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Characteristics, Microbiological, and Management Outcomes of Acute Cholangitis Patients in Hospital Settings

Satriya Kelana[1*]

[1] Universitas Airlangga, Surabaya, Indonesia

[*] *Corresponding author: Satriya Kelana (satriya.kelana@fk.unair.ac.id)*

Abstract

Acute cholangitis is a serious condition caused by cholestasis and biliary tract infection due to biliary stenosis, which carries a high risk of morbidity and mortality if not treated promptly. This study aimed to describe the characteristics of patients with acute cholangitis during the period January 2020–June 2021. The study used a descriptive observational approach with a cross-sectional design, utilizing secondary data obtained from patients' medical records. A total of 71 patients were identified, consisting of 7 patients with mild acute cholangitis, 40 patients with moderate severity, and 24 patients with severe conditions. The most commonly isolated bacteria were *Staphylococcus haemolyticus* (17%), *Escherichia coli* (16%), and *Staphylococcus hominis* (15%). Antibiotic sensitivity testing showed that vancomycin and linezolid were the most effective antibiotics (12% each), followed by chloramphenicol (11%). The most frequently performed procedures were open cholecystectomy (44%) and Percutaneous Transhepatic Biliary Drainage (PTBD) (29%). In conclusion, acute cholangitis requires prompt and comprehensive management, including fluid resuscitation, targeted antibiotic therapy based on culture results, and appropriate surgical intervention to reduce complications and improve patient outcomes.

Keywords

Acute Cholangitis, Antibiotic, Bacteria, Open Cholecystectomy.

1. Introduction

Cholangitis is a clinical condition characterized by cholestasis and infection of the biliary tract, resulting from partial or complete obstruction of bile flow due to biliary stenosis (Kiriyama et al., 2013; Cozma et al., 2024). This condition poses a significant risk of morbidity and mortality if not managed appropriately and in a timely manner. Cholangitis was first described by Jean Martin Charcot, who identified the classical clinical presentation known as Charcot's triad, consisting of fever, jaundice, and right upper quadrant abdominal pain. The etiology of cholangitis is highly diverse, encompassing causes such as bile duct stones, tumor-related strictures, and parasitic infections, all of which contribute to variations in the underlying pathogenesis depending on the specific cause involved (Carpenter, 1998; Lim et al., 2007; Kimura et al., 2007; Kiriyama et al., 2012; Gomi et al., 2017).

Cholangitis can generally be classified into several major categories, including Primary Sclerosing Cholangitis (PSC), secondary cholangitis, most commonly presenting as acute cholangitis, and immune-mediated forms of cholangitis (Alizadeh, 2017; Sarcognato et al., 2021; Manns et al., 2025). Among these classifications, acute cholangitis represents the most frequently encountered type in clinical practice. Although bacterial infection remains the primary underlying cause, other mechanisms such as immune-mediated processes, including IgG4-associated cholangitis, as well as genetic predisposition, particularly in cases of PSC, also play a role in disease development (Manganis et al., 2020). Due to the multifactorial nature and complexity of this condition, effective management of cholangitis necessitates a comprehensive approach that involves accurate diagnosis, appropriate therapeutic interventions, and ongoing clinical evaluation to ensure optimal patient outcomes.

Acute cholangitis is a severe and potentially life-threatening infection of the biliary tract that arises when bacterial invasion occurs in the setting of bile duct obstruction (Zimmer & Lammert, 2015). The presence of obstruction leads to increased intrabiliary pressure, which in turn facilitates the movement of bacteria and endotoxins into the systemic circulation through a mechanism known as cholangiovenous reflux. This process can rapidly progress to systemic infection and sepsis if not promptly managed. The most common underlying causes of biliary obstruction include choledocholithiasis, benign or malignant strictures, pancreatic tumors, and obstruction of biliary stents (Kiriyama et al., 2018; Susilawati et al., 2022).

Acute cholangitis was associated with very high mortality rates, reaching up to 50%. However, significant improvements in medical practice, particularly in diagnostic imaging, antimicrobial therapy, and biliary drainage techniques, have substantially reduced mortality to below 10% in many clinical settings. Despite these advances, delayed recognition and treatment of the condition continue to pose serious risks, as patients may develop severe complications such as septic shock, multiple organ failure, and even death. These risks are especially pronounced in elderly patients and in individuals with underlying comorbidities, highlighting the importance of early diagnosis and timely intervention (Gomi et al., 2018; Tjitrawati & Romadhona, 2024).

Despite advances in management, acute cholangitis remains a significant global health concern due to the high prevalence of gallstone disease and increasing biliary interventions. Epidemiological studies in hospital settings are essential to better understand patient characteristics, etiologies, treatment approaches, and outcomes. Such data are crucial for improving early diagnosis, optimizing management strategies, and reducing complications. Therefore, this study aims to analyze the characteristics of acute cholangitis patients treated at Dr. Soetomo Hospital

Surabaya during the period January to June 2021 in order to provide insights into local disease patterns and improve clinical management.

2. Literature Review

2.1. Overview of Acute Cholangitis

Acute cholangitis is a bacterial infection that occurs due to obstruction of the bile duct, most often from gallstones. The classic triad of symptoms is right upper quadrant pain, fever, and jaundice. Cholangitis is caused by a combination of two factors: significant bacterial colonization in the bile and biliary obstruction. Organisms commonly found in bile include *Escherichia coli*, *Klebsiella pneumoniae*, *the enterococci*, and *Bacteroides fragilis*. Biliary obstruction is a common cause of acute cholangitis. Choledocholithiasis is the most common cause of obstruction. Acute cholangitis has long been diagnosed based on Charcot's triad, a set of clinical signs with relatively low sensitivity (Sokal et al., 2019).

To improve the sensitivity of Charcot's triad, the Tokyo Guidelines 2018 (TG18) were developed by integrating three key components: systemic inflammation (fever and abnormal inflammatory markers), cholestasis (jaundice or abnormal liver function tests), and imaging findings (biliary dilatation and identification of the underlying etiology) (Briola, 2022). These criteria provide a more structured and sensitive diagnostic framework compared to clinical assessment alone. Imaging modalities such as abdominal ultrasound, Computed Tomography (CT), and Magnetic Resonance Imaging (MRI) or Magnetic Resonance Cholangiopancreatography (MRCP) are essential to support diagnosis. However, abdominal ultrasound cannot definitively confirm acute cholangitis, although it is useful in detecting biliary obstruction or stenosis that may underlie the condition.

2.2. Pathophysiology and Clinical Presentation of Acute Cholangitis

The pathophysiology of acute cholangitis is characterized by a complex interaction between biliary obstruction and bacterial infection. When obstruction occurs, it results in bile stasis and a progressive increase in intrabiliary pressure, creating an environment that facilitates bacterial growth and proliferation within the biliary system. This elevated pressure also promotes the translocation of bacteria and their endotoxins into the bloodstream, leading to systemic dissemination and increasing the risk of sepsis. The microorganisms most commonly involved are gram-negative bacteria, including *Escherichia coli*, *Klebsiella* spp., and *Enterobacter* spp., which originate from the gastrointestinal tract. In addition, gram-positive bacteria such as *Enterococcus* may also contribute to infection. Due to the diverse microbial flora present in the digestive system, infections are frequently polymicrobial, further complicating the disease process and its management (Miura et al., 2018; Tjitrawati et al., 2023).

From a clinical perspective, acute cholangitis is commonly identified through characteristic symptom patterns, although these may not always be fully present (An et al., 2021). The classic presentation is known as Charcot's triad, which consists of fever, right upper quadrant abdominal pain, and jaundice (de Virgilio, 2019). In more severe and advanced cases, patients may develop Reynolds' pentad, which includes additional features such as hypotension and altered mental status, indicating the presence of septic complications. However, not all patients exhibit these classical signs in their entirety, making diagnosis challenging in many cases. As a result, clinicians must rely on a comprehensive assessment that integrates clinical findings with laboratory investigations and imaging modalities to establish an accurate diagnosis and determine disease severity (Kiriyama et al., 2018; Kinasih et al., 2024; Wahyud et al., 2024).

2.3. Diagnostic Evaluation of Acute Cholangitis

Laboratory findings in acute cholangitis typically reflect the presence of systemic inflammation and impaired bile flow (cholestasis). Common abnormalities include leukocytosis and elevated levels of inflammatory markers such as C-reactive protein, indicating an ongoing infectious process. In addition, biochemical evidence of biliary obstruction is often observed, including increased serum bilirubin levels (hyperbilirubinemia) and elevated liver enzymes, particularly alkaline phosphatase and gamma-glutamyl transferase (Kalas et al., 2021). These laboratory parameters not only support the diagnosis but also help assess the severity of the condition and monitor the patient's response to treatment (Gomi et al., 2018).

Imaging studies play a pivotal role in confirming the diagnosis by identifying the presence, location, and cause of biliary obstruction. Ultrasonography is commonly used as the first-line modality due to its accessibility and non-invasive nature, although its sensitivity may be limited in certain cases. For a more comprehensive evaluation, CT and MRCP provide detailed visualization of the biliary tree and surrounding structures. To standardize the diagnostic approach and guide clinical management, the Tokyo Guidelines 2018 (TG18) are widely applied, integrating clinical, laboratory, and imaging criteria. These guidelines also classify disease severity into mild, moderate, and severe categories, which are essential for determining appropriate therapeutic strategies and improving patient outcomes (Kiriyama et al., 2018; Ramadani et al., 2024).

2.4. Management of Acute Cholangitis

Management of acute cholangitis primarily emphasizes prompt supportive care, appropriate antimicrobial therapy, and timely biliary decompression to prevent disease progression. Early management includes fluid resuscitation to restore intravascular volume, stabilization of hemodynamic status, and continuous monitoring of vital signs to detect any signs of deterioration. In addition, empirical broad-spectrum antibiotics should be initiated as soon as possible to control infection, particularly targeting gram-negative and anaerobic organisms commonly involved in biliary infections. Recommended regimens include piperacillin-tazobactam, third-generation cephalosporins combined with metronidazole, or carbapenems, depending on the severity of the condition and local antimicrobial resistance patterns (Gomi et al., 2018; Ramadani et al., 2023).

Definitive management of acute cholangitis requires the relief of biliary obstruction, especially in patients with moderate to severe disease or in those who do not respond adequately to initial medical therapy. Biliary drainage is a critical intervention aimed at reducing intrabiliary pressure, eliminating the source of infection, and preventing further systemic complications (See, 2020). Among the available techniques, Endoscopic Retrograde Cholangiopancreatography (ERCP) is considered the gold standard, as it enables both diagnostic evaluation and therapeutic intervention in a single procedure (Papaefthymiou et al., 2025). Through ERCP, clinicians can achieve effective decompression while simultaneously addressing the underlying cause, such as removing bile duct stones or placing stents, thereby significantly improving clinical outcomes and reducing mortality rates (Miura et al., 2018).

3. Methods

This study is a descriptive observational study with a cross-sectional design, conducted at Dr. Soetomo General Hospital, Surabaya, from January 2020 to June 2021. The study aimed to provide a detailed description of patients diagnosed with acute cholangitis, focusing on patient characteristics, disease severity, and treatment patterns. Data were obtained retrospectively from the medical records of patients admitted to the surgical department, which included both paper-based medical

record sheets and electronic medical records. By using medical records as the primary data source, the study ensured access to comprehensive clinical information, including demographic data, clinical symptoms, diagnostic results, and treatment details, reflecting real-world hospital practice.

The study population consisted of all patients whose medical records met the established inclusion criteria. A total of 71 patients were identified, consisting of 7 patients with mild acute cholangitis, 40 patients with moderate severity, and 24 patients with severe conditions. The inclusion criteria required a confirmed diagnosis of acute cholangitis by either a surgical specialist or a resident surgeon. To maintain data accuracy and relevance, records were excluded if the diagnosis was later revised and did not meet the criteria for acute cholangitis, or if essential information in the medical records was incomplete or missing. Applying these criteria allowed the researchers to focus on reliable data, ensuring that the descriptive analysis reflected true clinical patterns and patient management practices.

Data collection involved a systematic review of the selected medical records, and all relevant information was extracted and recorded. Descriptive statistical analysis was then performed to summarize the data, presenting the frequency and percentage of each variable, including the number of patients with mild, moderate, and severe acute cholangitis, as well as the medications and interventions administered. All analyses were conducted using IBM SPSS Statistics software, version 26. By presenting the data in a descriptive format, this study provides valuable insights into the clinical characteristics and management of acute cholangitis at a major referral hospital in Surabaya, which may inform future clinical practice and hospital policy, as well as serve as a foundation for further research on this condition.

4. Results

A total of 71 patients diagnosed with acute cholangitis were recorded at Dr. Soetomo General Hospital between January 2020 and June 2021. Based on disease severity classification, 7 patients (10%) were categorized as having mild acute cholangitis, 40 patients (56%) as moderate, and 24 patients (34%) as severe. This distribution indicates that moderate cases were the most prevalent in this cohort, followed by severe cases, while mild cases were relatively less common. The predominance of moderate and severe cases may suggest that many patients present to the hospital at a more advanced stage of the disease, potentially due to delayed diagnosis or referral (Gomi et al., 2018).

The classification of patients according to disease severity provides a comprehensive overview of the clinical profile of acute cholangitis in this setting. It reflects not only the burden of disease but also the complexity of cases managed in a tertiary referral hospital. Furthermore, severity stratification plays a crucial role in guiding clinical decision-making, as treatment approaches differ significantly between mild, moderate, and severe cases. For instance, mild cases may respond well to conservative management with antibiotics, whereas moderate and severe cases often require early biliary drainage and more intensive monitoring (Nve et al., 2023).

In addition, understanding the distribution of disease severity assists healthcare providers in planning appropriate treatment strategies, optimizing the allocation of medical resources, and improving overall patient management. It enables clinicians to prioritize patients who require urgent intervention, particularly those with severe disease who are at higher risk of complications such as sepsis, organ dysfunction, and mortality. Therefore, severity-based classification is essential not only for clinical assessment but also for improving outcomes and ensuring efficient healthcare delivery (Miura et al., 2018).

Table 1. Patient's Bacterial Culture

Bacterial Culture	Total Patient (%)
Corynobacterium species	10 (14%)
Escherichia coli	11 (16%)
Methicillin-Resistant Staphylococcus aureus	7 (10%)
Staphylococcus aureus	8 (11%)
Staphylococcus epidermidis	9 (13%)
Staphylococcus haemolyticus	12 (17%)
Staphylococcus hominis	11 (15%)
No germs found	3 (4%)
Total	71 (100%)

Table 1 shows the results of blood cultures from all patients who underwent testing during the study period. The distribution of bacterial pathogens causing acute cholangitis is presented in the table. After data analysis, the most frequently identified bacterium was *Staphylococcus haemolyticus*, found in 12 samples, representing 17% of the total. This was followed by *Escherichia coli* in 11 samples (16%) and *Staphylococcus hominis* in 11 samples (15%). Out of the 71 samples, 3 cases (4%) did not show any bacterial growth in the culture results. These findings indicate that while most cases of acute cholangitis were associated with identifiable bacterial pathogens, a small proportion did not yield detectable bacteria (Zimmer & Lammert, 2015).

The variation in bacterial species emphasizes the importance of performing blood cultures to guide appropriate antimicrobial therapy. The information from these results provides insight into the microbiological profile of acute cholangitis at Dr. Soetomo General Hospital and supports healthcare providers in selecting empirical antibiotic treatments tailored to the most commonly encountered pathogens. In the management of acute cholangitis, antibiotics are given to patients according to the results of antibiotic sensitivity tests from bacterial cultures (Kawamura et al., 2020).

Table 2. Types of Antibiotics

Types of Antibiotics that are Sensitive	Total (%)
Amikacin	5 (3%)
Amoxiclav	12 (7%)
Ampicilin-Sulbactam	1 (1%)
Cefoperzone-Sulbactam	1 (1%)
Chloramphenicol	20 (11%)
Ciprofloxacin	2 (1%)
Clindamycine	3 (2%)
Cotrimoxazole	11 (6%)
Erythromycine	8 (4%)
Fosfomycin	6 (3%)
Gentamycin	17 (9%)
Imipenem	1 (1%)
Linezolid	21 (12%)
Meropenem	5 (3%)
Moxifloxacin	5 (3%)
Oxacilin	7 (4%)
Piperacilin-Tazobactam	1 (1%)
Quinipristin-dalfopristin	3 (2%)
Teicoplanin	17 (9%)
Tetracylin	9 (5%)
Tigecycline	5 (3%)
Vancomycin	21 (12%)
Total	71 (100%)

According to the data presented in Table 2, the antibiotics that showed the highest sensitivity against the bacterial pathogens causing acute cholangitis in patients at Dr. Soetomo General Hospital were vancomycin and linezolid, each effective in 21 samples, accounting for 12% of the total cases. Chloramphenicol was the next most sensitive antibiotic, effective in 20 samples, representing 11% of the cases. These results indicate that vancomycin and linezolid are among the most suitable antibiotics for treating infections caused by the predominant bacteria identified in this study, while chloramphenicol remains a viable option for certain cases (Kiriyama et al., 2018; Risambessy, 2023).

The pattern of antibiotic sensitivity highlights the importance of selecting treatment based on blood culture and sensitivity testing (Cozma et al., 2024). By identifying the most effective antibiotics, healthcare providers can initiate empirical therapy with greater confidence and adjust treatment as needed according to laboratory results. This approach helps optimize patient outcomes, reduce the risk of complications, and minimize the development of antibiotic resistance among bacterial pathogens responsible for acute cholangitis.

Surgical procedures for the management of patients with acute cholangitis at Dr. Soetomo Regional Hospital include a variety of interventions aimed at relieving biliary obstruction, controlling infection, and preventing complications. These procedures are selected based on the severity of the disease, the patient's overall condition, and the underlying cause of cholangitis, ensuring that each patient receives the most appropriate surgical treatment (Sokal et al., 2019; An et al., 2021).

Table 3. Types of Surgical Procedures

Procedures	Percentages (%)
Double Bypass Biliodigestif	4 (6%)
External Drainage	9 (13%)
MRCP	5 (7%)
Open cholecystectomy	31 (44%)
PTBD	21 (29%)
Whipple procedure	1 (1%)
Total	71 (100%)

Based on Table 3, the data analysis revealed that the most common surgical procedures performed in this sample were open cholecystectomy, accounting for 31 cases (44%), followed by Percutaneous Transhepatic Biliary Drainage (PTBD) with 21 cases (29%). These findings indicate that open surgical intervention remains the predominant approach in managing patients within this cohort, likely reflecting the severity of biliary obstruction or limitations in access to less invasive procedures (Gomi et al., 2018; Miura et al., 2018). Meanwhile, PTBD was also frequently utilized as an alternative method for biliary decompression, particularly in patients who were not suitable candidates for endoscopic intervention.

In contrast, the Whipple procedure (pancreaticoduodenectomy) was the least commonly performed surgical intervention, with only 1 case (1%), suggesting that cases requiring extensive surgical management due to malignancy or complex pancreaticobiliary conditions were relatively rare in this study population (Gomi et al., 2018). The distribution of surgical procedures highlights a preference toward definitive and decompressive interventions, tailored to the clinical condition and underlying etiology of each patient.

5. Discussion

Acute cholangitis is a potentially life-threatening biliary tract infection that requires prompt diagnosis and management (Smith, 2024). Initial treatment includes adequate fluid resuscitation, administration of antibiotics, analgesics, and close

monitoring of vital signs. Patients are typically kept fasting in anticipation of possible urgent biliary drainage. The management strategy is largely guided by disease severity, as outlined in the Tokyo Guidelines 2018, which emphasize that biliary drainage and antimicrobial therapy are the two main pillars of treatment (Gomi et al., 2018; Miura et al., 2018).

In this study, most patients were classified as having moderate (56%) and severe (34%) acute cholangitis, with only 10% categorized as mild. This distribution suggests that patients often present at an advanced stage of disease, possibly due to delayed diagnosis or referral. Similar patterns have been reported in previous studies, where higher severity is associated with increased risk of complications such as sepsis and organ dysfunction (Kiriyama et al., 2018; Cozma et al., 2024). Severity stratification is therefore essential not only for clinical decision-making but also for predicting prognosis and determining the urgency of intervention.

The microbiological findings revealed that *Staphylococcus haemolyticus* (17%) was the most frequently isolated pathogen, followed by *Escherichia coli* (16%) and *Staphylococcus hominis* (15%). According to TG18 and other literature, the most common causative organisms of acute cholangitis are typically enteric bacteria such as *Escherichia coli*, *Klebsiella pneumoniae*, and *Enterococcus* species (Zimmer & Lammert, 2015; Gomi et al., 2017). The relatively high prevalence of *Staphylococcus* species in this study is notable, as these organisms are not commonly associated with biliary infections. This finding may be explained by factors such as prior invasive procedures, bacteremia, or prolonged antibiotic exposure, which can alter the normal microbial flora and promote opportunistic infections (Carpenter, 1998). Therefore, the local microbiological profile should be carefully considered when selecting empirical therapy.

Antibiotic sensitivity testing demonstrated that vancomycin and linezolid were the most effective agents, each showing sensitivity in 12% of cases, followed by chloramphenicol (11%). These results differ from standard recommendations in TG18, which typically prioritize broad-spectrum antibiotics targeting gram-negative bacteria (Gomi et al., 2018). The higher effectiveness of antibiotics active against gram-positive organisms in this study may correlate with the predominance of *Staphylococcus* species. This highlights the importance of culture-guided antibiotic therapy to ensure appropriate treatment, reduce the risk of antimicrobial resistance, and improve clinical outcomes (Sokal et al., 2019; An et al., 2021).

In terms of surgical management, open cholecystectomy (44%) and percutaneous transhepatic biliary drainage (29%) were the most commonly performed procedures. According to TG18, endoscopic transpapillary biliary drainage is recommended as the first-line intervention due to its minimally invasive nature and lower complication rates (Miura et al., 2018). However, the high proportion of open surgical procedures in this study may reflect the severity of cases, delayed presentation, or limited access to advanced endoscopic facilities. PTBD remains an important alternative, particularly in patients who are not suitable candidates for endoscopic intervention.

The findings of this study are consistent with existing literature regarding the importance of early diagnosis, severity-based management, and timely biliary decompression. However, differences in microbiological patterns and antibiotic sensitivity emphasize the need for localized clinical approaches. These results highlight the importance of integrating severity assessment, microbiological evaluation, and local antibiotic sensitivity patterns into clinical decision-making. Hospitals should strengthen early detection systems, optimize access to minimally invasive biliary drainage, and promote culture-based antibiotic stewardship to improve patient outcomes and reduce mortality in acute cholangitis.

6. Conclusion

Acute cholangitis is a life-threatening biliary tract infection that requires prompt diagnosis and immediate management. This study found that the most commonly identified pathogens were *Staphylococcus haemolyticus* and *Escherichia coli*, with vancomycin and linezolid showing the highest sensitivity among tested antibiotics. Initial management, including rehydration, empiric antibiotic therapy, and supportive care, remains essential to stabilize patients, while definitive interventions such as biliary drainage procedures, including percutaneous transhepatic biliary drainage and open cholecystectomy, play a crucial role in reducing intrabiliary pressure and improving clinical outcomes.

These findings underscore the importance of culture-based antibiotic selection in managing acute cholangitis, particularly in the context of varying antimicrobial resistance patterns, suggesting that empirical antibiotic regimens should be continuously evaluated and adapted to local microbiological data. Early and appropriate intervention, combining targeted antibiotic therapy with timely biliary decompression, can significantly improve patient prognosis and reduce mortality. However, this study has several limitations, including a relatively small sample size and its single-center design, which may limit the generalizability of the findings, as well as the retrospective nature of the data, which may introduce potential bias. Therefore, future research is needed to involve larger, multicenter populations and prospective study designs to provide more comprehensive evidence, as well as ongoing evaluation of antibiotic resistance patterns and the effectiveness of minimally invasive drainage techniques compared to conventional surgical approaches in order to optimize the management of acute cholangitis.

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The authors declare that there is no conflict of interest.

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Ethical approval was obtained for this study. The manuscript represents original work and has not been previously published, nor is it under consideration by another journal.

Data Disclosure Statement
The data that support the findings of this study are available from the corresponding author upon reasonable request.

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