

# Management of acute calculous cholecystitis in the emergency department: Evaluating the role of laboratory and radiological findings in a retrospective study

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## ABSTRACT

**BACKGROUND:** Acute calculous cholecystitis (ACC) is a significant cause of acute abdominal pain, accounting for 90-95% of gallbladder inflammations caused by gallstones. Its clinical presentation ranges from nonspecific abdominal pain to septic conditions associated with an acute abdomen. Timely and accurate diagnosis is critical in patient management, as delayed diagnosis or inadequate treatment can result in increased morbidity and life-threatening complications such as perforation or biliary peritonitis. This study aims to identify factors influencing the severity of ACC by analyzing the relationship between laboratory findings, radiological imaging, and pathology results in cases managed in the emergency department.

**METHODS:** This retrospective study was conducted at the emergency department of Etlik City Hospital, a tertiary care center. Patients diagnosed with acute cholecystitis were included in the study, while those under 18 years of age and those with choledocholithiasis were excluded. Patients' radiological findings, laboratory parameters, and pathological results were analyzed.

**RESULTS:** A total of 230 patients were included in the study. Patients with pericholecystic fluid exhibited significantly thicker gallbladder walls ( $p=0.002$ ). A significant association was found between elevated white blood cell (WBC) counts and gallbladder wall thickness ( $p=0.035$ ). However, no significant relationship was observed between liver function test results and gallbladder wall thickness.

**CONCLUSION:** This study evaluated the diagnostic and management parameters utilized by clinicians in cases of acute calculous cholecystitis. The association between increased gallbladder wall thickness and pericholecystic fluid was highlighted as a key factor in diagnosis and follow-up. Although laboratory and imaging modalities provide supportive roles in diagnosis, their necessity may vary depending on the individual case. The study emphasizes the importance of a holistic approach that integrates clinical, laboratory, and radiological findings to optimize patient outcomes in the emergency department, avoid unnecessary interventions, and prevent delays in surgical treatment.

**Keywords:** Acute calculous cholecystitis; pericholecystic fluid; gallbladder wall thickness; emergency diagnosis; ultrasonography.

## INTRODUCTION

Acute calculous cholecystitis (ACC) is a significant cause of acute abdominal pain, characterized by gallbladder inflammation due to gallstones in 90-95% of cases.<sup>[1]</sup> The current

literature reports a gallstone prevalence of 6%, with 1-3% of cases resulting in cystic duct obstruction and subsequent gallbladder inflammation.<sup>[2,3]</sup> The clinical presentation of ACC can range from nonspecific abdominal pain, similar to many intra-abdominal pathologies, to a septic condition associ-

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ated with an acute abdomen.<sup>[1,4]</sup> Typically, acute cholecystitis presents with right upper quadrant pain, a positive Murphy's sign, fever, and elevated markers of infection in laboratory results.<sup>[5]</sup> Radiological findings, such as gallbladder wall thickening and pericholecystic fluid, along with laboratory markers like elevated C-reactive protein (CRP), leukocytosis, and abnormal liver enzyme levels, are essential for diagnosing ACC and assessing its severity.<sup>[6,7]</sup> Delayed diagnosis or inadequate treatment without proper severity assessment can result in increased morbidity and severe complications, including perforation or biliary peritonitis.<sup>[8-11]</sup> Consequently, prompt and accurate diagnosis is crucial for effective patient management.

The management of ACC ranges from antibiotic therapy to elective or emergency surgery.<sup>[12,13]</sup> Although various diagnostic and grading systems have been developed to optimize the management of ACC, numerous guidelines for its treatment continue to evolve.<sup>[9]</sup> However, certain contentious issues related to ACC diagnosis and treatment necessitate ongoing revisions of these guidelines based on emerging research.<sup>[12,14-16]</sup> These challenges drive further investigations, particularly in emergency departments, where initial diagnosis and intervention are critical.

ACC represents a significant proportion of emergency department admissions worldwide, with its associated healthcare burden steadily increasing.<sup>[12,17]</sup> Key challenges include the accurate identification of suspected cases and the determination of the need for emergency surgical intervention, both of which are critical in balancing conservative and invasive treatment approaches. Evidence suggests that integrating clinical, biochemical, and radiological findings enhances diagnostic accuracy and leads to better patient outcomes.<sup>[18]</sup>

This study aims to evaluate the diagnostic utility of laboratory and radiological findings in managing ACC in the emergency department. By doing so, the study seeks to identify parameters that can guide clinicians during the diagnostic process, minimize unnecessary interventions and delays, and facilitate accurate diagnosis and effective patient management.

## MATERIALS AND METHODS

This study was designed as a retrospective analysis. Conducted between October 1, 2023 and March 31, 2024, it included patients admitted to the emergency department of Etlik City Hospital, a tertiary care center, who were diagnosed with acute calculous cholecystitis. The data collected included demographic information such as age (in years) and gender; blood parameters, including leukocyte count ( $10^3/\mu\text{l}$ ), total and indirect bilirubin levels (mg/dL), alanine aminotransferase (ALT) (IU/L), aspartate aminotransferase (AST) (IU/L), CRP (mg/dL), and lactate levels; radiological imaging findings, such as gallbladder wall thickness (mm), the presence of pericholecystic fluid, and perforation status; surgical status; and gallbladder pathology results. Ultrasonography (USG) was used as the gold standard for diagnosing cholecystitis.<sup>[9]</sup> To focus on isolated gallbladder pathology, patients with choledocholithiasis were excluded.

Patient data were retrieved through an analysis of the hospital information management system.

This study was reviewed and approved by the Ankara Etlik City Hospital Scientific Research Evaluation under the decision number AEŞH-BADEK-2024-377, dated May 8, 2024.

### Inclusion Criteria

- Patients diagnosed with acute calculous cholecystitis during emergency department evaluation
- Patients aged 18 years or older
- Patients with CRP, lactate levels, and complete blood count analyzed at the time of admission
- Patients with radiological imaging findings consistent with acute calculous cholecystitis
- Patients who underwent surgery with a histological diagnosis of calculous cholecystitis.

### Exclusion Criteria

- Patients with incomplete data
- Patients with concomitant choledocholithiasis.

### Statistical Analysis

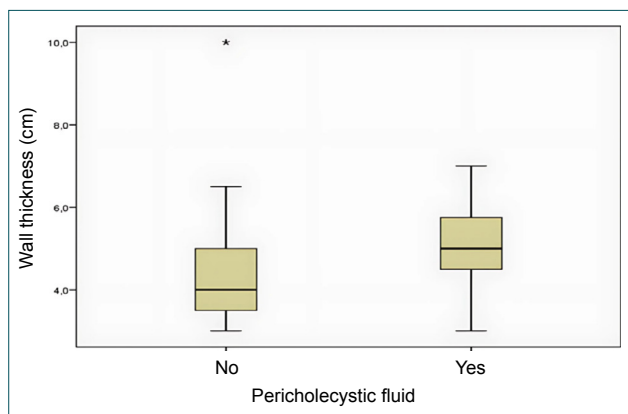
Statistical analysis was conducted using SPSS 22.0 (Statistical Package for the Social Sciences version 22) software. The Kolmogorov-Smirnov test was utilized to assess the normality of variable distributions. Categorical variables were expressed as number (n) and percentage (%), while continuous variables were reported as mean±standard deviation for normally distributed data or as median (minimum, maximum) for non-normally distributed data. The independent samples T-test was applied to compare normally distributed continuous variables, while the Mann-Whitney U test was used for non-normally distributed data. Categorical variables were analyzed using the Chi-square test or Fisher's exact test. The relationship between gallbladder wall thickness and biochemical parameters was examined using Spearman correlation analysis. Statistical significance was defined as  $p < 0.05$ .

## RESULTS

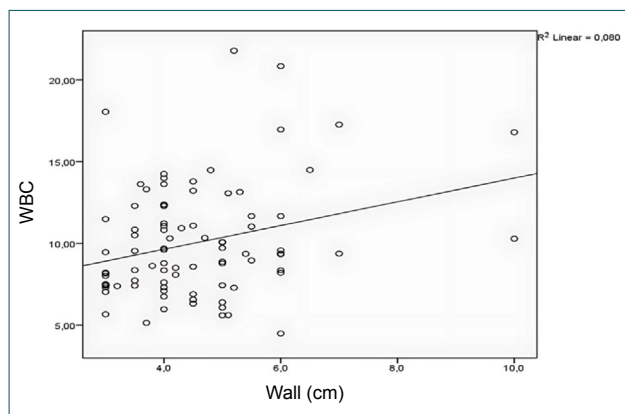
The study included 230 patients, of whom 111 (48%) were male and 119 (52%) were female, with a mean age of 54 years. Perforation was observed in one patient.

When gallbladder wall thickness was analyzed in relation to the presence of pericholecystic fluid, the median wall thickness was 5 mm (interquartile range [IQR]: 3-7) in patients with pericholecystic fluid and 4 mm (IQR: 3-10) in patients without pericholecystic fluid ( $p=0.002$ ). A statistically significant difference was identified between these two groups (Fig. 1, Table 1).

The presence of pericholecystic fluid, as detected by radiological imaging, was compared with pathology results using the Chi-square test. Patients whose pathology results confirmed cholecystitis exhibited a higher prevalence of pericholecystic fluid; however, this difference was not statistically significant.



**Figure 1.** Gallbladder wall thickness differs significantly by pericholecystic fluid presence.



**Figure 2.** Weak positive correlation between WBC count and gallbladder thickness.

**Table 1.** Relationship between pericholecystic fluid and gallbladder wall thickness

	Pericholecystic Fluid		p
	Yes	No	
Wall Thickness (mm)	5 (3,7)	4 (3,10)	0.002

( $\chi^2=1.506$ ,  $df=2$ ,  $p=0.471$ ). Similarly, analysis using Fisher’s exact test revealed no statistically significant difference, likely due to the limited sample size ( $p=1.000$ ) (Table 2).

The association between pericholecystic fluid and biochemical parameters was also analyzed. No significant differences were observed between the presence of pericholecystic fluid and levels of CRP, lactate, white blood cell (WBC) count, ALT, AST, total bilirubin, or indirect bilirubin ( $p>0.05$ ). Although ALT and AST levels were slightly higher in the group with pericholecystic fluid, these differences were not statistically significant. These findings indicate that pericholecystic fluid is not directly associated with biochemical parameters (Table 3).

Spearman’s  $\rho$  test was used to evaluate the relationship between gallbladder wall thickness and biochemical parameters. A low positive correlation was observed between WBC count and gallbladder wall thickness, which was statistically significant ( $\rho=0.225$ ,  $p<0.05$ ) (Fig. 2). Weak or very weak correlations were observed between gallbladder wall thickness and CRP ( $\rho=0.215$ ), lactate ( $\rho=0.132$ ), ALT ( $\rho=-0.187$ ), AST

( $\rho=-0.206$ ), total bilirubin ( $\rho=0.152$ ), and indirect bilirubin ( $\rho=0.017$ ). None of these relationships were statistically significant ( $p>0.05$ ). These findings suggest that gallbladder wall thickness has a limited association with biochemical parameters (Table 3).

## DISCUSSION

This study evaluated laboratory parameters, radiological imaging findings, and pathology results of patients diagnosed with ACC in the emergency department. Current guidelines classify ACC patients into low, moderate, and high severity levels to optimize management.<sup>[9]</sup> In a systematic review of preoperative evaluations for severe cholecystitis, Khan et al.<sup>[7]</sup> emphasized seven key parameters for assessing severity—five derived from radiological imaging, one related to emergency admission, and another linked to preoperative complications. Our study focused on radiological imaging findings to enhance diagnostic specificity and increase the robustness of the analysis. We found that radiological imaging was more specific than laboratory parameters in confirming ACC when compared to pathology results.

A significant correlation was observed between WBC levels and gallbladder wall thickness in our study. This finding aligns with the observations of Menéndez-Sánchez et al.,<sup>[19]</sup> who reported similar correlations, particularly in cases of severe acute cholecystitis. Previous studies have also demonstrated associations between elevated WBC and CRP levels and the severity of ACC.<sup>[7,20,21]</sup> However, studies by Lee et al.<sup>[22]</sup> and Martin et al.<sup>[23]</sup> noted that while these elevations indicate in-

**Table 2.** Relationship between pericholecystic fluid and pathology results

	No Pathology Report	Pathology Consistent with Cholecystitis	Pathology Inconsistent with Cholecystitis	Total
Presence of Pericholecystic Fluid	25	11	0	36
Absence of Pericholecystic Fluid	144	45	4	193
Total	169	56	4	229

**Table 3.** Relationship between gallbladder wall thickness and blood parameters

	Spearman's $\rho$	Spearman's $\rho$ Description	p
CRP	0.215	Weak	0.069
Lactate	0.132	Weak	0.225
WBC	0.225	Weak	0.035
ALT	-0,187	Weak	0.084
AST	-0.206	Weak	0.056
Total Bilirubin	0.152	Weak	0.161
Indirect Bilirubin	0.017	Very Weak	0.872

CRP: C-Reactive Protein; WBC: White Blood Cells; ALT: Alanine Transaminase; AST: Aspartate Aminotransferase.

flammation severity, they do not consistently correlate with radiological findings. This distinction between severity indicators and diagnostic criteria is crucial for clinicians to consider in patient management.

Interestingly, our study found no statistically significant relationship between other laboratory parameters and gallbladder wall thickness. While this finding contrasts with some literature, it emphasizes that changes in blood parameters are not consistent across all ACC patients. Laboratory findings, while complementary, cannot substitute for radiological findings in diagnosing ACC. Consistent with this, Jain et al.<sup>[24]</sup> emphasized that no single diagnostic measure is sufficient, and a combination of clinical, laboratory, and radiological findings remains essential. Rapid integration of elevated WBC levels with radiological imaging can help prevent delays in diagnosis and treatment.

Gallbladder wall thickening, often resulting from inflammation, is not specific to ACC and may also occur in conditions such as chronic cholecystitis, gallbladder carcinoma, liver cirrhosis, and pancreatitis.<sup>[25]</sup> To enhance diagnostic accuracy, we analyzed its association with pericholecystic fluid, a reliable radiological finding in emergency settings. Pericholecystic fluid, indicating inflammation extending to surrounding tissues, is a highly specific sonographic marker of ACC, with a specificity of 94%.<sup>[26]</sup> Studies by Qureshi et al.<sup>[27]</sup> and Altiner et al.<sup>[28]</sup> have demonstrated that increased wall thickness combined with pericholecystic fluid is an indicator of severe disease and predicts the likelihood of conversion from laparoscopic to open surgery. Sureka et al.<sup>[29]</sup> similarly noted that this combination strongly suggests severe inflammation and ACC. Our findings demonstrated a statistically significant association between gallbladder wall thickness and pericholecystic fluid, consistent with previous studies. This supports clinicians in identifying patients with a suspected diagnosis and managing them appropriately. Although the limited sample size affected the statistical significance in some analyses, all patients with

pericholecystic fluid were ultimately diagnosed with ACC, reinforcing the diagnostic value of this finding.

Interestingly, approximately 80% of pathologically confirmed ACC cases in our study did not exhibit pericholecystic fluid. This underscores the need for caution in relying solely on radiological findings, as their absence does not exclude the diagnosis. In their case report, Aleman Espino et al.<sup>[30]</sup> emphasized that different presentations of cholecystitis can occur beyond the expected physical examination findings and laboratory results. As mentioned earlier, while many studies highlight the positive correlation of radiological findings with the diagnosis, negative radiological findings do not exclude the diagnosis. Martin et al.,<sup>[23]</sup> in their study of 308 patients who underwent cholecystectomy, compared Murphy's sign, radiological findings, and leukocytosis. They concluded that the most accurate diagnostic approach involved clinical assessment combined with physical examination. They emphasized that each parameter contributed to the diagnosis of ACC to a certain extent, but the frequently encountered negative findings should not be overlooked. As seen in both our study and that of Martin et al.,<sup>[23]</sup> the absence of expected radiological findings, particularly in ACC patients, does not exclude the presence of cholecystitis. The pathological results of our study further support this conclusion. The high rate of absence of pericholecystic fluid and the weak correlation of WBC elevation indicate that radiological and laboratory tests alone do not provide a definitive diagnostic pathway for ACC. This underscores the importance of the physician's physical examination in the diagnostic process.<sup>[31]</sup> When the entirety of the medical literature is considered, fundamental aspects of history and physical examination, such as timing of pain onset and the presence of Murphy's sign, remain indispensable cornerstones of the diagnosis.

### Limitations

This study has several limitations. First, its retrospective design may have affected the accuracy and standardization of the collected data. Additionally, the relatively small sample size limits the ability to achieve statistical significance, particularly in subgroup analyses. Furthermore, the limited pathological validation may have reduced the generalizability of certain findings. Future research incorporating larger sample sizes and prospective designs is necessary to provide more robust results and address these limitations.

### CONCLUSION

We evaluated the key parameters used in diagnosing and managing ACC, emphasizing the importance of integrating clinical, laboratory, and imaging findings. While supportive, laboratory and imaging methods are not absolute prerequisites. A comprehensive approach can improve patient outcomes, prevent delays in surgical intervention, and reduce unnecessary procedures. Further research on emergency department practices and imaging techniques is essential to guide clinicians effectively.

**Ethics Committee Approval:** Ethics committee approval was obtained from Ankara Etilk City Hospital Scientific Research Evaluation and Ethics Committee (Approval Number: AEŞH-BADEK-2024-377, Date: 08.05.2024).

**Informed Consent:** Written informed consent was waived due to the retrospective nature of this study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept: Ö.F.T., Y.Y.; Design: Ö.F.T., E.S.; Supervision: J.S.; Resource: F.M.A., A.D., G.S.M.; Materials: A.S., F.M.A.; Data Collection and/or Processing - Ö.F.T.; Analysis and/or Interpretation: Ö.F.T., Ş.G.; Literature Review: Ö.F.T.; Writing: Ö.F.T., E.S.; Critical Review: Ö.F.T., J.S.

**Conflict of Interest:** The authors have no conflicts of interest to declare.

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## ORİJİNAL ÇALIŞMA - ÖZ

**Acil serviste akut taşlı kolesistit yönetimi: Laboratuvar ve radyolojik bulguların rolü: Retrospektif bir çalışma**

**AMAÇ:** Akut taşlı kolesistit (ATK), akut karın ağrısının önemli bir nedenidir ve %90-95 oranında safra taşına bağlı, safra kesesi iltihabı olarak karşımıza çıkar. Klinik seyri nonspesifik karın ağrısından başlayıp akut karının eşlik ettiği septik tabloya kadar ilerleyebilmektedir. Bu nedenle zamanında ve doğru tanı, hasta yönetiminde kritik rol oynamaktadır. Gecikmiş tanı veya ciddiyeti anlaşılamamış yetersiz tedavi morbiditenin artmasına yol açmakta, perforasyon veya biliyer peritonit gibi ölümcül durumlara neden olabilmektedir. Bu çalışma acil serviste tedavi edilen vakalarda laboratuvar bulguları, radyolojik görüntüleme ve patoloji sonuçları arasındaki ilişkiyi analiz ederek AKK'nin ciddiyetini etkileyen faktörleri belirlemek istemiştir.

**GEREÇ VE YÖNTEM:** 3. basamak bir klinik olan Etlik Şehir Hastanesi acil serviste akut kolesistit tanısı konulan hastalar kabul edildi. Hastaların radyolojik bulguları, laboratuvar ve patoloji sonuçları incelendi. 18 yaş altı hastalar ve koledokolitiazis olan hastalar dışlandı.

**BULGULAR:** Çalışma 230 hasta ile tamamlandı. Perikolesistik sıvısı olanların, safra kesesi duvar kalınlığı daha yüksek saptandı ( $p=0.002$ ). WBC yüksekliğinin safra kesesi duvar kalınlığı ile anlamlı ilişkisi saptandı ( $p=0.035$ ). Karaciğer fonksiyon testlerinin safra kesesi duvar kalınlığı ile anlamlı ilişkisi saptanmadı.

**SONUÇ:** Akut taşlı kolesistit hastalarının tanı ve tedavi süreçlerinde klinisyenlerin dayanak olarak kullandığı parametreleri inceledik. Safra kesesi duvar kalınlığı yüksekliğinin perikolesistik sıvı ile birlikteliğinin tanı ve takipteki önemini vurguladık. Laboratuvar ve görüntüleme yöntemleri tanıda destekleyici rol oynasa da, gereklilikleri vakalar arasında farklılık gösterebilir. Bu çalışma, ATK yönetiminde radyolojik ve laboratuvar bulgularının bütünleştirici rolünü vurgulayarak önceki araştırmaların üzerine inşa edilmiştir.

**Anahtar sözcükler:** Akut taşlı kolesistit; perikolesistik sıvı; safra kesesi duvar kalınlığı; acil tanı; ultrasonografi.

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