



General Surgery

TO EVALUATE THE ABILITY OF NEUTROPHIL TO LYMPHOCYTE RATIO IN ASSESING SEVERITY OF ACUTE CHOLECYSTITIS

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ABSTRACT **Background:** Acute cholecystitis, often due to cystic duct obstruction by gallstones, progresses from inflammation to severe complications like gangrene, perforation, or abscess, with higher morbidity in severe cases. Distinguishing simple from severe forms is challenging clinically; Neutrophil-to-Lymphocyte ratio (NLR) from routine blood counts offers a simple inflammatory marker to predict severity and guide surgical priority. **Patients and Methods:** Prospective cohort study of 89 cholecystectomy patients (median age 47.4 years, 52.8% male) with acute cholecystitis at Santhiram medical college and general hospital (July 2024–January 2026). Preoperative NLR calculated at admission; pathology classified simple (n=76) vs severe (n=13) cholecystitis. ROC analysis determined NLR cutoff; statistics via SPSS (p<0.05). **Results:** NLR cutoff of 3.0 yielded AUC 0.775, sensitivity 69.5%, specificity 68%. High NLR (≥ 3.0) correlated with older age, prolonged hospital stay, complications (abscess/perforation), longer operative time, and postoperative issues. **Conclusion:** Preoperative NLR ≥ 3.0 reliably identifies severe acute cholecystitis, enabling prioritized intervention to reduce morbidity and length of stay.

KEYWORDS : Neutrophil-to-lymphocyte Ratio, Acute Cholecystitis, Severity Assessment

INTRODUCTION

Acute cholecystitis represents a common surgical emergency, accounting for a significant proportion of hospital admissions due to abdominal pain. It primarily arises from obstruction of the cystic duct, most often by gallstones (calculous cholecystitis), though acalculous forms occur in critically ill patients. This obstruction leads to bile stasis, gallbladder distension, mucosal ischemia, and an intense inflammatory response. If unresolved, the process escalates: edema progresses to sub serosal hemorrhage, transmural inflammation, ischemia, necrosis, and gangrenous cholecystitis. Further complications include gallbladder perforation, abscess formation, peritonitis, or emphysematous cholecystitis from gas-forming organisms, with mortality rates rising sharply in severe cases—up to 30-50% in gangrenous or perforated variants compared to <5% in simple forms.

Clinical presentation varies widely, from mild right upper quadrant pain and fever to systemic toxicity, sepsis, and hemodynamic instability, complicating early severity stratification. Diagnostic tools like ultrasound confirm gallstones and wall thickening, while Tokyo Guidelines (TG18) integrate clinical, imaging, and laboratory criteria (e.g., WBC >10,000, CRP >3 mg/L, imaging findings) to grade severity as mild (Grade I), moderate (Grade II), or severe (Grade III, with organ dysfunction). However, these often require advanced imaging (CT/MRI) or delay assessment, and discrepancies persist between clinical suspicion and intraoperative/histopathologic findings. Various prognostic scores—such as APACHE II, Tokyo score, modified Glasgow, platelet-to-lymphocyte ratio—aid prediction but demand multiple parameters or complex calculations. The neutrophil-to-lymphocyte ratio (NLR), derived solely from routine complete blood counts, emerges as a superior, cost-free biomarker. Inflammation drives neutrophilia via arachidonic acid metabolites and platelet-activating factors, while stress-induced cortisol causes lymphopenia, amplifying NLR as a surrogate for systemic inflammatory burden. Validated in malignancies, sepsis, and other abdominal emergencies, NLR correlates with cytokine storms (IL-6, IL-1), macrophage infiltration, and adverse outcomes. This study evaluates NLR's utility in differentiating simple from severe acute cholecystitis, aiming to streamline surgical triage, reduce complications, and shorten hospital stays at a resource-limited setting like Santhiram medical and General hospital, Nandyal.

Aims and Objectives

Aim:

To evaluate the ability of the neutrophil-to-lymphocyte ratio (NLR), calculated from routine admission complete blood counts, in assessing

the severity of acute cholecystitis and differentiating simple cholecystitis from severe forms (gangrenous, perforated, or complicated) as confirmed by histopathology.

Specific Objectives:

1. To determine the optimal NLR cutoff value using receiver operating characteristic (ROC) curve analysis for predicting severe acute cholecystitis among patients undergoing cholecystectomy.
2. To correlate preoperative NLR levels with clinical outcomes, including patient age, length of hospital stay (LOS), presence of complications (e.g., abscess, perforation), operative time, and postoperative morbidity.
3. To assess the prognostic utility of NLR in prioritizing surgical intervention, thereby potentially reducing morbidity, mortality, and LOS in high-risk patients at Santhiram medical college and general hospital, Nandyal.

MATERIALS AND METHODS

This study was designed as a prospective cohort study conducted in the Department of General Surgery at Santhiram medical college and general hospital, Nandyal.

A total of 100 patients presenting to the surgery outpatient department or admitted to the surgical ward with a diagnosis of acute cholecystitis were included in the study. The study was carried out over a period from July 2024 to January 2026.

Inclusion and Procedure

- Patients diagnosed with acute cholecystitis were enrolled.
- Out of the total, 89 patients underwent laparoscopic cholecystectomy, and their diagnosis was confirmed through histopathological examination.
- At the time of admission, neutrophil-to-lymphocyte ratio (NLR) was calculated for each patient using routine complete blood count parameters.

Study Design

- Type: Prospective cohort study
- Setting: Department of General Surgery, SRMC, Nandyal
- Duration: July 2024– January 2026

Data Collection

- Demographic details, clinical findings, and laboratory values were recorded.
- Patients were categorized based on histopathological findings into:

- Simple cholecystitis
- Severe cholecystitis

Statistical Analysis

- Data were expressed as mean $\pm$ standard deviation or median with range.
- Receiver Operating Characteristic (ROC) curve analysis was used to determine the optimal cut-off value of NLR for predicting severity.
- Multiple regression analysis using a proportional hazards model was performed to identify factors associated with prolonged hospital stay.
- Results were expressed as odds ratios (OR) with 95% confidence intervals (CI).
- Statistical analysis was performed using SPSS version 15.0.
- A p-value < 0.05 was considered statistically significant.

Table 1: Demographic and Clinical Characteristics of Patients

Variable	Value
Total patients	89
Median age (years)	47.4 (Range: 13–72)
Gender	
Male	47 (52.81%)
Female	42 (47.19%)
Type of cholecystitis	
Calculous	72 (80.89%)
Acalculous	17 (19.11%)
Histopathological diagnosis	
Simple cholecystitis	76 (85.39%)
Severe cholecystitis	13 (14.61%)

Table 2: NLR Cut-off and Diagnostic Performance

Parameter	Value
NLR cut-off value	3.0
Area Under Curve (AUC)	0.775
Sensitivity	69.5%
Specificity	68.0%
NLR < 3.0 (Low-risk group)	76 patients
NLR ≥ 3.0 (High-risk group)	13 patients

DISCUSSION

Acute cholecystitis presents with a wide spectrum of clinical severity, ranging from mild inflammation to severe complications such as gangrene, perforation, and abscess formation. Early identification of patients at risk of developing severe cholecystitis is crucial, as it significantly impacts management decisions, surgical timing, and overall outcomes.

In the present study, the neutrophil-to-lymphocyte ratio (NLR) was evaluated as a predictive marker for assessing disease severity. The findings demonstrate that an elevated preoperative NLR is associated with severe cholecystitis. A cut-off value of 3.0, determined through ROC curve analysis, showed acceptable diagnostic performance with 69.5% sensitivity and 68.0% specificity, indicating moderate reliability in differentiating simple from severe cholecystitis.

The pathophysiological basis of NLR lies in the systemic inflammatory response. Acute inflammation leads to neutrophilia due to release of inflammatory mediators, while stress-induced hormonal changes result in relative lymphopenia. This dual response makes NLR a useful and easily accessible marker reflecting the severity of inflammation.

Consistent with previous studies, patients with higher NLR values in this study were found to have:

- Increased age
- Longer hospital stay
- Higher incidence of complications such as abscess and perforation
- Prolonged operative time
- Greater postoperative morbidity

These findings highlight the clinical relevance of NLR not only as a diagnostic tool but also as a prognostic indicator.

Severe cholecystitis, particularly gangrenous cholecystitis, is associated with compromised blood flow to the gallbladder, leading to ischemia and necrosis. This condition carries a higher risk of morbidity

and mortality, especially when complicated by perforation or peritonitis. Therefore, early surgical intervention in high-risk patients is essential.

In situations where imaging findings such as CT scans are inconclusive, NLR can serve as a valuable adjunct in decision-making. It helps in prioritizing patients for early surgery, thereby reducing complications and shortening hospital stay.

However, despite its advantages, the predictive value of NLR is not absolute. The moderate sensitivity and specificity observed in this study suggest that NLR should be used in conjunction with clinical assessment and imaging findings rather than as a standalone diagnostic tool. Overall, this study supports the use of preoperative NLR as a simple, cost-effective, and readily available marker for assessing severity and guiding management in patients with acute cholecystitis.

RESULTS

A total of 89 patients were included, with a median age of 47.4 years and a nearly equal gender distribution. The majority had calculous cholecystitis (80.89%), while 19.11% had acalculous type. On histopathology, 85.39% were simple and 14.61% were severe cholecystitis. An NLR cut-off value of 3.0 showed moderate diagnostic accuracy (AUC 0.775; sensitivity 69.5%, specificity 68%). Patients with NLR ≥ 3 were associated with increased complications, longer hospital stay, and prolonged operative time.

CONCLUSION

This study demonstrates that the neutrophil-to-lymphocyte ratio (NLR) is a simple, cost-effective, and readily available inflammatory marker that can aid in assessing the severity of acute cholecystitis. An NLR cut-off value of ≥ 3.0 shows moderate diagnostic accuracy in distinguishing severe from simple cases.

Patients with elevated NLR were found to have a higher risk of complications, longer hospital stay, increased operative time, and greater postoperative morbidity. Therefore, NLR can serve as a useful adjunct in early risk stratification and prioritization of surgical intervention.

However, due to its moderate sensitivity and specificity, NLR should not be used as a standalone diagnostic tool. It is most effective when combined with clinical evaluation and imaging findings. Overall, incorporating NLR into routine assessment may help improve patient outcomes by facilitating timely and appropriate management of acute cholecystitis.