Prognostic importance of nutritional assessment in patients with acute ischemic stroke undergoing endovascular thrombectomy

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Abstract. – OBJECTIVE: The prevalence of malnutrition in patients with acute ischemic stroke (AIS) can range from 8% to 34%. It has been shown that prognostic nutritional index (PNI) and control nutritional status (CONUT) scores can provide an opportunity to make prognostic predictions in some disease groups. Previous studies have shown a close relationship between malnutrition scores and stroke prognosis. We evaluated the effect of nutritional scores on in-hospital and long-term mortality in AIS patients undergoing endovascular therapy (EVT).

PATIENTS AND METHODS: 219 patients who underwent EVT for the AIS were included in this retrospective design and cross-sectional study. The primary endpoint of the study was accepted as all-cause death including in-hospital death, 1-year death, and 3-years death.

RESULTS: A total of 57 patients died in the hospital. In-hospital mortality rate was higher in the high CONUT group [36 (49.3%), 10 (13.7%), 11 (15.1%), *p*<0.001]. A total of 78 patients died within one year, and 1-year mortality was higher in the high CONUT group [43 (58.9%), 21 (28.8), 14 (19.2), *p*<0.001]. At the end of the 3-year follow-up, 90 patients had died, and the 3-year mortality rate was significantly higher in groups with a high CONUT score than in those with a low CONUT score (*p*<0.001).

CONCLUSIONS: A higher CONUT score, calculated easily by simple scoring with parameters studied from peripheral blood before the EVT procedure, is an independent predictor of in-hospital, 1-year, and 3-years all-cause mortality.

Key Words:
CONUT, Malnutrition, Endovascular treatment, PNI, Stroke.

Introduction

Acute ischemic stroke (AIS) accounts for approximately 85% of all strokes[1]. The prevalence of malnutrition after AIS varies between 8% and 34% in stroke patients[2]. It has been shown[3] that the presence of malnutrition detected at hospital admission is independently associated with poor prognostic outcomes in AIS patients. Since many nutritional assessment scores are subjective, it is very difficult to evaluate the nutritional status of stroke patients. Moreover, outcomes depend on the experience of the physician who determines the treatment. In addition, the collection of data in AIS patients inevitably increases the workload of the health system.

Controlling nutritional status (CONUT) and prognostic nutritional index (PNI) scores, which can be calculated simply by using serum albumin concentration, lymphocyte count, and total cholesterol levels in blood samples taken at hospital admission, are considered objective nutritional assessment scores.

In recent years, it has been shown[4] in some disease groups that PNI and CONUT scores can provide an opportunity to make prognostic predictions. Indeed, the prognostic significance of PNI and CONUT scores has been shown in recent studies[5]. In another study[6] a close relationship was found between malnutrition scores and long-term prognosis after stroke.

In recent years, endovascular therapy (EVT) in AIS patients has been a new and effective treatment for the management of these patients[7]. In addition, EVT is a cost-effective treatment method that provides effective results with its short and long-term effectiveness[8,9].

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Here, we evaluate the impact of nutritional scores on in-hospital and long-term mortality in AIS patients treated with EVT and aim to explore the prognostic significance of PNI and CONUT in this patient group.

Patients and Methods

Patients and Study Protocol

For this retrospective, single-center, cross-sectional study, 219 patients who underwent EVT for an AIS in Neurology and Cardiology Departments between January 2018 and January 2021 were screened and included in the study. Patient data were obtained by scanning medical records and searching phone numbers. The study was approved by the established Ethics Committee of the Faculty of Medicine of the Dicle University and was conducted in accordance with the Declaration of Helsinki and approved guidelines in terms of ethics. Routine comprehensive demographic assessments and routine physical examinations were performed on all patients. Cranial vascular structures were evaluated with contrast computed tomography angiography (CTA).

Data on clinical features such as hypertension (HT), diabetes mellitus (DM), coronary artery disease (CAD), chronic heart failure (CHF), atrial fibrillation, stroke and smoking were obtained from medical records. The primary endpoint of the study was accepted and determined as all-cause death. Patients were evaluated for in-hospital death; deaths at 1-year and 3-year follow-ups were also evaluated. Patients were classified according to the TOAST (Trial of Org 10,172 acute stroke treatment) criteria, which allows etiological evaluation in ischemic stroke according to clinical and laboratory findings.

Nutritional Assessment Using the CONUT Score and PNI Score

The CONUT score was calculated from three variables (albumin level in serum biochemistry, total cholesterol level in serum biochemistry, and lymphocyte count in total peripheral blood sample) in blood samples taken from stroke patients who underwent thrombectomy at admission.

Albumin score

If the albumin level is ≥3.5 g/dL = 0 points, if albumin level is between 3.0-3.4 g/dL = 2 points, if albumin level is between 2.5-2.9 g/dL = 4 points, if the albumin level is <2.5 g/dL = 6 points in serum biochemistry.

Total lymphocyte score

If the lymphocyte count is ≥1,600 count/mL = 0 point, if lymphocyte count is between 1,200-1,599 count/mL = 1 point, if lymphocyte count is between 800-1,199 count/mL = 2 points, if the lymphocyte count is <800 count/mL = 3 points in total peripheral blood sample.

Total cholesterol score

If the total cholesterol level is ≥180 mg/dL = 0 point, if total cholesterol level is between 140-179 mg/dL = 1 point, if total cholesterol level is between 100-139 mg/dL = 2 points, if the total cholesterol level is <100 mg/dL = 3 points in serum biochemistry.

Total CONUT score was calculated by albumin score + total lymphocyte score + total cholesterol score.

Finally, the cumulative total of each parameter determines the CONUT score. The CONUT score ranges from 0 to 12, and higher CONUT score values indicate worse poor nutritional status. Further, patients were divided into 3 tertiles according to their CONUT scores.

The prognostic nutritional index (PNI) score was calculated from two blood sample variables (albumin level in serum biochemistry and lymphocyte count in a total peripheral blood sample) found in blood samples taken on admission from AIS patients who underwent EVT. PNI was calculated according to this formula: PNI score = [10 × serum albumin in g/dL + 0.005 × total lymphocyte count in mm^3].

Assessment of Stroke Severity

The National Institutes of Health Stroke Scale (NIHSS) is a standardized test used to determine the severity of the stroke in the emergency department. The NIHSS is an 11-category, quick-assessment, reliable, and neurologic assessment compatible with the infarct area. It is a systematic scoring that provides the quantitative evaluation of stroke-related neurologic deficit. It is calculated routinely in all of our stroke patients.

The Alberta Stroke Program Early CT score (ASPECTS) is used to make an objective evaluation of early CTA findings in ischemic stroke. ASPECTS is a quantitative score that measures the extent of early ischemic changes. An ASPECTS score was calculated routinely in all of our stroke patients.

Thrombectomy Therapy

EVT procedures were performed according to the referral chain and treatment planning aimed at achieving reperfusion within 6 hours of the onset of ischemic stroke symptoms, based on previous study[9] design and results. EVT was initiated as quickly as possible after the required indication. EVT was performed by authorized interventional procedure specialists at our stroke center.

Follow-Up and Endpoint

The primary endpoint of the study was accepted as all-cause death including in-hospital death, 1-year death, and 3-years death. The follow-up period was defined as the time from admission to the stroke center to death or the last clinical contact. All patients were followed-up until January 2021 or until death after thrombectomy. Endpoint data detection was obtained blindly by scanning medical records or by phone interviews with first degrees of his/her trustees and searching phone numbers.

Statistical Analysis

Data were analyzed using SPSS for Windows version 25.0 (IBM Corp., Armonk, NY, USA). Parametric or non-parametric distribution of data was analyzed with the Kolmogorov-Smirnov test. Categorical variables were expressed as percentages (%) and were compared using the Chi-square test. Continuous variables with normal distribution were expressed as mean ± standard deviation (SD) and were compared using analysis of variance (ANOVA) test. Continuous variables with abnormal distribution were expressed as median (interquartile range) and were compared using the Kruskal-Wallis' test. Independent predictors of in-hospital mortality were determined using univariate and multivariate logistic regression analysis and the results were expressed with odds ratio (OR) and 95% confidence interval (CI), and also 1-year mortality and 3-years mortality were determined using Cox regression models as appropriate. The optimum CONUT score cut-off value (≥ 2.5) for the prediction of mortality was determined using receiver operating characteristic (ROC) curve analysis. Survival analysis of tertiles was performed using Kaplan-Meier analysis. A *p*-value of <0.05 was considered significant.

Results

A total of 219 consecutive patients were reviewed in the study. The mean age was 63.6±14.5 and 54.3% (119 of 219) were male. The median follow-up period was 22 months.

Baseline Demographic Characteristics

Table I indicates the baseline demographic characteristics of patients according to their CONUT scores. Heart failure and mean age were found higher in the Tertile 3 (T3) than in Tertile 2 (T2) and Tertile 1 (T1), (*p*=0.011, *p*=0.002, respectively, Table I).

A total of 57 patients (26%) died in the hospital. In-hospital mortality rates were found higher in Tertile 3 (T3) than in Tertile 2 (T2) and Tertile 1 (T1) [36 (49.3%), 10 (13.7%), 11 (15.1%), *p*<0.001, respectively, Table I]. A total of 78 (35.6%) patients were dead within a year and 1-year mortality was also found higher in T3 than in T2 and T1 [43 (58.9%), 21 (28.8), 14 (19.2), *p*<0.001, respectively, Table I]. Additionally, 90 (41.5%) patients died at the end of 3-years follow-up and the 3-years mortality rate was significantly higher in the higher CONUT score groups than those in the lower CONUT score groups (*p*<0.001, Table I).

Admission Laboratory Parameters at Admission

The distribution of laboratory parameters of the patients is divided into 3 equal nutritional tertiles as shown in Table II. It was determined that vitamin D level, hemoglobin value, LDL value, and triglyceride value decreased significantly as the nutritional status deteriorated.

ROC Analysis and Correlation Analysis

Both of the receiver operating characteristic (ROC) curve analyses and correlation analysis for CONUT and PNI scores values and the correlation analysis with each other are given in Figure 1. The optimum CONUT score cut-off value ≥2.5 predicted all-cause mortality with a sensitivity of 70%, specificity of 66% [area under curve (AUC): 0.714, 95% CI: (0.643-0.785); *p*<0.001] and PNI score cut-off value ≤40.14 predicted all-cause mortality with a sensitivity of 69%, specificity of 68% [AUC: 0.719, 95% CI: (0.649-0.788); *p*<0.001].

Nutritional Status and Survival

In Figure 2, 1-year mortality and 3-year mortality trends are shown by Kaplan-Meier analysis by nutritional tertiles. Accordingly, both 1-year and 3-years survival rates were found to be significantly lower in the T3 group compared to T1 and T2 (1-year mortality; log-rank test: 30, *p*<0.002 and 3-years mortality; log-rank test: 35, *p*<0.001; respectively).

Table I. Baseline demographic and clinical characteristics of the patients.

	Total N: 219	T1 N: 73	T2 N: 73	T3 N: 73	*p*
Age	63.6±14.5	60±15.2	62.6±14	68±13	**0.002**
Male, n%	119 (54.3)	42 (57.5)	39 (53.4)	38 (52.1)	0.787
Follow-up period (months), IQR	22 (23)	23 (5)	22 (21)	2 (24)	**<0.001**
Hypertension	132 (60.3)	40 (54.8)	47 (64.4)	45 (61.6)	0.475
Diabetes mellitus, n%	68 (31.1)	19 (26)	25 (34.2)	24 (32.9)	0.516
Atrial fibrillation, n%	58 (26.5)	15 (20.5)	20 (27.4)	23 (31.5)	0.317
Coronary artery disease, n%	59 (26.9)	16 (21.9)	19 (26)	24 (32.9)	0.321
Stroke or TIA, n%	21 (9.6)	9 (12.3)	6 (8.2)	6 (8.2)	0.622
Heart failure, n%	18 (8.2)	1 (1.4)	6 (8.2)	11 (15.1)	**0.011**
Smoking, n%	24 (11)	10 (13.7)	9 (12.3)	5 (6.8)	0.374
Thrombolytic treatment	106 (48.4)	33 (45.2)	45 (61.6)	28 (38.4)	**0.015**
Hemorrhagic transformation	56 (25.6)	14 (19.2)	22 (30.1)	20 (27.4)	0.287
OTT (minutes), n%					
0-180	27 (12.3)	10 (13.7)	10 (13.7)	7 (9.6)	
181-270	121 (55.3)	34 (46.6)	44 (60.3)	43 (58.9)	0.365
271-360	71 (32.4)	29 (39.7)	19 (26)	23 (31.5)	
TOAST classification, n%					
1	17 (7.8)	8 (11)	5 (6.8)	4 (5.5)	
2	75 (34.2)	21 (28.8)	25 (34.2)	29 (39.7)	
3	1 (0.5)	1 (1.4)	0	0	0.777
4	4 (1.8)	1 (1.4)	2 (2.7)	1 (1.4)	
5	122 (55.7)	42 (57.5)	41 (56.2)	39 (53.4)	
Culprit vessel, n%					
Left MCA	98 (44.7)	37 (50.7)	40 (54.8)	21 (28.8)	
Right MCA	86 (39.3)	27 (37)	21 (28.8)	38 (52.1)	**0.013**
Others	35 (16)	9 (12.3)	12 (16.4)	14 (19.2)	
NIHSS, IQR	18 (9)	18 (11)	17.75 (7)	16 (8)	0.361
ASPECTS, IQR	8 (1)	8 (1)	8 (0)	8 (2)	0.260
CONUT score, IQR	2 (3)	0 (1)	2 (1)	5 (3)	**<0.001**
PNI score, IQR	43.4 (8.9)	47.4 (4.8)	43.4 (6.6)	37.5 (4.6)	**<0.001**
In-hospital mortality, n%	57 (26)	11 (15.1)	10 (13.7)	36 (49.3)	**<0.001**
1-year mortality	78 (35.6)	14 (19.2)	21 (28.8)	43 (58.9)	**<0.001**
3-year mortality	90 (41.5)	17 (23.3)	24 (32.9)	49 (67.1)	**<0.001**
Antiaggregants	17 (7.8)	5 (6.8)	7 (9.6)	5 (6.8)	0.775
Anticoagulants	19 (8.7)	9 (12.3)	6 (8.2)	4 (5.5)	0.335

Data are expressed as mean ± SD, frequencies (percentages) or median (interquartile range: IQR) as appropriate. ASPECTS: Alberta Stroke Program Early CT Score. CONUT: Controlling Nutritional Status, MCA: middle cerebral artery, NIHSS: National Institutes of Stroke Scale, OTT: Optimal thrombectomy time, TOAST: Trial of Org 10172 in Acute Stroke Treatment, TIA: Transient Ischemic Event.

The Discriminative Power of CONUT Score to Predict Mortality

A univariate and multivariate logistic and cox regression model was created to determine independent predictors of in-hospital mortality in the patient population undergoing EVT due to AIS. Age, ASPECTS and CONUT scores were found to be independent predictors of in-hospital death [Age; odds ratio (OR): 1.040, 95% CI: (1.007-1.074), p=0.017, ASPECTS; OR: 0.601, 95% CI: (0.402-0.898), p=0.013, CONUT score; OR: 1.426, 95% CI: (1.189-1.711), p<0.001, Table III].

A Cox regression model was also constructed for independent predictors of 1-year and 3-year mortality. The Cox proportional hazard analysis model revealed that age, NIHSS, and CONUT score were associated with increased risk for 1-year mortality. Age, NIHSS, and CONUT score were found to be independent predictors of 1-year mortality. [Age; OR: 1.029, 95% CI: (1.007-1.050), p=0.009, NIHSS; OR: 1.051, 95% CI: (1.001-1.103), p=0.045, CONUT score; OR: 1.229, 95% CI: (1.097-1.377), p<0.001, Table III].

Table II. Laboratory parameters of the patients on admission.

	Total N: 219	T1 N: 73	T2 N: 73	T3 N: 73	*p*
Vitamin D, IQR	10 (11.5)	11.3 (7.6)	20.7 (24.1)	8.1 (5.5)	**0.038**
Hemoglobin (g/dl)	12.2±1.9	13±1.89	13±2	12.2±1.8	**0.012**
ESR, IQR	20 (23)	22 (21)	15 (26)	22 (47)	**0.039**
Lymphocytes (× 103 µL)	1.6±0.7	1.94±0.54	1.7±0.73	1.16±0.6	**<0.001**
Serum albumin (g/dL), IQR	3.49 (0.78)	3.9 (0.7)	3.3 (0.4)	3.1 (0.5)	**<0.001**
Total cholesterol (mg/dL)	193±45.6	208±35.8	181.7±41	148.5±36.4	**<0.001**
Triglyserides (mg/dL)	121±66	138.2±62.5	124.3±56.5	91.5±48.4	**<0.001**
LDL (mg/dL)	121.7±37.2	135.8±34.9	110.7±33.5	90.2±30.7	**<0.001**
HDL (mg/dL)	48.7±9.8	45.7±9	45.6±12.8	91.5±48.4	**0.042**

Data are expressed as mean ± SD or median (interquartile range: IQR) as appropriate. ESR: Eritrosit Sedimantation Rate, HDL: High-density lipoprotein, LDL: Low-density lipoprotein.

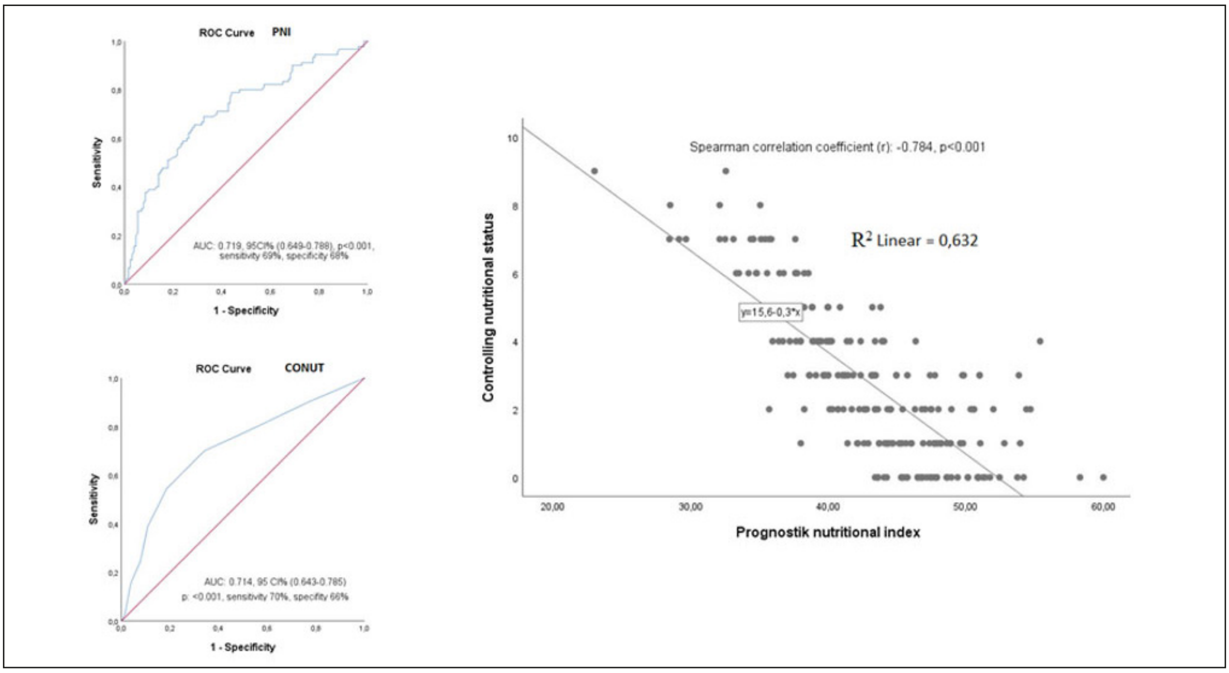

Figure 1. Receiver-operating characteristic (ROC) curve to predict mortality in patients with thrombectomy. AUC: Area under the curve, CI: Confident interval.

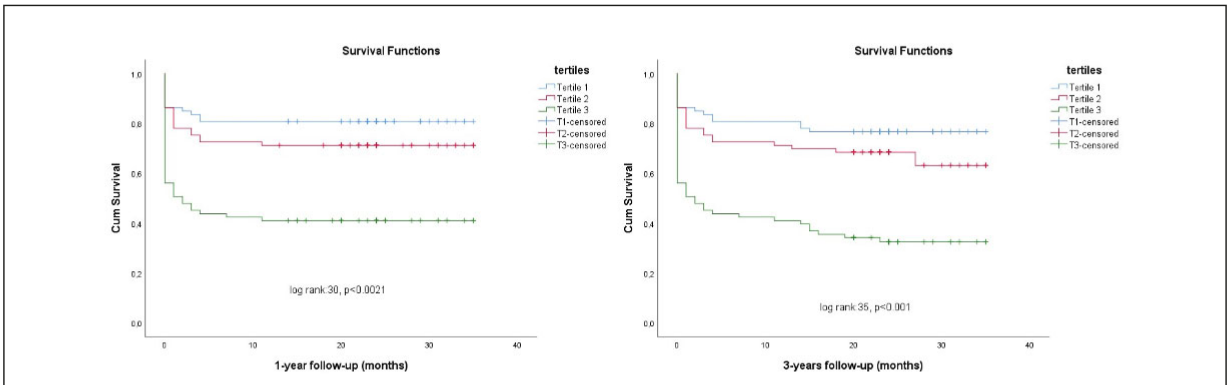

Figure 2. Kaplan-Meier survival analysis for 1-year and 3-year mortality. During follow-up period, patients' group with higher CONUT scores (Tertile 3) had significantly worse survival than patients' group with lower CONUT scores (Tertile 1 and Tertile 2) (*p*<0.001).

Table III. Predictors of mortality in univariate and multivariate regression analysis.

	Univariate analysis		Multivariate analysis	
In-hospital mortality	***OR (95% CI)***	***p***	***OR (95% CI)***	***p***
Gender	0.565 (0.307-1039)	**0.066**	0.743 (0.338-1.634)	0.460
Age	1.046 (1.020-1.074)	**0.001**	1.040 (1.007-1.074)	**0.017**
Diabetes mellitus	1.034 (0.539-1.981)	0.920		
Hypertension	0.965 (0.522-1.787)	0.911		
Atrial fibrillation	0.988 (0.498-1.961)	0.973		
Coronary artery disease	0.958 (0.483-1.898)	0.902		
Heart failure	1.922 (0.707-5.225)	0.200		
Smoking	0.724 (0.257-2.037)	0.540		
Thrombolytic therapy	1.040 (0.568-1.902)	0.899		
NIHSS	1.111 (1.046-1.179)	0.001	1.070 (0.985-1.162)	0.112
ASPECTS	0.507 (0.369-0.697)	<0.001	0.601 (0.402-0.898)	0.013
CONUT score	1.408 (1.221-1.625)	<0.001	1.426 (1.189-1.711)	<0.001
1-year mortality	***OR (95% CI)***	***p***	***OR (95% CI)***	***p***
Gender	0.549 (0.350-0.863)	**0.009**	0.738 (0.443-1.230)	0.244
Age	1.045 (1.025-1.065)	**<0.001**	1.029 (1.007-1.050)	**0.009**
Diabetes mellitus	0.989 (0.611-1.599)	0.964		
Hypertension	0.990 (0.629-1.558)	0.965		
Atrial fibrillation	0.867 (0.517-1.454)	0.589		
Coronary artery disease	0.931 (0.560-1.547)	0.782		
Heart failure	1.361 (0.655-2.829)	0.409		
Smoking	0.792 (0.364-1.721)	0.555		
Thrombolytic therapy	0.952 (0.610-1.485)	0.828		
NIHSS	1.069 (1.026-1.113)	**0.001**	1.051 (1.001-1.103)	**0.045**
ASPECTS	0.705 (0.589-0.844)	**<0.001**	0.850 (0.687-1.053)	0.136
CONUT score	1.252 (1.144-1.370)	**<0.001**	1.229 (1.097-1.377)	**<0.001**
3-year mortality	***OR (95% CI)***	***p***	***OR (95% CI)***	***p***
Gender	0.554 (0.364-0.843)	**0.006**	0.767 (0.478-1.230)	0.271
Age	1.049 (1.030-1.068)	**<0.001**	1.035 (1.015-1.056)	**0.001**
Diabetes mellitus	0.956 (0.609-1.500)	0.843		
Hypertension	1.085 (0.709-1.662)	0.707		
Atrial fibrillation	0.869 (0.537-1.405)	0.566		
Coronary artery disease	1.032 (0.651-1.637)	0.893		
Heart failure	1.352 (0.679-2.693)	0.391		
Smoking	0.994 (0.515-1.919)	0.986		
Thrombolytic therapy	0.840 (0.554-1.273)	0.411		
NIHSS	1.054 (1.014-1.095)	**0.008**	1.030 (0.984-1.079)	0.209
ASPECTS	0.713 (0.601-0.845)	**<0.001**	0.824 (0.676-1.005)	0.056
CONUT score	1.250 (1.149-1.360)	**<0.001**	1.208 (1.086-1.343)	**<0.001**

OR: Odds ratio, CI: Confident interval, ASPECTS: Alberta Stroke Program Early CT Score, CONUT: Controlling Nutritional Status, NIHSS: National Institutes of Stroke Scale.

Age and CONUT score were found to be independent predictors of 3-years mortality [Age; OR: 1.035, 95% CI: (1.015-1.056), *p*=0.001, CONUT score; OR: 1.208, 95% CI: (1.086-1.343), *p*<0.001, Table III] on COX regression analysis.

Discussion

This cross-sectional study was conducted to demonstrate the impact of malnutrition on poor prognosis in patients with ischemic stroke treated with EVT. The study showed three major findings. Firstly, malnutrition assessed by CONUT score is an independent predictor of in-hospital mortality, 1-year mortality, and 3-years mortality. Secondly, 1-year and 3-year survival rates were prominently lower in Tertile 3 as per Tertile 1 and 2. Thirdly, age was also a strong predictor of all-time mortality in ischemic stroke patients who had undergone mechanical thrombectomy.

In previous studies[10,11], a significant correlation was found between nutritional assessment scores, which have prognostic value, and the prognosis of patients with carotid stents. Similarly, we demonstrated the association between malnutrition and poor prognosis. Even in these patient groups, where all groups were treated endovascularly in terms of endpoint, nutritional scores were found to be a serious prognostic determinant. Since patients who underwent thrombectomy with the development of stroke were included in the study, it can be understood that the thrombectomy procedure can preserve the nutritional well-being after the stroke, with the result that the 1- and 3-year mortality increases at a relatively acceptable level when compared to the hospital mortality. More research on nutrition and lifestyle interventions is needed.

The NIHSS score is an objective scoring system that shows the severity of the sequelae of ischemic stroke[12]. It is noteworthy that in studies[13] conducted with patients who underwent EVT, the median NIHSS score before treatment was 17 and these patients were clinically severe stroke victims. A high NIHSS score has been shown in a recent study[13] to be an indicator of hemorrhagic transformation and poor prognosis in stroke patients treated with thrombolytics. A previous study[12] showed that the severity of stroke sequelae increased with a pre-treatment NIHSS score of 17 or greater with EVT. In our study, the mean NIHSS was 18 which is similar to the literature, and it was observed that patients presented with severe ischemic stroke sequelae. As a result, this shows that patients had severe sequelae of stroke in our trial. The extent of early ischemic lesions can be estimated by the ASPECTS score[14]. A positive score in a patient with proximal occlusion is an indication of salvageable penumbra and is associated with a good outcome. Therefore, the presence of occlusion of a proximal segment of the middle cerebral artery (MCA) regardless of internal carotid artery (ICA) occlusion with an ASPECTS score of 6-7 is an indication of thrombectomy. It had been seen[14] in the regression analysis that although NIHSS scores and ASPECT scores did not show a significant difference between nutritional group tertiles, they had a significant effect on prognosis. In our study, both NIHSS and ASPECTS were associated with increased risk of mortality as shown in Table III. In our study, NIHSS was an independent predictor of 1-year mortality, while ASPECTS was a predictor of in-hospital mortality. In this context, similar to ASPECTS and NIHSS scores, nutritional scores can be used to make prognostic predictions.

Similar to a stroke, the incidence of chronic heart failure (CHF) is also an increasingly common disease with the aging of the population. In a recent cohort[15], it was shown that the risk of stroke in patients with CHF is 2 and 3-fold times higher than in patients without CHF. Stroke-related morbidity and mortality rates in CHF patients are considerably higher than in stroke patients without CHF[16]. It is well known[17] that there is a very close relationship between the presence of heart failure and nutritional status. In our study, it is noteworthy that heart failure is more common in the malnourished group than expected.

It is observed that the nutritional status at admission worsens with increasing age, and advanced age is an independent predictor of mortality during all follow-up periods. It is also well known[18] that nutritional status deteriorates with advanced age. In our study, advanced age is one of the strong predictors of both in-hospital and long-term mortality. A recent meta-analysis[19] of individual data from previous EVT studies demonstrated a sustained benefit from EVT across all age groups, including patients over 80 years of age. Considering its close relationship with nutritional status, we think that it is important for the whole society to acquire good quality nutrition habits both before and after an illness. In addition, advanced age (>80 years) is an independent factor predicting clinical outcomes but should not be considered a contraindication for EVT[20].

Limitations

This study had some limitations. First, the sample size could have consisted of a larger number of patients. The possibility of bias cannot be excluded due to the single-center cross-sectional study structure based on retrospective data. We calculated the CONUT score and PNI scores only before EVT in hospital admission. Therefore, the effect of change in CONUT score and PNI scores over time could not be examined. Malnutrition was assessed only by using the CONUT score and PNI. Other nutritional indicators were not used. Finally, larger prospective multicenter studies are needed to confirm our findings.

Conclusions

A higher CONUT score, which is calculated easily by simple scoring with parameters studied from peripheral blood parameters before the EVT procedure, is an independent predictor of in-hospital, 1-year, and 3-years all-cause mortality. Since the CONUT score evaluation has such an effect on the prognosis in our study patients who have undergone EVT, we think that such patients will be followed-up with this score in the following periods and nutritional supports will be provided for the review and improvement of their nutritional status..

Conflict of Interest

There is no conflict of interest.

Ethics Approval

The study was approved by the Dicle University Faculty of Medicine Clinical Research Ethics Committee with the decision number 195 in 30.06.2021. The study was conducted in accordance with the Helsinki Declaration.

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None.

Informed Consent

The patients signed a written informed consent for the study.

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