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ORIGINAL RESEARCH

Prognostic Nutritional Index as a Predictor of Mortality in Hospitalized Geriatric Patients with Chronic Atrial Fibrillation

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Purpose: Internal medicine departments manage a broad spectrum of chronic diseases, which are frequently associated with higher mortality rates. In this context, we evaluated the relationship between the Prognostic Nutritional Index (PNI) and mortality in elderly inpatients with chronic atrial fibrillation (AF) admitted to an internal medicine department.

Patients and Methods: This study included 158 hospitalized patients who were followed for five years post-discharge. We compared the following variables between the survival and non-survival groups: age, sex, presence of diabetes mellitus, hypertension, coronary artery disease, anticoagulant use, Prognostic Nutritional Index (PNI) score, CHA_2DS_2-VASc score, HAS-BLED score, ejection fraction (EF%), and laboratory parameters including neutrophil count, lymphocyte count, glucose, urea, alanine aminotransferase (ALT), hemoglobin, C-reactive protein (CRP), albumin, total cholesterol, thyroid-stimulating hormone (TSH), free T3, and ferritin levels.

Results: When compared to the surviving patients, the patients who died were older ($p = 0.001$) and had a lower PNI scores ($p = 0.011$) Moreover the patients who died also had significantly higher total cholesterol and urea, levels and significantly lower Free T3 and albumin levels. The multivariate analysis revealed that the PNI score and urea level were significant independent factors in differentiating deceased patients from survivors ($p < 0.05$). The PNI score demonstrated a significant effect in distinguishing between non-survivors and survivors (Area under the curve (AUC)= 0.662).

Conclusion: The PNI score have indicated the clinical importance of as a novel marker for predicting mortality in geriatric chronic AF patients.

Keywords: PNI score, mortality, chronic atrial fibrillation

Introduction

The internal medicine wards serve a large and elderly patient population, many of whom have multiple chronic conditions. These hospitalized elderly patients face a variety of adverse factors that increase their mortality risk.

Atrial fibrillation (AF), the most prevalent cardiac arrhythmia, is progressively increasing in frequency. Its current prevalence is between 2% and 4%, rising with advanced age, and it is associated with an elevated risk of stroke and thromboembolism, resulting in significant morbidity and mortality.[1,2]

Malnutrition is prevalent, especially in patients with chronic diseases in low- and middle-income countries. Elderly inpatients show a high incidence of malnutrition, which is one of the various adverse factors affecting mortality risk in hospitalized populations. It can predict unfavorable clinical outcomes including frailty, immune system dysfunction, anemia, impaired cognitive function, longer hospital stays, and mortality. Over one-third of AF patients are at moderate to high risk of malnutrition.[3] Furthermore, nutritional deficiencies may drive disease progression as part of a vicious cycle linked to chronic systemic inflammation, neurohumoral activation, and cachexia. Therefore, proper nutritional

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screening and assessment for malnutrition are essential for all hospitalized patients.[4] Although no gold standard method currently exists for the diagnosis of malnutrition, several screening systems and scoring indices have been suggested for nutritional assessment.

Many previous studies have shown that conditions such as coronary heart disease (CHD) and transient ischemic attack or ischemic stroke are detected at a higher rate in the low Prognostic Nutritional Index (PNI) group compared to the high Prognostic Nutritional Index (PNI) group.[5]

The Prognostic Nutritional Index (PNI), which is calculated using the formula [(serum albumin (g/dL) × 10) + (total lymphocyte count (10^3/μL) × 0.005)], is employed in clinical practice for malnutrition screening. The presence of malnutrition as determined by the PNI might be an independent predictor of elevated mortality among patients with atrial fibrillation.[6]

The objective of this study was to assess the relationship between the Prognostic Nutritional Index (PNI) score and mortality among elderly inpatients with chronic atrial fibrillation (AF) in the internal medicine department.

Materials and Method

Patients

A total of 158 geriatric patients with nonvalvular chronic atrial fibrillation (AF) were included in the study from among those hospitalized and treated in the internal medicine ward between 1 January 2019 and 1 March 2020.

Patients under 65 years of age, patients with insufficient data, those transferred to the intensive care unit, patients with repeated hospitalizations, those with a delay in hospital admission (>24 hours), patients with hematologic or solid malignancies, those with chronic liver disease, and patients using nonsteroidal anti-inflammatory drugs (including aspirin), other anti-inflammatories, or immunosuppressants (eg, steroids) were excluded from the study due to the risk of their hemogram parameters being affected.

Patients who contracted COVID-19 during the five-year follow-up period were excluded to prevent potential confounding of the mortality data.

The primary endpoint of this study was all-cause mortality during the follow-up period. Mortality data were confirmed through the hospital's electronic information system and the Turkish National Mortality Registry. Patients who died from unnatural causes (accidents, suicide, homicide) during the follow-up period were excluded from the study. The secondary endpoints included the association between baseline prognostic nutritional index (PNI) scores, laboratory parameters, and mortality. Mortality data were recorded from electronic hospital information system. Demographic characteristics, medical history, mortality information, and laboratory results were retrieved from the electronic hospital information system and databases of Haseki Training and Research Hospital.

Ethical Aspects

This study was approved by the Ethics Committee of Haseki Training and Research Hospital, University of Health Sciences, Istanbul, Turkey (Approval No: 204–2025; Approval Date: October 15, 2025). All procedures were carried out in accordance with the principles of the Declaration of Helsinki and good clinical practice guidelines. Written informed consent was obtained from all patients upon hospital admission, as required by regulations. Data regarding demographic characteristics, medical history, laboratory findings, and follow-up outcomes were obtained from the hospital's electronic management system and the Turkish National Mortality Registry.

Study Design

This retrospective single center cohort study included patients hospitalized between January 1, 2019, and March 1, 2020. The specific variables of age and gender, presence of diabetes mellitus, hypertension, coronary artery disease, anticoagulant use, Prognostic nutritional index (PNI), CHA_2DVAS_2K, HAS-BLED, ejection fraction (EF%), as well as neutrophil, lymphocyte, glucose, urea, alanine aminotransferase (ALT), hemoglobin, C-reactive protein (CRP), albumin, cholesterol (total), thyroid-stimulating hormone (TSH), Free T3, and ferritin levels were recorded.

The diagnosis of chronic atrial fibrillation was established and confirmed by clinical assessment, patient history, review of medical records, and a 12-lead electrocardiogram (ECG), which verified the presence of AF for a duration of 7 days or more.

Anticoagulant therapy at admission was recorded as a categorical variable (none, vitamin K antagonist, direct oral anticoagulant). For patients on warfarin, time in therapeutic range (TTR) was calculated where data were available.

$CHADS_2$-VASc and HAS-BLED Scores were calculated according to the clinical findings at the time of hospitalization. EF was measured by echocardiography after hospitalization.

The Prognostic Nutritional Index (PNI) was calculated using the formula: PNI = serum albumin (g/dL) x 10 + total lymphocyte count (per mm^3) x 0.005, based on blood samples obtained at admission.

Blood samples were obtained after a 12-hour fasting period on the first day of hospitalization. All patients mortality were evaluated using the electronic hospital information system. Patients were categorized according to mortality (survivors vs. non-survivors) Biochemical parameters, age, gender, chronic diseases, anticoagulant use, CHADS-VASc, HASBLED (%EF) and PNI scores were compared and analyzed between the two groups. The follow-up period ended in October 2025. A Follow-up information was collected through data processing system of Haseki Training and Research Hospital. The primary endpoints of this study were composite outcome, including all-cause mortality, as documented in the database. The main outcome measure (dependent variable) in this study was all-cause-mortality. The Turkey national death registry was used to confirm mortality reports of the follow-up clinic. The 5-year mortality results of the patients were recorded. The 5-year mortality results of the patients were recorded. During the follow-up, a total of 132 participants died.

Statistical Analysis

Descriptive statistics of the data were presented using mean, standard deviation, median, minimum, maximum, frequency, and percentage values. The distribution of the variables was assessed using the Kolmogorov–Smirnov and Shapiro–Wilk tests. Student's *t*-test was used to compare normally distributed continuous variables between two independent groups. The Mann–Whitney *U*-test was used for the analysis of non-normally distributed quantitative independent variables. The chi-square test was used to analyze qualitative independent variables. Survival analysis was performed using the Kaplan-Meier method. The log-rank (Mantel-Cox) test was used to compare survival distributions between groups. A p-value of <0.05 was considered statistically significant Variables with a p-value < 0.10 in univariate comparisons (or all clinically relevant variables) were included in a backward stepwise multivariate logistic regression model to identify independent predictors of mortality. The discriminative power of continuous variables was assessed using Receiver Operating Characteristic (ROC) curve analysis, and optimal cut-off values were determined using the Youden's index. All statistical analyses were performed using SPSS version 28.0 (IBM Corp., Armonk, NY, USA).

Results

This study includes a total of 158 patients (94 females, 64 males). The five-year follow-up period was (Median = 10 months, min. = 0 months, max. = 70 months). The baseline characteristics of the 5 year survivor and exitus groups are presented in Table 1. The mean age of the study subjects was 71.8 ± 8 survival group and 79.0 ± 7.6 non-survival group. When compared to the surviving patients, the patients who died were older (p = 0.001) and had a lower PNI scores (p = 0.011). Moreover the patients who died also had significantly higher total cholesterol and urea levels and significantly lower Free T3 and albumin levels. In the multivariate logistic regression analysis, PNI was found to be an independent predictor of mortality (OR: 0.988, 95% CI: 0.979–0.997, p=0.012), indicating that each one-unit increase in PNI score was associated with a 1.2% reduction in the risk of mortality (Table 2).

The PNI score demonstrated a significant effect in distinguishing between non-survivors and survivors [Area under the curve (AUC) 0.662 (0.546–0.777)].

The median PNI score was 330 in the survival group and 300 in the non-survival group (p = 0.011).

A PNI cut-off value of 320 also showed a significant ability to differentiate between non-survivors and survivors [AUC 0.631 (0.509–0.752)].

Table 1 Baseline Characteristics of Patients According to Survival Status

	Survivor (n:26)	Non-Survivor (n:132)	*p*
Gender: Female n (%) Male n (%)	16 (61.5%) 10 (38.5%)	78 (59.1%) 54 (40.9%)	0.816
Age (Years)	71.8 ± 8	79.0 ± 7.6	0.000
Diabetes Mellitus, n (%)	10	55	0.761
Hypertension, n (%)	19	98	0.901
Coronary Artery Disease, n (%)	13	81	0.281
Anticoagulant Use (n)	14	78	0.620
PNI	323.6 ± 46	296.2 ± 48.9	0.011
CHADSVASC	4.2 ± 1.8	4.8 ± 1.7	0.100
HAS-BLED	3.3 ± 1.6	3.7 ± 1.4	0.285
EF (%)	50.4±8.7	46.9±11	0.129
Neutrophil, $\times 10^9$ /L	5.9 ± 3.6	6.6 ± 4.1	0.406
Lymphocyte, $\times 10^9$ /L	1.3 ± 0.5	1.1 ± 0.6	0.090
Glucose (mg/dL)	139.3 ± 69.3	139.7 ± 80.9	0.863
Urea (mg/dL)	59.4 ± 31.8	89.6 ± 58.2	0.0021
ALT (U/L)	35.9 ± 76.8	35.7 ± 67.2	0.858
Hs-CRP (mg/L)	58.4 ± 76.1	55.5 ± 63.9	0.856
Albumin (g/dL)	32.4 ± 4.6	29.6 ± 4.9	0.010
Cholesterol (mg/dl)	157.7 ± 45.1	138.2 ± 45.6	0.037
TSH (mIU/L)	2 ± 1.9	2.0 ± 3.8	0.962
Free T3 (mIU/L)	23.1±0.4	2.2±3.8	0.000
Ferritin (ug/L)	116.6 ± 188.2	234.7 ± 342.3	0.211

Note: Statistically significant variables ($p < 0.05$).
Abbreviations: PNI, Prognostic nutritional index; EF, ejection fraction; ALT, Alanine aminotransferase; Hs-CRP, High sensitivity C-reactive protein; TSH, thyroid-stimulating hormone; T3, triiodothyronin.

Table 2 Logistic Regression Analysis for PNI

	Univariate Model					Multivariate Model				
	OR	%95 GA			p	OR	%95 GA			p
Age	1.121	1.057	–	1.188	0.000					
PNI	0.988	0.979	–	0.998	0.013	0.988	0.979	–	0.997	0.012
Urea	1.014	1.002	–	1.026	0.017	1.014	1.002	–	1.026	0.019
Total Cholesterol	0.991	0.983	–	1.001	0.064					
HDL	0.959	0.923	–	0.997	0.035					
Albumin	0.886	0.805	–	0.974	0.012					
Free T3	0.007	0.000	–	0.119	0.001					

Note: Statistically significant variables ($p < 0.05$).
Abbreviations: PNI, Prognostic nutritional index; HDL, High-density lipoprotein, T3, triiodothyronine.

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Table 3 ROC Analysis of Prognostic Value of PNI

		Area Under the Curve		% 95 Confidence Interval			p
PNI		0.662		0.546	–	0.777	0.011
PNI 320 Cut Off value		0.631		0.509	–	0.752	0.039
		Survival (n)	**Non-Survival (n)**				%
PNI	< 320	10	84	Sensitivity			66.1%
	≥ 320	15	43	Positive Predictive Ratio			89.4%
				Specificity			60.0%
				Negative Predictive Ratio			25.9%

At this 320 cut-off value, the sensitivity for predicting mortality was 66.1%, the positive predictive value (PPV) was 89.4%, the specificity was 60.0%, and the negative predictive value (NPV) was 25.9% (Table 3). The ROC curve for the PNI score related to mortality is shown in Figure 1.

Bar graph showing the probability of mortality in low-PNI and high-PNI scores is shown in Figure 2. Average PNI scores in the mortality and non-mortality groups is shown in Figure 3.

Discussion

In this study, we investigated the utility and predictive power of PNI scores in evaluating the all-cause mortality for elderly inpatients with chronic atrial fibrillation in a department of internal medicine services. This study found that each unit increase in the PNI score was associated with a 1.2% decrease in the risk of death. We showed that PNI score were significant independent factor in differentiating deceased patients from survivors.

Mortality rates are significantly higher in elderly patients, largely attributable to the increased comorbidity associated with aging.[7,8] Mortality in the elderly is elevated due to diverse causes, with chronic atrial fibrillation being a prominent contributor; its incidence rises with age, making it a significant source of both mortality and morbidity.[9] Chronic atrial fibrillation elevates mortality through several pathways: by precipitating directly fatal events such as stroke and systemic embolism; by aggravating pre-existing cardiac conditions, notably heart failure; and through its frequent association with other lethal comorbidities.[10]

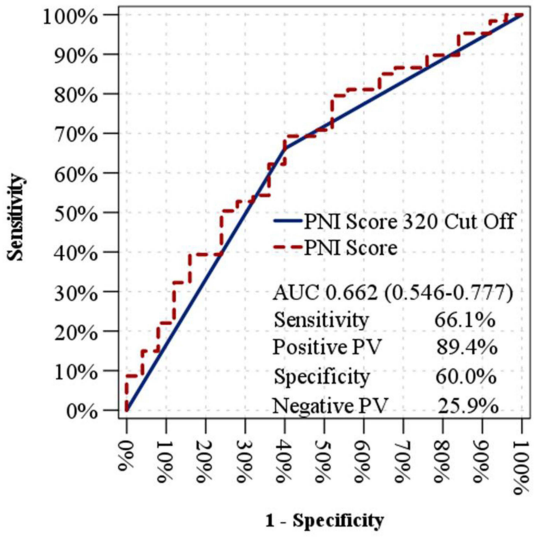

Figure 1 Kaplan-Meier survival curve stratified by PNI cut-off value. Negative predictive value (NPV) and positive predictive value (PPV) for varying prevalence values. NPV and PPV were calculated, based on the observed sensitivity and specificity in the blinded validation set, for varying prevalence values. Red line: the entire validation set for PNI score. (sensitivity: 66.1%, specificity: 60.0%), calculated NPV: 25.9%; calculated PPV: 89.4%.

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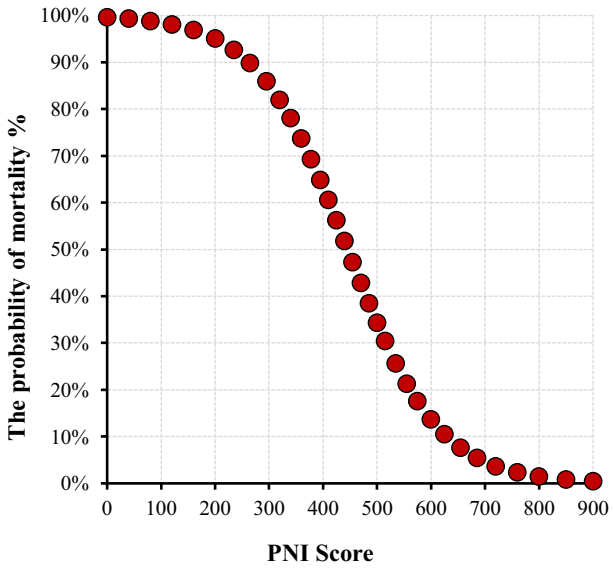

Figure 2 Bar graph showing the probability of mortality in PNI scores.

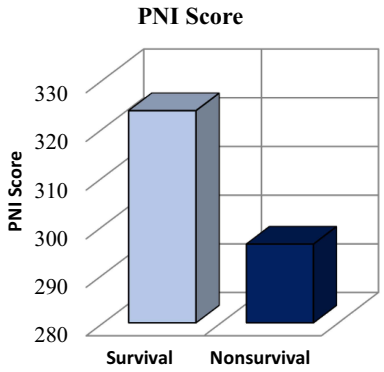

Figure 3 Average PNI scores in the mortality and non-mortality groups.

Nutritional deficiency, defined as an inadequate intake or absorption of essential nutrients, is prevalent among hospitalized patients and is a well-established risk factor for adverse clinical outcomes.[11,12]

The reported prevalence of malnutrition among hospitalized patients varies; for instance, one study in Switzerland found it to be 18.2%, while a 2015 study utilizing the Nutrition Risk Screening (NRS 2002) tool reported a rate of 27.8%.[13,14] In elderly and frail populations, malnutrition disrupts protein and energy homeostasis, induces hormonal changes, and frequently leads to anorexia. The relationship between disease and nutritional status is bidirectional, with malnutrition being strongly associated with increased morbidity, mortality, functional decline, and prolonged hospital stays. This high prevalence has heightened awareness of malnutrition's detrimental impact on patients with chronic diseases.[15] Evidence from randomized clinical trials indicates that targeted nutritional support can reduce the risk of mortality and complications. Consequently, current clinical practice guidelines recommend systematic malnutrition screening, comprehensive nutritional assessment, and the provision of nutritional support for at-risk hospitalized patients.[12,16,17]

İn addition to these established factors, various scoring systems have been developed to predict mortality. The Prognostic Nutritional Index (PNI), a novel malnutrition index, is based on components of laboratory analyses.[18] The PNI can be used for the rapid and effective assessment of a patient's nutritional status, providing a starting point to determine whether a patient is at risk. This enables early diagnosis for nutritional interventions and can assist in formulating treatment strategies. Low scores may indicate that a patient is at risk of malnutrition and highlight the potential need for nutritional support or supplements.

Furthermore, regular assessment of scores can be implemented to monitor the effectiveness of treatment. The PNI can also serve as a valuable tool for predicting patient prognosis. Low scores may be associated with adverse clinical outcomes and can help predict a lower probability of patient survival. In a multicenter study conducted by Soner et al, similar to the present study, a low PNI score was found to be associated with mortality in patients with chronic atrial fibrillation.[19]

From a clinical perspective, the PNI score is a highly cost-effective indicator that can be easily obtained through routine blood screening. These indicators can be used to predict mortality rates in various diseases, though research concerning them remains relatively novel and limited. The PNI score is calculated based on serum albumin and total lymphocyte count (TLC). These parameters are nutrition-dependent markers that provide information about malnutrition status. Furthermore, recent studies have shown that albumin and lymphocyte levels reflect chronic inflammation and immune function, both of which are closely linked to nutritional status.[20] It is also well-established that malnutrition is definitively associated with increased mortality. These nutritional parameters are calculated using objective measures that are low-cost, easy to assess, and simple to implement.

Low serum albumin levels are associated with increased mortality. Mathioudakis et al demonstrated that poor nutritional status, reflected by low albumin levels, is associated with a worse prognosis in COVID-19 patients.[21] Two primary mechanisms may explain this relationship. First, due to its molecular structure, albumin possesses specific antioxidant properties; consequently, hypoalbuminemia can exacerbate cellular oxidative damage and apoptosis. Second, serum albumin levels provide insight into systemic protein metabolism and the degree of inflammation. Studies have also shown that low serum albumin levels may serve as a marker associated with nutritional status and mortality risk.[22,23]

The other parameter comprising the PNI score is the total lymphocyte count (TLC). Recent studies indicate that lymphocyte count serves as a more stable indicator of body composition during long-term follow-up. Furthermore, lower TLC levels have been found to be associated with a diminished immune status, a heightened inflammatory state, as well as higher mortality rates and poorer prognoses in hospitalized patients.[24]

These nutritional parameters are calculated using objective parameters that are low cost, easy to evaluate, and simple.

Clinically, PNI scores are cost-effective and easily obtained through routine blood screening. These indices can be used to predict mortality in various diseases, and studies on these indices are relatively new and limited. Similar to our findings, Suzuki et al identified the PNI score as a predictive marker of in-hospital mortality among elderly COPD patients.[25] Gao et al demonstrated a significant association between the PNI and the prognosis of Esophageal Squamous Cell Carcinoma.[26] Furthermore, Candeloro et al established that a lower PNI score is associated with an increased risk of all-cause mortality in elderly patients hospitalized for acute heart failure.[27] The present study corroborates these findings, as our results also indicate that low PNI scores are significantly associated with mortality.

In this study, we found that the PNI score was an independent predictor of all-cause mortality in elderly hospitalized patients with chronic atrial fibrillation and a high disease burden.

This study possesses notable strengths. Our research is among the first to investigate the efficacy of the PNI score and its prognostic value for all-cause mortality in the long-term follow-up of patients aged 65 and over with chronic AF who were admitted to the internal medicine clinic, who have multiple chronic conditions and are at high risk of mortality. On the other hand, research in this area is new and limited. A review of the literature reveals that the number of studies is low and they are associated with limited indications. The features that distinguish the present study from others are its inclusion of advanced-age patients, long follow-up duration, and coverage of a comorbid patient group.

Our study has several limitations. First, it is a retrospective study. Second, only a limited number of laboratory markers were examined, which may restrict the generalizability of the findings. Further investigation into these markers and their clinical correlations is warranted.

Conclusion

Our study demonstrates the clinical utility of the PNI score as a novel prognostic marker for predicting mortality in hospitalized chronic atrial fibrillation (AF) elderly patients under internal medicine care. In this cohort, a low PNI score independently predicted poor outcomes. As an inexpensive and non-invasive tool, the PNI should be considered for integration into routine clinical practice for risk stratification. Further studies are warranted to validate these findings.

Data Sharing Statement

The private dataset is not publicly accessible due to data privacy and ethical constraints. The data is not permitted to be shared without prior authorization with any other entity.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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