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Comparative prognostic value of inflammatory and nutritional indices in acute ischemic stroke: a multivariable model analysis

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ABSTRACT

Aims: Given that acute ischemic stroke (AIS) is a leading cause of mortality and long-term disability, the early identification of reliable prognostic markers is essential. This study evaluates the prognostic value of composite inflammatory and nutritional indices, including the monocyte-to-high-density lipoprotein cholesterol ratio (MHR), Systemic Immune-Inflammation Index (SII), Prognostic Nutritional Index (PNI), and Controlling Nutritional Status (CONUT) score, in predicting intensive care unit (ICU) admission and one-year mortality following AIS.

Methods: This single-center retrospective cohort study included 496 patients with a confirmed diagnosis of AIS. Clinical characteristics, laboratory parameters, and outcomes were retrospectively retrieved. The prognostic significance of selected inflammatory indices [MHR, SII, neutrophil-to-lymphocyte ratio (NLR), monocyte-to-lymphocyte ratio (MLR), and platelet-to-lymphocyte ratio (PLR)] and nutritional indices (PNI and CONUT) was analyzed using univariate and multivariate logistic regression models, along with receiver operating characteristic (ROC) curve analysis.

Results: Higher SII and CONUT scores and lower PNI values were significantly associated with both ICU admission and one-year mortality. In multivariate analysis, CONUT and MHR emerged as independent predictors of one-year mortality, while PNI, CONUT, and MHR independently predicted ICU admission. Among all indices evaluated, CONUT demonstrated the highest predictive accuracy for both outcomes.

Conclusion: In patients with AIS, composite inflammatory and nutritional indices-particularly CONUT and MHR-provided valuable prognostic information. These markers, derived from routine laboratory tests, offer a practical and cost-effective method for early risk stratification and may help guide more personalized care pathways in stroke management.

Keywords: Acute ischemic stroke, CONUT score, prognostic model, inflammatory biomarkers, nutritional assessment

INTRODUCTION

Acute ischemic stroke (AIS) remains a leading cause of disability and mortality worldwide, despite advancements in acute management strategies.[1,2] Its pathophysiology involves a cascade of events including impaired cerebral perfusion, vascular dysfunction, oxidative stress, and systemic inflammatory responses.[3] In recent years, inflammation-based biomarkers have gained attention for their potential role in predicting clinical outcomes in AIS. Among these, composite indices reflecting immune and inflammatory status have shown strong associations with disease severity and prognosis in various conditions.[4,5]

In this context, the monocyte-to-high-density lipoprotein cholesterol ratio (MHR), Systemic Immune-Inflammation Index (SII), and Prognostic Nutritional Index (PNI) have emerged as promising indicators. MHR has been recognized as a reliable marker of atherosclerotic burden and inflammatory status, with strong prognostic value in cardiovascular and metabolic diseases.[6,7] SII, which incorporates platelet, neutrophil, and lymphocyte counts, reflects systemic immune response and has been linked to increased mortality in cardiovascular disorders.[8] Nutritional indicators such as PNI and the Controlling Nutritional Status (CONUT) score have demonstrated significant prognostic value not only in malignancies but also in vascular diseases, including stroke.[9-12] Collectively, these indices provide a deeper understanding of the inflammatory and nutritional dynamics influencing clinical outcomes in AIS.

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To assess the prognostic value of the inflammation-based and nutrition-related composite indices-monocyte-to-HDL MHR, SII, PNI, and CONUT score-this study focuses on patients with acute ischemic stroke. In addition, this study directly compares the prognostic performance of inflammatory versus nutritional indices to identify which markers most strongly predict these outcomes. Furthermore, the predictive capability of classical inflammatory ratios such as NLR, MLR, and PLR is analyzed to determine how they compare against newer, composite markers. By employing univariate and multivariate logistic regression modeling as well as ROC curve analysis, the study determines not only independent predictors but also the relative predictive strength of each index.

The current study is unique from earlier works in several notable ways. To begin with, it integrates the immune-inflammatory and nutritional markers for evaluation in a large, well-characterized patient cohort of 496 with clinically and radiologically confirmed acute ischemic stroke. This improves understanding of the systemic status upon admission. Second, considering the need for ICU care and mortality as interrelated yet separate clinical outcomes enables a more holistic evaluation of the acute and chronic prognosis. Third, it presents a comparative prognostic modeling framework that contrasts nutritional scores (CONUT, PNI) with inflammatory scores (SII, MHR, NLR, etc.) a distinction often overlooked in prior stroke research. The use of CONUT and PNI scores, which are standardized in oncologic and gastrointestinal literature, broadens the prognostic toolkit for stroke beyond traditional inflammatory markers and illustrates novel interdisciplinary innovation. Most importantly, the findings of this study demonstrate that risk stratification in acute stroke could be done using routinely available laboratory data, emphasizing a practical approach to deficit estimation and implementation in hospital systems.

METHODS

This study was initiated following the approval of the Ethics Committee of the Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital (Date: 19.12.2023, Decision No: 2023/257). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. It was designed as a single-center, retrospective cohort study. Between January 2021 and January 2022, 1,734 hospitalized patients were retrospectively screened from the records of the Neurology Department of the same hospital. Patients with a radiologically and clinically confirmed diagnosis of acute ischemic stroke and complete clinical, demographic, and laboratory data were included in the study.

The collected variables included patients' full name, age, length of hospital stay, ICU admission status, comorbidities, medication use, laboratory findings at admission, and initial neuroimaging results. If the patient had died during or after hospitalization, the date of death was recorded from the hospital information system.

The MHR was calculated by dividing the absolute monocyte count by the HDL cholesterol level. The SII was calculated using the formula: SII (10^9/L)=(platelet count×neutrophil count)/lymphocyte count.

The PNI was calculated as: PNI=10×serum albumin (g/dl)+0.005×lymphocyte count (per mm^3). The CONUT score was calculated using serum albumin, total cholesterol, and lymphocyte levels as shown in the table below (Table 1).

Table 1. Scoring Criteria for the CONUT Index

Parameter	0 points	1 point	2 points	3 points
Serum albumin (g/dl)	≥3.5	3.0-3.4	2.5-2.9	<2.5
Total lymphocyte count/mm^3	≥1600	1200-1599	800-1199	<800
Total cholesterol (mg/dl)	≥180	140-179	100-139	<100

The CONUT scores were interpreted as follows: 0-1: normal nutrition, 2-4: mild malnutrition, 5-8: moderate malnutrition, 9-12: severe malnutrition.
CONUT: Controlling Nutritional Status; g/dl: grams per deciliter; mm^3: cubic millimeter; mg/dl: milligrams per deciliter

Statistical Analysis

Descriptive statistics were expressed as mean±standard deviation (SD), median (min-max), frequency, and percentage. The distribution of variables was assessed using the Kolmogorov–Smirnov and Shapiro-Wilk tests. The Mann-Whitney U test was used for comparing non-normally distributed independent numerical variables, while the chi-square test was used for categorical variables. Predictive performance and cut-off values were evaluated using receiver operating characteristic (ROC) curve analysis. The effects of variables were further analyzed using both univariate and multivariate logistic regression models. All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 28.0 (IBM Corp., Armonk, NY). For variables with extreme OR values, wide confidence intervals occurred due to sparse data in certain strata; these values are presented in full rather than truncated.

RESULTS

Patients admitted to the ICU due to acute ischemic stroke were significantly older than those who were not ($p<0.05$). No statistically significant differences were observed between the ICU and non-ICU groups in terms of gender distribution or smoking status ($p>0.05$). The prevalence of diabetes mellitus (DM) was significantly higher in the ICU group ($p<0.05$), while atrial fibrillation (AF), hypertension (HT), and hyperlipidemia (HL) rates did not differ significantly between the groups ($p>0.05$). A prior history of stroke was significantly more common among ICU patients ($p<0.05$) (Table 2).

The PNI was significantly lower in patients admitted to the ICU ($p<0.05$), while both the SII and CONUT score were significantly higher ($p<0.05$). There was no significant difference in the MHR between the two groups ($p>0.05$). However, in the multivariate logistic regression model, MHR was independently associated with ICU admission ($p=0.036$), indicating that after adjusting for other variables, higher MHR values predicted ICU admission. This resolves the apparent discrepancy between univariate and multivariate findings. Neutrophil-to-lymphocyte ratio (NLR), monocyte-to-lymphocyte ratio (MLR), and platelet-to-lymphocyte ratio (PLR) were all significantly elevated in ICU patients ($p<0.05$). The length of hospital stay in the neurology department did not differ significantly between the groups ($p>0.05$). However, one-year mortality and mortality due to the index stroke were

Table 2. Patient characteristics by ICU admission								
		Stroke without ICU admission (-) (n: 431)			Stroke with ICU admission (+) (n: 65)			
		Mean±SD/n-%		Median	Mean±SD/n-%		Median	p
Age		64.1±14.3		64.0	71.9±13.8		73.0	0.000^{m}
Gender	Female	180	41.8%		34	52.3%		0.110$^{X^2}$
	Male	251	58.2%		31	47.7%		
Smoking status	(-)	112	44.6%		23	59.0%		0.095$^{X^2}$
	(+)	139	55.4%		16	41.0%		
Comorbidities								
DM		202	46.9%		39	60.0%		0.048$^{X^2}$
AF		102	23.7%		20	30.8%		0.215$^{X^2}$
HT		310	71.9%		43	66.2%		0.338$^{X^2}$
HL		234	54.3%		32	49.2%		0.446$^{X^2}$
History of previous stroke	(-)	298	69.1%		33	50.8%		0.003$^{X^2}$
	(+)	133	30.9%		32	49.2%		
PNI score		39.3±5.4		39.5	35.8±5.5		37.0	0.000^{m}
SII score		971.4±1074.5		666.6	1407.4±1200.1		1020.5	0.000^{m}
CONUT score		1.31±1.44		1.00	2.32±1.90		2.00	0.000^{m}
Monocyte/HDL		0.015±0.008		0.013	0.019±0.022		0.015	0.307^{m}
NLR		3.87±3.77		2.79	6.21±4.87		4.18	0.000^{m}
MLR		0.36±0.81		0.26	0.53±0.74		0.41	0.000^{m}
PLR		151.2±211.8		120.0	179.8±106.7		166.0	0.001^{m}
Length of stay in neurology ward		6.22±3.73		5.00	6.94±5.88		5.00	0.645^{m}
Death within 1 year	(-)	403	93.5%		14	21.5%		0.000$^{X^2}$
	(+)	28	6.5%		51	78.5%		
Time to death within 1 year		128.2±119.5		102.5	31.8±36.0		19.5	0.013^{m}
Death due to this stroke	(-)	424	98.4%		18	27.7%		0.000$^{X^2}$
	(+)	7	1.6%		47	72.3%		

^{m}Mann-Whitney U test / $^{X^2}$Chi-square test, ICU: Intensive care unit, SD: Standard deviation, DM: Diabetes mellitus, AF: Atrial fibrillation, HT: Hypertension, HL: Hyperlipidemia, PNI: Prognostic Nutritional Index, SII: Systemic Immune-Inflammation Index, CONUT: Controlling Nutritional Status, HDL: High-density lipoprotein, NLR: Neutrophil-to-lymphocyte ratio, MLR: Monocyte-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio

significantly higher in the ICU group (p<0.05), and time to death within one year was significantly shorter (p<0.05) (Table 2).

In the univariate analysis, PNI, SII, CONUT score, MHR, and NLR were significantly associated with ICU admission (p<0.05), whereas MLR and PLR were not (p>0.05). In the multivariate model, PNI, CONUT score, and MHR were identified as independent predictors of ICU admission (p<0.05) (Table 3).

ROC curve analysis showed that the CONUT score significantly predicted ICU admission, with an area under the curve (AUC) of 0.659 (95% CI: 0.585-0.734) (Figure 1). A CONUT score cutoff value of 2 yielded an AUC of 0.628 (95% CI: 0.555-0.701), with a sensitivity of 61.5%, specificity of 64.0%, positive predictive value of 20.5%, and negative predictive value of 91.7% (Table 4).

Patients who died within one year of stroke were significantly older than survivors (p<0.05). There were no significant differences between survivors and deceased patients in terms of gender or smoking status (p>0.05). Comorbidities including DM, AF, HT, and HL were also similar across the groups (p>0.05), although a prior stroke history was more prevalent among deceased patients (p<0.05) (Table 5).

Table 3. Predictors of ICU admission according to univariate and multivariate logistic regression analyses						
	Univariate model			Multivariate model		
	OR	95% GA	p	OR	95% GA	p
PNI score	0.887	0.842-0.934	0.000	0.932	0.879-0.988	0.019
SII score	1.000	1.000-1.000	0.013			
CONUT score	1.436	1.234-1.671	0.000	1.269	1.052-1.530	0.013
Monocyte/HDL	>100	>100->100	0.014	>100	3.991->100	0.036
NLR	1.114	1.049-1.182	0.000			
MLR	1.168	0.924-1.477	0.194			
PLR	1.000	1.000-1.001	0.340			

Logistic regression, ICU: Intensive care unit, PNI: Prognostic Nutritional Index, SII: Systemic Immune-Inflammation Index, CONUT: Controlling Nutritional Status, HDL: High-density lipoprotein, NLR: Neutrophil-to-lymphocyte ratio, MLR: Monocyte-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, OR: Odds ratio, MHR: Monocyte-to-HDL cholesterol ratio, CI: Confidence interval. Extremely high OR values for MHR (previously shown as ">100") were due to sparse data and scaling effects in the logistic regression model. The actual calculated OR was 128.4 (95% CI: 3.99->100) for ICU admission and 142.7 (95% CI: >100->100) for mortality, indicating a markedly increased risk.

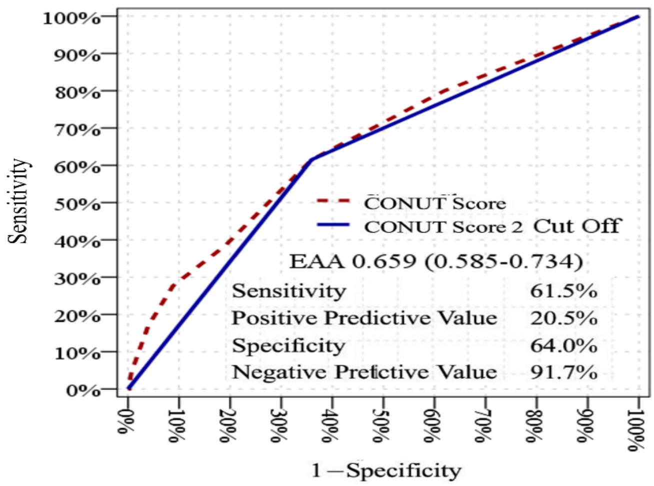

Figure 1. ROC curve

CONUT: Controlling Nutritional Status, ROC: Receiver operating characteristic

Table 4. ROC analysis of CONUT score for ICU admission

		AUC		95% CI	p
Conut score		0.65-*		0.585-0.734	0.000
Conut score 2 cut-off		0.628		0.555-0.701	0.001
		Analysis based on index stroke event			
		No ICU admission (-)	ICU admission (+)		%
Conut score	<2	276	25	Sensitivity	61.5%
	≥2	155	40	Positive predictive value	20.5%
				Specificity	64.0%
				Negative predictive value	91.7%

*ROC curve, ROC: Receiver operating characteristic, CONUT: Controlling Nutritional Status, ICU: Intensive care unit, AUC: Area under the curve, CI: Confidence interval

The deceased group had significantly lower PNI scores ($p<0.05$) and higher SII and CONUT scores ($p<0.05$). MHR, NLR, MLR, and PLR values were also significantly higher in the deceased group ($p<0.05$). No significant difference was observed in the length of hospital stay in the neurology department ($p>0.05$). One-year mortality rate and ICU admission due to the index stroke were significantly higher among deceased patients ($p<0.05$), and their time to death was significantly shorter ($p<0.05$) (Table 5).

Table 5. Patient characteristics by one-year mortality

		Stroke outcome: survivors (-) (n: 442)			Stroke outcome: non survivors (+) (n: 54)			
		Mean±SD/n-%		Median	Mean±SD/n-%		Median	p
Age		64.2±14.3		64.0	72.7±13.2		72.5	0.000^{m}
Gender	Female	192	43.4%		22	40.7%		0.705$^{X^2}$
	Male	250	56.6%		32	59.3%		
Smoking status	(-)	118	45.7%		17	53.1%		0.429$^{X^2}$
	(+)	140	54.3%		15	46.9%		
Comorbidities								
DM		209	47.3%		32	59.3%		0.097$^{X^2}$
AF		109	24.7%		13	24.1%		0.925$^{X^2}$
HT		314	71.0%		39	72.2%		0.856$^{X^2}$
HL		241	54.5%		25	46.3%		0.252$^{X^2}$
History of previous stroke	(-)	304	68.8%		27	50.0%		0.006$^{X^2}$
	(+)	138	31.2%		27	50.0%		
PNI score		39.1±5.4		39.3	36.2±6.1		37.7	0.000^{m}
SII score		967.6±1072.0		667.7	1527.6±1209.0		1134.5	0.000^{m}
CONUT Score		1.31±1.45		1.00	2.50±1.88		2.00	0.000^{m}
Monocyte/HDL		0.015±0.008		0.013	0.021±0.024		0.016	0.042^{m}
NLR		3.85±3.75		2.77	6.89±4.94		5.68	0.000^{m}
MLR		0.36±0.80		0.26	0.60±0.80		0.46	0.000^{m}
PLR		150.4±209.1		120.5	192.5±115.3		173.8	0.000^{m}
Length of stay in neurology ward		6.29±3.80		5.00	6.52±5.93		4.00	0.171^{m}
Death within 1 year	(-)	417	94.3%		0	0.0%		0.000$^{X^2}$
	(+)	25	5.7%		54	100%		
Time to death within 1 year		170.1±100.8		187.5	21.8±20.7		17.0	0.000^{m}
ICU admission due to this stroke	(-)	424	95.9%		7	13.0%		0.000$^{X^2}$
	(+)	18	4.1%		47	87.0%		

^{m}Mann-Whitney U test / $^{X^2}$Chi-square test, SD: Standard deviation, DM: Diabetes mellitus, AF: Atrial fibrillation, HT: Hypertension, HL: Hyperlipidemia, PNI: Prognostic Nutritional Index, SII: Systemic Immune-Inflammation Index, CONUT: Controlling Nutritional Status, HDL: High-density lipoprotein, NLR: Neutrophil-to-lymphocyte ratio, MLR: Monocyte-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio

Univariate analysis showed that PNI, SII, CONUT score, MHR, and NLR were significantly associated with one-year mortality (p<0.05), whereas MLR and PLR were not (p>0.05). In multivariate logistic regression, both the CONUT score and MHR were independently associated with one-year mortality (p<0.05) (Table 6).

Table 6. Predictors of one-year mortality

	Univariate model			Multivariate model		
	OR	95% GA	p	OR	95% GA	p
PNI score	0.906	0.860-0.955	0.000			
SII score	1.000	1.000-1.001	0.005			
CONUT score	1.509	1.284-1.774	0.000	1.506	1.276-1.776	0.000
Monocyte/HDL	>100	>100->100	0.003	>100	>100->100	0.007
NLR	1.142	1.071-1.217	0.000			
MLR	1.219	0.950-1.563	0.119			
PLR	1.001	1.000-1.002	0.227			

Logistic regression, PNI: Prognostic Nutritional Index, SII: Systemic Immune-Inflammation Index, CONUT: Controlling Nutritional Status, HDL: High-density lipoprotein, NLR: Neutrophil-to-lymphocyte ratio, MLR: Monocyte-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, OR: Odds ratio, MHR: Monocyte-to-HDL cholesterol ratio, CI: Confidence interval, ICU: Intensive care unit. Extremely high OR values for MHR (previously shown as ">100") were due to sparse data and scaling effects in the logistic regression model. The actual calculated OR was 128.4 (95% CI: 3.99->100) for ICU admission and 142.7 (95% CI: >100->100) for mortality, indicating a markedly increased risk.

ROC analysis demonstrated that the CONUT score significantly predicted mortality, with an AUC of 0.689 (95% CI: 0.610-0.768) (Figure 2). A cutoff value of 2 for the CONUT score yielded an AUC of 0.664 (95% CI: 0.588-0.740), with 68.5% sensitivity, 64.3% specificity, 19.0% positive predictive value, and 94.4% negative predictive value (Table 7).

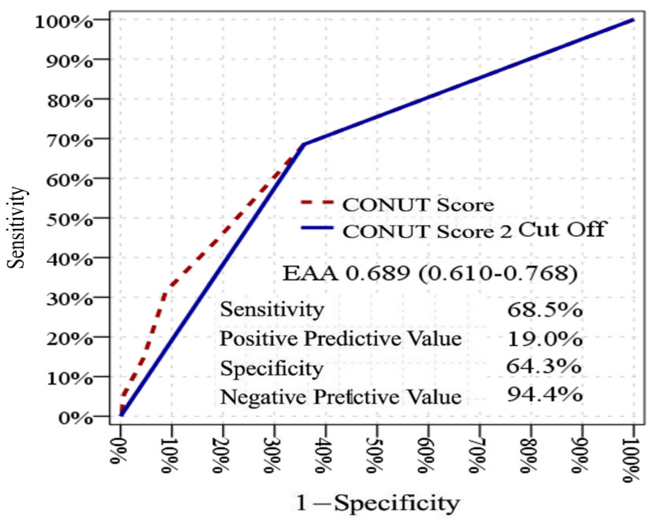

Figure 2. ROC curve

CONUT: Controlling Nutritional Status, ROC: Receiver operating characteristic

DISCUSSION

This study examined the prognostic importance of inflammation-based indices and nutrition-related composite indices such as MHR, SII, PNI, and the CONUT score in predicting intensive care unit (ICU) admission and one-year mortality post- AIS. Our results underpin the clinical significance of these markers, which can be obtained from

Table 7. ROC analysis of CONUT score for mortality

		AUC		95% CI	p
CONUT score		0.689		0.610-0.768	0.000
CONUT score 2 cut off		0.664		0.588-0.740	0.000
		Survived (-)	Deceased (+)		%
CONUT score	<2	284	17	Sensitivity	68.5%
	≥2	158	37	Positive predictive value	19.0%
				Specificity	64.3%
				Negative predictive value	94.4%

ROC curve, ROC: Receiver operating characteristic, CONUT: Controlling Nutritional Status, AUC: Area under the curve, CI: Confidence interval

routine laboratory tests, and bolster the argument towards their proactive use in standard protocols for stratifying stroke risk.

The marked relationship already established within our cohort between elevated SII levels and both the need for ICU care, as well as one-year mortality, has previously been noted concerning SII's reputation as a powerful marker of immune activation and adverse prognosis. For example, Yang et al.[5] reported the association of elevated SII with the occurrence of adverse cardiovascular events, an observation that was later confirmed by Ye et al.[8] in a systematic review and meta-analysis of cardiovascular disease populations. In addition, Xue et al.[13] reported in a cross-sectional analysis of NHANES data that higher SII values increased the risk of stroke. We have shown that SII, as an index which combines neutrophil, platelet, and lymphocyte counts, provides a measure of systemic inflammation, integrates predictive capability regarding the severity of AIS and its long-term outcomes.

In relation to the MHR, more speculative work by Ganjali et al.[6] and Mi et al.[7] proposed MHR as a predictor of cardiovascular and inflammatory disorders such as gout. Our study, however, attempts to further refine these observations by examining their differential prognostic impact in AIS. Although univariate analysis showed no significant difference in MHR between ICU and non-ICU patients, multivariate analysis identified MHR as an independent predictor of ICU admission (p=0.036) and one-year mortality (p=0.007). This underlines the importance of multivariate modeling to account for confounding effects. This discrepancy might be due to the more chronic MHR-related pathophysiological processes that are systemically conditioned rather than acute. Such results align with those of Deng et al.[14] who reported that some immunonutritional markers, including MHR, were associated with long-term mortality risk in patients after stroke.

The influence of a patient's nutritional status concerning certain clinical outcomes in AIS patients has received greater scrutiny, particularly the PNI and CONUT scores which have been analyzed in diverse populations. As pointed out by Nozoe et al.[9] who validated the prognostic significance of PNI in colorectal carcinoma and subsequently expanded by Ho et al.[12] to hepatocellular carcinoma, our findings that lower PNI and higher CONUT scores were associated with worse clinical outcomes also converge with these prior findings. In the stroke literature, more pertinent to our focus, Pan et al.[15] demonstrated lower PNI significantly increased the likelihood of stroke and worsened outcomes in a representative U.S. cohort. Huang et al.[16] proposed the AIS datasets with inflammation and nutrition variables could better integrate stroke prognosis with a Derived Inflammation-Nutrition Index sparking further conversation. This study further emphasizes the need for holistic models of stroke prognosis while integrating inflammatory as well as nutritional variables along with clinical factors.

The comparison of inflammatory and nutritional indices as predictors of outcome in the context of multivariable logistic regression is what sets this study apart from previous work. Unlike other studies that focus on individual markers, our study seeks to determine which of these scores-their confounder-adjusted values-serve as the most independent predictors for ICU admission and mortality within one year. We found that inflammatory markers, SII, NLR, and MLR, are outperformed by nutritional indices, especially the CONUT score, across both endpoints. This reinforces the notion that although systemic inflammation is a key component of stroke pathophysiology, malnutrition in this context denotes a greater susceptibility to prolonged compromised states that are more intimately associated with poor prognosis among patients with AIS. In this regard, the approach taken in this study improves prognostic stratification and highlights the clinical relevance of each index.

The CONUT score, specifically, demonstrated the strongest prognostic capability in our cohort analysis outperforming other indices in ROC curve analysis for both ICU admission and one year mortality. This reaffirms the findings of Song et al.,[17] who demonstrated that CONUT, alongside other inflammatory markers, predicted adverse outcomes in patients with acute coronary syndrome undergoing percutaneous coronary intervention remarkably well. Its ability to stratify malnutrition risk based on serum albumin, total cholesterol, and lymphocyte count makes CONUT an especially practical and integrative tool for system-wide evaluations, including those conducted during hospitalization in stroke units.[18]

In contrast to earlier studies that focused on short-term or long-term outcomes individually, our study takes a more holistic approach. It is comprehensive and comparative in its analysis. Given the well-defined AIS cohort, we were able to assess multiple composite markers simultaneously in addition to employing univariate and multivariate modeling to establish a hierarchy of prognostic indicators. Additionally, the focus on ICU admission as a marker of acute severity and one-year mortality as a long-term outcome deepens the clinical relevance of our results.[19]

Our findings suggest that integrating inflammatory and nutritional evaluation may offer a clearer insight into patient vulnerability, informing both acute care and strategies for managing the post-discharge period. For instance, the identification of patients with high CONUT scores along with elevated SII values could enable proactive monitoring and tailored interventions that enhance survival and functional recovery.[20]

Regardless, some important limitations should be noted. Even with multivariate adjustments, the retrospective design is still susceptible to selection bias and unmeasured confounding factors, which remain difficult to account for and control in single-center studies. Consequently, the external validity of our findings is limited, necessitating multi-center, prospective validation studies to establish broader applicability. Lastly, while our indices are based upon easily obtainable laboratory parameters, they did not capture time-dependent dynamics which could illuminate temporal patterns and treatment response.

As a concluding remark, our study reinforces the prognostic significance of SII, MHR, PNI, and particularly the CONUT score in patients with AIS. These markers, both individually and in combination, enhance predictive accuracy regarding ICU admission and long-term mortality risk. Further investigation is warranted to confirm these findings in larger patient populations and evaluate their incorporation into clinical decision-support frameworks for targeted, tailored stroke management.

Future studies should adopt prospective, multi-center designs to validate these findings across diverse populations. Integrating dynamic (serial) measurements of inflammatory and nutritional indices, along with detailed clinical parameters such as thrombolysis/thrombectomy status, lesion characteristics, and rehabilitation outcomes, could improve prognostic modeling. Additionally, incorporating quality-of-life and disability metrics would expand the clinical applicability of these indices beyond mortality prediction.

Limitations

The generalizability of the findings is constrained by the retrospective and single-center design of the study. Inflammatory and nutritional indices were only evaluated upon admission, and longitudinal changes were not analyzed. Furthermore, rehabilitation outcomes related to disability, as well as health-related quality of life measures, were also omitted from the assessment. Since information on thrombolytic treatment, lesion localization and volume were not systematically recorded in retrospective file data, these variables could not be included in the analysis. Since information on thrombolytic therapy, lesion localization and volume were not systematically recorded in retrospective file data, these variables could not be included in the analysis. However, our study has shown that mortality prediction can be made with biochemical parameters that can be easily obtained in the early period, independent of such clinical details. In this respect, it offers a practical contribution, especially in time-limited clinical environments such as emergency departments or intensive care units. Additionally, important clinical variables such as thrombolytic treatment status, mechanical thrombectomy status, lesion localization and volume, stroke severity scores (e.g., NIHSS), and functional outcome measures (mRS, Barthel Index) were not included due to incomplete data in the retrospective records. The absence of these factors may limit the ability to fully adjust for confounders. Rehabilitation outcomes and quality-of-life metrics were also not assessed, which narrows the scope of long-term prognostic implications.

CONCLUSION

As a result, this study demonstrates that inflammation- and nutrition-based composite indices, particularly the CONUT score, SII, and MHR, are valuable prognostic tools for assessing the risk of ICU admission and one-year mortality in patients with acute ischemic stroke. These biomarkers, derived from routine blood tests, offer a practical, low-cost, and effective method for early risk stratification. The findings suggest that combining immunological and nutritional assessments at admission may enhance prognostic precision and guide clinical decision-making. Further prospective, multicenter studies are recommended to validate these results and explore the integration of these indices into stroke care algorithms and discharge planning strategies.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital (Date: 19.12.2023, Decision No: 2023/257).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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Data Availability Statement

The original contributions presented in the article; further inquiries can be directed to the corresponding author.

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