The Predictive Value of Sarcopenia Index for Prognosis in Elderly Patients with Acute Ischemic Stroke: Postprint

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Abstract

Background: Poor prognosis in elderly patients with acute ischemic stroke (AIS) imposes a significant burden on public health, and actively searching for simple and easily applicable clinical indicators to identify high-risk populations with poor prognosis has become a research focus. Objective: To analyze the predictive value of the sarcopenia index (SI) for prognosis in elderly AIS patients. Methods: A total of 280 elderly AIS patients hospitalized at the First People's Hospital of Jintan, Changzhou from July 2021 to June 2022 were enrolled. Patients were divided into a poor prognosis group ($ 3*points*)*andagoodprognosisgroup*($2 points) based on the modified Rankin Scale (mRS). Baseline data and admission and discharge National Institutes of Health Stroke Scale (NIHSS) scores were compared between the two groups. Multivariate logistic regression analysis was used to explore factors affecting prognosis in elderly AIS patients, and receiver operating characteristic (ROC) curve analysis was performed to evaluate the value of SI in predicting poor prognosis. Results: There were 212 cases in the good prognosis group and 68 cases in the poor prognosis group. Statistically significant differences were observed between the poor and good prognosis groups in diabetes history, previous stroke history, neutrophil count (NE), lymphocyte count (LY), albumin (ALB), admission NIHSS score, discharge NIHSS score, and SI ($P<0.05$). Spearman rank correlation analysis revealed that SI was negatively correlated with mRS score (rs=-0.195, P=0.001), admission NIHSS score (rs=-0.163, P=0.006), and discharge NIHSS score (rs=-0.205, P=0.001) in elderly AIS patients. Multivariate logistic regression analysis demonstrated that SI was an independent predictor of prognosis in elderly AIS patients (OR=0.959, 95%CI=0.927~0.992, P=0.015). ROC curve analysis showed that the area under the ROC curve (AUC) of SI for predicting poor prognosis in elderly AIS patients was 0.694 (95%CI=0.619~0.769), with a sensitivity of 69.3%, specificity of 64.7%, and cut-off value of 63.46. Patients were divided into Q1, Q2, Q3, and Q4 groups based

on SI quartiles, with 70 cases in each group. Significant differences were found among the Q1, Q2, Q3, and Q4 groups in age, atrial fibrillation history, previous stroke history, uric acid (UA), homocysteine (Hcy), mRS score, admission NIHSS score, and discharge NIHSS score (P<0.05). Conclusion: SI was significantly lower in the poor prognosis group of elderly AIS patients. SI is an independent predictor of poor prognosis in elderly AIS patients and demonstrates good predictive value.

Full Text

Preamble

Predictive Value of Sarcopenia Index for Prognosis in Elderly Patients with Acute Ischemic Stroke

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Abstract

Background: Poor prognosis in elderly patients with acute ischemic stroke (AIS) has placed substantial pressure on public health. Identifying simple and easily applicable clinical indicators to screen high-risk populations for poor prognosis has become a pressing research priority.

Objective: To analyze the predictive value of the sarcopenia index (SI) for prognosis in elderly patients with AIS.

Methods: A total of 280 elderly AIS patients hospitalized at Changzhou Jintan First People's Hospital between July 2021 and June 2022 were selected. Patients were divided into a poor prognosis group ($ 3*points*)*andagoodprognosisgroup*($2 points) based on the modified Rankin Scale (mRS). Baseline characteristics and National Institutes of Health Stroke Scale (NIHSS) scores at admission and discharge were compared between groups. Multivariate logistic regression analysis was used to identify factors affecting prognosis, and receiver operating characteristic (ROC) curve analysis was performed to evaluate the value of SI in predicting poor prognosis in elderly AIS patients.

Results: The study included 212 patients in the good prognosis group and 68 in the poor prognosis group. Significant differences were observed between groups in diabetes history, previous stroke history, neutrophil count (NE), lymphocyte count (LY), albumin (ALB), admission NIHSS score, discharge NIHSS score, and SI (P<0.05). Spearman rank correlation analysis revealed that SI was negatively correlated with mRS score (rs=-0.195, P=0.001), admission NIHSS

score (rs=-0.163, P=0.006), and discharge NIHSS score (rs=-0.205, P=0.001). Multivariate logistic regression showed that SI was an independent factor affecting prognosis (OR=0.959, 95%CI=0.927~0.992, P=0.015). ROC curve analysis demonstrated that the area under the curve (AUC) for SI predicting poor prognosis was 0.694 (95%CI=0.619~0.769), with sensitivity of 69.3%, specificity of 64.7%, and a cutoff value of 63.46. When patients were divided into quartile groups (Q1, Q2, Q3, Q4) based on SI values (70 patients each), significant differences were found among groups in age, atrial fibrillation history, previous stroke history, uric acid (UA), homocysteine (Hcy), mRS score, admission NIHSS score, and discharge NIHSS score (P<0.05).

Conclusion: SI was significantly reduced in the poor prognosis group of elderly AIS patients. SI is an independent influencing factor for poor prognosis in elderly AIS patients and demonstrates good predictive value.

Keywords: Ischemic stroke; Aged; Acute ischemic stroke; Sarcopenia index; Prognosis; Retrospective study; Logistic models

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Introduction

Acute ischemic stroke (AIS) is an acute cerebrovascular disease with high mortality and disability rates. Population aging is a key driver of increasing AIS prevalence, and the high disability rate imposes growing economic and medical burdens on families and society. Consequently, early identification of high-risk populations for poor prognosis has become a critical research focus. The sarcopenia index (SI), calculated from serum creatinine and cystatin C, is a novel, simple, economical, and effective screening tool for sarcopenia. Recent studies have found that elevated SI is negatively associated with stroke risk in elderly hypertensive patients, with similar results observed for both ischemic and hemorrhagic stroke. Previous research indicates that sarcopenia is a common risk factor for poor outcomes in ischemic stroke patients and is associated with infectious complications and higher mortality. Elderly AIS refers to AIS patients aged $ $60 years. However, the relationship between SI and prognosis in elderly AIS patients remains unclear. This study investigates the predictive value of SI for prognosis in elderly AIS patients to explore potential clinical screening tools for identifying high-risk individuals.

Methods

1.1 Study Population and Grouping

We selected 300 elderly AIS patients hospitalized at Changzhou Jintan First People's Hospital between July 2021 and June 2022 as potential study participants. All patients received antiplatelet therapy, circulation improvement, and neurotrophic medication after admission. Inclusion criteria were: (1) age $ 60$years$; (2)AISdiagnosisconsistentwiththe"$ChineseGuidelinesforDiagnosisandTreatmentofAcuteIsche (1)$otherintracranialdiseasessuchascerebralhemorrhage, intracranialinfection, orbraintumor$; (2)$interventi $60mL \cdot min^{\{-1\}\cdot(1.73m}\{2\})\hat{}\{-1\}$$.

Based on these criteria, 18 patients were excluded: 1 with intracranial tumor, 10 receiving interventional thrombolysis, 3 with heart failure, and 4 with eGFR not meeting criteria. All patients were followed up for 3 months after discharge via telephone or outpatient visits to assess prognosis, with 2 patients lost to follow-up. A total of 280 patients were ultimately included, aged 60-91 years with a mean age of (70.3$±$6.7) years. Prognosis was assessed using the modified Rankin Scale (mRS), which evaluates neurological recovery based on symptoms, disability level, assistance required, and self-care ability (total score 0-5, with higher scores indicating worse prognosis). Patients were divided into a good prognosis group (mRS score $ $2, n=212) and a poor prognosis group (mRS score $ $3, n=68).

1.2 Research Methods

Baseline information and medical history were collected, and fasting venous blood samples were obtained from all enrolled patients within 24 hours for laboratory testing. Serum creatinine levels were measured using enzymatic methods, and cystatin C levels were measured using immunoturbidimetry. SI was calculated as: SI = serum creatinine (mg/dL) / cystatin C (mg/L) × 100. NIHSS scores were completed by professional physicians within 24 hours of admission and at discharge. The NIHSS assesses neurological deficit severity across 11 items (score range 0-42, with higher scores indicating more severe neurological impairment).

1.3 Statistical Analysis

SPSS 25.0 software was used for statistical analysis. Categorical data were expressed as relative frequencies and compared using the ^{2} test. All continuous variables were tested for normality. Normally distributed data were expressed as mean±standard deviation ($\bar{x}$±s), with independent samples t-test for two-group comparisons when variances were equal and t'-test when variances were unequal. One-way ANOVA was used for multi-group comparisons with equal variance, and LSD-t test for pairwise comparisons. Non-normally distributed data were expressed as median (P25, P75), with Mann-Whitney U test for two-group comparisons and Kruskal-Wallis test for multi-group comparisons. Spearman rank correlation analysis was used for correlation assessment. Multivariate logistic

regression analysis was performed to explore risk factors for poor prognosis in elderly AIS patients. ROC curve analysis was conducted to evaluate the value of SI in predicting poor prognosis. P<0.05 was considered statistically significant.

Results

2.1 Comparison of Clinical Data Between Poor and Good Prognosis Groups

Significant differences were observed between the poor and good prognosis groups in diabetes history, previous stroke history, neutrophil count (NE), lymphocyte count (LY), albumin (ALB), admission NIHSS score, discharge NIHSS score, and SI (P<0.05). No significant differences were found in age, gender, hypertension history, coronary heart disease history, atrial fibrillation history, monocyte count (MO), platelet count (PLT), uric acid (UA), homocysteine (Hcy), or glycated hemoglobin (HbA1c) (P>0.05) .

2.2 Correlation Analysis

Spearman rank correlation analysis showed that SI was negatively correlated with mRS score (rs=-0.195, P=0.001), admission NIHSS score (rs=-0.163, P=0.006), and discharge NIHSS score (rs=-0.205, P=0.001) in elderly AIS patients.

2.3 Multivariate Logistic Regression Analysis of Prognostic Factors

Using prognosis (good prognosis=0, poor prognosis=1) as the dependent variable and significant variables from univariate analysis as independent variables (diabetes history: yes=1, no=0; previous stroke history: yes=1, no=0; NE, LY, ALB, admission NIHSS score, discharge NIHSS score, and SI as continuous variables), multivariate logistic regression analysis revealed that previous stroke history, admission NIHSS score, and SI were independent influencing factors for prognosis in elderly AIS patients (P<0.05) .

2.4 Predictive Value of SI for Poor Prognosis

ROC curve analysis showed that the area under the curve (AUC) for SI predicting poor prognosis in elderly AIS patients was 0.694 (95%CI=0.619~0.769), with sensitivity of 69.3%, specificity of 64.7%, and a cutoff value of 63.46 [Figure 1: see original paper].

2.5 Comparison of Baseline Data Across SI Quartile Groups

Patients were divided into four groups (Q1, Q2, Q3, Q4) based on SI quartiles, with 70 patients in each group. Significant differences were observed among groups in age, atrial fibrillation history, previous stroke history, UA, Hcy, mRS score, admission NIHSS score, and discharge NIHSS score (P<0.05) .

Discussion

Ischemic stroke is a neurological disease caused by cerebral artery occlusion leading to ischemic necrosis of brain tissue. As the proportion of elderly individuals in China continues to grow, AIS represents a substantial at-risk population, and elderly patients often experience poor functional outcomes, creating socioeconomic pressures and medical burdens. Therefore, identifying simple and easily applicable clinical indicators to screen high-risk populations for poor prognosis and exploring new approaches for secondary stroke prevention are essential to reduce public health burdens.

Sarcopenia is a prevalent condition among older adults characterized by loss of muscle mass, weakness, or functional decline, and it increases the risk of falls and mortality. Recent studies indicate that 29.9% of ischemic stroke patients have sarcopenia, with prevalence rates of 21.4% in men and 49.3% in women. Sarcopenia is associated with poor functional outcomes, infectious complications during hospitalization, neurological deterioration, recurrent ischemic events, and cognitive dysfunction in AIS patients. The sarcopenia index calculated from serum creatinine and cystatin C has been proposed as a marker of muscle mass. KASHANI et al. found that SI is an effective indicator for estimating muscle mass in ICU patients and can moderately predict outcomes. A prospective study of 758 hospitalized Chinese elderly individuals showed that SI based on serum cystatin C and creatinine was associated with long-term mortality, nutritional risk/malnutrition, and sarcopenia. After adjusting for potential confounders, higher SI was independently associated with lower sarcopenia risk. TANG et al. found that SI was associated with 3-year all-cause mortality in hospitalized older patients. Recent research has also shown that elevated SI is negatively correlated with stroke risk in elderly hypertensive patients.

This study analyzed the relationship between SI and prognosis in elderly AIS patients. The results showed that SI levels were lower in the poor prognosis group compared to the good prognosis group. SI was an independent influencing factor for poor prognosis in elderly AIS patients, with good predictive value (AUC=0.694, 95%CI=0.619~0.769, sensitivity=69.3%, specificity=64.7%, cutoff=63.46). SI was negatively correlated with mRS scores and admission NIHSS scores in elderly AIS patients. On one hand, SI is a specific biological indicator of sarcopenia. Disuse muscle atrophy in elderly AIS patients accelerates the progression of sarcopenia, which may impair immune responses to pathogens through inflammatory mediators and autoimmune cells, and sarcopenia-related inflammation may exacerbate neurological symptoms, thereby affecting functional outcomes. On the other hand, recent studies have found that SI is associated with the prevalence of subclinical atherosclerosis in patients with type 2 diabetes. Sarcopenia may induce vascular disease through common pathogenic pathways such as malnutrition, physical inactivity, insulin resistance, and inflammation. Research has shown that sarcopenia disrupts the balance between muscle catabolism and anabolism, affecting insulin resistance, which participates in the atherosclerotic process of vascular walls and represents an important

pathophysiological basis for ischemic stroke. YANG et al. found that insulin resistance was significantly associated with poor clinical outcomes in non-diabetic AIS patients.

This study also found significant differences in NE, LY, and ALB between the poor and good prognosis groups, consistent with previous research. Neutrophils and lymphocytes play important roles in inflammation initiation, progression, and healing, and inflammation is a major factor in stroke occurrence. Previous studies have found that high serum ALB is associated with better prognosis and lower mortality in AIS patients, and may have neuroprotective effects in human ischemic stroke.

Creatinine is an indicator of renal function. Research shows that acute kidney disease (AKD) defined by serum creatinine standards is associated with 2.67 times higher risk of all-cause mortality in ischemic stroke patients compared to those without AKD. AKD development also increases post-stroke disability risk (adjusted OR=1.60, 95%CI=1.04~2.44), suggesting that AKD occurring within 3 months after ischemic stroke may negatively impact prognosis. Cystatin C, as a cysteine protease inhibitor, plays an important role in atherosclerosis pathogenesis, and atherosclerosis is a key pathological mechanism of AIS. Studies report that cystatin C levels are significantly higher in AIS patients than in controls, and cystatin C is independently associated with AIS. Increased cystatin C is also thought to be involved in endogenous neuroprotection. Therefore, SI can serve as a marker for poor functional prognosis in elderly AIS patients. Given its low cost, accessibility, and high reproducibility, expanded use of SI would enable early and targeted interventions to improve prognosis in elderly AIS patients.

This retrospective study has several limitations: it was conducted at a single center with a limited sample size, and blood samples were only tested at admission without dynamic follow-up measurements. Therefore, future studies should include multicenter, large-sample designs with dynamic SI measurements.

In conclusion, SI is an independent influencing factor for poor prognosis in elderly AIS patients and demonstrates good predictive value.

Author Contributions: XIE Yi proposed the research objectives, designed the study, conducted the research, wrote the manuscript, performed statistical analysis, and prepared figures and tables. XU Fangqin, LI Chao, and CHEN Chen collected and organized data. SHAO Chan revised the manuscript. XU Junma was responsible for quality control and review of the article and supervised the overall project.

Conflict of Interest: The authors declare no conflicts of interest.

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