Treatment begins immediately when urgency is recognized; Grade II and Grade III disease generally require early or urgent drainage.
Rumsey et al., 2017[4]	Systematic review; 16 studies and 4,288 patients.	Accuracy of Charcot triad.	Sensitivity was 36.3% and specificity 93.2%; the triad is a poor rule-out tool.
Sperna Weiland et al., 2022[5]	Prospective cohort; 794 patients undergoing ERCP for suspected biliary obstruction.	Diagnostic performance of TG18, Charcot triad, and Dutch criteria.	TG18 sensitivity was 82% and specificity 60%; Charcot triad was less sensitive but highly specific.
Bonomo et al., 2024[6]	IDSA evidence-based imaging guideline.	Initial and subsequent imaging in suspected acute cholangitis.	Ultrasonography is generally first; computed tomography and magnetic resonance cholangiopancreatography are used when initial studies are inconclusive or complications are suspected.
Kiriyama et al., 2017[7]	International multicenter cohort; 6,063 clinically diagnosed cases.	Validation of TG13 criteria and severity grades.	TG13 diagnosed 90.0% versus 79.4% with TG07; 30-day mortality increased from Grade I to Grade III.

Reference	Population / Intervention / Comparison	Outcomes	Main conclusions
Mohan et al., 2021[8]	Retrospective cohort; 262 adults.	TG diagnostic sensitivity and predictors of hospital mortality.	TG13/TG18 sensitivity was 85.1%; hypotension, altered consciousness, diabetes, and malignancy predicted mortality.
Gravito-Soares et al., 2018[9]	Retrospective cohort; 183 adults.	Clinical applicability of TG13/TG18.	TG13/TG18 improved diagnostic accuracy over Charcot triad, while additional physiologic variables refined risk assessment.
Gomi et al., 2018[10]	TG18 antimicrobial evidence review and consensus.	Empirical therapy, de-escalation, and duration.	Therapy should reflect severity, acquisition setting, prior instrumentation, and the local antibiogram; routine duration after control is commonly 4-7 days.
Otani et al., 2022[11]	Emergency-department cohort; 358 patients.	Frequency of bacteremia by TG18 grade.	Bacteremia occurred in 48% overall and in 35%, 59%, and 74% of Grades I, II, and III, supporting blood cultures across grades.
Gromski et al., 2022[12]	Retrospective series; 721 ERCP bile cultures.	Biliary microbiology and resistance.	Bile cultures were positive in 91.8%; Enterococcus, Klebsiella, and Escherichia coli were frequent, and prior sphincterotomy altered resistance patterns.
Lee et al., 2025[13]	Multicenter randomized noninferiority trial; 428 mild-to-moderate cases after drainage.	Antibiotic adjustment using blood cultures alone versus blood plus bile cultures.	Blood-culture-guided adjustment was noninferior for organ failure and mortality and modestly reduced treatment duration and length of stay.
Evans et al., 2021[14]	International sepsis guideline.	Resuscitation, antimicrobials, vasopressors, and source control.	Septic shock requires immediate resuscitation, early antimicrobials, norepinephrine when needed, and prompt source control.

Reference	Population / Intervention / Comparison	Outcomes	Main conclusions
Mukai et al., 2017[15]	TG18 drainage evidence review and consensus.	Route and technique of biliary drainage.	Endoscopic transpapillary drainage is preferred; temporary decompression may be safer than prolonged definitive therapy in unstable patients.
Buxbaum et al., 2021[16]	ASGE guideline based on systematic reviews.	Endoscopic versus percutaneous drainage, timing, and extent of index ERCP.	ERCP is preferred, decompression within 48 hours is suggested, and comprehensive therapy is appropriate when the patient can tolerate it.
Manes et al., 2019[17]	ESGE guideline for common bile duct stones.	Drainage timing and stone management.	Drainage is recommended as soon as possible in septic shock, within 48-72 hours for moderate disease, and electively for mild disease.
Du et al., 2020[18]	Meta-analysis; 14 observational studies and 84,063 patients.	ERCP before versus after 24, 48, and 72 hours.	Earlier ERCP was associated with lower hospital mortality and shorter stay at each threshold, but randomized confirmation is lacking.
Iqbal et al., 2020[19]	Meta-analysis; 9 observational studies and 7,534 patients.	ERCP within versus after 48 hours.	ERCP within 48 hours was associated with lower inpatient mortality and a shorter hospital stay.
Huang et al., 2022[20]	Retrospective cohort; 683 definite TG18 cases.	ERCP timing stratified by severity.	ERCP within 48 hours was associated with lower 30-day mortality in Grade III disease and shorter stay in Grades I and II.
Lyu et al., 2022[21]	Meta-analysis; 7 nonrandomized studies and 88,562 patients.	ERCP within 24 or 48 hours versus later intervention.	The clearest consistent benefit was avoidance of delay beyond 48 hours; estimates for a 24-hour threshold were less uniform.
Seo et al., 2020[22]	National database cohort; 91,051 admissions with cholecystectomy.	Timing of preoperative ERCP and mortality.	ERCP after 72 hours was associated with increased mortality, including among Grade III patients.

Reference	Population / Intervention / Comparison	Outcomes	Main conclusions
van der Merwe et al., 2022[23]	ESGE therapeutic EUS guideline.	EUS-guided versus percutaneous rescue drainage.	After failed ERCP for malignant distal obstruction, EUS-guided drainage is preferred over percutaneous drainage when expertise is available.
Pawa et al., 2024[24]	ASGE therapeutic EUS guideline.	EUS-guided rescue strategies in benign and malignant obstruction.	EUS-guided drainage can avoid external catheters, but selection depends on anatomy, indication, and advanced local expertise.
Srinu et al., 2024[25]	Randomized noninferiority trial; 120 patients with moderate or severe disease after drainage.	Four versus eight days of antibiotics.	Four days was noninferior for clinical cure, recurrence, and mortality in selected patients with successful source control.
Haal et al., 2020[26]	Multicenter retrospective cohort; 296 stone-related cases after successful ERCP.	Three days or less versus four days or more of antibiotics.	Local infectious complications were similar; the shorter course was associated with a one-day shorter median stay.
Masuda et al., 2024[27]	Retrospective cohort; 408 successfully drained cases treated for seven days or less.	Stopping therapy in febrile versus afebrile patients.	Clinical cure and recurrence were similar, but observational selection limits routine discontinuation in persistently febrile patients.
Buxbaum et al., 2019[28]	ASGE guideline for choledocholithiasis.	Risk stratification, ERCP, and definitive stone management.	ERCP should be therapeutic when possible; duct clearance and definitive gallstone management reduce recurrent obstruction.
Sohail et al., 2024[29]	National Readmission Database; 124,964 gallstone-related admissions.	Same-admission versus deferred cholecystectomy.	Thirty-day readmission was 5.56% versus 11.50%, although index stay and cost were higher with surgery.
Chandrashekar et al., 2026[30]	Retrospective cohort; 171 patients with choledocholithiasis-associated cholangitis.	Same-admission versus deferred cholecystectomy.	Same-admission surgery reduced recurrent biliary events and 30-day readmission without increasing complications after stabilization.

4.1 DEFINITION AND PATHOPHYSIOLOGY

Bile is not necessarily sterile in patients with biliary disease, but infection usually requires a setting that permits bacterial proliferation and systemic invasion. Obstruction causes stasis and elevated pressure, impairs tight-junction and Kupffer-cell defenses, and facilitates reflux of organisms and endotoxin into venous and lymphatic channels. The clinical syndrome therefore reflects both the inoculum and the physiologic consequences of an inadequately drained system.[1,2]

The cause of obstruction influences the pattern of illness. A mobile common bile duct stone may produce abrupt pain and complete obstruction, whereas malignant or benign strictures may cause progressive cholestasis before infection. Stent occlusion, incomplete drainage of hilar segments, and surgically altered anatomy can produce recurrent or healthcare-associated cholangitis with resistant or polymicrobial organisms.[1,10,12]

Not every patient with fever and biliary obstruction has acute cholangitis, and not every patient with cholangitis has marked ductal dilatation. Early infection, small-duct disease, partially patent stents, and bilioenteric anatomy can yield subtle imaging findings. Diagnosis must therefore synthesize physiology, laboratory evidence, imaging, and the probability of an alternative source.[2,5,6]

4.2 CLINICAL PRESENTATION AND DIAGNOSTIC CRITERIA

Fever or shaking chills, abdominal pain, and jaundice remain important clues. Older adults, immunosuppressed patients, and individuals with malignant obstruction may present mainly with weakness, delirium, hypotension, or laboratory cholestasis. Reynolds pentad adds hypotension and altered mental status to Charcot triad, but its very low sensitivity makes it a marker of advanced disease rather than a screening tool.[4]

In the systematic review by Rumsey and colleagues, Charcot triad had a sensitivity of 36.3% and specificity of 93.2%. A more recent prospective cohort found TG18 sensitivity of 82% and specificity of 60%, compared with 46% and 99% for Charcot triad. TG18 therefore captures more patients at the cost of more false-positive classifications, which must be resolved through imaging, clinical judgment, and response to treatment.[4,5]

TG18 separates diagnosis from severity. A suspected diagnosis requires one marker of systemic inflammation plus either cholestasis or a compatible imaging finding. A definite diagnosis requires at least one item from each of the three domains. The framework supports

early treatment while the etiology is being clarified and avoids requiring the complete classical triad.[2]

Table 2

Tokyo Guidelines 2018 diagnostic criteria for acute cholangitis.[2]

TG18 domain	Operational criterion
A Systemic inflammation	Fever or shaking chills; laboratory evidence of inflammation, including leukocyte count below 4,000/mm3 or above 10,000/mm3 and/or C-reactive protein at least 1 mg/dL.
B Cholestasis	Jaundice with total bilirubin at least 2 mg/dL; or alkaline phosphatase, gamma-glutamyl transferase, aspartate aminotransferase, or alanine aminotransferase above 1.5 times the upper limit of normal.
C Imaging	Biliary dilatation or imaging evidence of the cause, such as a stone, stricture, mass, or stent-related obstruction.
Suspected diagnosis	One item from A plus one item from B or C.
Definite diagnosis	One item from A, one item from B, and one item from C.

4.3 LABORATORY ASSESSMENT AND MICROBIOLOGY

Initial testing should include a complete blood count, C-reactive protein, bilirubin fractions, alkaline phosphatase, gamma-glutamyl transferase, aminotransferases, creatinine, electrolytes, albumin, coagulation studies, and lactate when sepsis or hypoperfusion is suspected. Arterial or venous blood gas analysis is useful in respiratory failure, severe acidosis, or shock. Serial results are more informative than a single value because organ dysfunction may emerge after presentation.[2,3,14]

Two sets of blood cultures should be collected before antibiotics when this does not delay therapy. In a 358-patient cohort, bacteremia occurred in 48% overall and remained present in 35% of Grade I cases. During ERCP or another drainage procedure, bile culture is valuable, particularly in severe, recurrent, stent-associated, healthcare-associated, or previously treated infection.[10,11]

The microbiological spectrum is broader after instrumentation. In 721 bile aspirates obtained during ERCP, 91.8% were culture-positive; Enterococcus species, Klebsiella species, and Escherichia coli were frequent, and prior sphincterotomy was associated with organisms and resistance patterns not typical of uncomplicated community-acquired infection. Culture results should drive de-escalation, but positive bile cultures may include colonizers and must be interpreted with the bloodstream isolate and clinical course.[12]

A 2025 randomized trial found that adjustment based on blood cultures alone was noninferior to adjustment based on blood and bile cultures in adequately drained mild-to-moderate disease. This result supports a stewardship role for blood cultures but does not eliminate bile culture in severe illness, incomplete drainage, recurrent infection, or complex anatomy, where local information can be decisive.[13]

4.4 DIAGNOSTIC IMAGING

Transabdominal ultrasonography is generally the first imaging test because it is rapid, portable, and free of ionizing radiation. It can demonstrate bile duct dilatation, gallstones, and some obstructing lesions, but distal common bile duct stones, obesity, bowel gas, and early obstruction reduce sensitivity. A normal or nondilated duct does not exclude cholangitis when clinical suspicion is high.[6]

Contrast-enhanced computed tomography (CT) is useful when ultrasonography is inconclusive, when a malignant or postoperative cause is possible, or when complications and alternative diagnoses must be assessed. CT can identify stones of sufficient attenuation, ductal wall enhancement, abscesses, pancreatitis, perforation, vascular complications, and metastatic disease. The need for contrast must be balanced against renal function and the diagnostic question.[6]

Magnetic resonance cholangiopancreatography (MRCP) provides a noninvasive map of the biliary tree and is particularly valuable for indeterminate strictures, hilar disease, and persistent suspicion after ultrasonography or CT. Endoscopic ultrasonography (EUS) is highly sensitive for small distal stones and can be performed before ERCP in stable patients with uncertain obstruction. Neither examination should delay therapeutic decompression in shock or clear progressive organ dysfunction.[6,28]

ERCP is no longer favored as a purely diagnostic test because it carries risks of pancreatitis, bleeding, perforation, and sedation-related complications. Its value in acute cholangitis is therapeutic: cholangiography should be limited to the information needed for drainage, and contrast injection into segments that cannot be drained should be avoided, especially in hilar obstruction.[15-17]

4.5 SEVERITY STRATIFICATION

TG18 Grade III disease is present when dysfunction affects at least one of six organ systems. Grade II disease is present when any two of five prognostic criteria coexist. Grade

I includes patients who meet neither definition. Grade III takes precedence when organ dysfunction is present, even if Grade II variables are also fulfilled.[2]

The classification predicts clinically meaningful outcomes. In the 6,063-patient international validation cohort, 30-day mortality was 1.2% in Grade I, 2.6% in Grade II, and 5.1% in Grade III. Early or urgent drainage among Grade II patients was associated with lower mortality than delayed or absent early drainage, supporting the use of the grade to organize care.[7]

Severity should be reassessed after initial treatment. A patient initially categorized as Grade I can develop oliguria, hypoxemia, hypotension, confusion, coagulopathy, or thrombocytopenia within hours. Frailty, malignancy, diabetes, low systolic pressure, and declining renal function may increase risk even before a formal Grade III threshold is crossed.[8,9]

Table 3

Tokyo Guidelines 2018 severity grading for acute cholangitis.[2]

Grade	Definition	Criteria
Grade III severe	At least one organ-system dysfunction.	Cardiovascular: dopamine ≥5 μg/kg/min or any norepinephrine. Neurologic: altered consciousness. Respiratory: PaO2/FiO2 (arterial oxygen partial pressure/inspired oxygen fraction) <300. Renal: oliguria or creatinine >2.0 mg/dL. Hepatic: PT-INR (prothrombin time international normalized ratio) >1.5. Hematologic: platelets <100,000/mm³.
Grade II moderate	At least two prognostic criteria.	White blood cells >12,000/mm³ or <4,000/mm³; temperature ≥39 °C; age ≥75 years; total bilirubin ≥5 mg/dL; albumin <0.7 times the lower limit of normal.
Grade I mild	Does not meet Grade II or Grade III criteria.	Requires close observation and repeated grading because lack of initial organ dysfunction does not guarantee a benign course.

4.6 INITIAL STABILIZATION AND SEPSIS CARE

Assessment begins with airway, breathing, circulation, mental status, oxygenation, urine output, and signs of tissue hypoperfusion. Intravenous access, blood cultures, laboratory testing, analgesia, antiemetics, and empirical antibiotics should proceed while the

drainage team is contacted. Patients with shock, rising lactate, respiratory failure, or altered consciousness require critical-care involvement.[3,14]

Balanced crystalloids are generally preferred for sepsis resuscitation. Fluid administration should be guided by perfusion and dynamic response rather than repeated fixed boluses, particularly in older adults and patients with heart failure, cirrhosis, or renal impairment. Norepinephrine is the preferred first-line vasopressor when hypotension persists, with an initial mean arterial pressure target near 65 mmHg for most adults.[14]

Resuscitation and source control are simultaneous priorities. Complete normalization of hemodynamics should not be required before drainage when the obstructed system is driving shock; equally, transfer to endoscopy should not occur without basic airway, oxygenation, and circulatory planning. Anesthesia, endoscopy, intensive care, interventional radiology, and surgery should agree on the safest location and shortest effective procedure.[3,14-16]

4.7 ANTIMICROBIAL THERAPY

Empirical therapy should begin promptly once acute cholangitis is suspected, especially when sepsis or shock is present. The regimen must cover common enteric gram-negative bacilli and should be selected according to TG18 grade, community versus healthcare acquisition, previous biliary procedures, recent antibiotics, prior resistant isolates, local susceptibility data, allergy history, and renal or hepatic function.[10,14]

Reasonable community-acquired options include a third-generation cephalosporin, with anaerobic coverage when indicated, or piperacillin-tazobactam. Severe or healthcare-associated infection may require an antipseudomonal beta-lactam or a carbapenem when the risk of extended-spectrum beta-lactamase-producing organisms is high. Enterococcal coverage is most relevant in severe disease, prior instrumentation, transplantation, or healthcare exposure; routine antifungal or methicillin-resistant Staphylococcus aureus coverage is not justified without specific risk.[10-12]

Anaerobic coverage deserves particular consideration after bilioenteric anastomosis. Doses must be adjusted for renal function, and potentially nephrotoxic combinations should be reviewed daily. Once cultures and clinical response are available, therapy should be narrowed or discontinued rather than continued solely because a biliary device remains in place.[10,12,13]

TG18 commonly recommends 4-7 days after successful source control. In a randomized trial of moderate or severe disease, four days was noninferior to eight days for clinical cure, recurrence, and mortality. Observational data also suggest that three days or less may be sufficient after uncomplicated stone-related cholangitis with complete drainage, but these studies do not support universal ultra-short therapy.[10,25,26]

Duration should be individualized when drainage is incomplete, undrained segments remain, hepatic abscess or another focus exists, bacteremia persists, endocarditis is a concern, the patient is immunocompromised, or clinical improvement is delayed. Persistent fever alone does not prove treatment failure, but it should trigger reassessment of source control, resistance, procedural complications, and alternative infection before antibiotics are stopped or broadened.[25-27]

4.8 BILIARY DRAINAGE AND TIMING

Biliary decompression is the definitive source-control intervention when obstruction persists. ERCP is preferred because it provides internal drainage and can often treat the cause. Percutaneous transhepatic drainage is appropriate when ERCP is unavailable, unsuccessful, or anatomically impossible, and surgery is generally reserved for cases in which less invasive methods cannot achieve control or another surgical indication is present.[15,16]

For Grade I disease, antibiotics and supportive care may be sufficient initially if the patient improves and obstruction is not ongoing. Failure to improve, persistent obstruction, a retained common bile duct stone, or recurrent infection should prompt drainage. Grade II disease generally requires early drainage, while Grade III disease requires organ support and urgent decompression as soon as the procedure can be conducted safely.[3,15-17]

The strongest consistent timing signal is to avoid delay beyond 48 hours. Meta-analyses found lower inpatient mortality and shorter hospitalization when ERCP occurred within this interval, although all included timing studies were observational and differed in the definition of admission, diagnosis, and intervention. Confounding remains possible because the sickest patients may undergo either unusually rapid intervention or delay caused by instability and transfer.[18,19,21]

Evidence for a universal 24-hour threshold is less certain. The 683-patient severity-stratified cohort found that ERCP within 48 hours was associated with lower 30-day mortality in Grade III disease, whereas earlier procedures mainly shortened stay in less severe

disease. National data likewise showed higher mortality when ERCP was deferred beyond 72 hours, especially in Grade III cases.[20,22]

A practical synthesis is to perform drainage as soon as possible in septic shock or progressive organ dysfunction, often with a goal within 12 hours when expertise and stabilization permit. Patients with Grade II disease should usually undergo drainage within 24-48 hours, and any patient with an ongoing indication for decompression should not experience an avoidable delay beyond 48 hours. Transfer to a center capable of drainage is itself part of source-control planning.[16-21]

4.9 EXTENT AND TECHNIQUE OF ERCP

The index procedure may be limited to decompression or may include definitive treatment. A plastic stent or nasobiliary drain can rapidly lower pressure. Nasobiliary drainage permits sampling, irrigation, and visual monitoring of output but is less comfortable and can be dislodged; an internal stent is generally better tolerated but requires a clear plan for removal or exchange.[15]

Stable patients with accessible stones can undergo sphincterotomy and stone extraction during the same ERCP. In contrast, hypotension, respiratory failure, coagulopathy, difficult cannulation, large or impacted stones, and complex hilar obstruction favor a shorter procedure focused on drainage. Sphincterotomy is not required merely to place a stent and may be deferred when bleeding risk is high.[15,16,28]

Temporary stenting is appropriate when complete clearance cannot be achieved. The report and discharge plan must specify the device, target duct or segment, need for repeat ERCP, and intended timing of removal or exchange. Forgotten plastic stents are a preventable cause of recurrent obstruction, sludge formation, and cholangitis.[15,17,28]

Hilar obstruction requires deliberate segmental planning. Excess contrast injection into ducts that will remain undrained can worsen infection. Preprocedural cross-sectional imaging, targeted cannulation, and coordination with interventional radiology are especially important when complete endoscopic drainage is unlikely.[15,23,24]

4.10 RESCUE DRAINAGE AFTER FAILED OR IMPOSSIBLE ERCP

Percutaneous transhepatic biliary drainage remains an effective and widely available rescue technique. It can access selected segments and may be the fastest option in altered

anatomy or proximal obstruction. Its disadvantages include an external catheter, pain, dislodgement, bile leakage, bleeding, and repeated maintenance procedures.[15,16]

EUS-guided biliary drainage creates internal access through a choledochoduodenostomy, hepaticogastrostomy, rendezvous, or antegrade approach. ESGE and ASGE guidelines support EUS-guided drainage over percutaneous drainage after failed ERCP in selected settings, most clearly for malignant distal obstruction when advanced expertise is available. These recommendations should not be generalized to every benign stone-related case or to centers without rescue capability.[23,24]

Surgically altered anatomy may require balloon-enteroscopy-assisted ERCP, EUS-guided access, percutaneous drainage, or surgery. The preferred route is the method that can achieve prompt and durable drainage with the lowest immediate risk in that institution. Repeated unsuccessful endoscopic attempts should not postpone an available rescue route in a deteriorating patient.[16,23,24]

4.11 ETIOLOGY-SPECIFIC DEFINITIVE MANAGEMENT

For choledocholithiasis, definitive care includes duct clearance and management of the gallbladder when the patient is an operative candidate. Same-admission laparoscopic cholecystectomy after stabilization and successful clearance reduces recurrent biliary events and readmission. In a national cohort of 124,964 gallstone-related admissions, 30-day readmission was 5.56% with same-admission cholecystectomy and 11.50% without it.[28,29]

A 2026 cohort produced a similar direction of effect, including among patients initially classified as Grade III, without higher postoperative complication rates after stabilization. These observational findings support same-admission surgery in appropriate patients but do not override frailty, unresolved organ failure, difficult anatomy, or a need for further oncologic or cardiopulmonary evaluation.[30]

Malignant obstruction requires drainage that aligns with resectability and the oncologic plan. In acute sepsis, rapid decompression takes priority over exhaustive tissue acquisition or complex bilateral stenting. Once infection is controlled, multidisciplinary review should determine tissue diagnosis, stent type, drainage volume, chemotherapy timing, and surgical candidacy.[15,16,23,24]

Benign strictures, post-transplant complications, primary sclerosing cholangitis, hepatolithiasis, and anastomotic disease frequently require staged procedures. Stent-associated cholangitis requires confirmation of stent position and patency, removal or

exchange when feasible, and a documented surveillance plan. Recurrent episodes should prompt review of whether all infected segments have actually been drained.[1,12,15]

4.12 SEVERITY-BASED MANAGEMENT PRIORITIES

Table 4

Practical management priorities according to TG18 severity.[3,15-21]

TG18 grade	Immediate priorities	Drainage strategy	Extent of index procedure
Grade I mild	Cultures, empirical antibiotics, hydration, analgesia, and close reassessment.	Drain if response is inadequate, obstruction persists, or definitive treatment is required.	Stone extraction or other etiologic therapy when clinically appropriate.
Grade II moderate	Early antibiotics, monitored care, correction of coagulopathy and physiologic abnormalities.	Early drainage, generally within 24-48 hours; avoid delay beyond 48 hours.	Complete therapy during index ERCP if stable; otherwise drain first and stage treatment.
Grade III severe	Critical-care support, early antibiotics, airway and circulatory management, and repeated organ assessment.	Drain as soon as resuscitation permits; septic shock often warrants a goal within 12 hours.	Use the shortest effective decompression when unstable; defer prolonged stone therapy or complex reconstruction.

4.13 ASSESSMENT OF RESPONSE AND TREATMENT FAILURE

Clinical response is usually reflected by improved blood pressure, mental status, urine output, fever, pain, and appetite, followed by improvement in inflammatory and cholestatic laboratory values. Bilirubin may decline slowly after effective drainage and should not be used alone to label early failure. The patient should be regraded whenever physiology changes.[2,3]

Failure to improve should prompt a structured review: Was the diagnosis correct? Is the antibiotic active and correctly dosed? Is a stent blocked or displaced? Were all relevant ducts drained? Is there a hepatic abscess, perforation, pancreatitis, cholecystitis, or another source of sepsis? Has the patient developed a procedure-related adverse event? Repeat imaging and repeat or alternative drainage should not be delayed when obstruction remains likely.[3,10,15,16]

Discharge planning must include the final microbiology, antibiotic stop date, stent management, timing of repeat ERCP when needed, definitive treatment of gallstones or strictures, and warning signs for recurrence. A technically successful emergency procedure is incomplete care if a temporary device or untreated cause is lost to follow-up.[15,28-30]

4.14 LIMITATIONS OF THE EVIDENCE

The exact benefit of very urgent ERCP remains uncertain because timing evidence is almost entirely observational. Definitions of time zero vary, and referral, stabilization, weekend access, anesthesia availability, disease severity, and anatomy can influence both the timing and the outcome. Associations favoring earlier ERCP should therefore be interpreted together with the biological rationale for source control rather than as proof that every patient benefits from the same clock threshold.[18-22]

Antibiotic-duration evidence also has limited generalizability. The strongest randomized evidence supports four days after successful drainage in selected moderate or severe cases, whereas courses of three days or less are supported mainly by observational cohorts. Patients with ongoing obstruction, complex hilar drainage, persistent bacteremia, abscesses, profound immunosuppression, or uncontrolled extra-biliary infection require individualized decisions.[25-27]

Diagnostic studies use different reference standards, and ERCP-based cohorts may overrepresent patients with obvious obstruction. TG18 improves sensitivity but can classify inflammatory cholestasis from another cause as suspected cholangitis. Repeated bedside assessment remains essential because no score, imaging test, or biomarker replaces evaluation of the whole patient.[2,4,5,7-9]

5 CONCLUSION

Acute cholangitis is a time-sensitive infection sustained by biliary obstruction. TG18 provides a practical diagnostic structure based on systemic inflammation, cholestasis, and imaging, while its severity grades identify patients who need intensified monitoring, organ support, and accelerated drainage. The classical triad remains useful when complete but is too insensitive to exclude disease.[2,4,7]

Management should begin before every diagnostic detail is settled. Blood cultures, empirical antibiotics, individualized sepsis resuscitation, and early consultation for source control should occur in parallel. Transabdominal ultrasonography is usually the first imaging

examination, with CT, MRCP, or EUS selected according to stability and diagnostic uncertainty; therapeutic ERCP should not be delayed by additional imaging when urgent decompression is clearly required.[3,6,10,14]

ERCP is the preferred drainage route. Septic shock and worsening organ dysfunction require decompression as soon as resuscitation permits, often within 12 hours, whereas Grade II disease generally warrants intervention within 24-48 hours. Across severity groups, avoidable delay beyond 48 hours should be prevented. Unstable patients may benefit from brief decompression alone, while stable patients can undergo definitive stone treatment during the same procedure.[15-21]

After successful source control, four days of antibiotics is supported by randomized evidence in selected patients, and narrower therapy should follow culture results and clinical response. Treatment is completed only when the cause is addressed, temporary devices have a follow-up plan, and recurrent events are prevented through duct clearance, cholecystectomy when appropriate, or definitive management of strictures and malignant obstruction.[25-30]

REFERENCES

1. Sokal A, Sauvanet A, Fantin B, de Lastours V. Acute cholangitis: diagnosis and management. J Visc Surg. 2019;156(6):515-525.

2. Kiriyama S, Kozaka K, Takada T, Strasberg SM, Pitt HA, Gabata T, et al. Tokyo Guidelines 2018: diagnostic criteria and severity grading of acute cholangitis. J Hepatobiliary Pancreat Sci. 2018;25(1):17-30.

3. Miura F, Okamoto K, Takada T, Strasberg SM, Asbun HJ, Pitt HA, et al. Tokyo Guidelines 2018: initial management of acute biliary infection and flowchart for acute cholangitis. J Hepatobiliary Pancreat Sci. 2018;25(1):31-40.

4. Rumsey S, Winders J, MacCormick AD. Diagnostic accuracy of Charcot's triad: a systematic review. ANZ J Surg. 2017;87(4):232-238.

5. Sperna Weiland CJ, Busch CBE, Bhalla A, Bruno MJ, Fockens P, van Hooft JE, et al. Performance of diagnostic tools for acute cholangitis in patients with suspected biliary obstruction. J Hepatobiliary Pancreat Sci. 2022;29(4):479-486.

6. Bonomo RA, Edwards MS, Abrahamian FM, Bessesen M, Chow AW, Dellinger EP, et al. 2024 Clinical Practice Guideline Update by the Infectious Diseases Society of America on complicated intra-abdominal infections: diagnostic imaging of suspected acute cholecystitis and acute cholangitis in adults, children, and pregnant people. Clin Infect Dis. 2024;79(Suppl 3):S104-S108.

7. Kiriyama S, Takada T, Hwang TL, Akazawa K, Miura F, Gomi H, et al. Clinical application and verification of the TG13 diagnostic and severity grading criteria for acute

cholangitis: an international multicenter observational study. J Hepatobiliary Pancreat Sci. 2017;24(6):329-337.

8. Mohan R, Goh SWL, Tan GW, Tan YP, Junnarkar SP, Huey CWT, et al. Validation of Tokyo Guidelines 2007 and Tokyo Guidelines 2013/2018 criteria for acute cholangitis and predictors of in-hospital mortality. Visc Med. 2021;37(5):434-442.

9. Gravito-Soares E, Gravito-Soares M, Gomes D, Almeida N, Tomé L. Clinical applicability of Tokyo Guidelines 2018/2013 in diagnosis and severity evaluation of acute cholangitis and determination of a new severity model. Scand J Gastroenterol. 2018;53(3):329-334.

10. Gomi H, Solomkin JS, Schlossberg D, Okamoto K, Takada T, Strasberg SM, et al. Tokyo Guidelines 2018: antimicrobial therapy for acute cholangitis and cholecystitis. J Hepatobiliary Pancreat Sci. 2018;25(1):3-16.

11. Otani T, Ichiba T, Seo K, Naito H. Blood cultures should be collected for acute cholangitis regardless of severity. J Infect Chemother. 2022;28(2):181-186.

12. Gromski MA, Gutta A, Lehman GA, Tong Y, Fogel EL, Watkins JL, et al. Microbiology of bile aspirates obtained at ERCP in patients with suspected acute cholangitis. Endoscopy. 2022;54(11):1045-1052.

13. Lee TS, Choi JH, Lee JM, Jeon H, Paik WH, Cho KB, et al. A randomized non-inferiority trial investigating antibiotic adjustments based on blood culture in acute cholangitis. Clin Microbiol Infect. 2025;31(6):987-994.

14. Evans L, Rhodes A, Alhazzani W, Antonelli M, Coopersmith CM, French C, et al. Surviving Sepsis Campaign: international guidelines for management of sepsis and septic shock 2021. Intensive Care Med. 2021;47(11):1181-1247.

15. Mukai S, Itoi T, Baron TH, Takada T, Strasberg SM, Pitt HA, et al. Indications and techniques of biliary drainage for acute cholangitis in updated Tokyo Guidelines 2018. J Hepatobiliary Pancreat Sci. 2017;24(10):537-549.

16. Buxbaum JL, Buitrago C, Lee A, Elmunzer BJ, Riaz A, Ceppa EP, et al. ASGE guideline on the management of cholangitis. Gastrointest Endosc. 2021;94(2):207-221.e14.

17. Manes G, Paspatis G, Aabakken L, Anderloni A, Arvanitakis M, Ah-Soune P, et al. Endoscopic management of common bile duct stones: European Society of Gastrointestinal Endoscopy guideline. Endoscopy. 2019;51(5):472-491.

18. Du L, Cen M, Zheng X, Luo L, Siddiqui A, Kim JJ. Timing of performing endoscopic retrograde cholangiopancreatography and inpatient mortality in acute cholangitis: a systematic review and meta-analysis. Clin Transl Gastroenterol. 2020;11(3):e00158.

19. Iqbal U, Khara HS, Hu Y, Khan MA, Ovalle A, Siddique O, et al. Emergent versus urgent ERCP in acute cholangitis: a systematic review and meta-analysis. Gastrointest Endosc. 2020;91(4):753-760.e4.

20. Huang YC, Wu CH, Lee MH, Wang SF, Tsou YK, Lin CH, et al. Timing of endoscopic retrograde cholangiopancreatography in the treatment of acute cholangitis of different severity. World J Gastroenterol. 2022;28(38):5602-5613.

21. Lyu Y, Wang B, Ye S, Cheng Y. Impact of the timing of endoscopic retrograde cholangiopancreatography for the treatment of acute cholangitis: a meta-analysis and systematic review. Surg Laparosc Endosc Percutan Tech. 2022;32(6):764-769.

22. Seo YJ, Hadaya J, Sareh S, Aguayo E, de Virgilio CM, Benharash P. National trends and outcomes in timing of ERCP in patients with cholangitis. Surgery. 2020;168(3):426-433.

23. van der Merwe SW, van Wanrooij RLJ, Bronswijk M, Everett S, Lakhtakia S, Rimbas M, et al. Therapeutic endoscopic ultrasound: European Society of Gastrointestinal Endoscopy guideline. Endoscopy. 2022;54(2):185-205.

24. Pawa S, Marya NB, Thiruvengadam NR, Ngamruengphong S, Baron TH, Bent CK, 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(6):967-979.

25. Srinu D, Shah J, Jena A, Jearth V, Singh AK, Mandavdhare HS, et al. Conventional vs short duration of antibiotics in patients with moderate or severe cholangitis: noninferiority randomized trial. Am J Gastroenterol. 2024;119(1):176-182.

26. Haal S, Ten Böhmer B, Balkema S, Depla ACTM, Fockens P, Jansen JM, et al. Antimicrobial therapy of 3 days or less is sufficient after successful ERCP for acute cholangitis. United European Gastroenterol J. 2020;8(4):481-488.

27. Masuda S, Imamura Y, Ichita C, Jinushi R, Kubota J, Kimura K, et al. Comparison of antimicrobial therapy termination in febrile and afebrile patients with acute cholangitis after drainage. Sci Rep. 2024;14(1):17858.

28. Buxbaum JL, Abbas Fehmi SM, Sultan S, Fishman DS, Qumseya BJ, Cortessis VK, et al. ASGE guideline on the role of endoscopy in the evaluation and management of choledocholithiasis. Gastrointest Endosc. 2019;89(6):1075-1105.e15.

29. Sohail A, Shehadah A, Chaudhary A, Naseem K, Iqbal A, Khan A, et al. Impact of index admission cholecystectomy vs interval cholecystectomy on readmission rate in acute cholangitis: National Readmission Database survey. World J Gastrointest Endosc. 2024;16(6):350-360.

30. Chandrashekar A, Jajoo AN, Li J, Srivastava R, Palakurthi A, Sandhu SK, et al. Same-admission cholecystectomy is safe and effective for patients with concurrent choledocholithiasis and cholangitis. Dig Dis Sci. 2026;71(9):4104-4112.