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Comparative Evaluation of Neutrophil-Lymphocyte Ratio and Platelet-Lymphocyte Ratio as Prognostic and Mortality Predictor in COVID-19 Patients: A Retrospective Study from a Tertiary Care Centre in Southern India

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ABSTRACT

Introduction: Coronavirus Disease-2019 (COVID-19) demonstrates marked heterogeneity in clinical outcomes, ranging from mild illness to severe disease and death. Early identification of patients at risk of deterioration is essential for timely intervention. Inflammatory haematological indices such as Neutrophil-Lymphocyte Ratio (NLR) and Platelet-Lymphocyte Ratio (PLR) have emerged as potential prognostic markers, but comparative evidence from Indian tertiary care settings remains limited.

Aim: To evaluate and compare the prognostic value of admission-day NLR and PLR for predicting mortality and Intensive Care Unit (ICU) admission among hospitalised COVID-19 patients.

Materials and Methods: This retrospective study included 521 Reverse Transcriptase Polymerase Chain Reaction (RT-PCR)-confirmed COVID-19 patients admitted between January and December 2021 in Sree Gokulam Medical College and Research Foundation, Thiruvananthapuram, Kerala, a tertiary care hospital in Southern India. Demographic details, co-morbidities, and baseline haematological parameters were analysed. NLR and PLR were calculated from admission complete blood counts. Receiver Operating Characteristic (ROC) curve analysis, logistic regression, and linear regression models were used to assess prognostic performance.

Results: The median NLR was 7.17 (IQR 3.71-11.25), and the median PLR was 200.22 (IQR 128.8-268.4). An NLR cut-off of 4.875 predicted mortality with an AUC of 0.832, sensitivity of 67.1%, and specificity of 83.1% (p-value <0.0001). PLR showed lower discriminative ability (AUC 0.694). Admission-day NLR independently predicted ICU admission (OR 1.257; 95% CI 1.181-1.339). Both NLR and PLR were associated with longer hospital and ICU stay.

Conclusion: Admission-day NLR is a superior predictor of mortality, ICU admission and duration of ICU/hospital stay duration compared to PLR. Its low cost, ease of calculation, and strong prognostic value make it a practical tool for early risk stratification.

Keywords: Coronavirus Disease-2019, Immunity, Multimorbidity, Respiration

INTRODUCTION

The COVID-19, caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), has placed an unprecedented strain on healthcare systems worldwide since its emergence in late 2019 [1]. Although vaccination programs and evolving treatment strategies have reduced overall mortality, COVID-19 continues to cause significant hospitalisation and severe disease, particularly among elderly patients and those with co-morbidities such as Diabetes Mellitus (DM), hypertension, cardiovascular disease, Chronic Kidney Disease (CKD), and chronic respiratory disorders [2-4]. The heterogeneity of clinical presentation and the potential for rapid deterioration necessitate early identification of high-risk patients at the time of hospital admission [5].

Severe COVID-19 is characterised by immune dysregulation, exaggerated systemic inflammation, endothelial injury, and activation of coagulation pathways, culminating in organ dysfunction and increased mortality [6-8]. These pathophysiological changes are reflected in routine haematological parameters, which are inexpensive, readily available, and reproducible, making them valuable tools for early risk stratification, particularly in resource-limited settings.

Among inflammatory indices derived from complete blood counts, the NLR reflects the balance between innate immune activation and adaptive immune suppression. Neutrophilia indicates heightened inflammatory response, while lymphopenia reflects immune exhaustion-both central features of severe COVID-19 [9,10]. Various observational studies and meta-analyses have consistently demonstrated that elevated NLR is associated with increased disease severity, ICU admission, need for Mechanical Ventilation (MV), and mortality in COVID-19 patients [11-13].

The PLR has also been proposed as a prognostic marker, incorporating platelet activation and lymphocyte count. Platelets contribute to inflammation, endothelial dysfunction, and thrombo-inflammatory processes, all of which play a critical role in COVID-19 pathogenesis [14,15]. Elevated PLR has been linked to adverse outcomes in several studies; however, its predictive performance has been variable and generally inferior to NLR [16,17].

Despite the expanding literature, significant gaps persist. Reported cut-off values for NLR and PLR vary widely across studies, likely due to differences in population characteristics, prevalence of co-morbidities, disease severity at presentation, thus limiting their clinical generalisability [18]. Many investigations have assessed these markers in isolation, with limited direct comparison of their relative prognostic value within the same cohort. Furthermore, data from Indian tertiary care centres where metabolic and cardiovascular co-morbidities are highly prevalent remain limited [19-22]. Most published studies have primarily evaluated inflammatory ratios for risk stratification rather than developing quantitative predictive models for downstream clinical outcomes [11,12,16,17] .

There is a paucity of literature exploring the use of admission-day inflammatory ratios to estimate hospital and ICU length of stay-an outcome of considerable relevance for healthcare planning during pandemic surges [23,24]. The continued emergence of SARS-CoV-2 variants underscores the persistent clinical burden of COVID-19 [25]. In this context, simple and scalable prognostic markers derived from routine haematological parameters remain clinically relevant [26,27]. Such tools may have broader applicability in future respiratory viral outbreaks, particularly for early risk stratification and resource allocation.

Against this background, the present study aimed to evaluate and compare the prognostic performance of admission-day NLR and PLR in predicting mortality and ICU admission among hospitalised COVID-19 patients. Additionally, the study sought to derive simple regression equations using admission-day values to estimate hospital and ICU length of stay, thereby extending the clinical applicability of these readily available inflammatory markers.

MATERIALS AND METHODS

This retrospective study was conducted on all adult patients whose nasopharyngeal swabs were either Rapid antigen Test (RAT) or RT-PCR–confirmed COVID-19 admitted between January and December 2021 at Sree Gokulam Medical College and Research Foundation, Kerala, India. The study was conducted between May 2025 and November 2025 after getting approval from the Institutional Ethics Committee (IEC No: SGMC IEC/63/842/05/2025/F). A total of 521 patients with complete clinical and laboratory data were included.

Inclusion criteria: All patients above 18 years of age admitted in the hospital whose nasopharyngeal swabs where RAT or RT-PCR SARS-CoV2 positive were included in the study.

Exclusion criteria: Patients' file with incomplete data, patients with surgical issue, pregnant women, cirrhosis patients, patients with platelet disorders, haematological malignancy, patients who had discharged against medical advice were excluded from the study.

Study Procedure

From patients' file epidemiological data like age, gender was collected. Co-morbidities like DM, hypertension, Coronary Artery Disease (CAD), CKD, Chronic Obstructive Pulmonary Disease (COPD), Bronchial Asthma (BA), Dyslipidaemia (DLP), any other co-morbidities if any were noted. Outcome data included oxygen requirement, ICU admission, duration of hospital stay, died due to COVID-19 during hospital stay. Laboratory parameters like Complete Blood Count (CBC), which includes Neutrophils, Lymphocytes, platelets, C-Reactive Protein (CRP) of day1 of admission were retrieved from the file. NLR and PLR were calculated from the raw data.

STATISTICAL ANALYSIS

Statistical analysis was performed using Addinsoft (2022); XLSTAT statistical and Life Sciences data analysis solution, version 2022.4.1; New York, USA. Fisher's exact test was used to compare the risk variables between the deceased and survived COVID-19 patient cohorts. ROC curves were used to determine optimal cut-off values. Logistic regression identified independent predictors of ICU admission, and linear regression assessed associations with duration of hospitalisation. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 521 COVID-19 patients were included in the study after considering the inclusion and exclusion criteria. The mean age of the patient study population was 54.45±17.77 years. The study population had almost equal representation of males (n=239, 45.87%) and females (n=282, 54.13%) Diabetes mellitus (n=239, 45.8%) and hypertension (n=207, 39.7%) were the most common co-morbidities [Table/Fig-1]. A total of 86 patients succumbed to COVID-19 infection in the study population, 213 (40.88%) patients required oxygen supplementation with 93 (17.85%) patients requiring Non Invasive Ventilation (NIV)/MV [Table/Fig-2]. Among the risk factors analysed between the deceased and survived cohorts

Co-morbidities	No. of COVID patients with Co-morbidities. n (%)	No. of patients died of COVID with Co-morbidities (n)	Percentage of COVID patients died with particular co-morbidity (%)	p-value
DM	239 (45.8)	85	35.5	<0.0001
SHT	207 (39.7)	58	28.09	<0.0001
CAD	50 (9.5)	20	40	<0.0001
CVA	22 (4.2)	6	27.27	<0.0001
CKD	18 (3.4)	15	83.3	<0.0001
Hypothyroidism	44 (8.4)	5	11.36	0.403
COPD	12 (2.3)	8	66.67	<0.0001
BA	44 (8.4)	4	9.09	0.205

[Table/Fig-1]: Distribution of Co-morbidities and their association with COVID mortality.
DM: Diabetes mellitus; SHT: Sytemic hypertension; CAD: Coronary Artery Disease; CVA: Cerebro-vascular accident; CKD: Chronic kidney disease; COPD: Chronic obstructive pulmonary disease; BA: Bronchial asthma

Clinical parameters	Observed outcomes
Oxygen support, n (%)	213 (40.88)
NIV/MV, n (%)	93 (17.85)
ICU admission, n (%)	184 (35.31)
Succumbed to COVID, n (%)	86 (16.50)
Length of ICU stay (mean±SD)	2.78±5.24
Length of hospital stay (mean±SD)	9.3±5.25

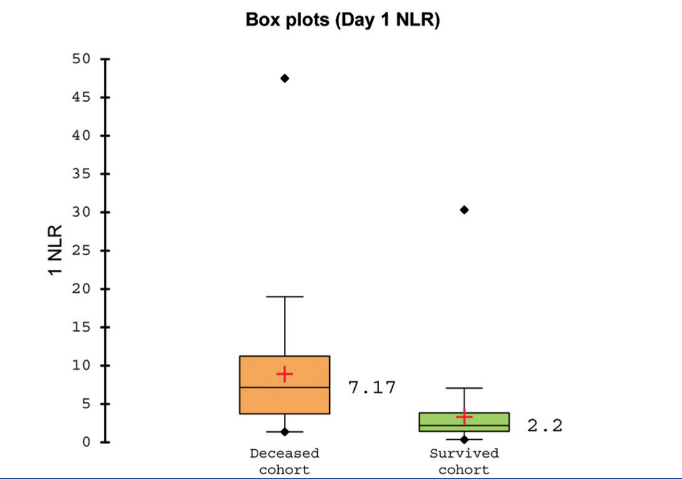
[Table/Fig-2]: Distribution of clinical outcomes among study cohort.
NIV: Non invasive ventilation, MV: Mechanical ventilation, SD: Standard deviation, ICU: Intensive care unit

in the study, statistical significance for mortality were observed for DM, hypertension, CAD, CKD, COPD, and cerebrovascular disease (p-value <0.0001). Statistical significance was not observed for BA and hypothyroidism. CRP measured on admission did not show statistical significance (p-value=0.931) in predicting mortality in COVID-19 patient cohort.

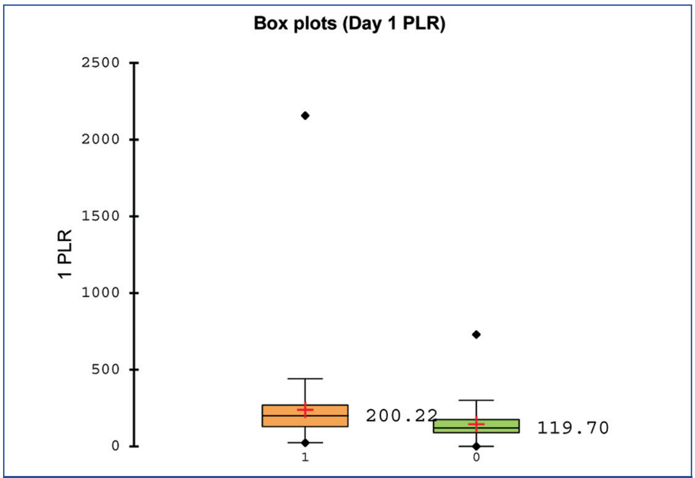
The median admission-day NLR was 7.17, while the median PLR was 200.22 in the deceased COVID-19 patient cohort [Table/Fig-3,4]. Statistical significance was observed for NLR (p-value=0.028) and PLR (p-value=0.041) on admission between the deceased and survivor patient cohorts.

Day1 NLR demonstrated superior mortality prediction with an AUC of 0.832 [Table/Fig-5] compared to PLR (AUC 0.694) [Table/Fig-6]. The optimal cut-off calculated for NLR and PLR along with the diagnostic parameters for the cut-off calculated by the ROC curve analysis is shown in [Table/Fig-7].

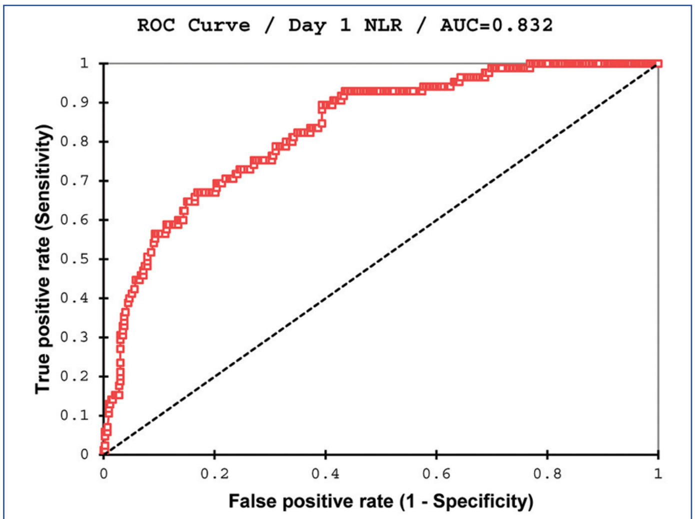
Admission-day NLR and PLR independently predicted ICU admission. Admission-day NLR demonstrated a stronger association with ICU admission compared to PLR. Each unit increase in NLR was associated with a 25.7% increase in the odds of ICU admission (OR 1.257, 95% CI: 1.181-1.339), whereas PLR showed only a marginal effect (OR 1.004, 95% CI: 1.002-1.006). The higher Wald



[Table/Fig-3]: Box and whisker plot analysis showing the differences in Day 1 NLR observed between the deceased and survived COVID-19 patient cohorts.

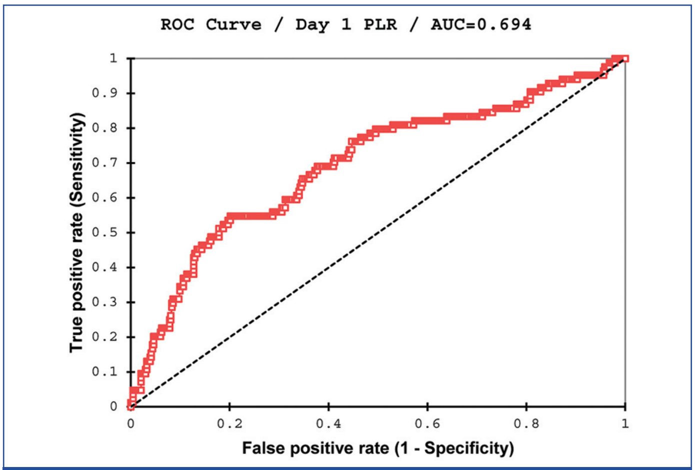


[Table/Fig-4]: Box and whisker plot analysis showing the differences in Day 1 PLR observed between the deceased and survived COVID patient cohorts.



[Table/Fig-5]: Receiver Operating Characteristic (ROC) curve analysis showing the Area Under Curve (AUC) for Day 1 NLR for COVID-mortality prediction at presentation.

chi-square value for NLR 51 compared to PLR (18) further supports its superior predictive performance [Table/Fig-8,9]. Higher NLR and PLR values were associated with prolonged hospital and ICU stay [Table/Fig-10,11].



[Table/Fig-6]: Receiver Operating Characteristic (ROC) curve analysis showing the Area Under Curve (AUC) for Day 1 PLR for COVID-mortality prediction at presentation.

The proposed prediction model equation for the length of hospital and ICU stay (Mathematical modelling) by linear regression analysis, using Day 1 NLR and Day 1PLR are as follows.

Length of hospital stay=8.79+0.11×Day 1 NLR

Length of ICU stay=1.43+0.31×Day1 NLR

Length of hospital stay=9.16+0.0007×Day1 PLR

Length of ICU stay=2.00+0.004×Day1 PLR

Based on the linear regression model, statistical significance was observed in predicting ICU stay duration for both Day 1 NLR (p-value <0.0001) and PLR (p-value=0.006), while only Day 1 NLR could reliably predict the hospital stay duration (p-value=0.019) [Table/Fig-12,13].

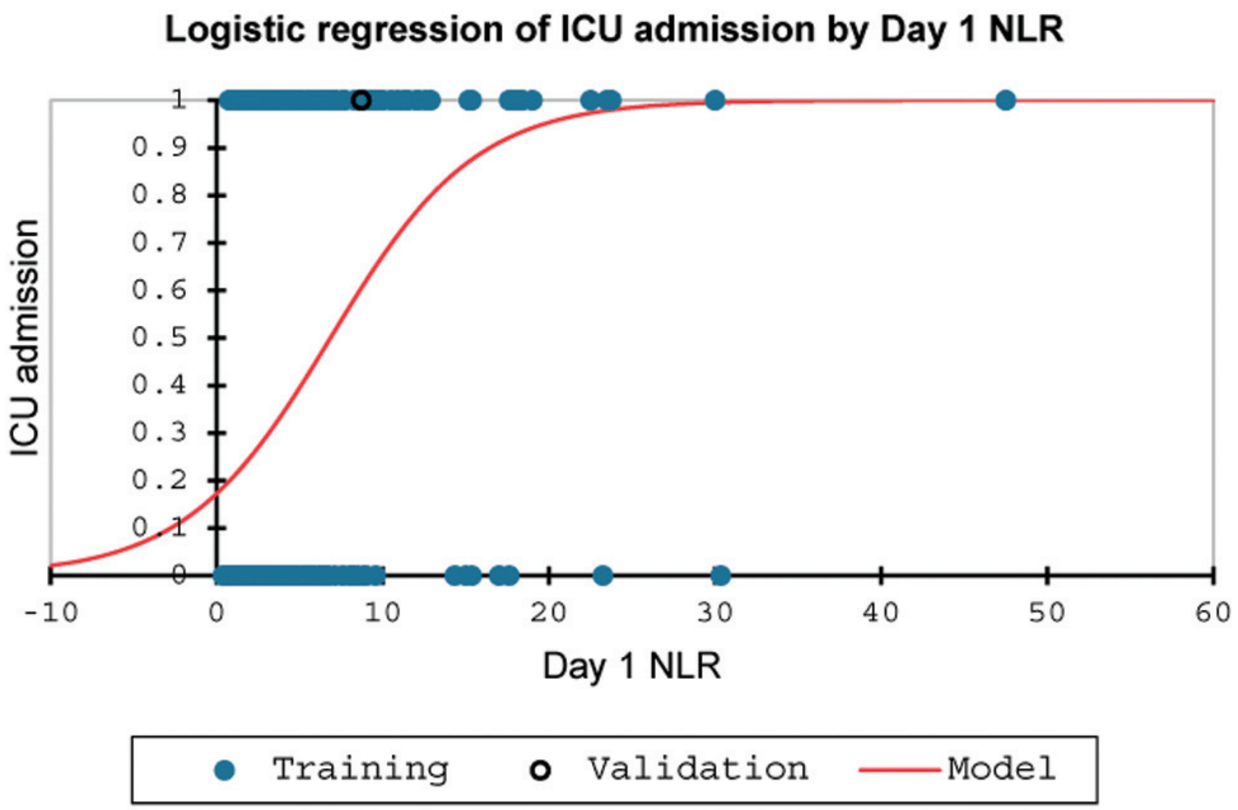
DISCUSSION

This retrospective study evaluated the prognostic utility of admission-day NLR and PLR in predicting mortality, ICU admission, and hospital resource utilisation among hospitalised COVID-19 patients during 2021. The findings demonstrate that while both ratios are significantly associated with adverse outcomes, NLR consistently exhibited superior predictive accuracy compared to PLR.

In the present study, NLR showed strong discriminative ability for mortality prediction, with an optimal cut-off value of 4.875 and an AUC of 0.832. The high specificity and negative predictive value suggest that NLR is particularly useful in identifying patients at low risk of mortality when values are below the threshold. Reported NLR cut-off values in the literature vary considerably. Lagunas-Rangel FA reported higher NLR values among patients with severe disease, although a specific cut-off was not proposed [11]. Liu Y et al., identified an NLR cut-off of 3.3 for mortality prediction, with an AUC of 0.82 [12], while Li X et al., reported a cut-off of 3.5, demonstrating strong predictive performance for disease severity and mortality [28]. Tatum D et al., observed significantly higher NLR values among non survivors but did not define a single optimal threshold [29]. Reported cut-off values for NLR vary across studies, likely due to differences in population demographics, prevalence of co-morbidities, disease severity, and healthcare settings [17-19]. The relatively higher cut-off identified in the present study likely reflects the substantial burden of metabolic and cardiovascular co-morbidities in the study population, which may contribute to higher baseline inflammatory states. Importantly, the high AUC observed in

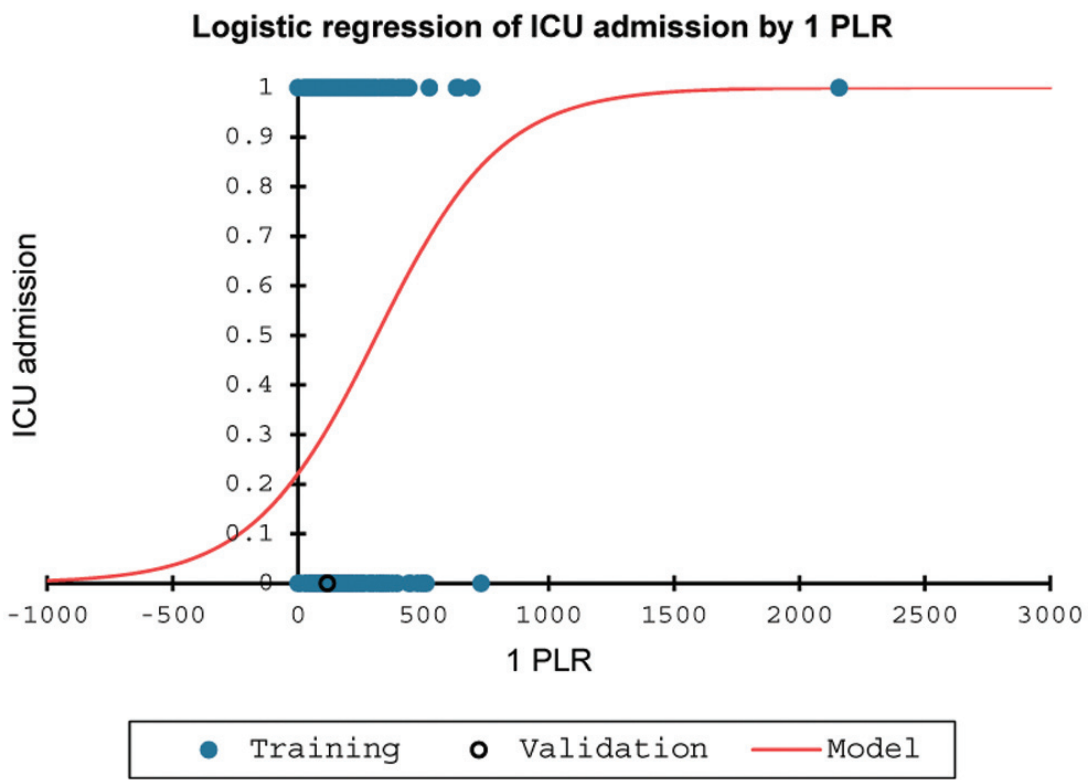
S. No.	Parameters for COVID-19 mortality prediction (At presentation)	Median	Inter-quartile range (IQR)	Receiver Operating Characteristic (ROC) curve analysis							
				Optimal cut-off ratio	Sensitivity	Specificity	PPV	NPV	Accuracy	AUC	p value
1.	Neutrophil-Lymphocyte Ratio (NLR)	7.17	3.71-11.25	4.875	67.1%	83.1%	43.8%	92.8%	80.5%	0.832	<0.0001
2.	Platelet-Lymphocyte Ratio (PLR)	200.22	128.8-268.4	189.39	54.8%	79.9%	34.6%	90.1%	75.8%	0.694	<0.0001

[Table/Fig-7]: Diagnostic parameters of Day 1 NLR and PLR for COVID-19 mortality prediction.



Model parameters (Variable ICU admission):									
Source	Value	Standard error	Wald Chi-square	Pr > Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)	Odds ratio	Odds ratio Lower bound (95%)	Odds ratio Upper bound (95%)
Intercept	-1.567	0.159	96.801	<0.0001	-1.879	-1.255			
Day 1 NLR	0.229	0.032	51.001	<0.0001	0.166	0.292	1.257	1.181	1.339

[Table/Fig-8]: Logistic regression analysis with model parameters of Day 1 NLR in predicting ICU admission.



Model parameters (Variable ICU admission):									
Source	Value	Standard error	Wald Chi-Square	Pr >Chi²	Wald Lower bound (95%)	Wald Upper bound (95%)	Odds ratio	Odds ratio Lower bound (95%)	Odds ratio Upper bound (95%)
Intercept	-1.261	0.179	49.406	<0.0001	-1.613	-0.909			
1 PLR	0.004	0.001	18.006	<0.0001	0.002	0.006	1.004	1.002	1.006

[Table/Fig-9]: Logistic regression analysis with model parameters of Day 1 PLR in predicting ICU admission.

Day 1 NLR	<4.875 (Below optimal cut-off as per ROC)	>4.875 (Above optimal cut-off as per ROC)
ICU stay duration in days, Mean (SD)	1.81 (4.23)	5.52 (6.69)
Hospital stay duration in days, Mean (SD)	8.91 (4.80)	10.39 (6.26)

[Table/Fig-10]: Comparison of ICU and hospital stay duration based on admission-day NLR.

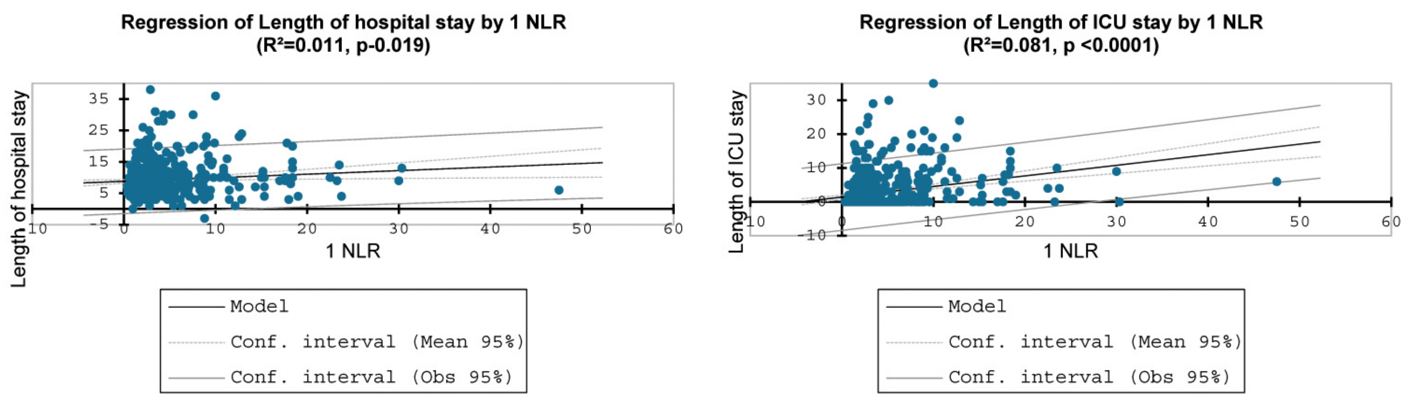
Day 1PLR (optimal cut-off ratio for mortality prediction)	<189.39 (Below optimal cut-off as per ROC)	>189.39 (Above optimal cut-off as per ROC)
ICU stay duration in days, Mean (SD)	2.24 (4.91)	4.27 (5.82)
Hospital stay duration in days, Mean (SD)	9.20 (5.22)	9.56 (5.37)

[Table/Fig-11]: Comparison of ICU and hospital stay duration based on admission-day PLR.

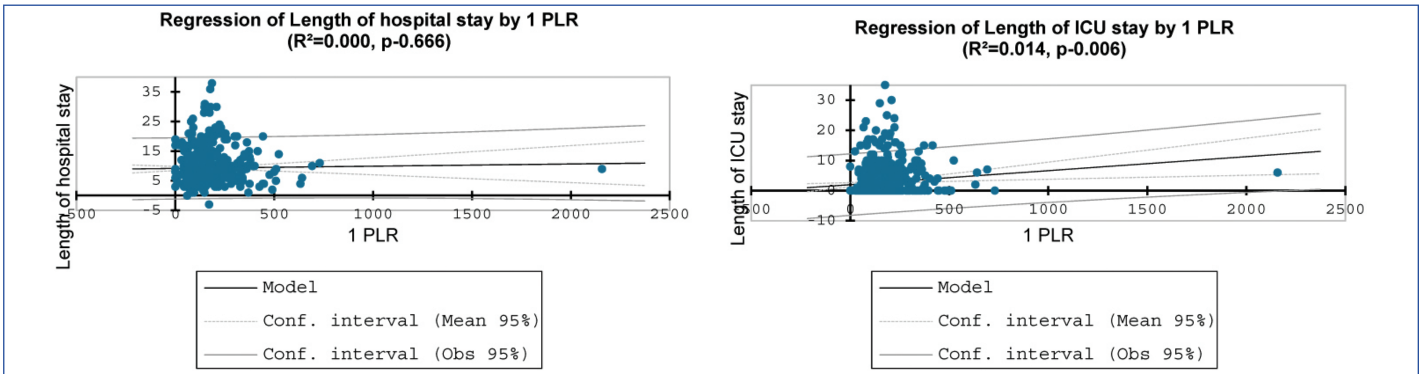
this cohort underscores the robustness of admission-day NLR as a prognostic marker, supporting its utility in early risk stratification within Indian tertiary care settings.

The prognostic significance of NLR can be explained by the immunopathology of COVID-19. Severe SARS-CoV-2 infection is characterised by excessive neutrophil activation due to cytokine-mediated inflammation, alongside marked lymphopenia caused by immune exhaustion and apoptosis [10,30]. This imbalance between innate and adaptive immunity results in an exaggerated inflammatory response, endothelial injury, and multiorgan dysfunction, which are central to adverse outcomes in COVID-19 [31]. The elevated NLR observed among non survivors in this study supports its role as a surrogate marker of immune dysregulation.

The PLR was also significantly associated with mortality in this study, although its predictive performance was inferior to that of NLR. Similar observations have been reported in prior studies, where



[Table/Fig-12]: Linear regression model correlating prediction of ICU and hospital stay duration using Day 1 NLR.



[Table/Fig-13]: Linear regression model correlating prediction of ICU and hospital stay duration using Day 1 PLR.

Author and year	Place of study	Sample size	Objective	Parameters assessed	Conclusion
Lagunas-Rangel FA, 2020 [11]	Mexico	74	To evaluate the role of NLR in predicting severity of COVID-19	NLR, disease severity	Elevated NLR was significantly associated with severe COVID-19 and poor outcomes.
Liu Y et al., 2020 [12]	China	245	To assess NLR as an independent risk factor for mortality	NLR, mortality	NLR was an independent predictor of in-hospital mortality.
Li X et al., 2020 [28]	China	1,571	To evaluate predictive value of NLR for severity and mortality	NLR, severity, mortality	Higher NLR was associated with increased severity and mortality.
Tatum D et al., 2020 [29]	USA	152	To study association of NLR with COVID-19 outcomes	NLR, ICU admission, mortality	Elevated NLR predicted ICU admission and mortality.
Yang AP et al., 2020 [17]	China	93	To evaluate NLR and PLR as inflammatory markers	NLR, PLR, disease severity	Both NLR and PLR were associated with disease severity; NLR showed better performance.
Qu R et al., 2020 [16]	China	30	To evaluate PLR as a prognostic marker	PLR, severity	Elevated PLR was associated with severe disease.
Singh Y et al., 2021 [19]	India	100	To evaluate whether admission NLR and PLR can predict disease severity in COVID-19 patients	Neutrophil count, lymphocyte count, platelet count, NLR, PLR; comparison between mild/moderate vs severe cases	Both NLR and PLR were significantly elevated in severe COVID-19 cases. NLR demonstrated better predictive performance compared to PLR and may serve as a simple, cost-effective marker for early risk stratification.
Cicculio A et al., 2020 [34]	Italy	411	To evaluate NLR for ICU admission	NLR, ICU admission	Higher NLR independently predicted ICU admission.

Henry BM et al., 2020 [13]	Multinational (Meta-analysis)	3377	To evaluate haematological biomarkers in COVID-19	NLR, PLR, lymphocyte count	NLR showed strongest association with severity and mortality.
Present study, 2026	India (Kerala)	521	To compare NLR and PLR in predicting mortality and ICU admission	NLR, PLR, mortality, ICU admission, LOS	NLR showed superior predictive accuracy over PLR for mortality and ICU admission.

[Table/Fig-14]: Review of literature on the utility of NLR and PLR in predicting outcomes in COVID-19.
NLR: Neutrophil-Lymphocyte Ratio;PLR: Platelet-Lymphocyte ratio;COVID-19:Coronavirus Disease-2019;ICU:Intensive Care Unit;LOS:Length of stay

PLR demonstrated prognostic value but lower discriminative power compared to NLR [16,17]. Platelets are actively involved in inflammatory and thrombotic pathways in COVID-19, contributing to endothelial dysfunction and microvascular thrombosis [14]. However, platelet counts in COVID-19 are influenced by multifactorial mechanisms including consumption, immune-mediated destruction, and thrombotic processes, which may limit the specificity of PLR as a standalone prognostic marker [15]. Despite these limitations, the relatively high negative predictive value of PLR observed in this study suggests that it may still be useful in identifying patients with a lower likelihood of adverse outcomes, particularly when used in conjunction with NLR.

In contrast to NLR and PLR, admission-day CRP did not demonstrate a statistically significant association with mortality in the present study. This finding differs from several reports that identified elevated CRP as a predictor of disease severity and adverse outcomes in COVID-19 [18,20]. CRP is a non specific acute-phase reactant and may be influenced by factors such as chronic inflammatory states, obesity, secondary bacterial infections, and prior corticosteroid or immunomodulatory therapy, which were commonly employed during the study period [15,32,33]. Consequently, a single admission-day CRP value may not accurately reflect COVID-19-specific immune dysregulation.

Furthermore, COVID-19 is a dynamic disease, and emerging evidence suggests that serial CRP trends rather than isolated baseline values may better correlate with disease progression and outcomes [18]. In contrast, haematological ratios such as NLR integrate information from both neutrophil-mediated inflammation and lymphocyte-mediated immune suppression, offering a more comprehensive assessment of immune imbalance [11-13]. This may explain the superior prognostic performance of NLR observed in this cohort despite the lack of significance of CRP. A notable finding of this study is the identification of admission-day NLR as an independent predictor of ICU admission. Each unit increase in NLR was associated with a significant rise in the odds of requiring intensive care. In the present analysis, NLR demonstrated a substantially stronger effect size (OR 1.257, 95% CI: 1.181-1.339) and higher Wald chi-square compared to PLR (OR 1.004, 95% CI: 1.002-1.006), indicating superior predictive performance. This finding was consistent with previous studies demonstrating higher admission NLR values among patients requiring ICU care or MV, with some studies identifying NLR as an independent predictor of severe outcomes [28-30].

In addition, both NLR and PLR were associated with longer hospital and ICU stays, indicating their potential utility in anticipating healthcare resource utilisation. Similar associations between elevated inflammatory indices and prolonged hospitalisation have been documented in earlier studies [16,34]. However, most published literature has focused on demonstrating associations rather than providing applicable models. The present study extends existing evidence by proposing simple linear regression equations using admission day NLR/PLR to estimate hospital and ICU length of stay. Such models may aid clinicians in early anticipation of healthcare resource utilisation, particularly during periods of surge capacity and in resource-limited settings. While these equations require external validation, they highlight the potential utility of haematological markers in operational planning and risk stratification beyond mortality prediction. These findings reinforce the role of simple haematological markers in early risk stratification and planning of care escalation. Similar studies from the literature on the utility of NLR and PLR in predicting outcomes in COVID-19 has been tabulated in [Table/Fig-14] [11-13,16,17,19,28,29,34].

The high prevalence of DM, hypertension, CAD, CKD, and chronic respiratory illnesses among non survivors in the present study reflects well-established risk factors for severe COVID-19 [2,20,21]. These co-morbidities are associated with chronic inflammation, endothelial dysfunction, and impaired immune responses, which may predispose patients to exaggerated inflammatory reactions following SARS-CoV-2 infection [22]. Elevated NLR in such patients may therefore reflect both baseline inflammatory burden and acute disease severity, contributing to poorer clinical outcomes.

Although vaccination and improved treatment strategies have reduced COVID-19-related mortality, the disease continues to pose a significant burden, particularly among high-risk populations. Furthermore, the emergence of new variants and the potential for future respiratory viral pandemics highlight the need for readily available and cost-effective prognostic tools. NLR and PLR meet these criteria, as they are derived from routine complete blood counts and can be calculated rapidly without additional cost [26].

The high negative predictive value of NLR observed in this study is particularly relevant in contemporary clinical practice, as it may help clinicians safely identify low-risk patients, avoid unnecessary ICU admissions, and optimise resource allocation- especially in resource-limited settings.

The present study has several important strengths. It included a relatively large cohort of 521 confirmed COVID-19 patients managed over an entire pandemic year (January-December 2021), enhancing temporal representativeness and clinical diversity. The study provides a direct head-to-head comparison of NLR and PLR within the same population, which remains limited in Indian settings with a high burden of metabolic and cardiovascular co-morbidities. Robust statistical analyses, including ROC curve evaluation, determination of optimal cut-off values, and regression modelling, strengthen the validity of the findings. Admission-day NLR demonstrated good discriminative ability (AUC 0.832) and independently predicted ICU admission. Importantly, the study extends existing literature by deriving simple regression equations to estimate hospital and ICU length of stay using admission-day inflammatory ratios, offering potential utility for early risk stratification and healthcare resource planning in real-world tertiary care settings.

Limitation(s)

Its retrospective single-centre design limits generalisability. Serial monitoring of NLR and PLR and comparison with other inflammatory biomarkers such as CRP, D-dimer, and interleukin-6 were not performed and could have provided additional prognostic insights.

CONCLUSION(S)

Admission-day NLR and PLR were associated with adverse outcomes in COVID-19; however, NLR demonstrated superior predictive performance for mortality and ICU admission. The identified NLR cut-off and the derived regression models for length of stay highlight the utility of simple haematological markers in early risk stratification and healthcare resource planning. Further prospective multicentric studies are required to validate these findings.

REFERENCES

[1] World Health Organisation. WHO Coronavirus (COVID-19) Dashboard. In. WHO; 2020. Available from: https://data.who.int/dashboards/covid19/cases.

[2] Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: A retrospective cohort study. The Lancet. 2020;395(10229):1054-62. Doi: 10.1016/S0140-6736(20)30566-3.

[3] Jie GW, Yi NZ, Hu Y, Hua LW, Quan OC, Xing HJ, et al. Clinical characteristics of Coronavirus Disease 2019 in China. N Engl J Med. 2020;382(18):1708-20. Doi: 10.1056/NEJMoa2002032.

[4] Gupta R, Ghosh A, Singh AK, Misra A. Clinical considerations for patients with diabetes in times of COVID-19 epidemic. Diabetes Metab Syndr. 2020;14(3):211-12. Doi: 10.1016/j.dsx.2020.03.002 PubMed PMID: 32172175; PubMed Central PMCID: PMC7102582.

[5] Wu Z, McGoogan JM. Characteristics of and important lessons from the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a report of 72 314 cases From the Chinese Center for Disease Control and Prevention. JAMA. 2020;323(13):1239-42. Doi: 10.1001/jama.2020.2648 PubMed PMID: 32091533.

[6] Mehta P, McAuley DF, Brown M, Sanchez E, Tattersall RS, Manson JJ, et al. COVID-19: Consider cytokine storm syndromes and immunosuppression. Lancet. 2020;395(10229):1033-34. Doi: 10.1016/S0140-6736(20)30628-0 PubMed PMID: 32192578; PubMed Central PMCID: PMC7270045.

[7] Varga Z, Flammer AJ, Steiger P, Haberecker M, Andermatt R, Zinkernagel AS, et al. Endothelial cell infection and endotheliitis in COVID-19. Lancet. 2020;395(10234):1417-18. Doi: 10.1016/S0140-6736(20)30937-5.

[8] Ackermann M, Verleden SE, Kuehnel M, Haverich A, Welte T, Laenger F, et al. Pulmonary vascular endothelialitis, thrombosis, and angiogenesis in COVID-19. N Engl J Med. 2020;383(2):120-28. Doi: 10.1056/NEJMoa2015432 PubMed PMID: 32437596; PubMed Central PMCID: PMC7412750.

[9] Zahorec R. Ratio of neutrophil to lymphocyte counts--Rapid and simple parameter of systemic inflammation and stress in critically ill. Bratisl Lek Listy. 2001;102(1):5-14. PubMed PMID: 11723675.

[10] Qin C, Zhou L, Hu Z, Zhang S, Yang S, Tao Y, et al. Dysregulation of immune response in patients With coronavirus 2019 (COVID-19) in Wuhan, China. Clin Infect Dis. 2020;71(15):762-68. Doi: 10.1093/cid/ciaa248 PubMed PMID: 32161940; PubMed Central PMCID: PMC7108125.

[11] Lagunas-Rangel FA. Neutrophil-to-lymphocyte ratio and lymphocyte-to-C-reactive protein ratio in patients with severe coronavirus disease 2019 (COVID-19): A meta-analysis. J Med Virol. 2020;92(10):1733-34. Doi: 10.1002/jmv.25819 PubMed PMID: 32242950; PubMed Central PMCID: PMC7228336.

[12] Liu Y, Du X, Chen J, Jin Y, Peng L, Wang HHX, et al. Neutrophil-to-lymphocyte ratio as an independent risk factor for mortality in hospitalized patients with COVID-19. J Infect. 2020;81(1):e6-e12. Doi: 10.1016/j.jinf.2020.04.002 PubMed PMID: 32283162; PubMed Central PMCID: PMC7195072.

[13] Henry BM, de Oliveira MHS, Benoit S, Plebani M, Lippi G. Hematologic, biochemical and immune biomarker abnormalities associated with severe illness and mortality in coronavirus disease 2019 (COVID-19): A meta-analysis. Clin Chem Lab Med. 2020;58(7):1021-28. Doi: 10.1515/cclm-2020-0369. PMID: 32286245.

[14] Manne BK, Denorme F, Middleton EA, Portier I, Rowley JW, Stubben C, et al. Platelet gene expression and function in patients with COVID-19. Blood. 2020;136(11):1317-29. Doi: 10.1182/blood.2020007214.

[15] Lippi G, Plebani M, Henry BM. Thrombocytopenia is associated with severe coronavirus disease 2019 (COVID-19) infections: A meta-analysis. Clin Chim Acta. 2020;506:145-48. Doi: 10.1016/j.cca.2020.03.022 PubMed PMID: 32178975; PubMed Central PMCID: PMC7102663.

[16] Qu R, Ling Y, Zhang YHZ, Wei LY, Chen X, Li XM, et al. Platelet-to-lymphocyte ratio is associated with prognosis in patients with Coronavirus disease-19. J Med Virol. 2020;92(9):1533-41. Doi: 10.1002/jmv.25767 PubMed PMID: 32181903; PubMed Central PMCID: PMC7228291.

[17] Yang AP, Liu JP, Tao WQ, Li HM. The diagnostic and predictive role of NLR, d-NLR and PLR in COVID-19 patients. Int Immunopharmacol. 2020;84:106504. Doi: 10.1016/j.intimp.2020.106504 PubMed PMID: 32304994; PubMed Central PMCID: PMC7152924.

[18] Vafadar Moradi E, Teimouri A, Rezaee R, Morovatdar N, Foroughian M, Layegh P, et al. Increased age, neutrophil-to-lymphocyte ratio (NLR) and white blood cells count are associated with higher COVID-19 mortality. Am J Emerg Med. 2021;40:11-14. Doi: 10.1016/j.ajem.2020.12.003 PubMed PMID: 33333477; PubMed Central PMCID: PMC7717776.

[19] Singh Y, Singh A, Rudravaram S, Soni KD, Aggarwal R, Patel N, et al. Neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio as markers for predicting the severity in COVID-19 patients: A prospective observational study. Indian J Crit Care Med. 2021;25(8):847-52. Doi: 10.5005/jp-journals-10071-23906 PubMed PMID: 34733022; PubMed Central PMCID: PMC8559739.

[20] Petrilli CM, Jones SA, Yang J, Rajagopalan H, O'Donnell L, Chernyak Y, et al. Factors associated with hospital admission and critical illness among 5279 people with coronavirus disease 2019 in New York City: Prospective cohort study. BMJ. 2020;m1966. Doi: 10.1136/bmj.m1966.

[21] Bansal M. Cardiovascular disease and COVID-19. Diabetes Metab Syndr. 2020;14(3):247-50. Doi: 10.1016/j.dsx.2020.03.013 PubMed PMID: 32247212; PubMed Central PMCID: PMC7102662.

[22] Bornstein SR, Rubino F, Khunti K, Mingrone G, Hopkins D, Birkenfeld AL, et al. Practical recommendations for the management of diabetes in patients with COVID-19. Lancet Diabetes Endocrinol. 2020;8(6):546-50. Doi: 10.1016/S2213-8587(20)30152-2 PubMed PMID: 32334646; PubMed Central PMCID: PMC7180013.

[23] Fois AG, Paliogiannis P, Scano V, Cau S, Babudieri S, Perra R, et al. The systemic inflammation index on admission predicts in-hospital mortality in COVID-19 patients. Molecules. 2020;25(23):5725. Doi: 103390/molecules25235725 PubMed PMID: 33291581; PubMed Central PMCID: PMC7731255.

[24] Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA. 2020;323(11):1061-69. Doi: 10.1001/jama.2020.1585 PubMed PMID: 32031570; PubMed Central PMCID: PMC7042881.

[25] Tao K, Tzou PL, Nouhin J, Gupta RK, de Oliveira T, Kosakovsky Pond SL, et al. The biological and clinical significance of emerging SARS-CoV-2 variants. Nat Rev Genet. 2021;22(12):757-73. Doi: 10.1038/s41576-021-00408-x PubMed PMID: 34535792; PubMed Central PMCID: PMC8447121.

[26] Lippi G, Sanchis-Gomar F, Henry BM. COVID-19: Unravelling the clinical progression of nature's virtually perfect biological weapon. Ann Transl Med. 2020;8(11):693. Doi: 10.21037/atm-20-3989 PubMed PMID: 32617313; PubMed Central PMCID: PMC7327324.

[27] Faria SS, Fernandes PC, Silva MJB, Lima VC, Fontes W, Freitas-Junior R, et al. The neutrophil-to-lymphocyte ratio: A narrative review. Ecancermedicalscience. 2016;10:702. Doi: 10.3332/ecancer.2016.702 PubMed PMID: 28105073; PubMed Central PMCID: PMC5221645.

[28] Li X, Liu C, Mao Z, Xiao M, Wang L, Qi S, et al. Predictive values of neutrophil-to-lymphocyte ratio on disease severity and mortality in COVID-19 patients: A systematic review and meta-analysis. Crit Care. 2020;24(1):647. Doi: 10.1186/s13054-020-3374-8 PubMed PMID: 33198786; PubMed Central PMCID: PMC7667659.

[29] Tatum D, Taghavi S, Houghton A, Stover J, Toraih E, Duchesne J. Neutrophil-to-lymphocyte ratio and outcomes in louisiana COVID-19 patients. Shock. 2020;54(5):652-58. Doi: 10.1097/SHK.0000000000001585 PubMed PMID: 32554992; PubMed Central PMCID: PMC7326320.

[30] Tan L, Wang Q, Zhang D, Ding J, Huang Q, Tang YQ, et al. Lymphopenia predicts disease severity of COVID-19: A descriptive and predictive study. Signal Transduct Target Ther. 2020;5(1):33. Doi: 10.1038/s41392-020-0148-4 PubMed PMID: 32296069; PubMed Central PMCID: PMC7100419.

[31] Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. The Lancet. 2020;395(10223):497-506. Doi: 10.1016/S0140-6736(20)30183-5.

[32] Pepys MB, Hirschfield GM. C-reactive protein: A critical update. J Clin Invest. 2003;111(12):1805-12. Doi: 10.1172/JCI18921 PubMed PMID: 12813013; PubMed Central PMCID: PMC161431.

[33] Sproston NR, Ashworth JJ. Role of C-reactive protein at sites of inflammation and infection. Front Immunol. 2018;9:754. Doi: 10.3389/fimmu.2018.00754 PubMed PMID: 29706967; PubMed Central PMCID: PMC5908901.

[34] Cicculo A, Borghetti A, Zileri Dal Verme L, Tosoni A, Lombardi F, Garcovich M, et al. Neutrophil-to-lymphocyte ratio and clinical outcome in COVID-19: A report from the Italian front line. Int J Antimicrob Agents. 2020;56(2):106017. Doi: 10.1016/j.ijantimicag.2020.106017 PubMed PMID: 32437920; PubMed Central PMCID: PMC7211594.

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