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Prognostic nutritional index as a predictor of mortality among patients admitted to ICU with acute exacerbation of chronic obstructive pulmonary disease

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Abstract

Background The PNI is a metric that may assess the combined impact of the inflammatory process and nutritional condition. It may be beneficial in evaluating the nutritional state of patients with AECOPD.

In recent years, it has also been utilized for prognostic assessment of cases admitted to the critical care unit.

Aim of the work The objective of the research was to assess the relationship between PNI and the prognosis for ICU patients with AECOPD.

Patients and methods This was a prospective cross-sectional observational research carried out in the RICU of Ain Shams University Hospitals from April 2023 to March 2024. The study included 161 AECOPD patients who were admitted to RICU. All patients underwent demographic data collection, special habits and comorbid conditions evaluations, and hematological indices with laboratory markers and ABG. ICU and hospital stay duration, SOFA score, and SAPS II were also documented. The PNI value was computed using the following equation: the formula to calculate the value is 10 times the serum albumin concentration in grams per deciliter plus 0.005 times the total lymphocyte count in cubic millimeters. The main measure of interest was the death rate within 30 days for all causes. Additional measures were the duration of stay in the ICU, the duration of hospitalization, and the rate of MV.

Results There was a significant relationship between PNI and type of respiratory failure, mechanical ventilation, fate, hypertension, and diabetes. One hundred five (65.2%) of the patients were extubated and discharged, while 56 (34.8%) of them died. The study also noted a significant positive relationship among PNI and HCT, lymphocytic %, HB, and albumin. However, there was a significant negative relationship between PNI and age, RDW, WBC, neutrophil count, neutrophil %, NLR, CRP, SAPSII, and SOFA. The SAPS II score (with SAPS II mortality) had greater AUROC in predicting mortality than PNI, NLR, and SOFA. The optimal cut-off value for PNI in this study was ≤ 29 with sensitivity 82.14% and specificity 56.19%.

Conclusion The study showed that PNI can be a useful biomarker for AECOPD. PNI with SAPS II scores on admission to ICU were closely correlated to adverse outcomes.

Keywords Prognostic Nutritional Index, RICU, AECOPD, Neutrophil-lymphocytic ratio

Introduction

COPD is a long-term inflammation of the airways that is marked by ongoing respiratory symptoms and constant restriction of airflow [1].

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The occurrence of AECOPD is strongly correlated with worse results in individuals with COPD. Transferring the patient to the ICU is crucial in cases of severe AECOPD since it is related to a significant risk of mortality [2].

Cases with COPD frequently have malnutrition [3]. Malnutrition can heighten the risk of aggravation and prolong the period of hospitalization [4]. Due to the critical nature of early risk assessment in severe AECOPD, it is essential to employ a biomarker that reflects both the nutritional status and inflammation of the patients. Serum albumin and peripheral lymphocyte count are utilized to compute PNI, a novel biomarker for prognosis [5].

PNI was first created to measure nutritional status before surgery and the occurrence of complications in cases with gastrointestinal malignancies [5]. It has been recognized as a reliable and autonomous prognostic indicator in human malignancies [6, 7], chronic renal and cardiac disease [8], and autoimmune illness [9]. The purpose of the current research is to assess the prognostic significance of PNI in cases with AECOPD.

Aim of the work

The objective of the present research was to assess the relationship between PNI and the prognosis for ICU patients with AECOPD.

Patients and methods

This was prospective cross-sectional observational research carried out in the respiratory ICU of Ain Shams University Hospitals from April 2023 to March 2024. The research included patients with AECOPD who were admitted to the respiratory ICU because of acute respiratory failure.

Inclusion criteria

AECOPD patients who were admitted to the respiratory ICU of Ain Shams University Hospitals due to acute respiratory failure (type I or type II).

Exclusion criteria

1- Patients < 18 years,
2- Duration of ICU stay below 48 h, or missing data above 10%
3- Non-COPD patients
4- COVID patients.

Sample size

Utilizing the PASS 15 program for sample size calculation, setting power at 80% and alpha error at 0.05 and according to Peng et al. 2022, the expected area under the ROC curve for PNI for prediction of 30-day mortality among patients = 0.64 Sample size of 160 cases will be needed to measure the predictive ability of PNI assuming 30% mortality rate among patients.

Ethical consideration

Informed consent was taken directly from the cases or their legal guardians for participating in the study.

Study procedures

1- Demographic data (age, gender), special habits (i.e., smoking, drug abuse), comorbid conditions including hypertension, DM, CHD, CKD, and malignancy.
2- Hematological indices (Hb level, RDW, WBC counts, NLR),
3- Arterial blood gas (ABG).
4- Duration of stay in ICU and hospital
5- Serum albumin, ALT, AST, bicarbonate, serum sodium, potassium, creatinine, and BUN.
6- Additionally, the SOFA score [10] and SAPS II score [11] were calculated.
7- PNI value was measured with the following equation: $10 \times$ serum albumin (g/dL) $+ 0.005 \times$ total lymphocyte count (mm^3) [12].
8- The 30-day mortality rate was the main outcome. The length of hospital stay and ICU stay, as well as the rate of mechanical ventilation (MV), were secondary outcomes.

Data management and analysis

The information obtained was reviewed, encoded, organized into tables, and inputted into a computer utilizing Statistical Package for the Social Sciences (SPSS 25). The data was presented and analyzed appropriately based on the specific parameters for each data type.

i. Descriptive statistics

1. Mean, standard deviation (± SD), and range for parametric numerical data, while median and interquartile range (IQR) for non-parametric numerical data.
2. Frequency and percentage of categorical data.

ii. Analytical statistics

1. Student's *t* test was utilized to evaluate the statistical significance of the variance among both study group means.

2. he ROC curve (receiver operating characteristic) provides a useful way to assess the Sensitivity and specificity for quantitative diagnostic measures that categorize patients into one of both groups.

Results

A significant positive relationship is found between PNI and respiratory failure type, MV, hypertension, Diabetes, and fate (Table 2). A significant positive relationship is noted among PNI and HCT, lymphocyte %, HB, and albumin. However, a significant negative relationship is noted among PNI and age, RDW, WBC, neutrophil count, neutrophil %, NLR, CRP, SAPSII, and SOFA (Table 3). The optimal cut-off value for PNI in this study was ≤ 29 with a sensitivity of 82.14% and specificity of 56.19%. On the other hand, the cut-off value for SAPSII was > 30 with a sensitivity of 80.36% and specificity of 74.29%, while the cut-off value for SOFA was > 3 with a sensitivity of 64.29% and specificity of 78.1%. The optimal cut-off value for NLR was > 5.39 with a sensitivity of 98.21% and specificity of 36.19% (Table 4). SAPSII score (with SAPS II mortality) had the highest AUROC in predicting mortality which was significantly greater than the values obtained for PNI (Fig. 1).

Discussion

AECOPD is a condition that can lead to worsening respiratory function and increased mortality. Malnutrition is common in cases with COPD and can further worsen their prognosis. PNI which is a biomarker reflecting both inflammation and nutritional status, has become a valuable tool for predicting outcomes in these patients [12].

Serum albumin, which is an acute-phase protein response, can be rapidly consumed during AECOPD [13]. A decrease in albumin levels may indicate a deteriorating clinical status or persistent inflammation [14]. Furthermore, albumin deficiency can impair cell-mediated immunity and weaken the immune defense system [15]. A study by Yamaya et al. stated that cases have lymphocytopenia had a greater risk of mortality during exacerbation [16].

This study was a prospective observational cross-sectional research carried out at the Respiratory ICU of Ain Shams University Hospitals between April 2023 and March 2024. The study included 161 patients with AECOPD who were admitted to the respiratory ICU because of acute respiratory failure.

In the present research, a total of 161 patients were involved. Out of these, 144 (89.4%) were men and 17 (10.6%) were women. Their age varied from 34 to 88 years, with a mean of 64.14 years (SD 9.84). Among the patients, 136 cases (84.6%) were current smokers (with the pack/year ranging from 15 to 100). Additionally, 7 cases (4.3%) were former smokers, 7 cases (4.3%) were exposed to biomass fuel, and 11 patients (6.8%) were non-smokers.

These results were similar to those of Peng J.C et al. (2022) in terms of age as they included **a** total of 494 cases involved in their research, with an average age of 70.8 ± 10.4 years. However, the study results were not comparable in terms of the sex of the included patients. In Peng J.C et al. study, 248 (50.2%) were male and 246 (49.8%) were female [12].

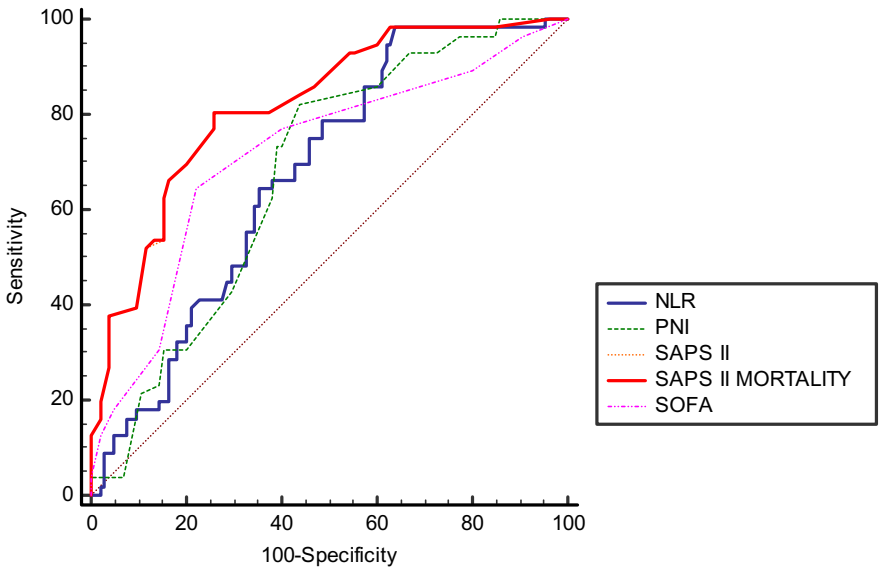

Fig. 1 ROC Curves of PNI, NLR, SAPS II, SAPS II mortality, and SOFA

In research conducted by Kayhan S et al. (2022), 80 cases (who were not diagnosed with COPD) were involved, and the average age of cases was 63 years (with a greater age of 66.5 years in non-survivors and a lower age of 61.5 years in survivors). However, the sex distribution was not similar as 50% of the patients (*n* equals 40) were women and 50% (n equals 40) were men. The cases were followed up for a median period of 5 days (with an IQR of 3–11), and the mortality rate was 38.7% (31 patients) [17].

In another research performed by Yuan et al. (2023), a total of 385 COPD patients were examined. The average age of cases was 74.2 years (with an SD of 8.7). 87.8% of the participants were male which matched with the sex distribution in present research [18].

In the present research, it was revealed that out of the total cases, 104 (64.6%) individuals had comorbidities while 57 (35.4%) individuals didn't have any comorbidity. Among those with comorbidities, 42 (26.1%) cases were hypertensive, 27 (16.8%) had diabetes, 16 (9.9%) had ischemic heart disease, 11 (6.8%) had congestive heart failure, 9 (5.6%) had atrial fibrillation, 10 (6.2%) had chronic kidney disease, 23 (14.3%) had Hepatitis C virus (not in liver cell failure), and 9 (5.5%) had lung cancer. Furthermore, 46 (28.6%) patients had respiratory failure type I, and 115 (71.4%) patients had respiratory failure type II.

Kayhan S et al. (2022) reported that 37.5% of the patients had diabetes mellitus, 46.3% were hypertensive, 12.5% had congestive heart failure, 6.3% had CKD, 21.3% had coronary artery disease, 16.3% had COPD, and 26.3% had malignancy [17].

The patient ICU stay varied from 2 to 30 days (mean 11.86 with SD 6.61), while the hospitalization varied from 3 to 30 days (mean 13.08 with SD 7.13). Out of all the patients, 88 (54.7%) were mechanically ventilated while 73 (45.3%) patients were not. The duration of MV ranged between 2 and 30 days (mean 9.70 with SD 6.88).

SAPS II score of the cases varied from 6 to 61 (mean 29.33 with SD 11.47). SOFA score ranged from 0 to 8; with 12 (7.5%) patients having 0 points, 15 (9.3%) having 1 point, 49 (30.4%) having 2 points, 26 (16.1%) having 3 points, 27 (16.8%) having 4 points, 17 (10.6%) having 5 points, 6 (3.7%) having 6 points, 7 (4.3%) having 7 points, and 2 (1.2%) having 8 points.

In terms of fate, 105 (65.2%) of the patients were extubated and discharged while 56 (34.8%) died. The mean and standard deviation of laboratory investigations and blood gases are expressed in Table 1.

In this research, a statistically significant relationship was noted between PNI and respiratory failure type, mechanical ventilation, hypertension, diabetes, and fate. However, there was no statistically significant relationship between PNI and smoking habits, gender, or other comorbidities such as CHF, AF, IHD, CKD, HCV, and lung cancer (Table 2).

Table 1 Mean, median, and range of all variables

	Mean ± SD	Range	Median (IQR)
Age	64.14 ± 9.84	34–88	65 (60–70)
RDW	15.64 ± 2.44	12–22	15 (13.9–17)
HCT	38.41 ± 8.06	16.9–58.6	40.6 (32.3–44.8)
WBC	12.53 ± 7.44	4.4–45	11 (7–15.9)
N COUNT	10.41 ± 6.59	2.3–38	9 (5.6–12.9)
N %	81.56 ± 10.09	42.5–97.7	83.7 (76–90)
L COUNT	1.08 ± 0.84	0.1–4.9	0.9 (0.5–1.3)
L%	10.04 ± 7.23	1–47.6	8.6 (5–13.7)
NLR	15.73 ± 16.28	0.89–112	10 (5.5–19.4)
HB	12.34 ± 2.41	5–18.5	13 (10.7–14)
PLAT	256.03 ± 105.43	65–582	244 (185–303)
CRP	91.13 ± 82.56	1.8–378	60 (34–116)
ALBUMIN	2.89 ± 0.59	1.6–4.6	2.8 (2.6–3.1)
PNI	28.91 ± 5.94	16–46	28 (26–31)
CREAT	1.29 ± 1.2	0.4–9.9	0.9 (0.7–1.4)
AST	81.04 ± 302.83	10–3650	29 (20–45)
ALT	79.39 ± 287.93	3–3216	25 (16–46)
PH	7.35 ± 0.12	7–7.63	7.36 (7.26–7.42)
PCO2	59.99 ± 20.52	26–115	57 (44–74)
PO2	52.71 ± 21.52	15–140	48.5 (39–66.5)
HCO3	30.46 ± 8.59	14–59	30 (24–33)
SPO2	79.6 ± 16.57	28–99	84 (73–93)
Fio2	38.49 ± 20.15	21–100	35 (21–44)
ICU stay	11.86 ± 6.61	2–30	10 (7–16)
Hospital stay	13.08 ± 7.13	3–30	11 (7–18)
MV DAYS	9.7 ± 6.88	2–30	8.5 (3–15)
SAPS II	29.33 ± 11.47	6–61	29 (21–39)
SAPS II MORTALITY	0.14 ± 0.14	0.01–0.7	0.1 (0.04–0.23)

SD Standard deviation, *IQR* Interquartile range, *RDW* Red cell distribution width, *HCT* Hematocrit, *WBC* White blood count, *N COUNT* Neutrophil count, *N %* Neutrophil percent, *L COUNT* Lymphocytic count, *L %* Lymphocytic percent, *NLR* Neutrophil-lymphocytic ratio, *HB* Hemoglobin, *PLAT* Platelets, *CRP* C-reactive protein, *PNI* Prognostic nutritional index, *CREAT* Creatinine, *AST* Aspartate transaminase, *ALT* Alanine transaminase, *PH* Potential of hydrogen, *PCO2* Partial pressure of carbon dioxide, *PO2* Partial pressure of oxygen, *HCO3* Bicarbonate, *SPO2* Oxygen saturation, *FiO2* Fraction of inspired oxygen, *ICU* Intensive care unit, *MV* Mechanical ventilation, *SAPS II* Simplified acute physiology score II

Present research stated a statistically significant positive relationship among PNI and HCT, lymphocytic %, HB, and albumin; however, there was a statistically significant negative relationship among PNI and age, RDW, WBC, neutrophil count, neutrophil %, NLR, CRP, SAPS II, and SOFA.

Furthermore, a positive relationship (without significance) was noted among PNI and lymphocyte count, ALT, and PCO2. Conversely, there was a negative correlation (without significance) between PNI and AST, PH,

Table 2 Relation between PNI and sex, respiratory failure, MV, Fate and comorbidities

				PNI		t test		
				Mean	SD	T	*p* value	sig.
Sex		male		28.82	6.05	-0.54	0.588	NS
		female		29.65	4.95			
Respiratory failure		1		26.89	6.63	-2.78	0.006	S
		2		29.71	5.46			
MV		no		30.04	6.32	2.24	0.027	S
		yes		27.97	5.46			
Fate		discharged		30.14	6.38	4.26	<0.001	S
		died		26.59	4.15			
Hypertension		no		28.08	6.02	-3.07	0.003	S
		yes		31.26	5.05			
Diabetes		no		28.48	6.14	-2.06	0.041	S
		yes		31.04	4.26			
Congestive heart failure		no		28.99	6.07	0.63	0.530	NS
		yes		27.82	3.63			
Atrial Fibrillation		no		28.91	6.10	0.03	0.980	NS
		yes		28.89	1.69			
Chronic Kidney disease		no		28.95	6.07	0.39	0.699	NS
		yes		28.20	3.49			
Ischemic heart disease		no		29.09	5.96	1.18	0.241	NS
		yes		27.25	5.66			
Hepatitis C virus		no		28.75	5.97	-0.80	0.424	NS
		yes		29.83	5.80			
Lung cancer		no		29.09	5.81	1.70	0.092	NS
		yes		25.66	7.41			
		PNI				ANOVA		
		N	%	Mean	SD	F	*p* value	sig.
Smoking	Non-Smoker	11	6.8	30.18	5.40	0.23	0.879	NS
	Smoker	136	84.5	28.86	6.07			
	Ex Smoker	7	4.3	28.00	6.48			
	Biomass	7	4.3	28.71	3.90			

PNI Prognostic nutritional index, *MV* Mechanical ventilation

PO2, HCO3, SPO2, FIO2, PLAT, creatinine, ICU stay, hospital stay, MV days, and SAPS II mortality (Table 3).

These results were similar to a study by Peng J.C et al. (2022) which divided 494 patients with AECOPD into three groups based on PNI level, cases in the low PNI group (≤ 30.2) had lesser levels of lymphocyte count, Hb, albumin and greater neutrophil count levels, BUN, SAPSII, NLR, and PLR [12].

Also, these results were similar to Peng J.C et al. 2022 regarding clinical outcomes, the low PNI group had a significantly greater 30-day mortality rate (24.4%, *P* below 0.001) than the other two groups. The Lengths of ICU and hospital stays were significantly lengthier in the low PNI group [12].

These results were consistent with those of Kayhan S et al. (2022) as the non-survivor group had a higher intubation (*P* below 0.001), and a lower PNI level (*P* equals 0.01). They also had greater APACHE II and SOFA scores (*P* equals 0.02, *P* below 0.001, correspondingly), and a shorter duration of mechanical ventilation (*P* equals 0.01) [17].

It was found that the results of this study did not entirely match the findings of Yuan et al. (2023). They noted that cases in the low tertile group had significantly reduced BMI, leukocyte, and lymphocyte counts, hemoglobin levels, and serum albumin. Furthermore, the group in the lowest tertile also experienced a considerably greater occurrence of negative outcomes and

Table 3 Correlation between PNI and all variables

	PNI			PNI	
	R	*P*		*R*	*P*
Age	**−0.156**	**0.049**	AST	−0.044	0.584
RDW	**−0.197**	**0.012**	ALT	< 0.001	0.995
HCT	**0.39**	**< 0.001**	PH	−0.090	0.257
WBC	**−0.265**	**0.001**	Pco2	0.127	0.110
N COUNT	**−0.279**	**< 0.001**	Po2	−0.125	0.114
N %	**−0.263**	**0.001**	Hco3	−0.011	0.893
L COUNT	0.088	0.267	SPO2	−0.116	0.142
L%	**0.288**	**< 0.001**	Fio2	−0.036	0.653
NLR	**−0.166**	**0.035**	ICU stay	−0.073	0.358
HB	**0.302**	**< 0.001**	hospital stay	−0.066	0.409
PLAT	−0.032	0.688	MV DAYS	−0.043	0.688
CRP	**−0.488**	**< 0.001**	SAPS II	**−0.196**	**0.013**
ALBUMIN	**1**	**< 0.001**	SAPS II MORTALITY	−0.141	0.075
CREAT	−0.074	0.350	SOFA	**−0.244**	**0.002**

longer durations of hospitalization. The study found that the levels of total protein, albumin, total cholesterol, triglycerides, and LDL rose as the tertiles of PNI increased [18].

Furthermore, Yuan et al. (2023) stated that The rates of poor hospitalization outcomes showed a substantial rise across the different levels of PNI (23.6% for PNI < 40.8, 13.2% for PNI 40.8–46, and 6.2% for PNI ≥ 46). cases in lower and middle tertiles had a greater occurrence of comorbidities, such as CAD, congestive heart failure, CKD, diabetes, and hypertension [18].

Yuan et al. (2023) also found that lymphocytes, eosinophils, RBCs, hemoglobin, albumin, serum calcium, total cholesterol, pH, and PNI exhibited a negative correlation with unfavorable hospitalization outcomes. On the other hand, platelets, D-dimer, duration of stay, needed NIMV, and PaCO2 levels showed a positive correlation with the odds of unfavorable hospitalization outcomes [18].

The results mentioned here are in line with the Keskin et al. study in 2022. They studied 306 patients who tested positive for COVID-19 and were admitted to ICU because of COVID-19 pneumonia. The study found that cases with low PNI values and were in ICU had a higher mortality rate. The cut-off point for PNI was measured as 34,075 ($P < 0.001$, and 95% CI 0.63–0.75) [19].

Additionally, Baldemir and Cirik (2022) conducted a study on 222 COPD cases who were hospitalized in the ICU. Their findings demonstrated a weak positive connection among PNI and lymphocyte count (r equals 0.456), PNI and basophil count (r equals 0.210), PNI and RBCs count (r equals 0.333), PNI and hemoglobin level (r equals 0.312), PNI and hematocrit level (r equals 0.334), and PNI and lymphocyte-to-monocyte ratio ($r = 0.281$) [20]. The results were in line with the findings of this investigation.

In this study, ROC curves analysis was done to measure potential prognostic values of several indicators in AECOPD patients, including PNI, NLR, SAPS II, SOFA, and SAPS II mortality. The findings revealed that the SAPS II score (with SAPS II mortality) had the highest AUROC in predicting mortality which was significantly greater than the values obtained for PNI, NLR, and SOFA (Fig. 1).

For the prediction of mortality, the optimal cut-off value for PNI in this study was ≤ 29 with a sensitivity of 82.14% and specificity of 56.19%. However, for SAPS II, the cut-off value was > 30, with a sensitivity of 80.36% and a specificity of 74.29%. For SOFA, the cut-off value was > 3, with a sensitivity of 64.29% and a specificity of 78.1%. The cut-off value for NLR was > 5.39 with a sensitivity of 98.21% and specificity of 36.19%. The cut-off value for SAPSII mortality was > 10.6, with a sensitivity of 80.36% and specificity of 74.29% (Table 4).

In another investigation done by Peng J.C et al. (2022), the researchers utilized ROC curve analysis to assess the predictive significance of PNI, serum albumin, NLR, and PLR in cases with AECOPD. The study found that the PNI had the highest AUROC for predicting 30-day mortality. This value was significantly greater than AUROC values obtained for serum albumin alone, NLR, and PLR. PNI had an ideal cut-off value of 31.8, with a sensitivity of 62.3% and a specificity of 64.1% [12].

Table 4 Cut-off value of PNI, NLR, SAPS II, SAPS II mortality, and SOFA

Variable	AUC	95% CI	*P* value	Cut-off point	Sensitivity	Specificity	PPV	NPV
NLR	0.676	0.597 to 0.747	< 0.001	> 5.39	98.21	36.19	45.1	97.4
PNI	0.675	0.597 to 0.747	< 0.001	≤ 29	82.14	56.19	50	85.5
SAPSII	0.818	0.750 to 0.874	< 0.001	> 30	80.36	74.29	62.5	87.6
SAPSII MORTALITY	0.818	0.750 to 0.874	< 0.001	> 10.6	80.36	74.29	62.5	87.6
SOFA	0.715	0.639 to 0.784	< 0.001	> 3	64.29	78.1	61	80.4

Based on research done by Peng J.C et al. (2022), it was observed that individuals in the low PNI group were older and had notably elevated levels of NLR, PLR, and SAPS II scores. The group with a low PNI also exhibited significantly greater rates of mortality within 30 days and longer durations of stay in ICU [12].

Furthermore, research has demonstrated a substantial increase in NLR levels in cases with AECOPD in comparison to those with stable COPD [21]. Furthermore, the PLR was elevated in cases with AECOPD as contrasted to individuals with stable COPD [22]. Nevertheless, when analyzing the area under ROC curves, it was shown that the PNI (AUROC 0.642, 95% confidence interval [CI] 0.560 to 0.717, *P* below 0.001) outperformed the NLR, PLR, and serum albumin alone as predictors of 30-day mortality. The PNI has an ideal cut-off value of 31.8, demonstrating a sensitivity of 62.3% and specificity of 64.1% [12].

In a study by Kayhan S et al. (2022), it was found that the PNI value [*P* equals 0.009] was a negative independent risk factor while the SOFA score [*P* equals 0.03] was a positive independent risk factor in assessing mortality in ICU cases. The research showed that PNI was as effective as the SOFA score in predicting mortality in ICU patients, where a low PNI may indicate poor survival because of the combined effect of albumin and lymphocytes reflecting the disease severity [17].

In a study by Yuan et al. (2023), the research revealed that with each incremental rise in the PNI, there was a significant 9% reduction in the likelihood of experiencing negative consequences (*P* below 0.0001). The PNI showed a direct correlation with negative hospitalization outcomes. Specifically, for every 1 unit rise in the PNI, there was a substantial 6% decrease in unpleasant hospitalization outcomes ($P < 0.0001$). Furthermore, the study revealed that if the PNI was below 42, every incremental rise in PNI was linked to a 13% reduction in the occurrence of negative results [18].

Baldemir and Cirik (2022) found that the PNI cut-off value, determined based on the albumin value, had a sensitivity of 80.8%, specificity of 88.1%, PPV of 92.9%, NPV of 88%, and AUC of 0.891. This cut-off value proved to be helpful in predicting a poor prognosis in cases with AECOPD. The NLR cut-off value was determined to be 7.972, with an AUC of 0.351. The sensitivity was 56.4%, while specificity was 67.7%. The statistical significance of these data was $P < 0.001$. These results closely align with the findings of this study. Multiple researches have indicated that an NLR greater than 10.23 is linked to a negative prognosis in AECOPD. Additionally, a threshold value of 10,345 may accurately predict the requirement for invasive ventilation, while an NLR beyond 16 is an independent risk factor for death in the ICU [20].

Conclusion

PNI can be utilized as a useful biomarker for AECOPD. PNI with SAPS II scores on admission to the ICU were closely correlated to adverse hospitalization outcomes.

Abbreviations

ABG	Arterial blood gas
AECOPD	Acute exacerbation of chronic obstructive pulmonary disease
ALT	Alanine transaminase
AST	Aspartate transaminase
CHF	Congestive heart failure
COVID-19	Corona virus 19
FiO2	Fraction of inspired oxygen
HB	Hemoglobin
HCO3	Bicarbonate
HCT	Hematocrit
HCV	Hepatits C virus
ICU	Intensive care unit
IHD	Ischemic heart disease
L count	Lymphocytic count
L %	Lymphocytic percent
LDH	Lactic dehydrogenase
LDL	Low-density lipoprotein
MV	Mechanical ventilation
N count	Neutrophil count
N %	Neutrophil percent
NLR	Neutrophil-lymphocytic ratio
NIMV	Non-invasive mechanical ventilation
NT-proBNP	N-terminal pro-brain natriuretic peptide
PCO2	Partial pressure of carbon dioxide
PCT	Procalcitonin
PH	Potential of hydrogen
PLR	Platelet-to-lymphocyte ratio
PNI	Prognostic Nutritional Index
PO2	Partial pressure of oxygen
RDW	Red cell distribution width
RICU	Respiratory intensive care unit
SAPS II	Simplified Acute Physiology Score II
SOFA	Sequential Organ Failure Assessment Score
SPO2	Oxygen saturation
TLC	Total leucocyte count
WBC	White blood count

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Authors' contributions

HM collected the patient's data. HM wrote the manuscript and reviewed the data collection and statistical analysis. The author read, approved, and published the final manuscript.

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Data availability

The data supporting the conclusions of this investigation may be obtained from the corresponding author, HM, upon a reasonable request.

Declarations

Ethics approval and consent to participate

The Research Ethics Committee of Ain Shams University, Faculty of Medicine, granted ethical permission for this work under the reference number FMASU R95/2023. The subject participant granted a written consent.

Consent for publication

Not applicable.

Competing interests
The author declares no competing interests.

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References

1. Vogelmeier CF, Criner GJ, Martinez FJ et al (2017) Global strategy for the diagnosis, management, and prevention of chronic obstructive lung disease 2017 report GOLD. Executive Summary. Am J Respir Crit Care Med. 195(5):557–82
2. Soler-Cataluña JJ, Martínez-García MA, Román Sánchez P et al (2005) Severe acute exacerbations and mortality in patients with chronic obstructive pulmonary disease. Thorax 60(11):925–931
3. Collins PF, Elia M, Stratton RJ (2013) Nutritional support and functional capacity in chronic obstructive pulmonary disease: A systematic review and metaanalysis. Respirology 18(4):616–629
4. Hoong JM, Ferguson M, Hukins C, Collins PF (2017) Economic and operational burden associated with malnutrition in chronic obstructive pulmonary disease. Clin Nutr 36(4):1105–1109
5. Onodera T, Goseki N, Kosaki G (1984) Prognostic nutritional index in gastrointestinal surgery of malnourished cancer patients. Nihon Geka Gakkai Zasshi. 85(9):1001–5 Japanese
6. Ucar G (2020) The prognostic value of the prognostic nutritional index in patients with metastatic colorectal cancer. J Gastrointest Surg. 16(5):e179-84 9. Yasar HA
7. Bir Yucel K, Arslan C et al (2020) The relationship between prognostic nutritional index and treatment response in patients with metastatic renal cell cancer 26(5):1110–1116
8. Zhang H, Tao Y, Wang Z, Lu J (2019) Evaluation of nutritional status and prognostic impact assessed by the prognostic nutritional index in children with chronic kidney disease. Medicine (Baltimore) 98(34):e16713
9. Correa-Rodríguez M, Pocovi-Gerardino G (2019) The prognostic nutritional index and nutritional risk index are associated with disease activity in patients with systemic lupus erythematosus 11(3):638
10. Vincent, JL; de Mendonca, A; Cantraine, F; Monero, R; Takala, J; Suter, PM; Sprung, CL(November 1998). Use of the SOFA score to assess the incidence of organ dysfunction/failure in intensive care units: results of a multicenter, prospective study. Working group on "sepsis-related problems of the European Society of Intensive Care Medicine. Critical Care Med. 26 (11): 1793–800.https://doi.org/10.1097/00003246-199811000-00016. SOFA calculator (https://www.mdcalc.com/calc/691/sequential-organ-failure-assessment-sofa-score)
11. Le Gall, JR; Lemeshow, S; Saulnier, F (1993). A new Simplified Acute Physiology Score (SAPS II) based on a European/North American multicenter study. JAMA. 270 (24): 2957–63. https://doi.org/10.1001/jama.1993.03510240069035. Simplified Acute Physiology Score (SAPS II) Calculator - ClinCalc.com (https://www.mdcalc.com/calc/4044/simplified-acute-physiology-score-saps-ii)
12. Peng JiangChen, Nie F, Li YuJie, QiaoYi Xu, Xing ShunPeng, Gao Y (2022) Prognostic nutritional index as a predictor of 30-day mortality among patients admitted to intensive care unit with acute exacerbation of chronic obstructive pulmonary disease: a single-center retrospective cohort study. Med Sci Monit 28:e934687
13. Chen R, Xing L, You C, Ou X (2018) Prediction of prognosis in chronic obstructive pulmonary disease patients with respiratory failure: a comparison of three nutritional assessment methods. Eur J Intern Med 57:70–75
14. Gunen H, Hacievliyagil SS, Kosar F et al (2005) Factors affecting survival of hospitalised patients with COPD. Eur Respir J 26(2):234–241
15. Lesourd BM (1997) Nutrition and immunity in the elderly: Modification of immune responses with nutritional treatments. Am J Clin Nutr 66(2):478s-s484
16. Yamaya M, Usami O, Nakayama S et al (2020) Malnutrition, airflow limitation and severe emphysema are risks for exacerbation of chronic obstructive pulmonary disease in Japanese subjects: a retrospective single-center study. Int J Chron Obstruct Pulmon Dis 15:857–868
17. Kayhan S, Simsek M, Kirnap NG (2022) The prognostic nutritional index is associated with mortality of patients in intensive care unit. J Surg Med 6(3):313–316
18. Yuan F-Z, Xing Y-L, Xie L-J, Yang D-L, Shui W, Niu Y-Y, Zhang X, Zhang C-R (2023) The relationship between prognostic nutritional indexes and the clinical outcomes of patients with acute exacerbation of chronic obstructive pulmonary disease: International Journal of Chronic Obstructive Pulmonary Disease 18:1155–1167
19. Gülsen Keskin, Hakan Dayanir, Melis Sumak Hazir, Nuri Cihan Narli , Julide Ergil, Melike Kaya Bahçecitapar. Is it possible to use prognostic nutrition index to predict mortality of ICU COVID-19 patients? J Cardiovasc Thoracic Anaesthesia Intensive Care Soc. GKDA Derg 2022;28(3):288–293. https://doi.org/10.14744/GKDAD.2022.30633
20. Ramazan B, Cirik MÖ (2022) Practical parameters that can be used for nutritional assessment in patients hospitalized in the intensive care unit with the diagnosis of chronic obstructive pulmonary disease; Prognostic nutritional index, neutrophil-to-lymphocyte, platelet-to-lymphocyte, and lymphocyte-to-monocyte ratio. Medicine 101(24):e29433
21. Lee SJ, Lee HR, Lee TW et al (2016) Usefulness of neutrophil to lymphocyte ratio in patients with chronic obstructive pulmonary disease: a prospective observational study. Korean J Intern Med 31(5):891–898
22. Zuo H, Xie X, Peng J et al (2019) Predictive value of novel inflammation-based biomarkers for pulmonary hypertension in the acute exacerbation of chronic obstructive pulmonary disease. Anal Cell Pathol (Amst) 2019:5189165

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