ORIGINAL RESEARCH PAPER

General Surgery

CHOLECYSTITIS : A SURGICAL OVERVIEW

KEY WORDS: Gall bladder,cholecystitis,gallstones

Dr.kavan.G.patel JR2,Department Of General Surgery,al-ameen Medical College Hospital,vijayapura

Dr.suresh. kagalkar* HOD & Professor,department Urology,al-ameen Medical College Hospital,vijayapura*Corresponding Author

Dr.vipul.mittal JR3,Department Of General Surgery,al-ameen Medical College Hospital,vijayapura

Dr.Anusha.C.S JR3,Department Of General Surgery,al-ameen Medical College Hospital,vijayapura

ABSTRACT

INTRODUCTION Cholecystitis, characterized by inflammation of the gallbladder, is a clinically significant condition that predominantly arises from obstruction of the cystic duct due to gallstones. The gallbladder, a small organ situated beneath the liver in the right upper abdominal quadrant, plays a pivotal role in the storage and regulated release of bile—a digestive fluid critical for lipid emulsification. When gallstones impede bile outflow, the resultant stasis triggers inflammatory pathways, leading to tissue damage and swelling. While gallstone-related obstruction accounts for the majority of cases, etiological factors such as biliary tract abnormalities, neoplasms, systemic critical illness, and infections may also contribute to pathogenesis. Acute cholecystitis, an inflammatory condition of the gallbladder, is most commonly triggered by gallstones obstructing the cystic duct (90-95% of cases), while 5-10% of cases occur without gallstones (acalculous cholecystitis), often linked to critical illness or systemic infection. Classic symptoms include sudden right upper abdominal pain, fever, and nausea, frequently accompanied by tenderness in the affected area. Initial diagnosis relies on abdominal ultrasound, which has moderate sensitivity (81%) and specificity (83%). If imaging is inconclusive, hepatobiliary scintigraphy—a nuclear medicine procedure using a radiotracer to visualize bile flow—provides definitive confirmation. Early surgical intervention with laparoscopic cholecystectomy (within 1-3 days of diagnosis) is strongly recommended, as it reduces complications (11.8% vs. 34.4% with delayed surgery), shortens hospital stays (5.4 vs. 10 days), and lowers healthcare costs. For pregnant patients, prompt surgery minimizes maternal-fetal risks (1.6% vs. 18.4% with delay) and is safe across all trimesters. Older adults (over 65) also benefit surgically, with a 15.2% mortality rate at two years compared to 29.3% with nonoperative care. While percutaneous cholecystostomy (gallbladder drainage) is an option for high-risk individuals, it carries higher complication rates (65%) than surgery (12%) and is reserved for severely ill acalculous cases. Timely, individualized management remains critical to optimizing outcomes and preventing life-threatening complications.Cholecystitis refers to inflammation of the gallbladder, a small organ beneath the liver that stores bile for fat digestion. Globally, it affects millions annually, with gallstones—hard deposits formed from bile components—causing 90-95% of cases by obstructing bile flow. The remaining 5-10% are acalculous cholecystitis, often tied to critical illness, trauma, or systemic infections. Modern lifestyles, including diets high in fats and sugars, contribute to rising gallstone prevalence, linking the condition to obesity and metabolic syndrome. Symptoms like sudden right upper abdominal pain, nausea, and fever make it a leading cause of emergency abdominal surgeries.Diagnosis combines ultrasound (81% sensitivity) and advanced imaging like hepatobiliary scintigraphy (HIDA scan) for unclear cases1. Treatment prioritizes early laparoscopic cholecystectomy, a minimally invasive surgery proven to reduce complications, hospital stays, and costs compared to delayed intervention. For high-risk patients, such as the elderly or critically ill, image-guided gallbladder drainage (percutaneous cholecystostomy) offers a temporary solution, though surgery remains definitive. In pregnancy, timely laparoscopic surgery is safe and reduces maternal-fetal risks. Globally, advancements in minimally invasive techniques and personalized care emphasize early intervention to prevent life-threatening complications like gallbladder rupture. Public health efforts target modifiable risk factors, such as promoting balanced diets and physical activity, to curb gallstone formation. With laparoscopic surgery now the gold standard, cholecystitis management reflects broader trends in healthcare: prioritizing efficiency, cost-effectiveness, and patient-centered outcomes in an increasingly resource-conscious world.

EPIDEMOLOGY

In India Gall bladder cancer and cholecystitis is most prevalent in northern and northeastern states of Uttar Pradesh, Bihar, Orissa, West Bengal and Assam. The incidence of any sort of gall bladder malfunctioning is two times higher in women than men and is the leading digestive cancer in women in northern Indian cities. Six Cancer registries of the Indian Council of Medical Research (1990–96) show a 10 times lower incidence of GBC per 100 000 in South India compared with the North, the age-adjusted incidence rate for females being 0.8 in Chennai in the south and 8.9 in Delhi in the north2. Acute cholecystitis, a significant global health concern, exhibits a marked age-related incidence, affecting approximately 6,300 individuals per 100,000 under 50 years of age and rising sharply to 20,900 per 100,000 in those over 50. In the United States, its prevalence is estimated at 369 cases per 100,000 people, underscoring its widespread clinical impact. While the overall mortality rate remains relatively low at 0.6%, the risk escalates with complications such as gangrenous gallbladder changes, perforation, or peritonitis—conditions that demand urgent intervention to prevent fatal outcomes. Though the WHO does not publish specific reports on cholecystitis, its advocacy for universal healthcare access and standardized treatment protocols aligns with efforts to reduce disparities in gallbladder disease outcomes. Public health campaigns targeting modifiable risk factors, such as obesity and poor dietary habits, further align with global goals to mitigate gallstone formation, a primary driver of cholecystitis. As populations age and metabolic disorders rise, understanding these

epidemiological trends and integrating preventive care remain essential to curbing the burden of this condition worldwide.

ETIOLOGY, PATHOGENESIS AND CLINICAL FEATURES

ETIOLOGY

Cholecystitis arises from two primary mechanisms: calculous (gallstone-related) and acalculous (non-gallstone-related).

1. CALCULOUS CHOLECYSTITIS (90–95% OF CASES):

Gallstones: Cholesterol stones (due to bile supersaturation) or pigment stones (linked to hemolysis or cirrhosis) obstruct the cystic duct, triggering inflammation.

Risk Factors:

Demographic: Female gender, age >40, Native American or Hispanic ethnicity.

Metabolic: Obesity, rapid weight loss, diabetes, metabolic syndrome.

Lifestyle: Prolonged fasting, high-fat/low-fiber diets.

Genetic: Family history of gallstones.

2. ACALCULOUS CHOLECYSTITIS (5–10% OF CASES):

Triggers: Critical illness (sepsis, trauma, burns), prolonged fasting, vasculopathy, or systemic inflammation.

Risk Groups: ICU patients, post-major surgery, immunocompromised individuals, or those on total parenteral nutrition (TPN).

3. OTHER CAUSES:

Biliary sludge, gallbladder tumors, parasitic infections (e.g., Ascaris lumbricoides), or congenital duct anomalies.

CLINICAL FEATURES

1. CLASSIC PRESENTATION:

Pain: Sudden, severe right upper quadrant (RUQ) pain radiating to the right scapula or shoulder.

Murphy's Sign: Arrest of inspiration during RUQ palpation due to pain.

Systemic Symptoms: Fever (>38°C), nausea, vomiting, anorexia.

Duration: Symptoms persist >6 hours, distinguishing it from biliary colic.

2. ATYPICAL PRESENTATIONS:

Elderly or Diabetics: Vague abdominal discomfort, absence of fever, or delayed symptom recognition.

Acalculous Cases: Subtle signs in critically ill patients (e.g., unexplained sepsis, ileus).

3. COMPLICATED DISEASE:

Gangrenous Cholecystitis: Severe pain, high fever, tachycardia, and hemodynamic instability.

Perforation/Peritonitis: Rigid abdomen, rebound tenderness, and systemic toxicity.

4. DIAGNOSTIC CRITERIA (TOKYO GUIDELINES 2018):

Local Inflammation: RUQ pain/tenderness.

Systemic Signs: Fever, leukocytosis, elevated CRP.

Imaging Findings: Gallbladder wall thickening (>4 mm), pericholecystic fluid, or sonographic Murphy's sign.

PATHOGENESIS

1. CALCULOUS CHOLECYSTITIS:

Obstruction: Gallstones block the cystic duct, causing bile stasis and increased intraluminal pressure.

Ischemia: Distended gallbladder compresses mucosal blood flow, leading to tissue hypoxia and necrosis.

Inflammation: Damaged mucosa releases prostaglandins (e.g., PGE2), attracting neutrophils and cytokines (IL-6, TNF-).

Secondary Infection: Bacterial overgrowth (E. coli, Klebsiella, Enterococcus) in stagnant bile exacerbates inflammation.

2. ACALCULOUS CHOLECYSTITIS:

Bile Stasis: Critical illness or fasting reduces gallbladder motility, concentrating bile and promoting sludge formation.

ISCHEMIA-REPERFUSION INJURY: Hypotension or vasospasm in systemic illness causes endothelial damage and oxidative stress.

INFLAMMATORY CASCADE: Cytokine storm (e.g., in sepsis) triggers gallbladder wall edema and microthrombosis.

Direct Mucosal Injury: Bile salt toxicity in the absence of protective mucin.

3. PROGRESSION TO COMPLICATIONS:

Persistent inflammation leads to gangrene (tissue death), perforation (rupture), or abscess formation.

Bacterial translocation into the bloodstream risks septic shock.

DIAGNOSIS

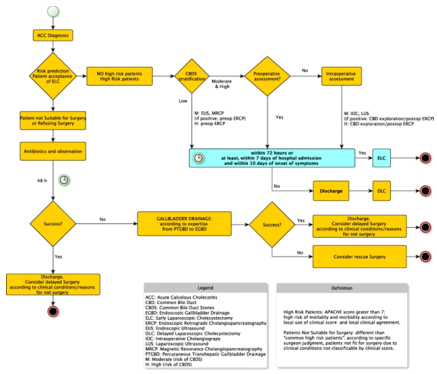
The diagnosis of cholecystitis hinges on a combination of clinical evaluation, imaging, and laboratory findings. Clinically, patients typically present with persistent right upper quadrant (RUQ) pain, fever, and tenderness on palpation (Murphy's sign), though atypical presentations, such as vague discomfort in elderly or critically ill individuals, require heightened suspicion. Initial imaging begins with abdominal ultrasound, the first-line modality due to its accessibility and moderate sensitivity (81%) and specificity (83%) for detecting hallmark features like gallbladder wall thickening (>4 mm), pericholecystic fluid, or impacted gallstones. For equivocal cases, hepatobiliary scintigraphy (HIDA scan) serves as the gold standard, confirming cystic duct obstruction by tracing radiotracer excretion into the bile. Laboratory studies often reveal leukocytosis and elevated C-reactive protein (CRP), supporting systemic inflammation. In complicated scenarios, such as suspected gangrene or perforation, cross-sectional imaging with CT or MRI provides detailed anatomical assessment.Ultrasound (US) is the most employed imaging technique for the initial diagnosis of AC. Thickening of the gallbladder wall (>3 mm) with a layered appearance, gallstones or retained debris, pericholecystic fluid, and gallbladder enlargement are the typical sonographic signs3. The Tokyo Guidelines (2018) offer a structured diagnostic framework, integrating clinical, laboratory, and imaging criteria to standardize accuracy and reduce diagnostic delays, ensuring timely intervention.In short useful features for the diagnosis of ACC are:

- History and clinical examination: fever, right upper quadrant pain or tenderness, vomiting or food intolerance; Murphy's sign
- Laboratory tests: elevated C-reactive protein, elevated white blood cell count
- Imaging: signs suggestive of gallbladder inflammation4

The above flowchart shows management of Cholecystitis according to the 2020 guidelines of the world society of emergency surgery

Fig. 1-Management of cholecystitis)[4]

MANAGEMENT AND SURGICAL APPROACH



SURGICAL APPROACH

The surgical approach to cholecystitis prioritizes early intervention, with laparoscopic cholecystectomy remaining the gold standard due to its minimally invasive nature, shorter recovery, and reduced complication rates compared to traditional open cholecystectomy, which is now reserved for complex cases (e.g., gangrene, perforation) or limited-resource settings. Conventional methods, such as open surgery, involve larger incisions and longer hospital stays but offer direct visualization in anatomically challenging scenarios. In contrast, advanced modern techniques emphasize precision and patient-specific care: robotic-assisted laparoscopic surgery enhances dexterity in intricate dissections, while single-incision laparoscopic surgery (SILS) improves cosmesis with comparable outcomes. For high-risk patients (e.g., critically ill, elderly), percutaneous cholecystostomy—a temporary image-guided drainage procedure—bridges unstable individuals to definitive surgery, though its higher complication rates (65% vs. 12% for laparoscopy) limit routine use. Emerging alternatives like endoscopic gallbladder drainage offer non-surgical relief in select cases. Recent guidelines advocate for early cholecystectomy (within 72 hours of diagnosis), shown to reduce postoperative complications (11.8% vs. 34.4% with delayed surgery), shorten hospital stays, and lower costs. Innovations such as AI-assisted preoperative planning and targeted antibiotic protocols further refine outcomes, particularly in vulnerable groups like pregnant patients, where early laparoscopy reduces maternal-fetal risks (1.6% vs. 18.4%). Modern management thus balances minimally invasive efficiency with tailored strategies, reflecting advancements in technology and evidence-based precision5.However, it is important to note that early Laparoscopic procedure should only be performed by surgeons who possess a high level of competence, and if the surgical conditions make it challenging to identify the anatomical structures, it should be promptly converted to open procedure. For patients diagnosed with severe cholecystitis, initial management often involves conservative treatment utilizing antibiotics6.Recent innovations in cholecystitis surgery prioritize precision, reduced invasiveness, and enhanced recovery. Robotic-assisted laparoscopic cholecystectomy has emerged as a breakthrough, offering superior dexterity and 3D visualization, particularly beneficial in complex cases involving severe inflammation or aberrant anatomy. Single-incision laparoscopic surgery (SILS) minimizes scarring by using a single umbilical port, improving cosmesis without compromising safety or efficacy. The paradigm shift toward ultra-early cholecystectomy (within 24–72 hours of symptom onset) is now strongly supported by evidence, reducing complications (e.g., bile duct injury rates <0.5%) and hospital stays compared to delayed approaches. For high-risk patients, endoscopic gallbladder drainage via lumen-apposing metal stents (LAMS) provides a nonsurgical alternative, while fluorescence cholangiography—using indocyanine green dye—enhances real-time biliary tree mapping during laparoscopy, slashing bile duct injury risks. Additionally, enhanced recovery after surgery (ERAS) protocols integrate preoperative nutrition, minimized opioid use, and early mobilization, accelerating postoperative recovery. AI-driven tools now aid in preoperative risk stratification, predicting complications like gangrene or conversion to open surgery. These advancements, coupled with tailored approaches for vulnerable groups (e.g., pregnant patients, the elderly), reflect a transformative era in cholecystitis management, balancing technical innovation with patient-centered outcomes.As elaborated upon earlier, the single-site laparoscopic cholecystectomy is a scarless surgery with minimal access[7].

CONCLUSION

Recent advancements in cholecystitis surgery have revolutionized patient care through minimally invasive precision and personalized strategies. Robotic-assisted and single-incision laparoscopic techniques minimize scarring and enhance safety, while ultra-early intervention (within 72 hours) reduces complications and hospital stays. Innovations like fluorescence cholangiography and endoscopic drainage offer targeted solutions for high-risk cases, complemented by AI-driven risk assessment and ERAS protocols to optimize recovery. These developments underscore a shift toward patient-centered, technology-enhanced management, improving outcomes across diverse populations, including vulnerable groups like the elderly and pregnant individuals. By integrating cutting-edge tools with evidence-based timing, modern surgery for cholecystitis ensures safer, faster, and more effective care in the evolving landscape of gastrointestinal health. While laparoscopic cholecystectomy is now the standard of care, patients should be informed about the possibility of conversion to an open procedure. The risk of injury to the bile duct is always a possibility depending on the experience of the surgeon. For those patients who are asymptomatic, it is important to recommend a healthy low-fat diet, maintenance of low body weight and regular exercise8.

REFERENCES

1. Gallaher, J. R., & Charles, A. (2022). Acute cholecystitis. JAMA, 327(10), 965. https://doi.org/10.1001/jama.2022.2350
2. Unisa, S., Jagannath, P., Dhir, V., Khandelwal, C., Sarangi, L., & Roy, T. K. (2011). Population-based study to estimate prevalence and determine risk factors of gallbladder diseases in the rural Gangetic basin of North India. HPB : the official journal of the International Hepato Pancreato Biliary Association, 13(2), 117–125. https://doi.org/10.1111/j.1477-2574.2010.00255.x
3. 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
4. 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(1). https://doi.org/10.1186/s13017-020-00336-x
5. The difference between laparoscopy and traditional surgery - Dr. Senai Aksoy. (n.d.). https://draksoyivf.com/blog/difference-between-laparoscopy-and-traditional-surgery/
6. Mannam, R., Sankara Narayanan, R., Bansal, A., Yanamaladoddi, V. R., Sarvepalli, S. S., Vemula, S. L., & Aramadaka, S. (2023). Laparoscopic Cholecystectomy Versus Open Cholecystectomy in Acute Cholecystitis: A Literature Review. Cureus, 15(9), e45704. https://doi.org/10.7759/cureus.45704
7. Ansari, U., Syed, B., Sedighi, R., Ansari, K., Akhtar, M., & Davies, Y. (2024). Advancing Robotic Single-Site Cholecystectomy: Innovations, Challenges, and Future Directions. Cureus, 16(5), e60643. https://doi.org/10.7759/cureus.60643
8. Hassler, K. R., Collins, J. T., Philip, K., & Jones, M. W. (2025, January 21). Laparoscopic cholecystectomy. StatPearls - NCBI Bookshelf. https://www.ncbi.nlm.nih.gov/books/NBK448145/
9.