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ORIGINAL RESEARCH

Comparing GLIM and SGA Nutritional Criteria for Malnutrition Assessment and Prognosis in Chronic Heart Failure Patients

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Background: Chronic heart failure (CHF) is a prevalent condition with high morbidity and mortality. Malnutrition is common in CHF patients and is associated with poor prognosis. The Subjective Global Assessment (SGA) and Global Leadership Initiative on Malnutrition (GLIM) criteria are widely used to assess nutritional status, but their prognostic value in CHF remains unclear. This study aimed to compare the effectiveness of SGA and GLIM criteria in assessing malnutrition and predicting adverse outcomes in CHF patients.

Material and Methods: This retrospective cohort study included 240 CHF patients admitted between January 2022 and June 2024. Nutritional status was assessed using both SGA and GLIM within 48 hours of admission. The primary outcome was the occurrence of adverse events (worsening heart failure, readmission, or all-cause mortality) within 90 days post-discharge. Statistical analyses included Cohen's kappa for agreement, Receiver Operating Characteristic (ROC) curves for predictive value, and multivariate logistic regression to identify independent risk factors for adverse outcomes.

Results: The agreement between SGA and GLIM criteria was good (Cohen's Kappa = 0.8). ROC analysis showed an AUC of 0.744 for SGA and 0.793 for GLIM in predicting adverse outcomes. The DeLong test revealed that GLIM had a significantly better predictive value ($Z = -1.93$, $p = 0.043$). Multivariate analysis identified malnutrition (both SGA and GLIM), smoking, and elevated BNP as independent risk factors for adverse outcomes. Nomograms incorporating these factors showed good predictive accuracy, with the GLIM model yielding a higher AUC of 0.854 compared to 0.816 for SGA.

Conclusion: Malnutrition was identified in 38.8% of patients when assessed by the SGA and in 40.0% when evaluated using the GLIM criteria. GLIM criteria are a reliable and superior tool for predicting adverse outcomes in CHF patients compared to SGA. Incorporating nutritional assessments, BNP, and smoking history into predictive models can enhance risk stratification and guide clinical decision-making in managing CHF patients.

Keywords: malnutrition, chronic heart failure, GLIM criteria, subjective global assessment, prognostic value

Introduction

Heart failure (HF) is a complex clinical syndrome characterized by the inability of the heart to pump sufficient blood to meet the metabolic demands of the body. Despite advances in medical therapy, HF remains a major public health burden, with high morbidity, mortality, and healthcare costs worldwide.[1] Malnutrition is a common comorbidity in patients with HF, affecting up to 50% of this population.[2,3] The pathophysiology of malnutrition in HF is multifactorial, involving reduced dietary intake, increased metabolic demand, and altered nutrient absorption and utilization.[4] Malnutrition has been associated with adverse clinical outcomes in HF patients, including increased hospitalization rates, reduced functional capacity, and decreased survival.[3] Effective malnutrition interventions have been shown to improve clinical outcomes in CHF patients, highlighting the need for accurate and early nutritional assessment to optimize care and reduce disease burden.[5,6]

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Accurate assessment of nutritional status is crucial for the management of HF patients. However, there is no universally accepted gold standard for the diagnosis of malnutrition in this population. The Subjective Global Assessment (SGA) is a widely used nutritional assessment tool that has been validated in various clinical settings, including HF.[7] The SGA is based on a comprehensive evaluation of patients' medical history and physical examination, and it classifies patients as well-nourished, mildly to moderately malnourished, or severely malnourished.[8,9] Although the SGA has been shown to predict clinical outcomes in HF patients, it has limitations, such as its subjective nature and the need for trained personnel to perform the assessment.[10,11]

Recently, the Global Leadership Initiative on Malnutrition (GLIM) has proposed a new set of diagnostic criteria for malnutrition, aiming to standardize the diagnosis and facilitate early recognition and treatment of malnutrition in clinical practice.[8] The GLIM criteria are based on a combination of phenotypic (low body mass index, unintentional weight loss, and reduced muscle mass) and etiologic (reduced food intake or assimilation, and disease burden/inflammation) components.[7] The GLIM criteria have been validated in various patient populations, but their performance in HF patients has not been extensively studied.[12] Moreover, the agreement between the GLIM criteria and the SGA in assessing malnutrition in HF patients remains unclear.

Therefore, this study aimed to compare the GLIM criteria with the SGA in assessing malnutrition in patients with chronic HF and to evaluate their prognostic value in predicting adverse clinical outcomes. We hypothesized that the GLIM criteria would have good agreement with the SGA in identifying malnourished HF patients and that both methods would be predictive of adverse outcomes, such as HF-related hospitalizations and mortality. The findings of this study could provide valuable insights into the optimal nutritional assessment strategy for HF patients and contribute to improving their clinical management and outcomes.

Methods

Study Population

This retrospective cohort study included 240 patients with chronic heart failure (CHF) who were admitted at our hospital between January 2022 and June 2024. The inclusion criteria were: (1) age ≥ 18 years; (2) diagnosis of CHF according to the 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure; and (3) New York Heart Association (NYHA) functional class II–IV. Patients were excluded if they had: (1) severe hepatic or renal dysfunction; (2) malignant tumors; (3) severe infectious diseases; or (4) incomplete medical records. Data was collected retrospectively from the hospital electronic medical records. Informed consent was obtained from all subjects. The study's methods, design, and protocols underwent rigorous review by our hospital's ethics committee and were conducted in strict accordance with relevant guidelines. Adhering to the ethical principles of the Declaration of Helsinki, this study ensured confidential handling of data and removal of all personal identifiers to safeguard participant privacy.

Subjective Global Assessment (SGA)

The nutritional status of CHF patients was assessed using the SGA method within 48 hours of admission. The SGA is a validated nutritional assessment tool that evaluates patients' nutritional status based on medical history and physical examination. It consists of two parts: (1) a medical history, including weight change, dietary intake, gastrointestinal symptoms, and functional capacity; and (2) a physical examination, focusing on loss of subcutaneous fat, muscle wasting, and fluid retention. Based on the SGA, patients were classified as well-nourished (SGA A), mildly to moderately malnourished (SGA B), or severely malnourished (SGA C). In this study, patients with SGA B or C were considered malnourished.

Global Leadership Initiative on Malnutrition (GLIM) Criteria

The GLIM criteria were also used to assess the nutritional status of CHF patients within 48 hours of admission. The GLIM criteria are a consensus-based approach to diagnosing malnutrition in clinical settings. They consist of a two-step model for risk screening and diagnosis assessment. The first step is to identify patients at risk of malnutrition using a validated screening tool, such as the Malnutrition Universal Screening Tool (MUST) or the Nutritional Risk Screening

2002 (NRS-2002). The second step is to assess for the presence of at least one phenotypic criterion (non-volitional weight loss, low body mass index, or reduced muscle mass) and one etiologic criterion (reduced food intake or assimilation, or inflammation). In this study, patients meeting at least one phenotypic criterion and one etiologic criterion were considered malnourished according to the GLIM criteria.

Assessment of Adverse Outcomes in CHF Patients

The primary outcome of this study was the occurrence of adverse events within 90 days after discharge, including worsening heart failure, readmission, or all-cause mortality. Worsening heart failure was defined as a deterioration in NYHA functional class or the need for increased diuretic therapy. Readmission was defined as any unplanned hospitalization due to heart failure or other cardiovascular causes. All-cause mortality included deaths from any cause. Patients were followed up through telephone interviews and medical record reviews at 30, 60, and 90 days after discharge.

Clinical Data Collection

Demographic and clinical data were collected from patients' medical records, including age, gender, smoking history, alcohol consumption, NYHA functional class, presence of valvular disease, presence of cardiac arrhythmias, and laboratory parameters (B-type natriuretic peptide [BNP], cardiac troponin I [cTnI], prealbumin, hemoglobin, blood urea nitrogen [BUN], and serum iron). Nutritional status was assessed using both the SGA and GLIM criteria, as described above.

Statistical Analysis

All statistical analyses were performed using R software (version 4.0.3). A two-tailed p-value < 0.05 was considered statistically significant. Continuous variables were expressed as mean ± standard deviation or median (interquartile range), depending on their distribution. Categorical variables were presented as frequencies and percentages. The agreement between the SGA and GLIM criteria in assessing malnutrition was evaluated using Cohen's kappa coefficient. Receiver operating characteristic (ROC) curves were plotted to assess the predictive value of the SGA and GLIM criteria for adverse outcomes in CHF patients, and the area under the curve (AUC) was calculated. The DeLong test was used to compare the AUCs of the SGA and GLIM criteria.

Univariate analysis was performed to compare the characteristics of patients with and without adverse outcomes. Continuous variables were compared using the Student's *t*-test or Mann–Whitney *U*-test, while categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. Variables with a p-value < 0.05 in the univariate analysis were included in the multivariate logistic regression analysis to identify independent risk factors for adverse outcomes in CHF patients.

Correlation analysis was conducted to assess the collinearity among the variables. Sensitivity analysis was performed by varying key assumptions and evaluating the impact on the predictive models. Based on the results, BNP was selected as the continuous variable, and SGA or GLIM criteria were combined with BNP and smoking history for multivariate analysis and predictive model construction. Nomograms were plotted based on the multivariate logistic regression models, and their predictive performance was evaluated using ROC curves, calibration plots, and decision curve analysis.

Results

Consistency Between GLIM Criteria and SGA Standard in Assessing Malnutrition in Heart Failure Patients and Comparison of Their Prognostic Prediction

A total of 240 heart failure patients were ultimately included in this study based on the inclusion and exclusion criteria. Among them, 93 patients were found to have malnutrition according to the SGA standard, while 96 patients were identified as malnourished based on the GLIM criteria. The Cohen's Kappa coefficient for the consistency test between the two assessment methods was 0.8 (95% CI: 0.72–0.88), indicating good agreement between the two methods. ROC curves were plotted using SGA and GLIM methods as the gold standard, respectively, showing an area under the curve (AUC) of 0.902 (95% CI:

0.812–0.958). Patients were grouped according to whether they experienced adverse outcomes (heart failure exacerbation, readmission, or all-cause mortality within 90 days after discharge), with a total of 46 patients having poor prognosis. ROC curves were plotted to evaluate the predictive discrimination and specificity of SGA and GLIM for adverse outcomes in heart failure patients. The results showed that the AUC for SGA was 0.744 (95% CI: 0.695–0.813), while the AUC for GLIM was 0.793. The DeLong test comparing the two methods revealed that GLIM had a better predictive value than SGA for adverse outcomes in heart failure patients (Z = −1.93, p-value = 0.043) (Figure 1).

Univariate Analysis of Adverse Outcomes in Heart Failure Patients

Patients were grouped according to whether they experienced adverse outcomes (heart failure exacerbation, readmission, or all-cause mortality within 90 days after discharge), with a total of 46 patients having poor prognosis. Univariate analysis was performed after grouping, and the results are shown in Table 1. Demographic data (gender, age, smoking history, drinking history), disease characteristics (NYHA classification, presence of valvular disease, presence of arrhythmia), laboratory tests (BNP, cTnI, prealbumin, hemoglobin, BUN, serum iron), and the presence of malnutrition (assessed by SGA and GLIM) were compared between the two groups. The results showed statistically significant differences (P<0.05) in SGA-assessed malnutrition, GLIM-assessed malnutrition, smoking history, BNP, cTnI, and prealbumin levels between the two groups.

Multivariate Analysis and Predictive Model Establishment for Adverse Outcomes in Heart Failure Patients

Correlation analysis was performed to assess the presence of collinearity among the factors, and the results are shown in Figure 1D. The results indicated significant correlations (P<0.05) among the continuous variables BNP, cTnI, and prealbumin levels. SGA and GLIM indicators also showed significant correlations and collinearity. Therefore, among the continuous variables, this study included the BNP indicator and combined it with the SGA indicator and GLIM

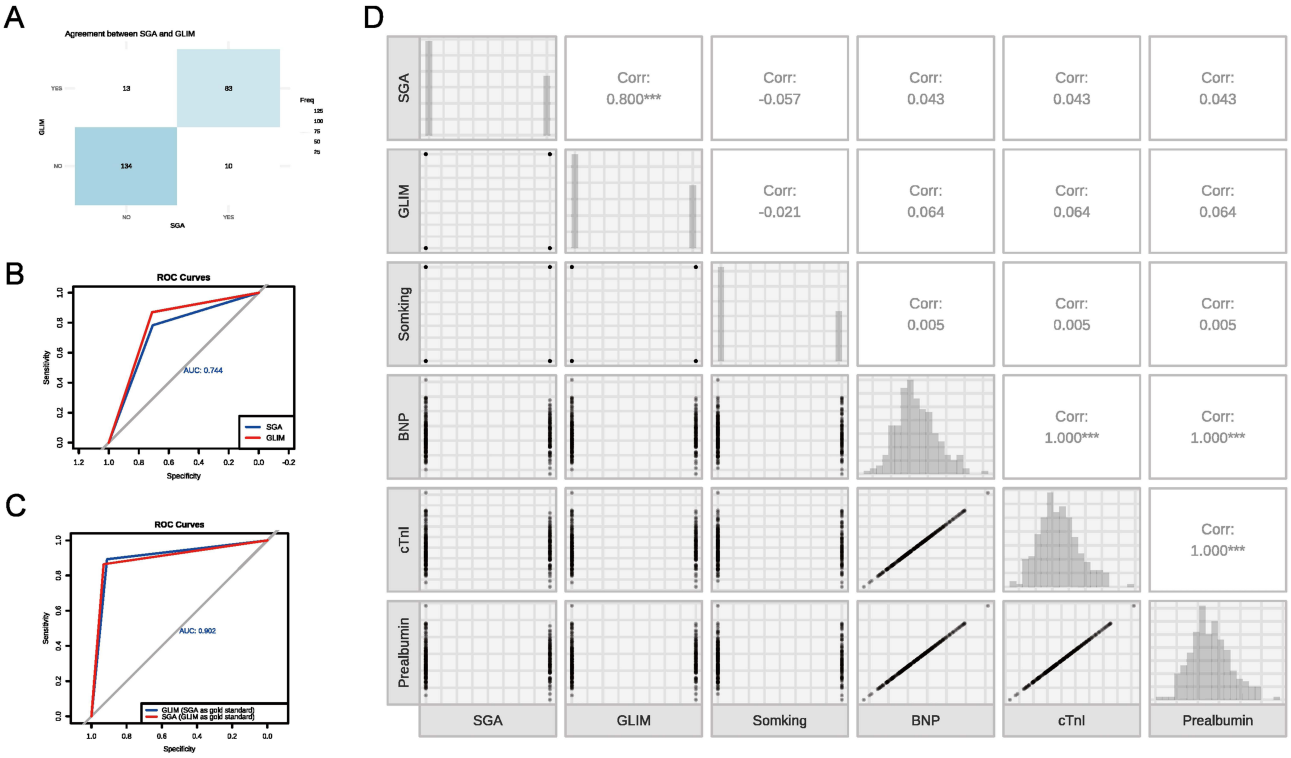

Figure 1 Consistency of GLIM and SGA Criteria in Assessing Malnutrition and Predicting Prognosis in Heart Failure Patients. (**A**) heatmap of the agreement between SGA and GLIM; (**B**) ROC curve of SGA and GLIM; (**C**) ROC curve of GLIM (SGA as gold standard) and SGA (GLIM as gold standard); (**D**) correlation plot among different factors, ***P<0.001.

Table 1 Univariate Analysis of Adverse Prognostic Outcomes in Heart Failure Patients

	[ALL] *N=240*	No Adverse Prognostic Outcomes *N=194*	Adverse Prognostic Outcomes *N=46*	p.Overall
SGA				<0.01
NO	147(61.3%)	137(70.6%)	10(21.7%)	
YES	93(38.8%)	57(29.4%)	36(78.3%)	
GLIM				<0.01
NO	144(60.0%)	138(71.1%)	6(13.0%)	
YES	96(40.0%)	56(28.9%)	40(87.0%)	
Age	64.0[30.0;114]	64.0[30.0;114]	64.0[36.0;98.0]	0.96
Sex:				0.17
Female	76(31.7%)	57(29.4%)	19(41.3%)	
Male	164(68.3%)	137(70.6%)	27(58.7%)	
BMI	22.6[11.4;39.2]	22.6[11.4;39.2]	22.6[13.2;34.0]	0.96
NYHA_Grade4				1.00
NO	118(49.2%)	95(49.0%)	23(50.0%)	
YES	122(50.8%)	99(51.0%)	23(50.0%)	
Smoking				<0.01
NO	146(60.8%)	129(66.5%)	17(37.0%)	
YES	94(39.2%)	65(33.5%)	29(63.0%)	
Drinking				0.73
NO	138(57.5%)	110(56.7%)	28(60.9%)	
YES	102(42.5%)	84(43.3%)	18(39.1%)	
Valve_disease				0.72
NO	175(72.9%)	140(72.2%)	35(76.1%)	
YES	65(27.1%)	54(27.8%)	11(23.9%)	
Heart_rhythm:				0.77
NO	148(61.7%)	121(62.4%)	27(58.7%)	
YES	92(38.3%)	73(37.6%)	19(41.3%)	
BNP	878[305;1553]	838[305;1553]	1006[625;1492]	<0.01
cTnI	2.84[−1.19;7.86]	2.59[−1.19;7.69]	4.50[1.14;7.86]	<0.01
Prealbumin	188±65.3	199±62.7	138±51.9	<0.01
CRP	29.2[6.91;62.4]	29.2[6.91;62.4]	29.1[10.3;52.0]	0.96
HB	87.7[20.7;187]	87.7[20.7;187]	87.3[31.0;156]	0.96
BUN	11.6[0.45;28.2]	11.6[0.45;28.2]	11.6[2.17;23.0]	0.96
Serum_Iron	5.34[0.65;12.3]	5.34[0.65;12.3]	5.31[1.37;10.1]	0.96

Abbreviations: SGA, Subjective Global Assessment; GLIM, Global Leadership Initiative on Malnutrition; BMI, Body Mass Index; NYHA Grade4, New York Heart Association Functional Classification Grade 4; BNP, B-type Natriuretic Peptide; cTnI, Cardiac Troponin I; CRP, C-Reactive Protein; HB, Hemoglobin.

indicator, respectively, along with smoking history, for multivariate analysis and predictive model establishment for adverse outcomes in heart failure patients (Table 2).

In the multivariate analysis incorporating SGA combined with BNP and smoking history, the results showed that SGA-assessed malnutrition and smoking history were independent risk factors for adverse outcomes in heart failure patients ($P<0.05$, $OR>0$). A nomogram was constructed based on SGA combined with BNP and smoking history indicators, and the ROC curve showed an AUC of 0.816 (95% CI: 0.732–0.915). The clinical calibration curve demonstrated good agreement between the predicted and actual values, and the clinical impact curve indicated that the predictive model had a good net clinical benefit (Figure 2).

In the multivariate analysis incorporating GLIM combined with BNP and smoking history, the results showed that GLIM-assessed malnutrition and smoking history were independent risk factors for adverse outcomes in heart failure patients ($P<0.05$, $OR>0$). A nomogram was constructed based on GLIM combined with BNP and smoking history

Table 2 Multivariate Regression Analysis of Subjective Global Assessment (SGA) Combined with B-Type Natriuretic Peptide (BNP) and Smoking History

	Coef	S.E.	Wald.Z	OR	95% CI	Pr(>|Z|)
SGA=YES	2.3501	0.4972	4.73	1.38	1.26–1.52	<0.0001
Smoking=YES	1.4078	0.3814	3.69	1.06	1.01–1.17	0.0002
BNP	−0.0002	0.0009	−0.25	1.00	0.97–1.03	0.8001

Abbreviations: SGA, Subjective Global Assessment; BNP, B-type Natriuretic Peptide; OR, Odds Ratio; S.E., Standard Error; Wald.Z, Wald Z-value; 95% CI, 95% Confidence Interval; Pr(>|Z|), P-value.

indicators, and the ROC curve showed an AUC of 0.854 (95% CI: 0.751–0.962) (higher than the predictive model established using SGA combined with BNP and smoking history). The clinical calibration curve demonstrated good agreement between the predicted and actual values, and the clinical impact curve indicated that the predictive model had a good net clinical benefit (Table 3) (Figure 3).

To assess the robustness of our findings, sensitivity analysis was performed by varying key assumptions and evaluating their impact on the predictive models. The analysis also explored the influence of outliers and data imputation methods for missing values. The results showed that variations in variable selection and handling of missing data had minimal impact on the predictive performance of the models, confirming the stability of the findings.

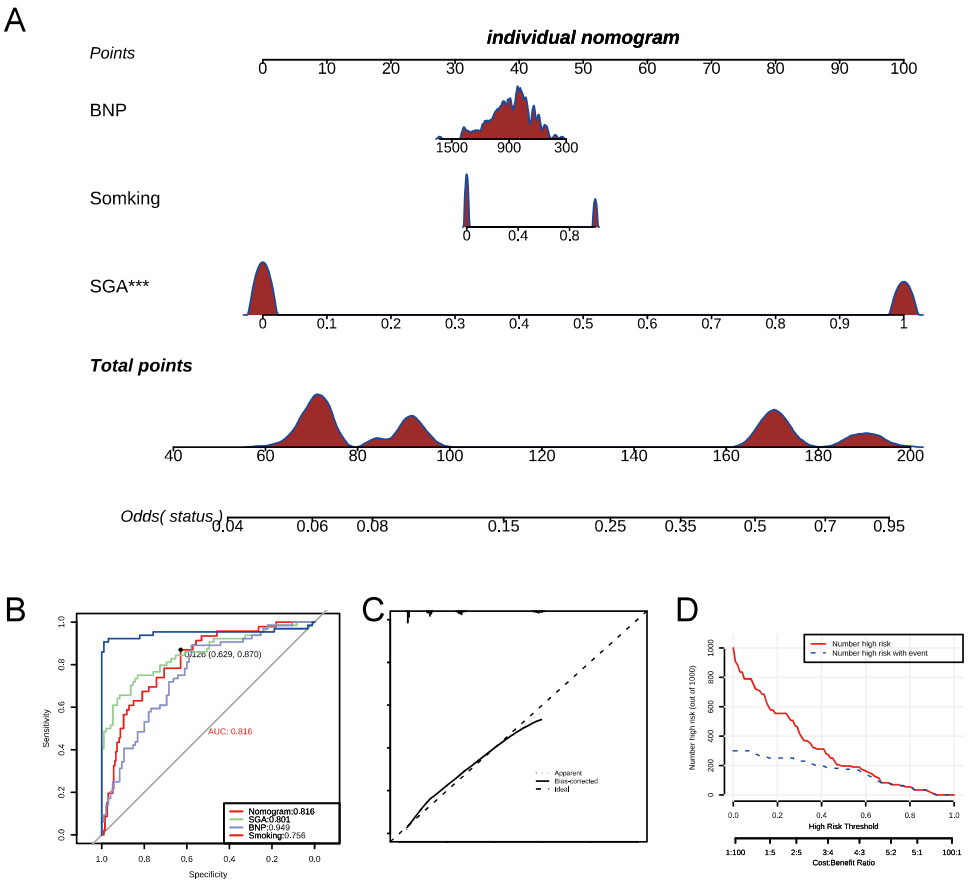

Figure 2 Establishment and validation of a predictive model combining SGA, BNP, and smoking history. (**A**) nomogram to present the predictive model, *** P<0.001; (**B**) ROC curve of the predictive model and each factor; (**C**) clinical calibration curve; (**D**) clinical decision curve.

Table 3 Multivariate Regression Analysis of Global Leadership Initiative on Malnutrition (GLIM) Combined with BNP and Smoking History

	Coef	S.E.	Wald.Z	OR	95% CI	Pr(>|Z|)
GLIM=YES	2.9334	0.5321	5.51	1.46	1.33–1.60	<0.0001
Smoking=YES	1.4012	0.3952	3.55	1.12	1.05–1.15	0.0004
BNP	−0.0001	0.0008	−0.15	1.02	0.98–1.09	0.8837

Abbreviations: GLIM, Global Leadership Initiative on Malnutrition; BNP, B-type Natriuretic Peptide; OR, Odds Ratio; S.E., Standard Error; Wald.Z, Wald Z-value; 95% CI, 95% Confidence Interval; Pr(>|Z|), P-value.

Power Analysis and Statistical Power

To ensure the adequacy of the sample size, a power analysis was conducted for the primary analyses of AUC comparisons, Cohen's Kappa agreement, and multivariate logistic regression.

The sample size was calculated to be sufficient for detecting a statistically significant difference between the AUC values of the SGA (0.744) and GLIM (0.793) methods. For assessing the agreement between the SGA and GLIM criteria, we aimed to detect a Cohen's Kappa value of 0.8, indicating good inter-method reliability. In line with the rule of thumb of 15 events per predictor variable and given that we observed 46 adverse outcomes in our cohort, the power analysis

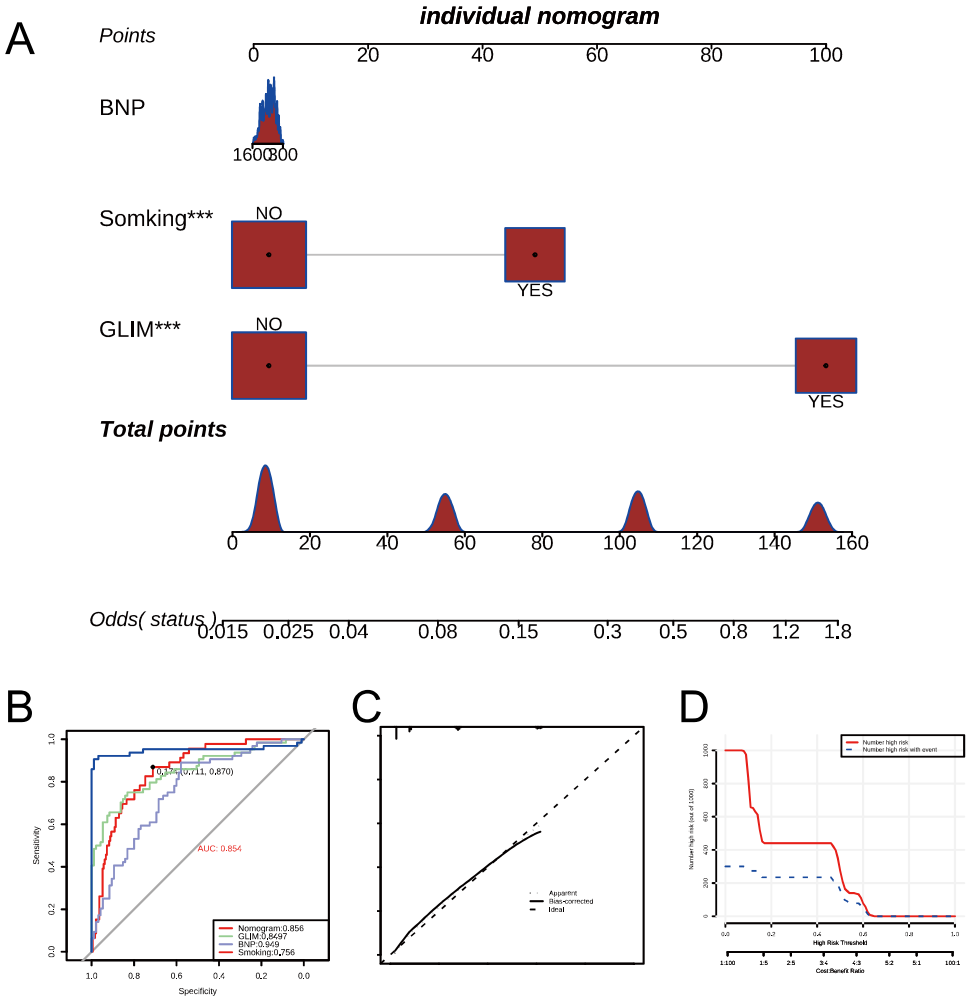

Figure 3 Establishment and validation of a predictive model combining GLIM, BNP, and smoking history. (**A**) nomogram to present the predictive model, *** P<0.001; (**B**) ROC curve of the predictive model and each factor; (**C**). clinical calibration curve; (**D**). clinical decision curve.

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confirmed that our sample size of 240 patients is more than adequate to conduct multivariate regression modeling. This ensures reliable identification of independent risk factors for adverse outcomes.

The conducted power analyses confirm that the sample size of 240 patients provides sufficient power for all primary analyses. This reinforces the validity and reliability of our findings and their generalizability.

Discussion

Comparison of the GLIM Criteria and SGA in Assessing Malnutrition in CHF Patients

In this study, we compared the performance of the GLIM criteria and SGA in assessing malnutrition in 240 patients with chronic heart failure (CHF). Our results showed that the prevalence of malnutrition was 38.8% (93 patients) according to the SGA and 40.0% (96 patients) according to the GLIM criteria. The agreement between the two methods was good, with a Cohen's kappa coefficient of 0.8 (95% CI: 0.72–0.88). This finding is consistent with previous studies that have reported good agreement between the GLIM criteria and other nutritional assessment tools, such as the Mini Nutritional Assessment (MNA) and the Malnutrition Universal Screening Tool (MUST).[13,14] The high agreement between the GLIM criteria and SGA in our study suggests that the GLIM criteria can be used as a reliable tool for assessing malnutrition in CHF patients.

Furthermore, we evaluated the diagnostic accuracy of the GLIM criteria and SGA using ROC curve analysis, with each method serving as the gold standard. The AUC was 0.9 for both methods, indicating excellent diagnostic accuracy. This finding supports the use of either the GLIM criteria or SGA as a valid tool for diagnosing malnutrition in CHF patients. However, it is important to note that the GLIM criteria have the advantage of being based on objective measures, such as body mass index (BMI) and muscle mass, which may improve the reproducibility and comparability of nutritional assessments across different settings.[15,16]

Univariate Analysis of Risk Factors for Adverse Outcomes in CHF Patients

We compared the demographic characteristics, disease features, laboratory parameters, and nutritional status of CHF patients with and without adverse outcomes (worsening heart failure, readmission, or all-cause mortality) within 90 days after discharge. Univariate analysis revealed significant differences between the two groups in terms of malnutrition assessed by SGA and GLIM criteria, smoking history, BNP, cTnI, and prealbumin levels ($P<0.05$). These findings suggest that malnutrition, smoking, and elevated levels of BNP, cTnI, and prealbumin are potential risk factors for adverse outcomes in CHF patients.

Our results are consistent with previous studies that have identified malnutrition as an independent predictor of poor prognosis in CHF patients.[17,18] Malnutrition can lead to muscle wasting, immune dysfunction, and increased inflammation, which may contribute to the progression of heart failure and adverse clinical outcomes.[19,20] Smoking has also been recognized as a risk factor for the development and progression of heart failure, as it can cause endothelial dysfunction, oxidative stress, and inflammation.[21] Additionally, elevated levels of BNP, cTnI, and prealbumin have been associated with worse outcomes in CHF patients, as they reflect the severity of heart failure, myocardial injury, and nutritional status, respectively.[18]

Multivariate Analysis and Predictive Models for Adverse Outcomes in CHF Patients

We performed correlation analysis to assess the presence of collinearity among the variables identified as potential risk factors in the univariate analysis. The results showed significant correlations between BNP, cTnI, and prealbumin levels ($P<0.05$), as well as between SGA and GLIM criteria. To avoid collinearity, we included BNP as the representative continuous variable and separately combined it with SGA or GLIM criteria and smoking history in the multivariate analysis and predictive model development.

Multivariate analysis revealed that malnutrition assessed by either SGA or GLIM criteria and smoking history were independent risk factors for adverse outcomes in CHF patients ($P<0.05$, $OR>1$). These findings highlight the importance of incorporating nutritional assessment and smoking status in the risk stratification of CHF patients. Previous studies

have also reported that malnutrition and smoking are independent predictors of poor prognosis in CHF patients, even after adjusting for other established risk factors, such as age, NYHA class, and left ventricular ejection fraction.[22]

Based on these results, we developed two predictive models using nomograms: one combining SGA, BNP, and smoking history, and the other combining GLIM criteria, BNP, and smoking history. The ROC curve analysis showed that the model incorporating GLIM criteria had a higher AUC (0.854) than the model incorporating SGA (0.816), suggesting that the GLIM criteria may have better predictive value for adverse outcomes in CHF patients. The calibration curves for both models demonstrated good agreement between predicted and actual probabilities, indicating the reliability of the models. Furthermore, the decision curve analysis showed that both models had good clinical net benefit, supporting their potential utility in guiding clinical decision-making and resource allocation.

Practicality and Cost-Effectiveness of GLIM Implementation in CHF Management

The implementation of the GLIM criteria in CHF management offers several advantages that can enhance patient care and outcomes. One of the most significant benefits of GLIM is its objective, standardized approach to assessing malnutrition, which includes the use of measurable indicators such as BMI, muscle mass, and nutritional intake. This can improve the accuracy and reproducibility of malnutrition assessments compared to more subjective tools like the SGA, which may rely more on clinical judgment and visual assessments. This objectivity can lead to earlier and more accurate identification of malnourished patients, enabling timely nutritional interventions that can potentially reduce complications and hospital readmissions.

In real-world clinical settings, GLIM may prove to be more practical and cost-effective than SGA. SGA, although effective, can be time-consuming as it requires detailed patient history and physical examination by trained clinicians, which may not always be feasible in busy clinical environments. In contrast, GLIM's combination of objective criteria like BMI and muscle mass can be assessed more quickly and with less subjective input. This makes GLIM a more scalable tool in hospitals with limited resources, potentially leading to more efficient resource utilization while ensuring the optimal care of malnourished patients.

Furthermore, integrating GLIM into routine clinical practice can contribute to better risk stratification, ensuring that healthcare providers allocate appropriate resources to those most at risk, thereby improving both clinical outcomes and cost-efficiency in CHF management.

Limitations and Future Directions

Despite the valuable insights provided by this study, several limitations must be acknowledged. First, the study was conducted at a single center may limit the generalizability of our findings. To enhance the external validity of the results, future studies should include larger, multi-center cohorts, adopt a prospective study design, and extend the follow-up period to assess the long-term outcomes of patients. A longer follow-up duration could provide more comprehensive data on the sustained effects of malnutrition and its management in CHF patients. Second, our study did not examine the impact of nutritional interventions on the clinical outcomes of CHF patients. Given the potential benefits of early nutritional interventions, future research should focus on intervention-based studies to evaluate whether targeted nutritional support can improve long-term prognosis and reduce adverse outcomes such as readmission rates and mortality in CHF patients.

Conclusion

In conclusion, our study demonstrates that the GLIM criteria exhibit good agreement with the SGA in assessing malnutrition in CHF patients and may offer superior predictive value for adverse outcomes. Malnutrition, smoking, and elevated levels of BNP, cTnI, and prealbumin were identified as independent risk factors for adverse outcomes in this population. While causal relationships cannot be established due to the retrospective design, incorporating GLIM alongside traditional markers (BNP, smoking history) into predictive models could enhance risk stratification and support clinical decision-making in the management of CHF patients. Further prospective studies are needed to confirm these findings and assess the utility of GLIM for routine clinical use.

Data Sharing Statement

The datasets used and/or analyzed during the present study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

Approved by the Ethics Committee of The First Affiliated Hospital of Ningbo University. All research involving human participants was conducted in compliance with the ethical guidelines of both the institutional and national research committees, adhering to the 1964 helsinki Declaration and its subsequent updates. Informed consent was secured from all participants in the study.

Consent for Publication

Written informed consent for publication was obtained from all patients included in this analysis.

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Disclosure

All authors affirm that there is no conflict of interest.

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