ORIGINAL RESEARCH

DOI: 10.4274/ejgg.galenos.2023.2023-5-2

Eur J Geriatr Gerontol

Can Postoperative 90-Day Complications and Mortality Predict in Elderly Patients with Hip Fracture Using the Geriatric Nutrition Risk Index?

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Abstract

Objective: Malnutrition is a severe cause of increased morbidity and mortality and decreased functionality and quality of life that can be treated and prevented in the geriatric population. The geriatric nutritional risk index is used to determine the nutritional status of the geriatric population. We evaluated the ability of geriatric nutrition risk index (GNRI) values to predict 90-day complications and mortality in elderly patients with hip fractures. Our study hypothesises that low GNRI values can help predict early complications and mortality.

Materials and Methods: Patients over 65 years of age were retrospectively included in this study. Age, gender, height, weight, fracture type, hemogram, and routine biochemical values at the time of admission to the hospital, previous trauma history, and hospitalization within 90 days after surgery were evaluated from the patient's files. Surgical site infection and periprosthetic joint infections that developed in the first 90 days were recorded as early complications.

Results: The study included 1345 patients with a mean age of 80.27±7.45. The 90-day mortality rate of the patients examined in the study was 10.6%. In addition, when we look at early complications, this rate is 4%. Statistically, although there was no significant relationship between early complications and GNRI ($p=0.724$), it was found to be significant with mortality ($p<0.001$).

Conclusion: In hip fractures with high mortality in the geriatric age group, 90-day mortality can be predicted by GNRI score calculated using albumin, height, and weight values.

Keywords: Geriatric, hip fracture, geriatric nutritional risk index

Introduction

Simple falls are common in the elderly population. Studies have shown that approximately 1 in 3 older adults fall at least once yearly, and of those who fall, approximately half fall more than once (1,2). Because of these falls, hip fracture is a common injury in elderly patients. Developing hip fractures, unfortunately, cause high mortality rates, but their frequency is gradually increasing (3). In the literature, mortality rates within 1 year range from 12% to 37% (4,5). The risk of mortality is approximately five times higher for females and approximately eight times higher for males in the first 3 months after fracture (6).

Malnutrition is a severe cause of increased morbidity and mortality and decreased functionality and quality of life that can be treated and prevented in the geriatric population (7). When it occurs with a catabolic response to surgical treatment together with malnutrition, it causes muscle loss and is associated with impaired postoperative rehabilitation, postoperative complications, worse clinical outcomes, longer length of stay, and mortality (8-10).

The geriatric nutrition risk index (GNRI) is used to determine the nutritional status of the geriatric population. It is calculated on the basis of serum albumin levels and the ratio of current body weight to ideal body weight (11). GNRI allows for the early detection and diagnosis of malnutrition, timely and appropriate administration of interventions, and identification of postoperative complications and mortality in patients on dialysis and those with cardiovascular disease (12,13).

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Received: 10.05.2023 **Accepted:** 24.07.2023

Cite this article as: Yerli M, Erkurt N, Bayraktar TO, Saygılı MS, Yüce A, Gürbüz H. Can Postoperative 90-Day Complications and Mortality Predict in Elderly Patients with Hip Fracture Using the Geriatric Nutrition Risk Index?. Eur J Geriatr Gerontol

In this study, we evaluated the ability of GNRI values to predict 90-day complications and mortality in elderly patients with hip fractures. Our study hypothesises that low GNRI values can help predict early complications and mortality.

Materials and Methods

The study was approved by the local institutional review board (date-number: 27/03/2023 - 90) and performed under the ethical standards laid down in the Declaration of Helsinki. All patients provided written informed consent before their inclusion in the study.

This study was planned retrospectively, and patients over the age of 65 years who applied to our hospital between 2014 and 2023 were examined for the study. Age, gender, height, weight, fracture type, hemogram, and routine biochemical values at the time of admission to the hospital, previous trauma history, and hospitalization within 90 days after surgery were evaluated from the patient's files. Patients over 65 who applied with the diagnosis of the femoral neck or intertrochanteric femur fracture were treated surgically; patients whose preoperative height, weight, and albumin values were recorded in their files, and patients with a follow-up period of at least three months were included in the study. Patients under the age of 65 years,patients whose files could not be accessed, and patients with pathological fractures were excluded.

GNRI was calculated using the formula (1,489 x albumin [g/L]) + [41.7 x (body weight/ideal weight) (14). While determining the ideal weight of the patients, a body mass index of 22 kg/m^2 was taken (15). An index of more than 98 was normal; values between 92 and 98 were determined as low risk and <92 as moderate/severe risk (16).

The neutrophil-to-lymphocyte ratio, albumin, C-reaktif protein (CRP) values, and CRP-to-albumin ratio were recorded by examining the hemogram and biochemistry tests taken routinely at the time of admission to the hospital. The Charlson comorbidity index (CCI) and American Society of Anaesthesiologists score were calculated manually based on preoperative comorbidities and patient records (17). Surgical site infection and periprosthetic joint infections that developed in the first 90 days were recorded as early complications.

Statistics

Statistical analyzes were performed using SPSS version 25.0 software. Descriptive data are presented using percentage, mean, and standard deviation. The compliance of the variables with normal distribution was examined using histogram graphs and the Kolmogorov-Smirnov test. The independent group student t-test and one-way ANOVA test were used when evaluating the normally distributed (parametric) variables between the groups. The chi-square test was used to determine the categorical data. Cox regression analysis was performed to determine the relationship between mortality and GNRI class. Cases where the p value was under 0.05, were accepted as statistically significant.

Results

The study included 1,345 patients with a mean age of 80.27±7.45. 62.9% of the cases were female; their demographic data are shown in Table 1. The 90-day mortality rate of the

Table 1. Demographic data of the patients included in the study

	Normal risk (n=523)	Low risk (n=442)	Moderate/severe risk (n=380)	Total (n=1345)	P-value
Age (years)	79.97±7.33	80.61±7.51	80.27±7.54	80.27±7.45	0.416*
Gender					
Female [n (%)]	332 (63.5%)	279 (63.1%)	235 (61.8%)	846 (62.9%)	0.875**
BMI (kg/m^2)	25.67±2.41	25.46±2.48	25.13±2.46	25.45±2.45	**0.004***
GNRI	102.96±3.54	95.11±1.62	86.79±4.37	95.82±7.36	**<0.001***
Length of stay	11.91±5.73	11.99±5.23	12.62±5.51	12.13±5.51	0.124*
CCI	5.89±1.12	5.85±1.15	5.97±1.13	5.9±1.13	0.266*
ASA score [n (%)]					
I	71 (13.6%)	67 (15.2%)	55 (14.5%)	193 (14.3%)	
II	166 (31.7%)	132 (29.9%)	135 (35.5%)	433 (32.2%)	0.663**
III	202 (38.6%)	172 (38.9%)	139 (36.6%)	513 (38.1%)	
IV	84 (16.1%)	71 (16.1%)	51 (13.4%)	206 (15.3%)	
Fracture type [n (%)]					
Femoral neck	206 (39.6%)	153 (34.6%)	118 (31.1%)	477 (35.5%)	**0.032****
Intertrochanteric	317 (60.6%)	289 (65.4%)	262 (68.9%)	868 (64.5%)	
Mortality [n (%)]					
Releated reason	7 (9.1%)	8 (12.9%)	6 (8.5%)	21 (10%)	0.657**
Unreleated reason	70 (90.9%)	54 (87.1%)	65 (91.5%)	189 (90%)	

*One-way ANOVA test, **Pearson Chi-Square test, BMI: Body mass index, GNRI: Geriatric nutritional risk index, CCI: Charlson comorbidity index, ASA: American Society of Anaesthesiologists

patients examined in the study was 10.6%. In addition, when we look at early complications, this rate is 4%. Statistically, although there was no significant relationship between early complications and the geriatric nutrition risk index, it was found to be significant with mortality (Table 2). A statistically significant difference was found as a result of cox regression analysis for the relationship between mortality and GNRI class (p=0.039, Figure 1).

It was observed that the albumin and hemoglobin values of the patients included in the study and CCI were significantly lower in the 90-day mortality group. Age, CRP values, neutrophil to lymphocyte and CRP to albumin ratios were significantly higher in the mortality group (Table 3).

In the study, low albumin was found to be statistically significant in patients with early complications. CRP, neutrophil to lymphocyte ratio, and CRP to albumin ratio were found to be statistically significantly higher in the group with complications. There was no statistically significant difference between the two groups in the hemoglobin values of the patients included in the study (Table 4).

Table 2. Complication and 90-day mortality rates of the patients included in the study

	Normal risk (n=523)	Low risk (n=442)	Moderate/severe risk (n=380)	Total (n=1345)	P-value
Complication n (%)	20 (3.8%)	21 (4.8%)	18 (4.7%)	59 (4.4%)	0.724*
90-day mortality n (%)	39 (7.5%)	40 (9%)	64 (16.8%)	143 (10.6%)	**<0.001***

*Pearson chi-square test

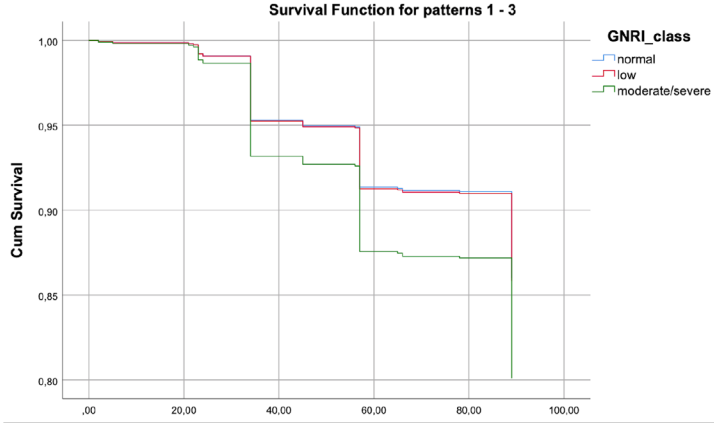

Figure 1. Cox regression analysis for the relationship between mortality and GNRI class

GNRI: Geriatric nutrition risk index

Table 3. Comparison of 90-day mortality and blood values of the patients included in the study

	Survived (n=1202)	Died (n=143)	P-value
Albumin (g/L)	37.26±4.54	32.33±4.55	**<0.001***
Haemoglobin (g/dL)	11.71±1.28	10.53±0.65	**<0.001***
CRP (mg/dL)	67.84±10.34	84.74±4.46	**<0.001***
Neutrophil to lymphocyte ratio	4.58±0.65	5.73±0.87	**<0.001***
CRP to albumin ratio	18.5±3.75	27.74±4.11	**<0.001***

*Student t-test, CRP: C-reactive protein

Table 4. Comparison of complications and blood values of the patients included in the study

	No-complicated (n=1202)	Complicated (n=143)	P-value
Albumin (g/L)	36.66±4.91	34.09±3.77	**<0.001***
Haemoglobin (g/dL)	11.53±1.27	11.34±1.25	0.177*
CRP (mg/dL)	70.13±11.53	75.26±8.88	**<0.001***
Neutrophil to lymphocyte ratio	4.74±0.75	5.1±1.33	**<0.001***
CRP/albumin ratio	19.6±4.84	22.41±4.13	**<0.001***

*Student t-test, CRP: C-reactive protein

Discussion

Nutritional status is essential for mortality in patients with various diseases (18-20). Studies examining the mortality rates of patients with hip fractures have shown it to be associated with malnutrition (21,22). This study found a significant relationship between malnutrition and 90-day mortality in the geriatric population after hip fracture.

The literature has reported that wound infection is more common due to surgical treatment in patients with hypoalbuminemia due to malnutrition (21,22). This study found no significant relationship between early complications and malnutrition.

Because the neutrophil-to-lymphocyte ratio, CRP, and CRP-to-albumin ratios indicate inflammatory responses, it is available in the literature where it is used to predict complications and mortality in various diseases (23-25). The results of this study were statistically significant both in the group with early complications and in the group with 90-day mortality, consistent with the literature.

This study has several limitations. First, the study is retrospective. Second, the functional status of the patients included in the study was not evaluated in the postoperative period. Finally, only the GNRI is used to assess malnutrition, and other scoring systems are not used. Despite these limitations, this study has the highest number of patients in the literature. More precise data can be obtained using studies with more patients using other malnutrition scoring systems to be prospectively conducted in the future.

Conclusion

In hip fractures with high mortality in the geriatric age group, 90-day mortality can be predicted by GNRI score calculated using albumin, height, and weight values.

Ethics

Ethics Committee Approval: The study was approved by the local institutional review board (date-number: 27/03/2023 - 90) and performed under the ethical standards laid down in the Declaration of Helsinki.

Informed Consent: All patients provided written informed consent before their inclusion in the study.

Peer-review: Externally peer reviewed.

Authorship Contributions

Surgical and Medical Practices: M.Y., N.E., T.O.B., M.S.S., A.Y., H.G., Concept: M.Y., N.E., T.O.B., M.S.S., A.Y., H.G., Design: M.Y., N.E., T.O.B., M.S.S., A.Y., H.G., Data Collection or Processing: M.Y., N.E., T.O.B., M.S.S., A.Y., Analysis or Interpretation: M.Y., N.E., T.O.B., M.S.S., A.Y., H.G., Literature Search: M.Y., N.E., T.O.B., M.S.S., A.Y., H.G., Writing: M.Y., N.E., T.O.B., M.S.S., A.Y., H.G.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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