

ORIGINAL ARTICLE

Neutrophil-Lymphocyte-Platelet Ratio as a Prognostic Marker in Rural ICU Patients: a Two-Year Cross-Sectional Study

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ABSTRACT

Background: Early risk identification can improve treatment outcomes for sepsis patients, leading to timely intervention and better quality of life. An identification of certain parameters in such patients is necessary to determine the risk in such patients. The present study evaluated the predictive efficiency of various critical care assessment scores (CAS), including SOFA, qSOFA, APACHE IV, and biomarkers such as NLR and NLPR, for in-hospital mortality, the need for mechanical ventilation (MV), and hospital length of stay (LOS), as a risk for sepsis patients.

Methods: A total of 300 patients were included in the study; however, 70 mortalities were recorded. A significant difference was observed in the hematological and biochemical parameters between the survivors and non-survivors ($p < 0.001$). Associations between CAS, biomarkers, and clinical outcomes were assessed by binary logistic regression, while receiver operating characteristic (ROC) curve analysis was used to determine optimal cutoffs for mortality and MV prediction.

Results: SOFA was the best predictor of mortality (OR: 2.98, $p < 0.001$) and MV requirement (OR: 2.90, $p < 0.001$), with a cutoff of ≥ 9 having 94% sensitivity and 86% specificity for mortality. APACHE IV with a cutoff > 71 , AUC: 0.840, and NLPR with a cutoff > 3.1 , AUC: 0.716, also significantly predicted mortality. $\text{PaO}_2/\text{FiO}_2$ had a negative correlation with both mortality (OR: 0.022, $p < 0.001$) and MV need (OR: 0.004, $p < 0.001$). An inverse prediction of LOS with SOFA scores was seen ($\beta = -0.191$, $p = 0.003$), whereas higher $\text{PaO}_2/\text{FiO}_2$ ratios indicated prolonged hospitalization ($\beta = 0.193$, $p = 0.011$).

Conclusions: When predicting sepsis-related mortality and MV requirement, SOFA is a better option than other CAS and biomarkers. In setups with limited resources, NLPR is a helpful substitute. Important information about mortality risk and length of hospital stay is provided by $\text{PaO}_2/\text{FiO}_2$. However, to confirm these results in various contexts, more investigation is necessary.

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KEYWORDS

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INTRODUCTION

"Critical illness is any condition requiring the support of failing vital organ systems without which survival would not be possible," according to Chandrashekar et al. [1,2]. According to Painter et al., a patient is considered critically sick or injured if they have a disease or injury that affects one or more essential organ systems and increases the likelihood that their health may deteriorate rapidly or in a way that could be fatal [3,4]. Critical care delivery and epidemiology are complicated in India. The complexity and scarcity of available data are exacerbated by variations in patient backgrounds, clinical procedures, carer objectives, resource distribution, and the absence of systematic assessment [5]. In cases of critical illness, particularly where sepsis is a significant contributor to patient suffering and death, the swift identification of the condition is crucial for initiating prompt and targeted therapy.

In addition to sharing a similar underlying pathomechanism, adult respiratory distress syndrome (ARDS) is a frequent complication of sepsis [6]. Various scoring systems are currently employed in a critical care setting to stratify patients with sepsis, namely, APACHE IV (Acute Physiology and Chronic Health Evaluation IV) [7], SOFA (Sepsis-Related Organ Failure Assessment) [8], qSOFA (quick SOFA) [9]. Both SOFA and APACHE IV require various patient particulars in addition to laboratory tests, which may consume time to categorize potentially critical patients. Additionally, qSOFA performs poorly in the prediction of severe sepsis and related mortality among infective patients approaching institutional care [10]. The ratio of the partial pressure of arterial oxygen to the fraction of inspired oxygen ($\text{PaO}_2/\text{FiO}_2$) is an easily calculated and reliable indicator of hypoxemia. However, little is known about its predictive value in rural medical intensive care units (MICUs) in India. Finding reliable prognostic indicators that are appropriate for rural intensive care units is a crucial need that the planned study seeks to fill [2,3]. In addition, the integration of blood biomarkers into clinical practice has undoubtedly revolutionized patient care [11,12]. Clinically, a biomarker should be an adjunct to medical judgment and other diagnostic and prognostic tools, providing additional insights that enhance patient treatment. The ideal biomarker would be characterized by rapid response alongside high accuracy and precision [13]. Moreover, it would be fully automated, deliver results quickly, and ideally, be accessible as a cost-effective point-of-care test [13,14]. In this study, we have highlighted the neutrophil-lymphocyte-platelet ratio (NLPR) as a prognostic marker of mortality, length of hospital stay, and need for mechanical ventilation in

critically ill patients admitted to the medical intensive care unit at rural set-up. Further, we aimed to ascertain the prognostic significance of $\text{PaO}_2/\text{FiO}_2$ among septic patients for mortality and the need for mechanical ventilation.

MATERIALS AND METHODS

Study design, setting, and study period

A prospective observational, cross-sectional study was conducted to evaluate the efficacy of neutrophil-lymphocyte-platelet ratio as a prognostic marker in critically ill patients admitted to medical intensive care units at rural setup. This study was conducted following the ethical principles outlined in the Declaration of Helsinki. During the data collection period from June 2022 through May 2024, all critically sick patients admitted to the hospital's medical intensive care unit were included in the research. The Institutional Ethics Committee provided ethical clearance before the study's commencement (DMIMS(DU)/IEC/2022/1092). After explaining the goal, design, and methods of the research to each participant's parent or guardian, informed consent in writing was acquired without any form of coercion. Participants received an assurance of full secrecy. There were no mandatory conditions, and participants could choose to opt out of the research at any time.

Study participants

Inclusion criteria include consenting patients with organophosphate poisoning with sepsis, acute respiratory distress syndrome, congestive cardiac failure, chronic obstructive pulmonary disease, pneumonia, acute kidney injury, chronic kidney disease, stroke, cirrhosis, hepatic failure, pancreatitis, or sepsis. Exclusion criteria include non-consenting patients, patients undergoing antiplatelet treatment, patients refusing investigations, pregnant patients, and patients who died within 24 hours of hospital stay.

Sample size

Using a 95% confidence level and a prevalence of 50%, the sample size of 235 was determined by applying the formula $n = \chi^2 * n * P * (1 - P) / c^2 (n - 1) + \chi^2 * P * (1 - P)$. A total of 300 study participants were included in the study.

Study procedure

The study was started after receiving ethical approval from the Ethics Committee. All the sociodemographic details, clinical features of the patients, and laboratory findings, such as complete blood count, liver function tests, kidney function tests, and arterial blood gas analysis, were collected. The patient outcome was considered in terms of length of hospital stay, mortality, and mechanical ventilation correlated with NLPR [$\text{NLPR} = (\text{Neutrophil count} \times 100) / (\text{Lymphocyte count} \times \text{Platelet count})$]. The flow chart of the study is depicted in Fig-

ure 1. The primary outcome of the study was to assess mortality, length of hospital-stay, and need for mechanical ventilation. The secondary outcome was to compare those for APACHE IV, SOFA, NLR, NLPR, PaO₂/FiO₂ and qSOFA.

In this study, the relationship between critical care assessment scores (SOFA, qSOFA, APACHE IV) and biomarkers (NLR, NLPR, PaO₂/FiO₂) with key clinical outcomes - namely, in-hospital mortality, requirement for mechanical ventilation (MV), and length of hospital stay (LOS) - was analyzed. Clinical assessment scores (SOFA, qSOFA, APACHE IV) were calculated based on patient clinical and laboratory parameters collected at admission. Biomarker values, including neutrophil count, lymphocyte count, platelet count, and arterial blood gas analysis (to calculate PaO₂/FiO₂), were obtained simultaneously.

Statistical analysis

Data were entered into Microsoft Excel (Windows 7; version 2007), and analyses were done using the Statistical Package for Social Sciences (SPSS) for Windows software (version 22.0; IBM Corp., Armonk, NY, USA). Descriptive statistics, such as mean and standard deviation (SD) for continuous variables, frequencies and percentages for categorical variables, were determined. The association between variables was analyzed using the chi-squared test and Fisher's exact test for categorical variables. Pearson's correlation coefficient was calculated between 2 quantitative parameters. Binary logistic regression was used for the categorical dependent variable for predictive analysis. A generalized linear model was employed for the continuous dependent variable. The receiver operator characteristic curve was utilized for the identification of appropriate cutoffs for various parameters, and variables with area under curve (AUC) > 0.5 are presented in the results. Positive predictive value for predicting events, either mortality or the need for mechanical ventilation, was calculated using the equation [PPV = true positive / (true positive + false positive)]. Cox regression proportional hazard was used for the association between critical assessment scores and mortality. An unpaired *t*-test was used to compare the mean of quantitative variables between the two groups. The level of significance was set at $p < 0.05$.

RESULTS

Out of 300 patients enrolled, mortality was seen in 70 individuals. In this study, males accounted for 77.6% of the total, while females comprised 22.3%. The prevalence of various comorbidities within the surveyed population, with a significant proportion reporting alcohol use, followed diabetes mellitus and hypertension, as shown in Table 1.

The comparison of hematological parameters between survival ($n = 230$) and mortality ($n = 70$) groups re-

vealed compelling insights. Hemoglobin (HB), red blood cell count (RBC), white blood cell count (WBC), neutrophil, lymphocyte, hematocrit (HCT), and platelet displayed statistically significant differences in mean values between the two groups, with *p*-values ranging from 0.001 to less than 0.001.

The comparison of various parameters between the survival and mortality groups revealed significant differences in several key indicators. The mean values for FiO₂, PaO₂, PCO₂, urine output, creatinine, urea, albumin, and bilirubin were notably distinct between the two groups, with *p*-values of less than 0.001, as shown in Table 2.

To investigate the association between SOFA, qSOFA, NLPR, NLR, APACHE IV, and PaO₂/FiO₂ with mortality and the need for mechanical ventilation among patients, we performed binary logistic regression. The SOFA and NLPR prognosticate positively, with strong odds ratios of 2.98 (p -value < 0.001) and 1.35 (< 0.001) for mortality. Moreover, both SOFA and NLPR positively predicted the need for mechanical ventilation among admitted patients with odds ratios of 2.90 and 1.33, respectively. Likewise, we noticed positive associations between mortality and APACHE IV (OR/*p*-value; 1.07/< 0.001) as well as NLR (1.17/0.003). Furthermore, NLR significantly predicted the need for mechanical ventilation with an odds ratio of 1.17 (0.002). On the other hand, we observed that PaO₂/FiO₂ can negatively predict both the need for mechanical ventilation (0.004/< 0.001) and mortality (0.022/< 0.001). However, we failed to notice any significant association between qSOFA and mortality (Table 3a). Subsequently, to ascertain the predictive potential of SOFA, qSOFA, NLPR, NLR, APACHE IV, and PaO₂/FiO₂ for the length of stay (LOS) in the hospital, we performed a generalized linear model. As shown in Table 3b, we noted a significant but positive association between PaO₂/FiO₂ and LOS with a 0.193 beta coefficient (p -value = 0.011). On the other hand, we observed that SOFA negatively predicts the duration of hospital stay with a beta coefficient of -0.191 at a p -value of 0.003. However, we failed to notice any significant association between any other critical care assessment scores and LOS.

To determine the optimum cutoff of NLPR, APACHE IV, NLR, and SOFA to rule out mortality (Figure 2a), the need for mechanical ventilation (Figure 2b), and longer length of stay (Figure 2c) in our study, we performed receiver operating characteristic (ROC) curve analysis. As depicted in Table 4, the AUC for SOFA was 0.963 with a p -value < 0.001 for ruling out mortality. Similarly, for predicting the need for mechanical ventilation, the AUC for SOFA was 0.954 (p -value < 0.001). In addition, we found a score of 9 as the appropriate cutoff for SOFA in ruling out mortality with 94% sensitivity (PPV 94%) and 86% specificity, with a diagnostic accuracy of 87%. Interestingly, we observed the same cutoff of SOFA for ruling out the need for mechanical ventilation with 92% (with 92% of PPV) sensi-

Table 1. Demographics of the study participants.

Demographics		Number of patients (n = 300)	Percentage (%)
Gender	male	233	77.6
	female	67	22.3
Age (years)	18 - 40	126	42.0
	41 - 60	108	36.0
	> 60	66	22.0
	mean (SD)	47.19 (15.49)	
	range	17 - 86	
Comorbidities	diabetes mellitus	141	47.0
	hypertension	94	31.3
	alcohol	202	67.3
	smoking	23	7.7
Risk factors	chronic kidney disease	20	6.7
	cirrhosis	100	33.3
	hepatic failure	53	17.7
	metastatic carcinoma	7	2.3

Table 2. Comparison of hematological and vital parameters with mortality.

Parameter	Survival (n = 230)	Mortality (n = 70)	p-value
HB	10.72 (2.79) *	9.42 (2.93)	0.001
RBC	3.78 (1.00)	3.29 (1.23)	0.001
WBC	16,532 (7507)	22,000 (9,832)	< 0.001
Platelet	2.20 (1.34)	2.52 (10.04)	0.043
Neutrophil	76.83 (10.08)	80.10 (9.22)	0.016
Lymphocyte	16.75 (6.85)	14.06 (6.56)	0.004
Monocyte	3.84 (1.02)	3.90 (1.16)	0.695
HCT	32.44 (8.39)	28.69 (9.17)	0.002
MCV	86.55 (10.90)	88.46 (9.77)	0.188
MCH	28.52 (4.64)	28.92 (4.05)	0.514
MCHC	33.04 (4.03)	32.66 (2.00)	0.452
RDW	27.46 (5.94)	19.01 (3.84)	0.041
Vital parameters			
Temperature	37.08 (1.20)	37.08 (0.94)	0.996
MAP	79.99 (5.22)	79.54 (4.74)	0.525
HR	87.62 (13.01)	88.96 (14.70)	0.467
RR	18.04 (3.77)	18.73 (4.02)	0.189
SBP	98.47 (24.24)	99.34 (27.33)	0.799
Other parameters			
FiO ₂	26.43 (11.72)	90.24 (9.33)	< 0.001
PaO ₂	87.33 (13.67)	38.24 (16.68)	< 0.001
PaCO ₂	43.22 (12.24)	46.40 (9.70)	0.048
Sodium	133.38 (6.41)	134.93 (8.54)	0.272
Urine output	1,032.3 (483.26)	676.86 (386.95)	< 0.001
Creatinine	1.85 (1.93)	2.97 (1.87)	< 0.001
Urea	49.36 (44.25)	99.27 (71.83)	< 0.001
Basal sugar	124.78 (42.62)	126.16 (52.20)	0.823
Albumin	3.16 (2.28)	2.58 (0.71)	0.038
Bilirubin	3.56 (5.37)	7.36 (8.34)	< 0.001

* Values presented as mean (SD).

Table 3a. Binary logistic for the association between critical care assessment scores and mortality and the need for mechanical ventilation.

Parameter	Mortality				Mechanical ventilation			
	OR	lower	upper	p-value	OR	lower	upper	p-value
SOFA	2.98	2.27	3.92	< 0.001	2.90	2.23	3.78	< 0.001
NLR	1.17	1.05	1.3	0.003	1.17	1.06	1.30	0.002
qSOFA	1.37	0.92	2.04	0.118	1.51	1.02	2.24	0.039
PaO ₂ /FiO ₂	0.02	0.01	0.11	< 0.001	0.01	0.00	0.08	< 0.001
APACHE IV	1.07	1.05	1.09	< 0.001	-	-	-	-
NLPR	1.35	1.18	1.55	< 0.001	1.33	1.16	1.51	< 0.001

Values presented as odds ratios (ORs) with their 95% confidence interval.

Table 3b. Generalized linear model for the association between critical care assessment scores and length of stay.

Parameter	B	Lower	Upper	p-value
PaO ₂ /FiO ₂	0.193	0.044	0.342	0.011
SOFA	- 0.191	- 0.316	- 0.067	0.003
qSOFA	- 0.189	- 0.611	0.233	0.350
NLR	- 0.039	-0.168	0.091	0.561
APACHE IV	- 0.008	- 0.022	0.006	0.246
NLPR	- 0.067	- 0.201	0.066	0.324

Values presented as unstandardized beta coefficients with their 95% confidence interval.

Table 4. Area under curve (AUC) for various assessment scores of critical care and their cutoff levels with sensitivity, specificity, and positive predictive value (PPV).

	Parameters	AUC (95% CI)	p-value	Cutoff	Sensitivity (%)	Specificity (%)	Accuracy (%)	PPV (%)
Mortality	NLPR	0.716 (0.630 - 0.802)	< 0.001	3.1	70	69	73	70
	SOFA	0.963 (0.942 - 0.984)	< 0.001	9	94	86	87	94
	APACHE IV	0.840 (0.775 - 0.906)	< 0.001	71	77	78	77	77
	NLR	0.624 (0.533 - 0.715)	0.008	5.3	55	68	51	74
Mechanical ventilation	NLPR	0.701 (0.615 - 0.786)	< 0.001	3.1	68	70	73	69
	SOFA	0.954 (0.928 - 0.980)	< 0.001	9	92	88	84	92
	APACHE IV	0.813 (0.742 - 0.883)	< 0.001	-	-	-	-	-
	NLR	0.626 (0.537 - 0.715)	0.006	5.3	55	70	51	75
LOS	NLPR	0.506 (0.238 - 0.773)	0.961	-	-	-	-	-
	SOFA	0.739 (0.491 - 0.987)	0.358	-	-	-	-	-
	APACHE IV	0.696 (0.440 - 0.952)	0.698	-	-	-	-	-
	NLR	0.497 (0.257 - 0.737)	0.928	-	-	-	-	-

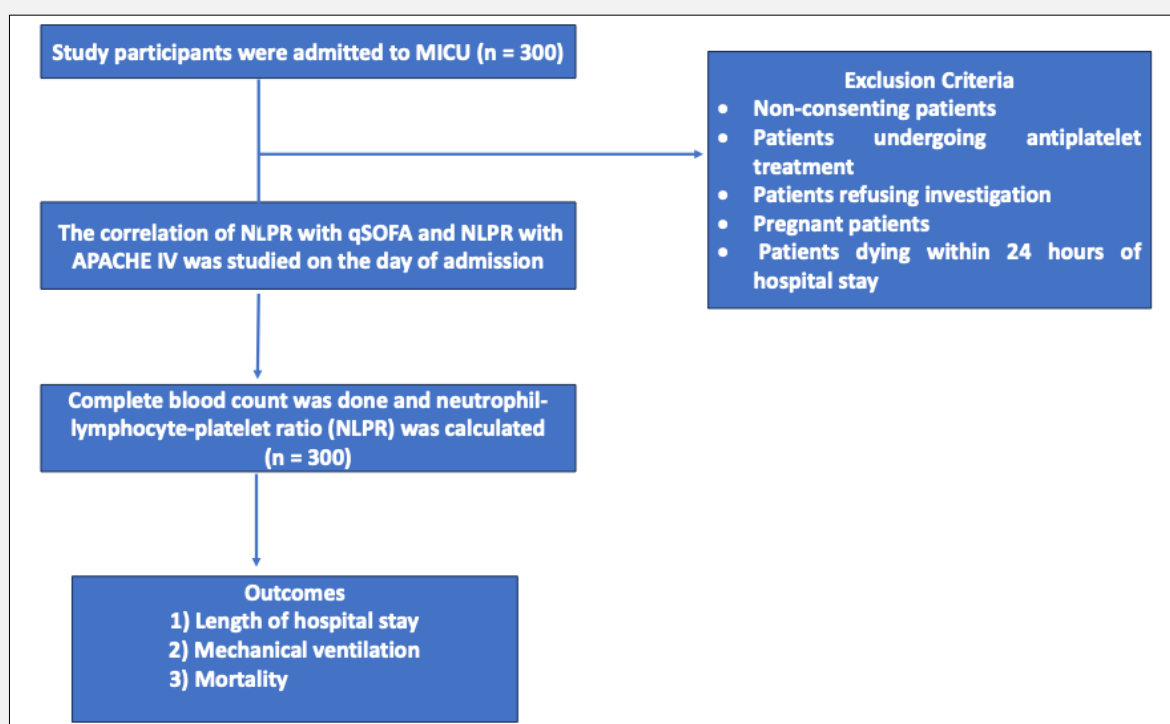
Table 5. Univariate (5A) and multivariable (5B) Cox regression for the association between various CAS and mortality.**A**

Variables	B	Exp (B)	95.0% CI for Exp (B)		p-value
			lower	upper	
SOFA	0.491	1.634	1.478	1.807	< 0.001
APACHE IV	0.045	1.046	1.033	1.059	< 0.001
NLR	0.157	1.170	1.029	1.331	0.017
NLPR	0.226	1.254	1.131	1.390	< 0.001

B

Variables	B	Exp (B)	95.0% CI for Exp (B)		p-value
			lower	upper	
SOFA	0.527	1.694	1.438	1.996	< 0.001
APACHE IV	-0.006	0.994	0.976	1.012	0.515
NLR	0.154	1.167	1.000	1.362	0.050
NLPR	0.014	1.014	0.879	1.170	0.851

Values presented as beta coefficient (B) and hazard ratio (Exp (B)) with 95% confidence interval (CI).

**Figure 1. Flow chart of the study.**

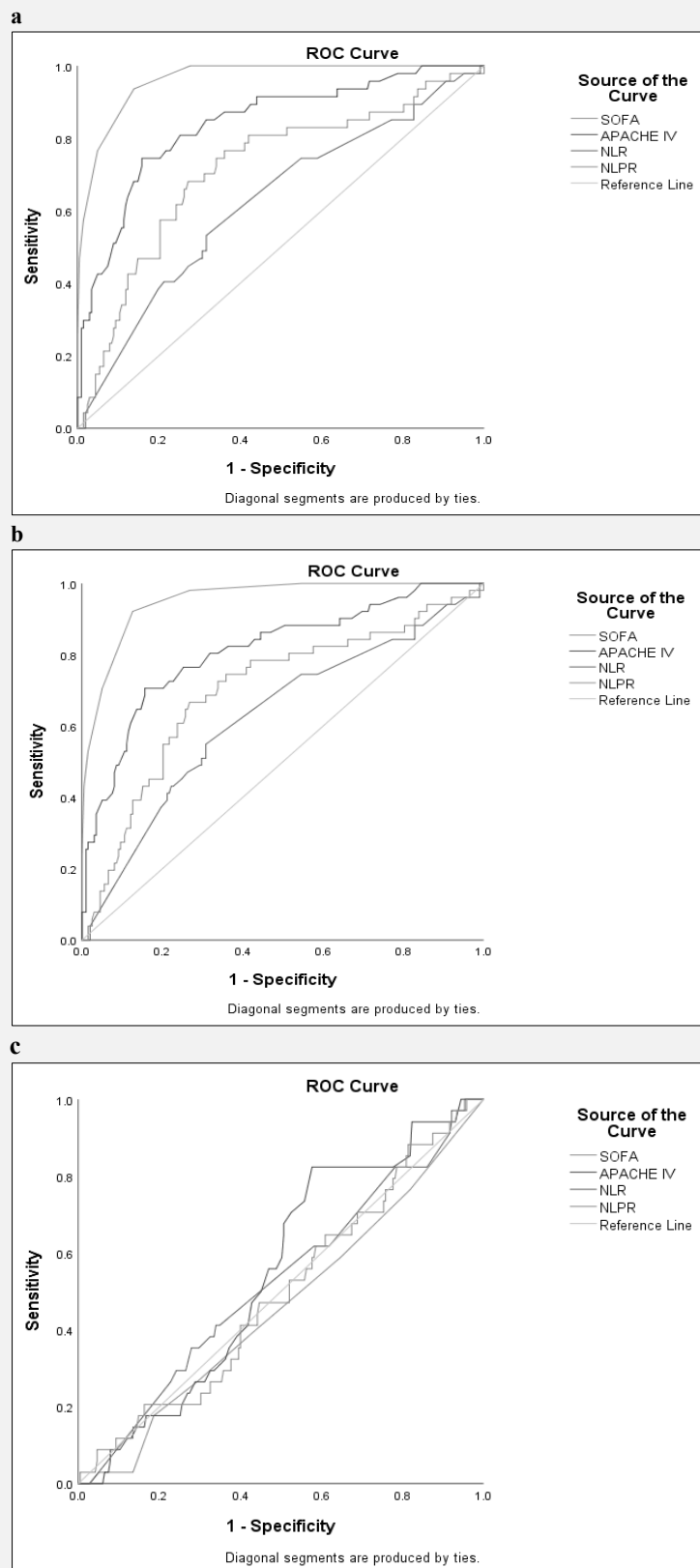


Figure 2. The receiver operating characteristic (ROC) curves depict the areas under the curves (AUCs) for NLPR, APACHE IV, SOFA, and NLR. The dependent variables are for Figure 2a: mortality, for Figure 2b: need for mechanical ventilation, and for Figure 2c: length of hospital stay.

tivity and 88% specificity, with an accuracy of 84%. Furthermore, the AUC for APACHE IV and NLPR were significant, with 71 and 3.8 as their respective cut-offs for ruling out mortality. However, their specificity (78 and 69%) and sensitivity (77 and 70%) were inferior to SOFA. Moreover, we noticed the same cutoffs for NLPR, with marginally lower sensitivity (68%) but similar specificity of 70%, in ruling out the need for mechanical ventilation among ICU patients. Further, a cutoff of 5.3 for NLR was met with a poor sensitivity of 55% and diagnostic accuracy of only 51% to rule out mortality. Lastly, we failed to observe any significance in AUC for any critical care assessment score or NLR/NLPR in ruling out a longer duration of the hospital stay.

Next, to estimate mortality hazard ratios, we performed a univariate Cox regression to determine an association between SOFA, APACHE IV, NLR, and NLPR and death. We observed a significant positive association between all CAS and mortality. However, in multivariable Cox regression, we found significant hazard ratios with SOFA (hazard ratio/p-value; 1.694/< 0.001) and NLR (1.167/0.05) only.

DISCUSSION

A multitude of studies in a variety of intensive care units have proved the utility of risk stratification for timely intervention. Further, to accomplish the task, a wide range of critical care assessment scores (CAS) were put forth in the past for the identification of high-risk patients with sepsis. Some of these CAS require the patient's particulars in conjunction with laboratory support, for example, SOFA, APACHE IV, and PIRO (pre-disposition, insult, response, organ dysfunction); thus, may delay categorization. However, others can be performed quickly at the time of admission, e.g. qSOFA, due to the lack of inclusion of any laboratory analyte measurements. In addition, a few ratios, NLR, NPR, and NLPR, are purely based on laboratory analysis and have gained renewed interest in ICU setups for prognostication of mortality and/or the need for invasive respiratory support. Here, we compared the predictive efficiency of various critical care assessment scores, namely SOFA, qSOFA, and APACHE IV, and ratios of commonly used biomarkers for risk stratification in clinical setup, namely, NLR and NLPR, at the time of admission among patients diagnosed with sepsis for in-hospital mortality, the need for mechanical ventilation, and duration of hospital stay.

In our study, SOFA appeared as the strongest predictor for mortality (OR/p-value; 2.98/< 0.001). Likewise, a previous meta-analysis reinforced the prognostic significance of SOFA for mortality during sepsis [15]. The SOFA was proposed more than two decades back by Vincent et al. to assess the functions of six different organs among critically ill patients [8]. Due to heterogeneity in sepsis, the inclusion of organ dysfunction in the

scoring system improved its utility in the stratification of septic patients. Although its prognostic value was extensively studied in disparate systems, limited observations were cited in resource-limited medical ICUs in rural areas of middle or lower-middle-income countries. Recently, Dronamraju et al. noted high SOFA scores at the time of admission as a strong risk factor for mortality in a rural MICU [16]. We observed that at the time of admission, SOFA score greater or equal to 9 (with AUC = 0.963; $p < 0.001$) predicts mortality with 94% sensitivity and 86% specificity, including a diagnostic accuracy of 87%, which follows previous findings in a similar setup [16].

Furthermore, our finding of SOFA score for the need for mechanical ventilation with odds ratio (2.9; p -value < 0.001) was in accordance with previous observation [17]. In addition, we noted 9 (AUC = 0.954) or more as an optimum cutoff of SOFA score for the prediction of the need for MV, with 92% sensitivity and 88% specificity. Zhou et al. reported a lower cutoff of 5, with inferior sensitivity (76%) and specificity (79%) to our value. However, their study included septic patients with community-acquired pneumonia with higher mortality (36%) than our study [17].

Though qSOFA is easier and quicker to obtain because of the lack of laboratory measurements, our study failed to observe any significant association between qSOFA and mortality, and a similar finding was noted by Askim et al. [10]. However, qSOFA can predict the need for MV (1.51/0.039).

Further, we found a comparable, to the previously noted, finding regarding the association between acute physiology and chronic health evaluation (APACHE) IV scores and mortality (OR/p-value; 1.07/< 0.001) [19,20]. APACHE IV includes comorbidities and needs complete information from admitted patients to accurately categorize them. Therefore, APACHE IV scoring is a time-consuming process and may not be readily available in emergencies as compared to other scoring systems. We noted APACHE IV can predict mortality at a cutoff point of more than 71 (with AUC/p-value; 0.840/< 0.001) with 77%/78% sensitivity/specificity and 77% diagnostic accuracy. In addition, our cutoff level was slightly lower than the previously reported; however, with similar sensitivity (77 vs. 80) and specificity (78 vs. 81) in comparison to Naglh et al. [18].

The systemic inflammatory markers, i.e. NLR and NLPR, were observed as independent predictors for in-hospital mortality in critically ill newborns [19-21], pediatric [22], and septic patients [23]. The supportive evidence for the use of NLPR for the stratification of septic patients is scarce, especially in the MICU from rural areas. We provide evidence in support of the previous findings that higher NLR and NLPR ratios at the time of admission are positively associated with in-hospital mortality [23]. Moreover, we observed that NLPR (1.35/< 0.001) was better at predicting mortality when compared with NLR (1.17/0.003). The better prognostic value of NLPR could be due to the inclusion of platelet

count in the ratio calculation. Previously, thrombocytopenia was frequently noted as a poor prognostic indicator in sepsis [24,25]. Additionally, a worsening platelet count was observed in nearly half of the septic patients with high mortality [25]. Further, we noted 3.1 and 5.3 as the optimum cutoffs for the prognostication of mortality among septic patients with AUC 0.716 (p-value < 0.001) and 0.624 (0.008) for NLPR and NLR, respectively. Recently, Shi et al. observed a higher cutoff of NLPR ratio at the time of admission for mortality with lower sensitivity (ours/theirs; 70/55%) and specificity (69/57%), as compared to our study [23]. This difference might be due to heterogeneity in the origin of sepsis or ethnicity and/or severity of the subjects included in the study. In addition, we observed 23.3% of deaths in our group. However, a higher 37.6% of patients died in their study [23]. Moreover, Shi et al. noted the best result with the 5th-day NLPR ratio, though such a comparison was out of the scope for the present study. Nevertheless, further studies are needed to discern the actual reasons for differences.

In addition to the prediction of mortality, we noted significant associations between NLPR (1.33/< 0.001) and NLR (1.17/0.002) with the need for MV. This finding was in agreement with earlier study by Guney et al. [26]. Although the predictive potential of NLPR for in-hospital mortality, as well as for the need for MV, is inferior to SOFA, it can be beneficial in a setup with limited laboratory support as it is readily available in comparison to SOFA.

Our study observed that a lower $\text{PaO}_2/\text{FiO}_2$ ratio was associated with higher mortality and the need for mechanical ventilation (MV) among patients admitted due to sepsis. Similar findings were cited by previous research groups in disparate setups [27-29]. Though Hongying et al. noted a U-shaped association between $\text{PaO}_2/\text{FiO}_2$ ratio and 28 days mortality in their retrospective study, i.e. both higher and lower $\text{PaO}_2/\text{FiO}_2$ ratio were identifiable risk factors for higher mortality, we, on the contrary, observed a linear relationship [29]. The disagreement might be due to 1) differences in the type of studies, 2) the number of subjects in our study was less as compared to them, 3) ethnicity, or a combination of either of these factors. The lower $\text{PaO}_2/\text{FiO}_2$ ratio means hypoxemia, which ensues in cellular dysfunction followed by multiorgan dysfunction.

Lastly, we observed that SOFA scores were negatively associated with LOS (beta coefficient/p-value; -0.191/0.003). On the other hand, higher $\text{PaO}_2/\text{FiO}_2$ predicted longer LOS (0.193/0.11). Our findings were in exact contradiction with the previous research reports [30,31]. Contrary to the previous observations, surviving patients in our study stayed longer in hospital (mean $\pm$ SD; 5.4 ± 2.2), with lower SOFA scores (6.8 ± 1.5), when compared with the deceased (LOS; 4.0 ± 2.6 , SOFA score; 11.2 ± 1.9) septic patients. The SOFA score includes $\text{PaO}_2/\text{FiO}_2$. Thus, this might be a reason for the inconsistency. Nonetheless, we did not find any signifi-

cant AUC in ROC curve analysis with any CAS or NLR/NLPR ratios for LOS.

The comprehensive analysis of various parameters and risk factors about mortality, length of stay, and survival outcomes in clinical settings provides valuable insights for prognostic assessment and patient care. The study identified the prognostic significance of NLPR in critical care in rural areas. The predictive ability is superior to qSOFA and NLR, comparable to the APACHE IV scoring system, whereas it is inferior to SOFA. However, further studies are needed to explore the full potential of NLPR. By recognizing and addressing key risk factors, healthcare providers can enhance clinical decision-making, maximize resource allocation, and improve patient outcomes and quality of care.

Declaration of Generative AI in Scientific Writing:

Generative AI tool (ChatGPT) was used only to enhance the language and readability of the manuscript at very few places. No AI-generated text, data, or analysis was used, and the intellectual content and interpretations are solely the authors' own.

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Declaration of Interest:

There are no conflicts of interest.

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