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Association between Neutrophil-to-Lymphocyte Ratio and High Hepatitis B Virus DNA Load in Patients with Hepatitis B

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Abstract

Objective: To investigate the association between peripheral blood neutrophil-to-lymphocyte ratio (NLR) and the levels of viral replication and hepatocyte injury in patients with hepatitis B, and to preliminarily explore the potential application of NLR as an auxiliary indicator for assessing hepatic inflammatory activity. **Methods:** A retrospective study was conducted on 383 patients with hepatitis B who attended Nanning Third People's Hospital from January 2023 to December 2024 and completed simultaneous testing of hepatitis B virus (HBV) DNA quantification, liver function (ALT, AST), hepatitis B surface antigen, and complete blood count. NLR was calculated, and its correlation with HBV-DNA load and transaminase (ALT, AST) levels was analyzed. Patients were divided into low, medium, and high viral load groups according to HBV-DNA load. Differences in NLR, ALT, and AST levels among groups were compared. Spearman correlation analysis, ROC curve analysis, and multivariate logistic regression analysis were used to evaluate the predictive efficacy of NLR for high HBV-DNA load and the associations among various indicators. **Results:** NLR levels showed a gradual increasing trend with increasing HBV-DNA load (low → medium → high), and NLR in the high viral load group was significantly higher than that in the non-high viral load group ($P < 0.0001$). NLR was significantly positively correlated with ALT and AST levels (both $P < 0.001$). ROC curve analysis showed that the area under the curve (AUC) of NLR for predicting high HBV-DNA load was 0.737, with an optimal cut-off value of 4.088, a sensitivity of 70.19%, and a specificity of 70.97%. Multivariate logistic regression analysis showed that with high viral load as the outcome variable, after adjusting for confounding factors such as sex, age, ALT, and AST, NLR remained an independent predictor of high viral load in patients with hepatitis B (OR = 1.08, 95% CI: 1.01 - 1.15, $P = 0.017$).

Conclusion: NLR is significantly correlated with HBV-DNA load and liver injury indicators in patients with hepatitis B, and it maintains independent predictive value after adjusting for relevant confounding factors. As a convenient and readily available inflammatory marker, NLR can be used in combination with traditional virological and biochemical indicators to facilitate a more comprehensive assessment of hepatic inflammatory status and viral replication activity in patients with hepatitis B. It has certain application potential in clinical settings with limited medical resources or where rapid preliminary screening is needed.

Keywords

Neutrophil-to-Lymphocyte Ratio, Hepatitis B, Viral Load, Liver Function, Inflammatory Marker

1. Introduction

Hepatitis B is a chronic infectious disease caused by hepatitis B virus (HBV) infection, posing a serious threat to global public health [1] [2]. According to statistics from the World Health Organization, hundreds of millions of people worldwide are chronically infected with HBV, with some patients gradually progressing to cirrhosis, liver failure, or even hepatocellular carcinoma. As of 2021, the number of patients with hepatitis B in China reached approximately 43.3 million [3]. HBV itself does not directly cause hepatocyte damage; its replication within hepatocytes triggers a series of complex immune responses and inflammatory reactions in the host, and sustained immune attack ultimately leads to hepatocyte damage, necrosis, and even fibrotic changes [4] [5].

Currently, clinical assessment of disease severity in patients with chronic hepatitis B primarily relies on two categories of indicators: virological markers and biochemical markers [6]. Serum HBV-DNA quantification is the core basis for determining the degree of HBV replication activity and an important reference standard for initiating antiviral therapy in clinical practice [7]. Serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) are the most commonly used biochemical markers reflecting hepatocyte injury [8]. However, the traditional disease assessment model has certain limitations: elevated ALT and AST can only indicate the presence of hepatocyte injury but cannot effectively differentiate the intensity of the immune-inflammatory response underlying the injury. Some patients may have high viral load while ALT levels remain within the normal range, exhibiting an "immune-tolerant" state, which poses a significant challenge for accurate clinical judgment of disease status and determining the optimal timing for antiviral therapy [9]. Therefore, identifying supplementary biomarkers that can more early and comprehensively reflect the body's immune-inflammatory state and are closely associated with hepatocyte injury is of great practical significance for optimizing the clinical management of

chronic hepatitis B.

In recent years, systemic inflammatory markers have gained widespread attention in the field of chronic liver disease. The neutrophil-to-lymphocyte ratio (NLR), derived from routine complete blood count, is easy to calculate and highly reproducible, integrating immune information from both the innate (neutrophils) and adaptive (lymphocytes) immune systems [10] [11]. Studies have confirmed the significant value of NLR in the prognostic assessment of various inflammatory diseases and tumors [12] [13]. In the field of liver disease, NLR has also been shown to be closely related to the severity and prognosis of cirrhosis [14]-[17]. The potential underlying mechanism is that an increase in neutrophil count may represent an exacerbation of tissue inflammation, while a decrease in lymphocyte count may reflect immune exhaustion or suppression. The ratio of the two may more sensitively reflect the imbalance in the body's "immune-inflammation" network [18].

Although previous studies have explored the application value of NLR in liver disease [19] [20], its specific role in hepatitis B, particularly in elucidating the complex relationship among viral replication, immune-inflammatory response, and hepatocyte injury, still requires further clarification. It remains unclear whether changes in NLR are directly driven by viral replication itself or are secondary to the inflammatory response following virus-induced hepatocyte injury. Clarifying this issue could precisely define the applicable scenarios for NLR in the clinical diagnosis and treatment of hepatitis B. Based on this, the present study retrospectively analyzed the clinical data of patients with hepatitis B to systematically investigate the correlation of NLR with HBV-DNA load and traditional liver injury indicators such as ALT and AST. The primary aim was to determine whether NLR could serve as an indirect indicator for assessing HBV replication and to validate its potential value as a supplementary marker reflecting the degree of hepatitis B-related immune inflammation and hepatocyte injury, thereby providing a richer set of tools for clinical assessment of disease severity in patients with hepatitis B.

2. Materials and Methods

2.1. General Data

This study was a retrospective analysis. The study subjects were 383 patients with hepatitis B surface antigen positivity who attended Nanning Third People's Hospital from January 2023 to December 2024 and completed simultaneous testing for hepatitis B virus (HBV) DNA quantification, liver function (ALT, AST), and complete blood count. All patients were treatment-naïve (had not received nucleos(t)ide analogues or interferon-based antiviral therapy) at the time of blood sample collection, ensuring that the test results reflected the patients' baseline status.The study protocol was approved by the Medical Ethics Committee of the hospital, and the collection of clinical data from all study subjects complied with relevant medical ethics requirements.

2.2. Research Methods

The names, ages, sexes, clinical diagnoses, and relevant laboratory test data of all enrolled patients were retrospectively collected through the hospital information system. Fasting peripheral venous blood (3 mL) was collected from all patients. Complete blood count parameters were measured using a Mindray automated hematology analyzer, and the NLR value was calculated (NLR = neutrophil count/lymphocyte count). Transaminase (ALT, AST) levels were measured using a Beckman AU5800 biochemical analyzer. HBV-DNA load was measured using a Hongshi SLAN-96P real-time fluorescence quantitative analyzer. Hepatitis B serological markers were detected using an Autobio PHOMO microplate reader.

2.3. Grouping and Definitions

Patients positive for hepatitis B surface antigen (HBsAg) were the primary subjects of analysis. Based on HBV-DNA load, the 383 patients were divided into three groups: low viral load group (HBV-DNA < 1000 IU/mL, n = 175), medium viral load group (HBV-DNA 1000 - 100,000 IU/mL, n = 104), and high viral load group (HBV-DNA > 100,000 IU/mL, n = 104). The cutoff values were determined based on commonly used viral load stratification criteria in the Guidelines for the Prevention and Treatment of Chronic Hepatitis B (2022 Edition) [6] and relevant literature [21] [22]: <1000 IU/mL was defined as low replication or near the detection limit, 1000 - 100,000 IU/mL as moderate replication, and >100,000 IU/mL as high replication. These thresholds were further validated against the distribution characteristics of the study population. In this study, "liver injury" was defined as ALT and/or AST levels exceeding the upper limit of the laboratory's normal reference range (normal reference: ALT ≤ 50 U/L for males, ≤40 U/L for females; AST ≤ 40 U/L).

Inclusion criteria: Meeting the diagnostic criteria for hepatitis B in the "Guidelines for the Prevention and Treatment of Chronic Hepatitis B (2022 Edition)" [6]; having complete clinical data and completing HBV-DNA quantification, liver function tests, hepatitis B surface antigen testing, and complete blood count within the same period.

Exclusion criteria: Patients with concurrent systemic infectious diseases; patients already diagnosed with cirrhosis or hepatocellular carcinoma; patients with other types of hepatitis (e.g., hepatitis A, C, E) or drug-induced hepatitis, alcoholic hepatitis; patients with other systemic tumors; pregnant women; patients with autoimmune diseases.

2.4. Statistical Analysis

R 4.3.0 statistical software was used for data processing and analysis. The dataset was complete with no missing values; all laboratory parameters were successfully collected for all 383 patients. Measurement data were first tested for normality using the Shapiro-Wilk test. Data conforming to a normal distribution were ex-

pressed as mean ± standard deviation (Mean ± SD). Intergroup comparisons were performed using the chi-square test or one-way analysis of variance (ANOVA), with pairwise comparisons using the LSD method. Non-normally distributed measurement data were expressed as median (interquartile range) M (P25, P75) M (P25, P75), and intergroup comparisons were performed using the Mann-Whitney U test or Kruskal-Wallis H test. To explore the independent predictive value of NLR for high viral load in patients with hepatitis B, univariate and multivariate logistic regression analyses were performed to calculate odds ratios (OR) and their 95% confidence intervals (CI). To further verify the robustness of NLR prediction, progressively adjusted regression models were constructed for analysis: Model 1 (unadjusted), Model 2 (adjusted for sex and age), and Model 3 (further adjusted for ALT and AST). The multivariate regression model included sex, age, ALT, AST, and NLR as independent variables, with high viral load as the dependent variable. All hypothesis tests were two-sided, and $P < 0.05$ was considered statistically significant.

3. Results

3.1. Baseline Characteristics of the Study Population

A total of 383 patients with hepatitis B were included in this study, including 175 in the low viral load group (45.69%), 104 in the medium viral load group (27.15%), and 104 in the high viral load group (27.15%). There were no statistically significant differences in age or sex distribution among the three groups ($P > 0.05$), indicating comparability. However, differences in ALT, AST, and NLR levels among the three groups were statistically significant ($P < 0.05$). The age, sex, and laboratory indicators of patients in each group are detailed in Table 1.

Table 1. Baseline characteristics and laboratory parameters of patients in the three groups.

Variables	Total (n = 383)	Low Load (n = 175)	High Load (n = 104)	Medium Load (n = 104)	Statistic	P
Age, Mean ± SD	51.46 ± 13.45	52.59 ± 13.43	49.46 ± 14.24	51.57 ± 12.53	F = 1.78	0.171
ALT, M (Q_1, Q_3)	29.00 (18.50, 60.50)	22.00 (14.00, 36.00)	59.00 (33.00, 99.25)	30.00 (19.00, 62.00)	χ^2 = 66.69#	**<0.001**
AST, M (Q_1, Q_3)	32.00 (23.00, 68.50)	26.00 (20.00, 37.00)	61.00 (37.75, 143.75)	33.50 (23.75, 67.25)	χ^2 = 68.32#	**<0.001**
NLR, M (Q_1, Q_3)	3.10 (1.87, 6.29)	2.61 (1.65, 3.92)	6.58 (3.02, 9.71)	3.16 (1.86, 5.43)	χ^2 = 54.21#	**<0.001**
Sex, n (%)	—	—	—	—	χ^2 = 0.42	0.811
Female	145 (37.86)	69 (39.43)	37 (35.58)	39 (37.50)	—	—
Male	238 (62.14)	106 (60.57)	67 (64.42)	65 (62.50)	—	—

Note: F: ANOVA, #: Kruskal-Wallis test, χ^2: Chi-square test; SD: standard deviation, M: Median, Q_1: 1st Quartile, Q_3: 3rd Quartile.

3.2. Comparison of Indicators among Different Viral Load Groups

Comparative analysis of NLR, ALT, and AST across different HBV-DNA load groups (Figure 1) revealed: No significant difference in AST levels between the

low and medium load groups (P > 0.05), but statistically significant differences between the low and high load groups (P < 0.01) and between the medium and high load groups (P < 0.05). No significant difference in ALT levels between the low and medium load groups (P > 0.05), but statistically significant differences between the low and high load groups (P < 0.001) and between the medium and high load groups (P < 0.01). No significant difference in NLR levels between the low and medium load groups (P > 0.05), but highly statistically significant differences between the low and high load groups and between the medium and high load groups (both P < 0.0001).

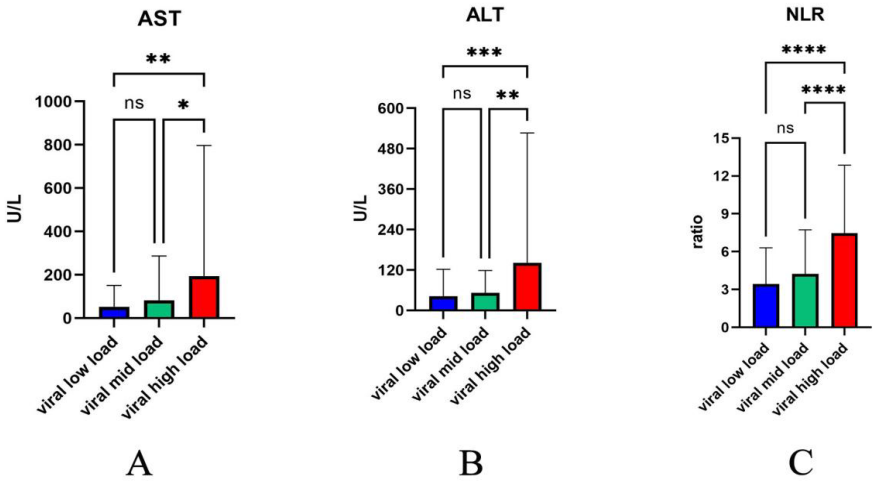

Figure 1. Comparison of NLR, ALT, and AST levels among different HBV-DNA load groups.

According to the pre-specified study protocol, a three-group comparison (low, medium, and high load groups) was first performed. The results showed no significant differences in any indicator between the low and medium load groups (P > 0.05), while significant differences were observed between the high load group and both the low and medium load groups. To further validate this finding, as a sensitivity analysis, the low and medium load groups were combined into a non-high viral load group (n = 279) and compared with the high viral load group (n = 104). The results showed statistically significant differences in AST, ALT, and NLR levels between the non-high and high viral load groups (Figure 2). The consistent results from both the three-group comparison and the combined two-group comparison support the conclusion that the high viral load group is the primary source of differences. Furthermore, HBeAg status was available for 321 patients (83.8%). Subgroup analysis showed that among HBeAg-positive patients (n = 186), the association between NLR and high viral load remained significant (OR = 1.09, 95% CI: 1.02 - 1.17, P = 0.011); among HBeAg-negative patients (n = 135), the association was slightly attenuated but still statistically significant (OR = 1.06, 95% CI: 1.00 - 1.13, P = 0.048), suggesting that the NLR-HBV DNA association is consistent across different disease phases.

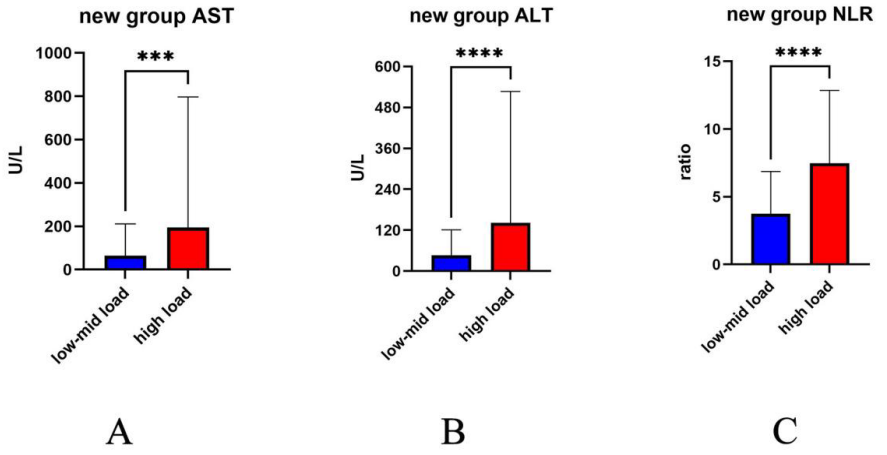

Figure 2. Differences in AST, ALT, and NLR levels between the non-high and high viral load groups.

ROC curve analysis was performed on the laboratory indicators showing statistically significant differences between the non-high and high viral load groups to evaluate their predictive efficacy for HBV replication activity. ROC curves were plotted based on high HBV-DNA load status (Figure 3). The results showed an AUC of 0.737 (95% CI: 0.683 - 0.791) for NLR, 0.746 (95% CI: 0.692 - 0.800) for AST, and 0.743 (95% CI: 0.689 - 0.797) for ALT. Using the maximum Youden index to determine the optimal cut-off value for each indicator, an NLR ≥ 4.088 predicted high viral load with a sensitivity of 70.19% (95% CI: 63.5% - 76.9%) and specificity of 70.97% (95% CI: 65.8% - 76.1%). An AST ≥ 40.50 predicted high viral load with a sensitivity of 74.04% and specificity of 68.82%. An ALT ≥ 39.5 predicted high viral load with a sensitivity of 70.19% and specificity of 73.48%.

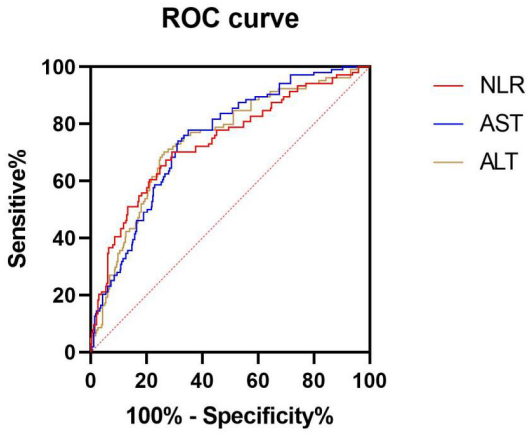

Figure 3. ROC curves for predicting high HBV-DNA load.

3.3. Multivariate Logistic Regression Analysis

To further clarify the association between NLR and HBV-DNA load, the high viral load group was set as the outcome variable, and univariate and multivariate logistic regression analyses were performed (Table 2).

Table 2. Univariate and multivariate logistic regression analyses (with high viral load as outcome variable).

Variable	Univariate OR (95% CI)	Univariate P	Multivariate OR (95% CI)	Multivariate P
ALT	1.01 (1.01 - 1.01)	<0.001	1.01 (1.01 - 1.01)	0.009
AST	1.01 (1.01 - 1.01)	<0.001	1.00 (1.00 - 1.01)	0.170
NLR	1.12 (1.06 - 1.18)	<0.001	1.07 (1.01 - 1.14)	0.019
Sex (Male vs Female)	1.08 (0.68 - 1.72)	0.741	0.92 (0.55 - 1.55)	0.761
Age	0.99 (0.97 - 1.00)	0.089	0.99 (0.97 - 1.01)	0.154

Note: Multivariate model adjusted for sex, age, ALT, and AST. OR: Odds Ratio, CI: Confidence Interval.

Univariate logistic regression model results showed that ALT and AST were significantly associated with the study outcome (ALT: $P < 0.001$, OR = 1.01, 95% CI: 1.01 - 1.01; AST: $P < 0.001$, OR = 1.01, 95% CI: 1.01 - 1.01). NLR was also a significant predictor of the study outcome ($P < 0.001$, OR = 1.12, 95% CI: 1.06 - 1.18).

Multivariate logistic regression model results showed that after adjusting for relevant confounding factors, the significant association between ALT and the study outcome remained ($P = 0.009$, OR = 1.01, 95% CI: 1.01 - 1.01). NLR retained significant predictive value ($P = 0.019$, OR = 1.07, 95% CI: 1.01 - 1.14). However, the association between AST and the study outcome was attenuated and became statistically non-significant ($P = 0.170$, OR = 1.00, 95% CI: 1.00 - 1.00).

3.4. Multi-Model Validation of NLR Predictive Stability

To verify the stability of NLR in predicting high viral load in hepatitis B, three progressively adjusted regression models were constructed for analysis. The results are shown in Table 3. Model 1 (unadjusted): NLR was significantly positively correlated with the study outcome (OR = 1.12, 95% CI: 1.06 - 1.18, $P < 0.001$). Model 2 (adjusted for sex and age): After adjusting for demographic confounders, the significant association between NLR and the outcome remained stable (OR = 1.12, 95% CI: 1.06 - 1.19, $P < 0.001$). Model 3 (adjusted for sex, age, ALT, AST): After further including liver function indicators, the association between NLR and the outcome was slightly attenuated but remained statistically significant (OR = 1.08, 95% CI: 1.01 - 1.15, $P = 0.017$).

Table 3. Multi-model validation of NLR predictive stability.

Variable	**Model 1** OR (95% CI)	**Model 1** P	**Model 2** OR (95% CI)	**Model 2** P	**Model 3** OR (95% CI)	**Model 3** P
NLR	1.12 (1.06 - 1.18)	**<0.001**	1.12 (1.06 - 1.19)	**<0.001**	1.08 (1.01 - 1.15)	**0.017**

Note: OR: Odds Ratio, CI: Confidence Interval; Model 1: unadjusted; Model 2: adjusted for sex and age; Model 3: adjusted for sex, age, ALT, AST.

4. Discussion

This study retrospectively analyzed the clinical data of 383 patients with chronic HBV infection to systematically investigate the relationship between the systemic inflammatory marker NLR and HBV-DNA load, as well as the liver injury markers ALT and AST. The results clearly demonstrate a significant positive correlation between NLR and HBV-DNA load. Furthermore, NLR maintained independent predictive value in multivariate logistic regression analysis and multi-model adjusted analyses, confirming its potential as a supplementary indicator for assessing disease severity in patients with hepatitis B.

The study found that NLR levels progressively increased with increasing HBV-DNA load, and NLR in the high viral load group was significantly higher than in the non-high viral load group. This trend was consistent with the patterns observed for ALT and AST, suggesting a close relationship between NLR and the level of HBV replication. Combined with the good diagnostic performance of NLR shown in the ROC curve analysis, these findings further support NLR as an auxiliary inflammatory indicator reflecting hepatocyte injury. Multivariate logistic regression analysis showed that after adjusting for confounders, NLR remained an independent predictor of high viral load in hepatitis B, whereas the predictive value of AST was attenuated. This suggests that NLR may capture systemic inflammatory components not fully reflected by AST, which could be particularly indicative in the context of immune-mediated hepatocyte injury mechanisms [21]. The results of the multi-model adjusted analysis further validated the independent predictive value of NLR. From the unadjusted model to models progressively incorporating demographic characteristics and liver function indicators, the association between NLR and high viral load remained consistently significant, with only a slight decrease in the OR value. This indicates that the association between NLR and HBV-DNA load is not entirely mediated by factors such as sex, age, or liver function status.

This finding has significant implications for clinical practice. In traditional clinical management, HBV-DNA quantification is the "gold standard" for assessing HBV replication activity [22] [23]. However, this testing method is relatively costly and time-consuming, making it difficult to implement routinely in some primary healthcare institutions. In contrast, NLR is derived from a routine complete blood count, offering advantages such as speed, convenience, and low cost [10]. This study confirms that NLR changes synchronously with HBV-DNA load, with significant elevations particularly in states of high viral replication. This suggests its potential utility as an indirect auxiliary marker for active HBV replication. In clinical scenarios where timely HBV-DNA testing is unavailable, an abnormally elevated NLR could alert clinicians to the possibility of active viral replication and associated immune-inflammatory status in the patient, providing a reference for preliminary clinical judgment.

From a mechanistic perspective, an elevated NLR may reflect two interrelated pathophysiological processes. First, active HBV replication can trigger a systemic

inflammatory response, stimulating neutrophil proliferation and leading to an increased peripheral blood neutrophil count [24]. Second, persistent HBV infection can modulate or exhaust the immune system, suppressing lymphocyte proliferation and function, resulting in a relative decrease in the peripheral blood lymphocyte count [25]. This dual imbalance of "inflammation activation-immune suppression" is closely associated with persistent HBV-DNA replication and subsequent hepatocyte injury [26] [27]. Therefore, NLR may serve not merely as a simple inflammatory marker but potentially as a bridging indicator connecting HBV replication, host immune response, and hepatocyte injury [18].

The practical advantages of using NLR in the clinical assessment of hepatitis B are noteworthy. As a derived parameter from routine blood tests, it requires no additional specimen collection, has low detection costs, and utilizes a mature, highly reproducible methodology [11] [28]. It can be implemented in medical institutions at all levels, making it particularly suitable for primary hospitals with limited resources or for clinical scenarios requiring rapid preliminary patient screening. Combining NLR with traditional ALT, AST, and HBV-DNA testing allows for a comprehensive assessment of the patient's condition from the perspectives of inflammatory status, hepatocyte injury, and viral replication. Compared to evaluating single indicators, this combined approach may provide a more robust basis for developing personalized diagnosis and treatment plans [9].

Furthermore, the optimal cut-off value for NLR identified in this study was 4.088. This value provides a clear reference standard for clinical practice. When a patient's NLR exceeds this threshold, clinicians should maintain a high index of suspicion for the possibility of high-level HBV replication and potential hepatocyte injury, prompting timely further investigations and targeted interventions. This has significant guiding value for the early detection and intervention of disease progression in patients with hepatitis B.

5. Conclusions

This retrospective analysis of 383 patients with hepatitis B confirms a significant positive correlation between the neutrophil-to-lymphocyte ratio (NLR) and both HBV-DNA load and the liver injury indicators ALT and AST. Furthermore, after adjusting for confounding factors such as sex, age, ALT, and AST, NLR remains an independent predictor of high viral load in patients with hepatitis B [24]. As a systemic inflammatory marker derived from routine complete blood counts, NLR is simple to obtain, operationally convenient, readily available, and cost-effective [10]. It sensitively reflects the body's immune-inflammatory status and is closely related to the activity of HBV replication, serving as a valuable supplement to traditional virological and biochemical markers.

In clinical practice, incorporating NLR into the comprehensive assessment system for patients with hepatitis B, alongside HBV-DNA, ALT, and AST, enables a more complete and accurate evaluation of the patient's hepatic inflammatory status and the degree of viral replication activity [6]. This provides additional refer-

ence information for clinical judgment of disease severity and the selection of treatment timing. NLR holds particular value in primary healthcare settings where medical resources are limited and timely HBV-DNA quantification may not be feasible, or in clinical scenarios requiring rapid preliminary screening of patient status, where it can function as an important auxiliary indicator suggestive of high-level HBV replication.

Overall, NLR offers a new perspective and tool for assessing the condition of patients with hepatitis B. Its clinical application can help compensate for the limitations of traditional evaluation indicators and contribute to optimizing clinical management strategies for hepatitis B, potentially positively impacting patient diagnostic and therapeutic outcomes.

6. Limitations

This study was a single-center retrospective study. All study subjects were from Nanning Third People's Hospital, which introduces potential selection bias and may limit the generalizability of the findings. Subsequent multi-center, large-sample studies are needed to further validate the correlation between NLR and HBV-DNA load and its predictive value in patients with hepatitis B [18].

This was a cross-sectional study, analyzing only NLR levels, HBV-DNA load, and liver function indicators at a single time point for each patient. It did not dynamically observe changes in NLR levels during the course of antiviral treatment or disease progression, nor could it establish an association between dynamic changes in NLR and treatment efficacy or disease prognosis [19]. Future prospective cohort studies with long-term follow-up of patients with hepatitis B are needed to explore the clinical significance of dynamic NLR changes.

This study did not incorporate liver imaging findings (e.g., liver ultrasound, CT) or histopathological biopsy results. Consequently, it was unable to directly correlate NLR levels with the grade of hepatic inflammation or the degree of fibrosis, and could not further clarify the association between NLR and the extent of liver pathological damage [25]. Future studies should include more comprehensive clinical parameters to fully elucidate the clinical assessment value of NLR.

As a non-specific inflammatory marker, NLR levels can be influenced by various factors, such as concurrent systemic infections (e.g., respiratory or urinary tract infections) or the use of certain medications affecting blood counts [23]. Although this study excluded patients with concurrent systemic infections, it did not perform stratified analyses for other potential factors influencing NLR levels, which may have introduced some degree of interference with the results.

This study did not include patients with severe hepatitis B complications such as cirrhosis or liver failure, focusing only on the application value of NLR in patients with chronic hepatitis B. Therefore, it could not determine the predictive and assessment value of NLR in patients with severe hepatitis B [26]. Future studies should expand the scope of the study population to include patients with varying degrees of disease severity to further refine the clinical application scenarios for NLR.

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Conflicts of Interest

All authors declare that they have no conflicts of interest regarding the research process and manuscript preparation.

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