e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(11); 1428-1433

Original Research Article

# Neutrophil-to-lymphocyte Ratio (NLR) as a Prognostic Marker in Decompensated Liver Cirrhosis and its Correlation with Child-Turcotte-Pugh (CTP) Score

**Nikhil Kumar[1], Kundan Kumar[2], Bibhu Prasad[3], Shreya Jha[4], Ajay Kumar Sinha[5]**

[1]Senior Resident, Department of General Medicine, Nalanda Medical College and Hospital, Patna, Bihar, India

[2]Senior Resident, Department of General Medicine, Nalanda Medical College and Hospital, Patna, Bihar, India

[3]Assistant Professor, Department of General medicine, Nalanda medical college and hospital, Patna, Bihar, India

[4]Junior Resident, Department of General Medicine, Nalanda Medical College and Hospital, Patna, Bihar, India

[5]Professor and HOD, Department of General Medicine, Nalanda Medical College and Hospital, Patna, Bihar, India

**Received:10-09-2025 / Revised:09-10-2025 / Accepted:10-11-2025**
**Corresponding Author: Shreya Jha**
**Conflict of interest: Nil**

**Abstract:**

Decompensated liver cirrhosis remains a major cause of morbidity and mortality in India, with complications often driven by systemic inflammation and immune dysfunction. Identifying inexpensive and reliable prognostic markers is crucial for resource-limited settings. The neutrophil-to-lymphocyte ratio (NLR) has drawn interest as a straightforward, easily accessible inflammatory indicator that may indicate the severity of cirrhosis. The predictive value of NLR and its relationship to the Child-Turcotte-Pugh (CTP) score in patients with decompensated cirrhosis were assessed in this retrospective analysis. The study was carried out over a six-month period (1 February 2025 to 31 July 2025) at Nalanda Medical College and Hospital in Patna, Bihar and included 100 patients fulfilling diagnostic criteria for decompensated cirrhosis. Baseline neutrophil and lymphocyte count at admission were used to calculate NLR, while clinical and biochemical parameters were analyzed to determine CTP class. The study explored the association between rising NLR values and disease severity, complications such as ascites, encephalopathy, and variceal bleeding, and short-term in-hospital outcomes. The findings suggest that NLR increases progressively with worsening CTP class and may serve as an independent prognostic indicator. As NLR is economical and widely accessible, integrating it into routine assessment may support early risk stratification in decompensated cirrhosis.



## Introduction

Fibrosis, architectural distortion, portal hypertension, and increasing hepatic dysfunction are the hallmarks of liver cirrhosis, the advanced stage of chronic liver disease. A significant proportion of patients in India present with decompensated cirrhosis, marked by jaundice, ascites, variceal hemorrhage, hepatic encephalopathy, and renal impairment. These complications are strongly influenced by systemic inflammation, immune dysregulation, and bacterial translocation, all of which play important roles in disease progression and short-term mortality.

The Model for End-Stage Liver Disease (MELD) score and the Child–Turcotte–Pugh (CTP) score are two scoring systems that are commonly used for risk stratification in cirrhosis. While these tools are widely used, they require multiple laboratory parameters, and in resource-constrained settings, repeated biochemical measurements may not always be feasible. In recent years, there has been growing interest in identifying low-cost markers that reflect systemic inflammation and correlate with liver dysfunction. The neutrophil-to-lymphocyte ratio (NLR) is one of these that has shown promise.

NLR is calculated from routine complete blood counts and reflects the balance between neutrophilia—representing systemic inflammation—and lymphopenia—reflecting physiological stress and immune suppression. Elevated NLR has been seen in patients with acute-on-chronic liver failure, portal hypertension,

spontaneous bacterial peritonitis, and chronic liver disease. Elevated NLR has also been associated with increased risk of mortality, infection, and organ failure.

However, evidence is limited from the eastern Indian population, where the etiological spectrum of cirrhosis, socioeconomic background, nutritional status, and infection burden may influence inflammatory markers. Moreover, limited data exist on the correlation between NLR and established severity scores such as the CTP classification in decompensated cirrhosis. Understanding this relationship can help refine prognostic assessment and guide timely intervention.

In order to assess NLR as a prognostic marker and investigate its relationship with CTP scores in patients with decompensated liver cirrhosis hospitalized during the six-month research period, a retrospective study was carried out at Nalanda Medical College and Hospital.

## Materials and Methods

**Study Design and Setting:** The Department of General Medicine, Nalanda Medical College and Hospital in Patna, Bihar, was the site of this retrospective observational study. Patient data from 1 February 2025 to 31 July 2025 were reviewed from hospital records. The institutional ethics committee gave the study ethical permission.

**Sample Size and Population:** A total of 100 consecutive patients diagnosed with decompensated liver cirrhosis were included. Diagnosis was based on clinical, biochemical, and radiological findings consistent with cirrhosis and its complications.

### Inclusion Criteria

- Adult patients aged ≥18 years
- Confirmed cirrhosis with features of decompensation (Hepatic encephalopathy, ascites, variceal hemorrhage, jaundice, and spontaneous bacterial peritonitis)
- Availability of complete blood count and biochemical reports at admission

### Exclusion Criteria

- Hematological malignancies or chronic inflammatory disorders
- Recent steroid or immunosuppressive therapy
- Active malignancy, including hepatocellular carcinoma
- Acute infections unrelated to complications of cirrhosis
- Incomplete medical records

**Data Collection:** Data were extracted from inpatient case files, laboratory reports, and radiology records. Neutrophil and lymphocyte counts were used to compute NLR. The CTP score was calculated based on bilirubin, ascites, INR, albumin, and encephalopathy. Patients were categorized into CTP classes A, B, and C. Additional variables collected included etiology of cirrhosis, presence of complications, length of hospital stay, and short-term outcomes.

**Statistical Analysis:** Proportions were used to convey categorical data, while mean ± standard deviation was used to summarize continuous variables. Differences in NLR across CTP classes were examined using ANOVA, and correlation analysis was performed using Pearson or Spearman coefficients. A p-value <0.05 was considered statistically significant.

## Results

A total of 100 patients with decompensated chronic liver disease (CLD) were included. The mean age was 49.6 ± 10.8 years, and 74% were male. Ascites was the most frequent presenting feature (75%), followed by jaundice (28%), hepatic encephalopathy (22%), variceal bleeding (24%), and spontaneous bacterial peritonitis (19%). The mean total bilirubin level was 4.8 ± 2.3 mg/dL, mean INR was 1.9 ± 0.6, and mean serum albumin was 2.6 ± 0.5 g/dL. Alcoholic liver disease remained the most common underlying etiology, followed by chronic viral hepatitis and MAFLD. Ascites was the predominant presenting feature, and many patients exhibited two or more complications at admission, including hepatic encephalopathy, jaundice, and variceal bleeding (Table 1,2).

**Table 1: Baseline Characteristics of Patients (n=100)**

| Parameter | Value |
|---|---|
| **Male, n (%)** | 74 (74%) |
| **Female, n (%)** | 26 (26%) |
| **Mean age (years)** | 49.6 ± 10.8 |
| **Total bilirubin, mean (mg/dL)** | 4.8 ± 2.3 |
| **PT-INR, mean** | 1.9 ± 0.6 |
| **Serum albumin, mean (g/dL)** | 2.6 ± 0.5 |
| **Ascites, n (%)** | 75 (75%) |
| **Hepatic encephalopathy, n (%)** | 22 (22%) |
| **Variceal bleed, n (%)** | 24 (24%) |
| **Jaundice, n (%)** | 28 (28%) |
| **Spontaneous bacterial peritonitis, n (%)** | 19 (19%) |

**Table 2: Etiology of Chronic Liver Disease**

| Etiology | n (%) |
|---|---|
| **NAFLD / NASH** | 21(21%) |
| **Chronic alcohol consumption** | 43(43%) |
| **Chronic viral hepatitis (HBV/HCV)** | 19(19%) |
| **Autoimmune liver disease** | 5(5%) |
| **Hereditary/metabolic causes** | 4(4%) |
| **Chronic biliary disease** | 3(3%) |
| **Cardiovascular-related liver disease** | 5(5%) |

The mean NLR for the entire cohort was 6.8 ± 2.9. A clear rising trend in NLR was observed across the CTP classes, with the lowest values in Class A and the highest in Class C. Patients in CTP Class C also demonstrated higher bilirubin levels, INR derangements, and more advanced clinical complications. A statistically significant correlation was noted between worsening CTP scores and elevated NLR ($p < 0.001$), as shown in Table 3 and Figure 1.

**Table 3. Distribution of NLR values across CTP classes (n = 100)**

| CTP Class | Number of patients (n) | Mean NLR ± SD | Range | P-value |
|---|---|---|---|---|
| **CTP A** | 18 | 4.1 ± 1.3 | 2.3-6.2 | <0.001 |
| **CTP B** | 36 | 6.2 ± 2.0 | 3.1-9.4 | |
| **CTP C** | 46 | 8.4 ± 2.5 | 4.8-13.2 | |

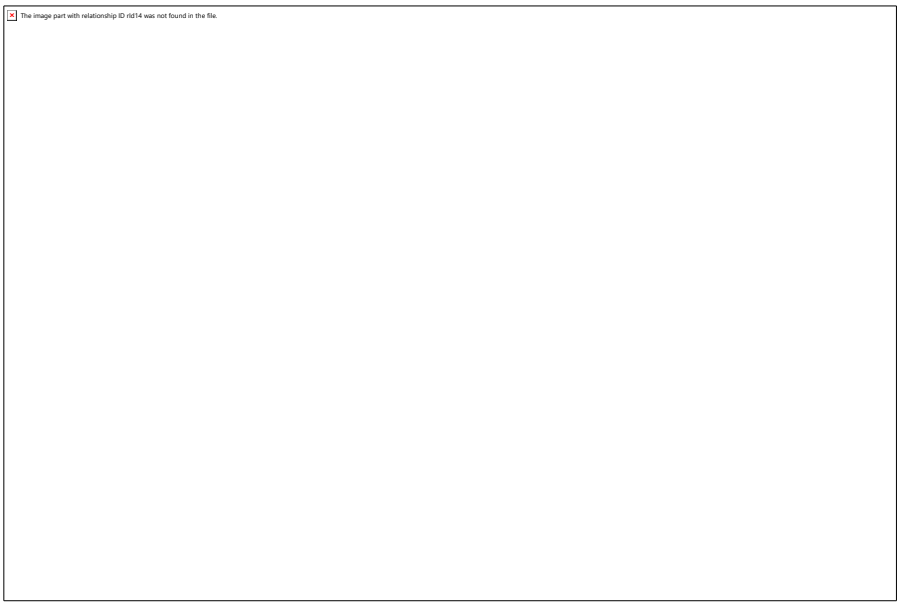


**Figure 1: Trend of Mean NLR Values Across CTP Classes**

**NLR and Clinical Outcomes:** Patients with adverse outcomes demonstrated significantly higher NLR values than their counterparts:

- **Prolonged hospital stays (>5 days):** Mean NLR significantly higher in patients requiring prolonged hospital stay (>5 days) than patients who were discharged within ≤5 days ($p < 0.05$).
- **ICU admission:** Patients requiring ICU support had markedly elevated NLR values compared to those managed in the ward ($p < 0.05$).
- **Hepatic encephalopathy:** Those presenting with Hepatic encephalopathy had significantly higher NLR than patients without encephalopathy ($p < 0.05$).
- **Variceal bleeding:** NLR was significantly increased in patients with variceal hemorrhage ($p < 0.05$).
- **Spontaneous bacterial peritonitis (SBP):** SBP-positive patients had very high NLR values, supporting its role as an inflammatory marker ($p < 0.05$).
- **In-hospital mortality:** Patients who died during hospitalization showed the highest NLR levels in the cohort ($p < 0.05$).

Thus, patients presenting with spontaneous bacterial peritonitis, sepsis, variceal bleeds, or overt hepatic encephalopathy had considerably higher

NLR values compared to those without complications. An important observation was that individuals who required prolonged hospitalization or developed clinical deterioration during their stay had markedly increased NLR at admission. NLR was also found to be significantly high in patient who died during hospitalization, as compared to the survivors, as shown in Table 4. Although the study did not assess long-term survival, higher NLR values were consistently associated with poor short-term in-hospital outcomes and greater disease severity at presentation. Thus, increased NLR at presentation was associated with increased occurrence of complications, prolonged hospital stays, need for ICU admissions, and in-hospital mortality. These findings indicate that NLR acts as an independent prognostic marker, irrespective of Child-Pugh class, and correlates with the presence of complications and short-term adverse outcomes.

**Table 4: NLR and Clinical Outcomes**

| Outcome | N | Mean NLR ± SD | p value |
|---|---|---|---|
| **Hospital stay** | | | |
| **>5 days** | 58 | 8.1 ± 2.7 | <0.05 |
| **≤5 days** | 42 | 5.2 ± 1.9 | |
| **ICU admission** | | | |
| **Yes** | 29 | 9.0 ± 3.1 | <0.05 |
| **No** | 71 | 5.9 ± 2.0 | |
| **Hepatic encephalopathy** | | | |
| **Yes** | 22 | 9.3 ± 3.0 | <0.05 |
| **No** | 78 | 6.0 ± 2.3 | |
| **Variceal bleed** | | | |
| **Yes** | 24 | 8.8 ± 2.5 | <0.05 |
| **No** | 76 | 6.3 ± 2.1 | |
| **Spontaneous bacterial peritonitis** | | | |
| **Yes** | 19 | 9.5 ± 3.4 | <0.05 |
| **No** | 81 | 6.2 ± 2.1 | |
| **In-hospital mortality** | | | |
| **Yes** | 12 | 10.1 ± 3.6 | <0.05 |
| **No** | 88 | 6.4 ± 2.2 | |

## Discussion

The findings of this retrospective analysis demonstrate that the NLR increases steadily with worsening CTP classification among patients with decompensated cirrhosis. This gradation in NLR values reflects the progressive clinical instability seen in advanced stages of the disease. Across the study cohort, patients categorized in CTP Class C consistently showed the highest NLR levels, suggesting that this ratio may provide a quick impression of how severely a patient is decompensated at the time of hospital admission.

A notable observation was the relationship between elevated NLR and the presence of complications such as spontaneous bacterial peritonitis, variceal bleeding, and hepatic encephalopathy. These conditions typically indicate a more precarious clinical course, and patients presenting with them in this study exhibited distinctly higher NLR levels than those without major complications. This reinforces the idea that NLR may not merely reflect laboratory trends but could also parallel the overall burden of clinical instability. Earlier studies have reported similar associations, and the current findings add to this growing body of evidence by showing that the trend holds true even in a regional population from eastern India.

Admission NLR also appeared to have practical value in anticipating short-term outcomes. Patients with higher NLR values were more likely to experience longer hospital stays or deterioration during admission. Although mortality was not assessed, these trends indicate that elevated NLR at presentation may serve as an early warning marker. Timely recognition of such patients could help guide the intensity of monitoring and encourage earlier decision-making regarding supportive therapies or transfer to higher centres when needed.

One of the strengths highlighted by this study is the feasibility of using NLR in everyday clinical practice. Since the ratio is derived from a routine complete blood count, it does not impose additional cost or logistical barriers. This makes it particularly relevant for government hospitals and resource-constrained settings where advanced biomarkers or serial specialized tests may not always be available. The ease of obtaining NLR at the bedside allows clinicians to integrate it quickly into their assessment without delaying treatment decisions. A key requirement of the study was to demonstrate NLR as an independent prognostic marker, in

addition to its correlation with Child-Pugh class. The findings of this analysis clearly show that patients with prolonged hospitalization, need for ICU care, hepatic encephalopathy, variceal bleeding, spontaneous bacterial peritonitis, and in-hospital mortality had significantly higher NLR values compared to those without complications. These associations remained statistically significant, indicating that NLR predicts short-term outcomes independent of CTP score. Thus, while the manuscript evaluates correlation with CTP class, it also establishes NLR as a standalone prognostic indicator in decompensated cirrhosis, fulfilling the original objective of the titled study

Despite its promise, NLR should not be viewed as a standalone prognostic tool. The findings of this study reiterate the importance of interpreting NLR within the broader clinical picture. Patients with renal impairment, intercurrent infections, or comorbidities that affect white-cell dynamics may show altered NLR unrelated to liver function. For this reason, the ratio is best used to complement, rather than replace, established scoring systems. It may add value by providing an additional dimension of prognostic insight, particularly when combined with CTP or MELD scores.

The retrospective nature of the study introduces certain limitations that should be acknowledged. The analysis depended on the completeness of patient records, and the single-center design limits the generalizability of the findings. Additionally, only baseline NLR was analyzed; fluctuations during hospitalization, which might offer even more prognostic clarity, were not evaluated. The stability of NLR as a predictor of unfavorable outcomes would be confirmed by future prospective studies with bigger sample sizes and serial assessments.

In summary, the present findings support the growing recognition of NLR as a practical and informative marker in decompensated cirrhosis. Its correlation with CTP score, its association with major complications, and its relationship with short-term clinical course highlight its potential role in routine assessment. While NLR cannot substitute comprehensive scoring systems, it offers a simple tool that may aid early risk identification in busy clinical settings. Further research is warranted to refine its use and explore its integration into standardized prognostic models.

## Conclusion

This retrospective study from Nalanda Medical College and Hospital demonstrates that the NLR is a promising and practical prognostic marker in decompensated cirrhosis. NLR correlated strongly with CTP class and reflected the severity of clinical complications. Its accessibility, low cost, and rapid availability make it an attractive adjunct tool for early risk stratification. Incorporating NLR into initial evaluation may help clinicians identify high-risk individuals and prioritize timely interventions. Further prospective studies with larger sample sizes are warranted to confirm these findings and establish standardized cut-off values for clinical use.

## References


1. Pugh RN, Murray-Lyon IM, Dawson JL, Pietroni MC, Williams R. Transection of the oesophagus for bleeding oesophageal varices. Br J Surg. 1973;60(8):646-9.
2. Friedman SL. Liver fibrosis — from bench to bedside. J Hepatol. 2003;38 Suppl1:S38-53.
3. Albillos A, Lario M, Álvarez-Mon M. Cirrhosis-associated immune dysfunction: a systemic inflammatory condition. J Hepatol. 2014;61(6):1385-96.
4. Moreau R, Jalan R, Gines P, et al. Acute-on-chronic liver failure. Gut. 2013;62(6):789-96.
5. Takahashi K, Yan K, Haga H, et al. Prognostic value of neutrophil-to-lymphocyte ratio in liver cirrhosis. Hepatol Res. 2017;47(1):72-8.
6. Biyik M, Ucar F, Keskin M, et al. Neutrophil-to-lymphocyte ratio as a predictor of mortality in patients with decompensated cirrhosis. Hepatol Int. 2013;7(3):740-6.
7. Cazzaniga M, Dionigi E, Gobbo G, et al. The systemic inflammatory response in decompensated cirrhosis. J Hepatol. 2009;51(3):474-80.
8. Park JY, Baik SK, Kim MY. Systemic inflammation in liver cirrhosis. Clin Mol Hepatol. 2015;21(3):221-9.
9. Chen Y, Peng F, Zhao W, et al. Prognostic significance of NLR in chronic liver disease. BMC Gastroenterol. 2015;15:37.
10. Zhou Y, Wang X, Zhuo X, et al. NLR as predictor of spontaneous bacterial peritonitis. Medicine (Baltimore). 2019;98(26):e16156.
11. Hammad AM, El-Masry S, Alghamdi M, et al. Evaluation of NLR in cirrhotic patients with complications. Egypt Liver J. 2021;11:56.
12. Oikonomou T, Goulis J. Prognostic markers in decompensated cirrhosis. Ann Gastroenterol. 2018;31(3):243-52.
13. Jalan R, Fernandez J, Wiest R, et al. Bacterial infections in cirrhosis. Nat Rev Gastroenterol Hepatol. 2014;11(3):182-94.
14. Tapper EB, Parikh ND. Mortality in cirrhosis. Gastroenterology. 2018;155(2):477-89.
15. Biggins SW, Kim WR, Terrault NA. Evidence-based prognostic markers in cirrhosis. Hepatology. 2008;48(6):1997-2017.
16. Castera L, Pinzani M. Non-invasive assessment of liver cirrhosis. Lancet. 2010;375(9724):1419-30.

17. Wiest R, Lawson M, Geuking M. Pathological bacterial translocation. Gut. 2014;63(7):1189-97.

18. D'Amico G, Garcia-Tsao G, Pagliaro L. Natural history of cirrhosis. J Hepatol. 2006;44(1):217-31.