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Relationship between hemoglobin, albumin, lymphocyte, and platelet (HALP) score and 28-day mortality in very elderly geriatric critically ill patients with acute ischemic stroke

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ABSTRACT

Aim: In this study, we aimed to evaluate the relationship between the HALP score, calculated by hemoglobin, albumin, lymphocyte and platelet values, and 28-day mortality in very elderly geriatric critically ill patients with acute ischemic stroke.

Material and Method: The study was designed retrospectively and patients aged 85 years and older admitted to the general intensive care unit with the diagnosis of acute ischemic stroke were evaluated. Demographic data, laboratory data and HALP scores of these patients were recorded. Patients who died within 28 days in intensive care follow-up were defined as the Non-Survival group, and patients who did not die were defined as the survival group.

Results:There was a statistically significant difference between the groups in terms of hemoglobin values admitted to the intensive care unit (p:0.00). For albumin, patients in the Non-Survival group had lower values, but there was no statistically significant difference between the groups (p: 0.054). Non-Survival group had lower values for lymphocytes and there was a statistically significant difference between the groups (p: 0.00). For platelet value, patients in the Non-Survival group had higher values and there was no statistically significant difference between the groups (p: 0.164). Patients in the Non-Survival group had lower values for HALP score and there was a statistically significant difference between the groups (p: 0.00)

Conclusion: The HALP score is associated with 28-day mortality in very elderly geriatric critically ill patients with acute ischemic stroke. However, it has low sensitivity (30.1%) and specificity (27.9%).

Keywords: HALP Score, very elderly geriatric patient, acute ischemic stroke

INTRODUCTION

Acute ischemic stroke (AIS) is one of the leading causes of mortality (1). The incidence of AIS increases with aging, and age is an important risk factor (2). Inflammation is known to occur in the pathophysiology of AIS. Necrotic cells, which are formed in the brain due to vascular occlusion, trigger inflammation in acut ischemic stroke (3). In addition, abnormal blood clotting, poor nutritional status and inflammation are associated with a poor prognosis of AIS (4,5).

Lymphocytes have an essential role in inflammation, and since inflammation is also involved in the pathophysiology of AIS, the lymphocyte values of these patients should be considered (6).

Platelet hyperactivity increases the risk of atherosclerosis and thromboembolism . Problems, abnormal thrombosis occurs and causes an increase in inflammation (7). Anemia and hypoalbuminemia are risk factors for AIS and are parameters associated with malnutrition (8).

Recently, the scoring system called Hemoglobin, albumin, lymphocyte, and thrombocyte (HALP) has started to take place in the literature as a mortality indicator, especially in patients with malignancy. This score reflects general nutritional status and systemic inflammation (9,10). These four parameters are involved in the pathogenesis and prognosis of AIS. In this study, we aimed to evaluate the HALP score, a typical combination of these parameters, in terms of prognosis and 28-day mortality in very elderly geriatric patients with AIS.

MATERIAL AND METHOD

The study was designed retrospectively, and ethical committee approval was obtained from the Kastamonu University Clinical Researches Ethics Committee (Date: 19.10.2022, Decision No: 2022-KAEK-97). All procedures were performed by the Declaration of Helsinki and ethical rules.

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Patients aged 85 and over who were admitted to the general intensive care unit (ICU) of Kastamonu Training and Research Hospital between January/2020 and October/2022 with the diagnosis of acute ischemic stroke, admission to intensive care biochemistry values (glucose, albumin, creatinine, etc.), National Institutes of Health Stroke Scale (NIHSS) scores, demographic data (age, gender), comorbidities, and whole blood values (hemoglobin, thrombocyte) of were reviewed and recorded retrospectively from the patient file and hospital information system. The diagnosis of AIS was based on the criteria of the World Health Organization (WHO) (11).

At admission, the severity of AIS was assessed according to the National Institutes of Health Stroke Scale (NIHSS). Patients with major trauma or surgery within three months,malnutrie, neoplastic hematological disorders or using immunosuppressant drugs ,active or chronic inflammatory disease, and severe hepatic and renal dysfunction were excluded from the study. After the exclusion criteria, 179 patients were included in the study.

The HALP scoring of these patients, hemoglobin (g/L) x albumin (g/L) x lymphocytes (/L)/platelet (/L), were calculated and recorded (12).

NIHSS scoring; 1-15 points: mild; moderate between 16-20 points; A score between 21 and 42 was classified as high (13).

Of the 179 patients included in the study, 93 patients who died within 28 days in ICU follow-up were in the Non-Survival group; 86 patients who survived more than 28 days were designated as the survival group.

Statistical Analysis

All statistical analyzes were performed using SPSS Version 26.00 (SPSS Inc, Chicago, USA). Whether the data showed normal distribution was determined using Kolmogorov-Smirnov and Shapiro-Wilk tests. It was defined as the median (± standard deviation) for continuous variables and frequency (percent) for categorical variables. Chi-square for categorical variables, Student-t test for normally distributed continuous variables, and Mann-Whitney U test for non-normally distributed continuous variables. Binary logistic regression was performed for confounding factors in 28-day mortality. Roc curve analysis was performed to determine the sensitivity and specificity of the Halp score. The $p<0.05$ value was considered statistically significant.

RESULTS

A total of 179 patients were included in the study, and 93 (51.9%) patients (Non-Survival group) died within the first 28 days of intensive care follow-up. 86 (48.1%) patients (Survival group) survived longer than 28 days. Gender and mean age were similar in both groups and there was no statistical difference between the groups. When both groups were evaluated in terms of comorbidities, there was no statistically significant difference between the groups. However, hypertension was more common among additional diseases in both groups (**Table 1**).

Table 1. Demographic data and comorbidities

	Non-Survival Group (n:93)	Survival Group (n :86)	P
Gender (N/%)			0.956
Male	31 (33.3%)	29 (33.7%)	
Female	62 (66.6%)	57 (66.3%)	
Age (Mean±SD)	89.17±3.39	88.57±3.26	0.208
Hypertension (N/%)			0.645
Yes	54 (58%)	47 (54.7%)	
No	39 (42%)	39 (45.3%)	
Diabetes mellitus			0.574
Yes	34 (36.5%)	28 (32.6%)	
No	59 (63.5%)	58 (67.4%)	
Hyperlipidemia			0.663
Yes	14 (15.1%)	16 (18.6%)	
No	79 (84.9%)	70 (81.4%)	
Heart failure			0.518
Yes	39 (42%)	32 (37.2%)	
No	54 (58%)	54 (62.8%)	
Atrial fibrillation			0.607
Yes	37 (39.8%)	31 (36%)	
No	56 (60.2%)	55 (64%)	
Coronary artery disease			0.625
Yes	29 (31.2%)	23 (26.7%)	
No	64 (68.8%)	63 (73.3%)	

In terms of Apache II and Saps II scores, patients in the Non-Survival group had higher scores. For Apache II, the Median±SD value of the patients in the Non-Survival group was 29.62±8.53; Median±SD for Saps II was 44.57±7.52. There was a statistically significant difference between the groups in terms of Apache II and Saps II scores (P: 0.00 for Apache II, p: 0.00 for Saps II).

There was a statistically significant difference between the groups in the statistical analysis for the hemoglobin value admitted to the intensive care unit, and the patients in the Non-Survival group had lower values. (Non-Survival group Median±SD: 125.13±17.67, Survival group Median±SD: 134.99±11.92; p: 0.00). Patients in the Non-Survival group had lower values for albumin and there was no statistically significant difference between the groups (p: 0.054). Non-Survival group had lower values for lymphocytes and there was a statistically significant difference between the groups. (Non-Survival group Median±SD: 1.34±0.54, Survival group Median±SD: 1.96±64; p: 0.000) For platelet value, patients in the Non-Survival group had higher values

and no statistically significant difference was found between the groups (p: 0.164). For the HALP score, which is the combination of these four parameters, the patients in the Non-Survival group had lower values and there was a statistical significant difference between the groups (Non-Survival group Median±SD: 27.81±16.05, Survival group Median±SD: 48.71± 22.37; p: 0.000). In addition to these findings, nearly half of the patients in the Non-Survival group (48.3%) had a more severe acute ischemic stroke clinic than the NIHSS score, and there was a statistically significant difference between the groups (p:0.00). (**Table 2**)

Table 2. Laboratory data and HALP scoring

	Non-Survival group (n:93) Median±SD	Survival gruop (n :86) Median±SD	p
Apache II	29.62±8.53	22.20±5.19	0.000*
Saps II	44.57±7.52	34.92±7.72	0.000*
Albumin(g/L)	32.35±6.11	34.09±6.58	0.054
CRP (mg/L)	7.33±9.79	7.86±6.28	0.156
HDL (mg/dL)	43.91±9.09	45.90±10.09	0.807
LDL (mg/dL)	106.04±33.27	105.19±36.23	0.518
Triglyceride(mg/dL)	117.45±51.03	119.49±48.93	0.884
Total Cholesterol, (mg/dl)	151.86±46.80	158.41±42.49	0.248
Creatinine (mg/dl)	1.13±0.28	1.05±.0.30	0.070
Glucose (mg/dL)	154.98±76.86	138.92±39.19	0.425
White Blood Cell (103 /ul)	9.44±2.31	9.80±2.34	0.410
Hemoglobin (g/L)	125.13±17.67	134.99±11.92	0.000*
Platelet (103 /ul)	219.49±80.09	199.83±61.70	0.164
Neurophil (103 /ul)	5.71±1.29	5.75±1.22	0.814
Lymphocyte(103 /ul)	1.34±0.54	1.96±64	0.000*
NIHSS (n/%)			0.000*
Mild	10 (10.8%)	41 (47.8%)	
Moderate	38 (40.9%)	34 (39.5%)	
High	45 (48.3%)	11 (12.7%)	
HALP	27.81±16.05	48.71±22.37	0.000*

According to logistic regression analysis, there was a correlation between 28-day mortality and HALP, Saps II and NIHSS scoring. (for HALP; p: 0.001, for Saps II; p: 0.00 for NIHSS; p: 0.001). However, the HALP score had low sensitivity and specificity for 28-day mortality. (Sensitivity: 30.1%, specificity: 27.9%) (**Table 3**, **Figure**).

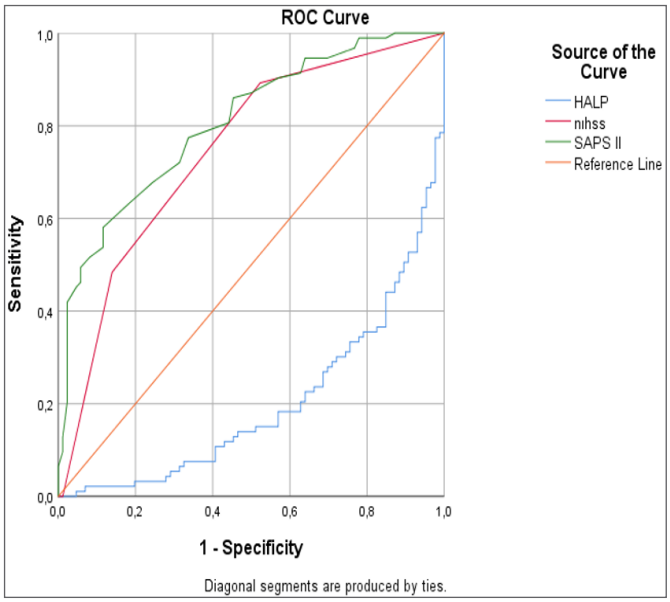

Figure. ROC curve analysis

DISCUSSION

In this study, we found a statistically significant difference between the groups in terms of Apache II score, Saps II score, NIHSS score, HALP score, hemoglobin and lymphocyte values at 28 days of mortality in advanced geriatric acute ischemic stroke patients. In addition, HALP score (p: 0.001), Saps II score (p:0.00), and NIHSS score (p: 0.001) were associated with 28-day mortality. However, the HALP score had low sensitivity (30.19%) and specificity (27.9%) for 28-day mortality.

The HALP score indicates the inflammation and nutritional status of patients. HALP score is a parameter that has been associated with survival in patients with malignancy in recent years. Peng et al. (10) showed that there is a significant correlation between HALP score and survival in patients with bladder cancer. Similar to this study, Xu et al. (12)reported that the HALP score was associated with survival and recurrence in a study conducted in patients with postoperative pancreatic cancer. In our study, we found that the HALP score was associated with 28-day mortality in very elderly geriatric critically ill patients with acute ischemic stroke.

Table 3. Logistic regression analysis

	B	S.E	Exp(B)	95%C.I.for EXP(B)		P
				Lower	Upper	
HALP	0.065	0.020	1.067	1.027	1.109	0.001
Apache II	-0.087	0.044	0.917	0.840	1.000	0.051
Saps II	-0.141	0.038	0.869	0.807	0.935	0.000
Hemoglobin (g/L)	0.017	0.018	1.017	0.982	1.054	0.346
Lymphocyte (10^3/ul)	0.509	0.462	1.664	0.673	4.114	0.270
NIHSS	-0.852	0.251	0.427	0.261	0.697	0.001
Constant	3.974	2.858	53.190			0.164

Nagelkerke R Square 0.671 NIHSS: The National Institutes of Health Stroke Scale Scores, HALP: Hemoglobin, Albumin, Lymphocyte , Platelet,APACHE: Acute Physiology and Chronic Health Evaluation, CRP: C-reactive protein, SAPS: Simplified Acute Physiology Score

Acute ischemic stroke begins with gradual or sudden cerebral hypoperfusion, including oxidative stress, hemostatic activation, and inflammation, eventually leading to a corresponding loss of neurological function (14). Low hemoglobin is a risk factor for AIS, a poor prognostic marker, and a strong parameter associated with mortality (15,16). In addition, anemia is a condition that increases inflammation (17). Albumin is a parameter associated with nutrition and inflammation produced in the liver. In addition, albumin level is also associated with the severity and prognosis of the disease in case of acute illness (18). Dziedzic et al. (19) reported that albumin level is associated with prognosis in patients with ischemic stroke. Lymphocytes are cells involved in the regression of inflammation. Low lymphocyte count causes exacerbation of inflammation. Since inflammation plays a role in the pathogenesis of acute ischemic stroke, low lymphocyte counts are associated with poor prognosis in these patients. In their study, Kim et al. (20) reported that low lymphocyte value in patients with acute ischemic stroke was associated with less recovery during the first week after admission and poor functional outcome at three months. Although platelets are mainly responsible for hemostasis, they affect the immunomodulatory system (21). Inflammation triggers the thrombosis process in which platelets participate in aggregation, release reaction and adhesion (7). Studies have shown that platelet count can be a qualified predictor of poor functional outcome ,mortality and long-term recurrent stroke. Yang et al. (22), in their study with patients with acute ischemic stroke, stated that there was a U-shaped relationship between the initial platelet count and poor functional outcome. Each parameter (hemoglobin, albumin, lymphocyte, thrombocyte) is valuable in terms of prognosis when evaluated individually. The HALP score, which is a combination of these parameters, may be a better prognostic indicator than these four parameters. In our study, there was a statistically significant difference in hemoglobin and lymphocyte values between the groups for 28-day mortality, but there was no statistically significant difference between the groups for albumin and platelet values. The HALP score, on the other hand, was statistically different between the groups and was associated with 28-day mortality.

CONCLUSION

The HALP score is an easily calculated, cost-effective parameter associated with inflammation and nutrition. The HALP score is associated with 28-day mortality in very elderly geriatric critically ill patients with AIS. However, it has low sensitivity (30.1%) and specificity (27.9%). More studies on HALP score are needed in this patient group.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Kastamonu University Clinical Researches Ethics Committee (Date: 19.10.2022, Decision No:2022-KAEK-97).

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.

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