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ORIGINAL RESEARCH

Clinical Relevance of HALP Score in Predicting Hospital Stay Duration and Outcomes in Acute Heart Failure

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Background: Heart failure (HF) remains a global health burden characterized by frequent hospitalizations and high mortality. The Hemoglobin, Albumin, Lymphocyte, and Platelet (HALP) score has emerged as a composite marker reflecting nutritional and inflammatory status, but its prognostic utility in acute HF settings remains underexplored.

Objective: To investigate the association between the HALP score and prolonged hospital stay and in-hospital mortality among patients admitted with acute heart failure.

Methods: This retrospective study included 222 patients hospitalized with acute heart failure at a tertiary care center in Somalia between January 2024 and April 2025. Patients were stratified by hospital stay duration: short (≤7 days) vs long (>7 days). The HALP score was calculated using routine laboratory values, and a previously validated cut-off was used for stratification. Logistic regression analysis was used to identify predictors of long hospital stay. Model performance was assessed using Hosmer–Lemeshow test, Nagelkerke R^2, classification statistics, and ROC curve analysis.

Results: A total of 222 patients were analyzed; 86 (38.7%) had prolonged hospitalization. Patients with the HALP score above the prognostic threshold were significantly more likely to experience long hospital stay (p = 0.002). In multivariable analysis, The HALP score ≥ cut-off (OR: 10.19, 95% CI: 2.49–41.63, p = 0.002) and prior stroke (OR: 8.44, 95% CI: 1.15–61.88, p = 0.035) independently predicted prolonged hospital stay. Model fit was adequate (Hosmer–Lemeshow p = 0.105), and explanatory power was moderate (Nagelkerke R^2 = 0.31). However, the HALP score's standalone discriminative ability was poor (AUC = 0.511).

Conclusion: The HALP score is an independent predictor of prolonged hospitalization in acute heart failure patients. While its individual discriminative power is limited, its role within multivariable risk stratification models appears promising. Further prospective validation is warranted.

Keywords: HALP score, acute heart failure, hospital stay, inflammation, nutrition, prognosis, mortality

Introduction

Heart failure is a clinical syndrome characterized by symptoms such as dyspnea, ankle swelling, and fatigue, often accompanied by signs including pulmonary crackles, elevated jugular venous pressure, or peripheral oedema. It results from structural and/or functional cardiac abnormalities leading to elevated intracardiac pressures and/or inadequate cardiac output. Acute heart failure denotes the rapid onset or worsening of these manifestations, typically requiring urgent hospitalization.[1] Approximately 26 million people worldwide are affected, and the number is expected to rise due to aging populations and improved survival after myocardial infarction.[2]

The burden of heart failure in low-resource settings, including Sub-Saharan Africa, is compounded by the high prevalence of rheumatic and ischemic etiologies. Somali studies have reported the presence of left ventricular thrombus in patients with reduced ejection fraction[3] and the persistence of rheumatic valvular disease.[4] Hospitalization for acute decompensated heart failure (ADHF) constitutes a major clinical and economic challenge,[5] and contemporary guidelines emphasize the need for risk stratification to improve outcomes.[6]

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Beyond structural disease, malnutrition and systemic inflammation have emerged as important determinants of prognosis in HF. Regional angiographic data highlight the burden of coronary artery disease among systolic HF patients,[7] while indices such as the Prognostic Nutritional Index (PNI) have been linked to mortality.[8] Evidence from the AFTER-2 registry demonstrated the predictive value of simple nutritional scores in atrial fibrillation,[9,10] and similar findings have been reported for other nutritional and inflammatory indices, including the CONUT score, Nutritional Risk Index (NRI), and neutrophil-to-lymphocyte ratio (NLR).[11,12]

One emerging markersis the hemoglobin, albumin, lymphocyte, and platelet (HALP) score, initially introduced in oncology.[13,14] Its prognostic role has since been extended to cardiovascular disease, where low HALP was associated with adverse outcomes in heart failure populations.[15]

Despite these advances, data on HALP as a predictor of hospital length of stay in acute HF remain scarce. This study aimed to investigate the prognostic utility of HALP in predicting prolonged hospitalization among patients admitted with acute heart failure.

Methods

Study Design and Population

This retrospective observational study included 222 patients admitted with acute heart failure to a tertiary hospital in Somalia between January 2024 and April 2025. Patients were included if they were aged 18 years or older, had a confirmed diagnosis of heart failure according to the European Society of Cardiology (ESC) guidelines (1), and had complete laboratory data available for calculating the HALP score (Hemoglobin × Albumin × Lymphocyte count / Platelet count).

Patients with conditions known to significantly influence hemoglobin, albumin, lymphocyte, or platelet counts were excluded. This included those with active infection, active malignancy, hematological disorders, advanced liver failure (Child–Pugh C), severe renal impairment requiring dialysis, or recent chemotherapy.

Data Collection

Demographic characteristics (age, sex), clinical history (hypertension, diabetes mellitus, chronic kidney disease, ischemic heart disease), and laboratory results obtained within the first 24 hours of admission were collected from electronic medical records. Chronic kidney disease was defined as an estimated glomerular filtration rate (eGFR) <60 mL/min/1.73 m^2 for at least three months, calculated using the CKD-EPI formula.

Laboratory parameters included complete blood count, serum albumin, C-reactive protein (CRP), procalcitonin, ESR, urea, and pro-BNP. Clinical outcomes recorded were in-hospital mortality and length of stay.

Patients were categorized into two groups: short stay (≤7 days) and long stay (>7 days). The 7-day cutoff was derived from ROC curve analysis using Youden's index, as no standardized definition of prolonged hospitalization in acute heart failure exists.

HALP Score Calculation

The HALP score was calculated using the standardized formula: Hemoglobin (g/L) × Albumin (g/L) × Lymphocyte count (/L) ÷ Platelet count (/L).

Patients were stratified into high or low HALP groups using a cutoff value derived from receiver operating characteristic (ROC) curve analysis with Youden's index in this cohort, as no universally accepted threshold for acute heart failure populations is available.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables were first tested for normality using the Kolmogorov–Smirnov test. Normally distributed data were expressed as mean ± standard deviation (SD), and non-normally distributed data were expressed as median and interquartile range (IQR). The independent samples *t*-test was used for comparing normally distributed continuous

variables, while the Mann–Whitney *U*-test was used for non-normally distributed variables.Categorical variables were presented as frequencies and percentages and compared using the Chi-square test or Fisher's exact test, as appropriate.

Variables with a p-value < 0.10 in univariate analysis were entered into a binary logistic regression model to determine independent predictors of prolonged hospital stay. Multicollinearity was assessed using Variance Inflation Factor (VIF), and variables with VIF > 5 were considered collinear. Model calibration was assessed using the Hosmer–Lemeshow goodness-of-fit test, and the Nagelkerke R^2 was used to evaluate model explanatory power. The Receiver Operating Characteristic (ROC) curve was plotted to evaluate the discriminative performance of the HALP score.A two-tailed p-value < 0.05 was considered statistically significant.

Ethical Considerations

The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board of Mogadishu Somali Türkiye Recep Tayyip Erdoğan Training and Research Hospital (Approval Number: MSTH/22406). Given the retrospective design of the study, which relied exclusively on anonymized data extracted from electronic medical records without any direct patient contact or intervention, the requirement for individual informed consent was formally waived by the Institutional Review Board.

Results

Baseline Characteristics and Hospital Stay Duration

A total of 222 patients hospitalized with acute heart failure were included in this study. Based on hospital length of stay, 136 (61.3%) were classified as having a short hospital stay (≤7 days), and 86 (38.7%) had a long hospital stay (>7 days). The demographic and clinical characteristics of the study population are summarized in Table 1.

Table 1 Comparison of Demographic, Clinical, and Laboratory Parameters According to Hospital Stay Duration in Acute Heart Failure Patients

Variable	Total (n = 222)	Short Hospital Stays (n = 136)	Long Hospital Stays (n = 86)	p-value
Demographics				
Age ≥65 years, n (%)	42 (19.1%)	13 (9.6%)	29 (34.5%)	**<0.001**
Male sex, n (%)	138 (62.7%)	90 (66.2%)	48 (57.1%)	0.229
Comorbidities				
Chronic Kidney Disease, n (%)	29 (13.2%)	14 (10.3%)	15 (17.9%)	0.160
Hypertension, n (%)	118 (53.6%)	75 (55.1%)	43 (51.2%)	0.665
Diabetes, n (%)	123 (55.9%)	74 (54.4%)	49 (58.3%)	0.668
Laboratory values				
Albumin low, n (%)	148 (67.3%)	98 (72.1%)	50 (59.5%)	0.076
CRP elevated, n (%)	198 (90.0%)	120 (88.2%)	78 (92.9%)	0.379
Procalcitonin elevated, n (%)	31 (14.1%)	17 (12.5%)	14 (16.7%)	0.507
ProBNP elevated, n (%)	216 (98.2%)	132 (97.1%)	84 (100.0%)	0.286
Outcomes				
HALP Score ≥ cut-off, n (%)	23 (10.5%)	7 (5.1%)	16 (19.0%)	**0.002**
In-hospital mortality, n (%)	21 (9.5%)	4 (2.1%)	17 (65.4%)	**<0.001**

Note: Bold p-values indicate statistically significant differences (p < 0.05).
Abbreviations: CRP, C-reactive protein; ProBNP, Pro–B-type natriuretic peptide; HALP, Hemoglobin, Albumin, Lymphocyte and Platelet score.

Patients in the long-stay group were significantly older than those with shorter hospitalization. Notably, individuals aged ≥65 years were more frequently observed in the long-stay group (34.5%) compared to the short-stay group (9.6%) ($p < 0.001$). There was no significant difference in gender distribution between the two groups ($p = 0.229$).

Although comorbid conditions such as hypertension, diabetes mellitus, and chronic kidney disease were common across both groups, they did not differ significantly. In contrast, certain laboratory parameters demonstrated meaningful associations. Thrombocytopenia was significantly more prevalent among patients with prolonged hospitalization ($p = 0.027$), while low serum albumin showed a trend toward significance ($p = 0.076$).

Patients with elevated HALP scores (above the prognostic cut-off) were more likely to experience long hospital stays (19.0% vs 5.1%; $p = 0.002$). Furthermore, in-hospital mortality was markedly higher in the long-stay group compared to the short-stay group (65.4% vs 2.1%, $p < 0.001$).

Multivariable Logistic Regression Analysis

A multivariable logistic regression model was constructed to identify independent predictors of long hospital stay. Variables with $p < 0.10$ in univariate analysis were included. The results of the regression analysis are presented in Table 2.

After adjustment, a HALP score ≥ cut-off emerged as a significant independent predictor of long hospital stay (odds ratio [OR]: 10.19; 95% confidence interval [CI]: 2.49–41.63; $p = 0.002$). In addition, a prior history of stroke was associated with a significantly increased risk of prolonged hospitalization (OR: 8.44; 95% CI: 1.15–61.88; $p = 0.035$). Interestingly, low platelet count was inversely associated with long hospital stay (OR: 0.18; 95% CI: 0.04–0.79; $p = 0.028$).

Model diagnostics indicated good calibration, as reflected by the Hosmer–Lemeshow goodness-of-fit test ($\chi^2 = 13.190$; $df = 8$; $p = 0.105$). The Nagelkerke R^2 value of 0.31 indicated moderate explanatory power. Multicollinearity was ruled out, with all variance inflation factor (VIF) values below 2.0.

Model Classification Performance

The final logistic regression model demonstrated satisfactory classification performance. The model correctly classified 75.5% of the study population. Sensitivity (true positive rate) for predicting long hospital stay was 51.8%, specificity (true negative rate) was 90.4%, and the overall accuracy was 75.5%.

Receiver Operating Characteristic (ROC) Curve Analysis

The discriminatory ability of the HALP score to predict long hospital stay was assessed using ROC curve analysis. The area under the curve (AUC) was 0.511, with a sensitivity of 51.8% and a specificity of 90.4%, indicating poor predictive accuracy when used alone. Despite its independent predictive value in the multivariable model, the standalone utility of the HALP score for classifying patients based on hospital stay duration was limited.

Table 2 Multivariable Logistic Regression Analysis of Predictors of Long Hospital Stay in Acute Heart Failure Patients

Variable	Odds Ratio (95% CI)	p-value
HALP score ≥ cut-off	10.19 (2.49–41.63)	0.002
Stroke	8.44 (1.15–61.88)	0.035
Platelet count low	0.18 (0.04–0.79)	0.028
Age ≥65 years	2.30 (0.84–6.27)	0.110
Male sex	1.98 (0.94–4.15)	0.077

Abbreviations: CI, Confidence Interval; OR, Odds Ratio; HALP, Hemoglobin, Albumin, Lymphocyte, and Platelet; HF, Heart Failure.

Discussion

In this study, we evaluated the prognostic role of the HALP score in predicting prolonged hospitalization among patients admitted with acute heart failure (AHF). Our results demonstrated that HALP was an independent predictor of longer hospital stay, even after adjustment for conventional risk factors, underscoring the potential clinical utility of this score in risk stratification.

These findings are consistent with prior studies linking malnutrition to adverse outcomes in HF. Malnutrition has been shown to independently increase long-term mortality in hospitalized HF patients.[16] Recent work has also validated HALP as a predictor of in-hospital mortality and short-term prognosis in acute HF populations.[17,18] Similarly, inflammation-based indices have been demonstrated to predict 90-day mortality in HF cohorts.[19]

The local Somali context reinforces the relevance of these findings. Previous work has shown that systemic inflammatory indices were independently associated with mortality in Somali HF patients.[20] Together with the nutritional–inflammatory interplay captured by HALP, these results highlight the importance of combined risk assessment in low-resource settings.

Nutritional risk assessment remains a cornerstone of patient management. The CONUT score at admission has been associated with poor outcomes in HF patients,[21] while interventional studies have shown that nutritional support can improve survival in malnourished HF populations.[22] Incorporating HALP into this framework may provide a low-cost, integrative biomarker for clinical decision-making.

Our results also suggest that HALP should not be applied in isolation. While it retained independent significance in multivariable models, the ROC analysis yielded modest discrimination. This aligns with evidence that multimodal scores, such as those developed for acute coronary syndromes,[23] often outperform single-parameter indices. HALP may therefore be most effective as part of a broader risk stratification strategy.

Finally, the platelet component of HALP merits attention. Thrombocytopenia has been associated with adverse outcomes following myocardial infarction,[24] supporting the biological plausibility of HALP as an integrative marker reflecting nutritional, inflammatory, and hematological status.

Study Strengths and Limitations

Strengths and Limitations

This study provides the first evaluation of the HALP score in predicting hospitalization outcomes among acute heart failure patients in Somalia, offering novel data from a low-resource setting where such evidence is scarce. The topic is clinically important and has potential citation value, as it integrates nutritional and inflammatory status into heart failure risk stratification using a simple and cost-effective biomarker. Rigorous statistical analyses were applied, ensuring robustness of the results despite contextual challenges.

However, several limitations should be acknowledged. The retrospective, single-center design restricts generalizability and introduces potential selection bias. The relatively small sample size (n = 222), with a limited proportion of patients in the high HALP group, reduces statistical power and contributes to wide confidence intervals. In addition, important confounders—including heart failure etiology (ischemic vs non-ischemic), Killip class, NYHA class, frailty status, comorbidities, and medication use—were not available for adjustment and may have influenced the associations observed. The ROC analysis yielded poor discriminatory ability (AUC ≈ 0.51), indicating that HALP is not reliable as a stand-alone predictor. Furthermore, exclusion criteria did not comprehensively account for diseases affecting HALP components (eg, advanced liver or renal failure), which could influence validity.

Future multicenter, prospective studies with larger and more diverse cohorts are needed to confirm these findings and explore HALP's utility as part of multimodal prognostic models.

Conclusion

The HALP score was independently associated with prolonged hospitalization in acute heart failure but showed poor discriminatory ability (AUC ≈0.51), limiting its value as a stand-alone predictor. These findings should be interpreted cautiously given the retrospective, single-center design and lack of key confounders. Larger multicenter prospective studies are needed to clarify the role of HALP within multimodal risk stratification strategies.

Disclosure

The authors report no conflicts of interest in this work.

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