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Contents

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From The Editor In Chief

The multiple problems of older individuals in this aging world are well defined. Approaches to these problems can only achieve success if they are based on the results of scientific researches conducted in this field. Unfortunately, there is still concern that older persons are underrepresented in scientific researches, which is considered a form of discrimination.

Although there are some barriers for the elderly to enroll in clinical researches, factors that facilitate their participation include: 1) approval of family members, 2) the positive attitude of the medical team toward the research, 3) the approach of the person who communicates with the patient about the study, and 4) factors such as the patient's high level of education, which positively affect participation.

Unfortunately, there is no "standardized methodology" for including older patients with comorbidities and disabilities in clinical trials. It is important to design a protocol which is carefully prepared and equipped with sufficient references that takes ethical aspects into account.

In terms of compliance with the research, study protocols should be appropriate for the admission of the elderly. They should not include complex and difficult applications, and the research should not impose an economic burden on the patient.

The approach to be applied after the research should be designed at the very beginning of the study and approved by the ethics committee. At the end of the study, elderly patients should be informed about the results of the research, monitored for unwanted side effects for a while longer, and referred for medically necessary treatments.

Yeşim GÖKÇE KUTSAL

ORIGINAL ARTICLE

THE PREDICTIVE POWER OF SIMPLE SYSTEMIC INFLAMMATORY PARAMETERS FOR IN–HOSPITAL MORTALITY IN ELDERLY PATIENTS

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Abstract

Introduction: We evaluated the predictive power of systemic inflammatory parameters, including the neutrophil/lymphocyte ratio, C-reactive protein/albumin ratio, monocyte/eosinophil ratio, and platelet/lymphocyte ratio, for all-cause in-hospital mortality in elderly.

Materials and Method: This single–center and retrospective study enrolled 46,563 patients aged ≥65 years who presented to the emergency department due to various complaints from June 2019 to June 2022. We evaluated the demographics, clinical characteristics, laboratory data, and clinical outcomes of the patients.

Results: A total of 3,385 hospitalized patients, 1,808 males and 1,577 females, were included in the study. The average age was 76.25±7.35 years. The overall mortality rate was 11.73%. Nonsurvivors had significantly elevated neutrophil/lymphocyte, C-reactive protein/albumin, monocyte/eosinophil, and platelet/lymphocyte ratios compared to survivors (p=0.0001 for all comparisons). Elevated neutrophil/lymphocyte and C-reactive protein/albumin ratios were determined as independent predictors of mortality. A neutrophil/lymphocyte ratio ≥9.41 had 46.97% sensitivity and 79.99% specificity for predicting mortality. While the positive predictive value was 23.7%, the negative predictive value was 91.9%. Additionally, a C-reactive protein/albumin ratio ≥13.18 was identified as the cut-off for mortality, with 57.07% sensitivity and 69.91% specificity. Its positive and negative predictive values were 20.1% and 92.5%, respectively.

Conclusion: Mean serum neutrophil/lymphocyte and C-reactive protein/albumin ratios on hospital admission were associated with all-cause mortality in hospitalized patients aged ≥65 years. However, their sensitivity and positive predictive value were relatively low. Nevertheless, negative predictive value for both were significantly high. This implies that these parameters could be used to determine the elderly at a lower risk of mortality.

Keywords: Aged; Biomarkers; Decision Making; Mortality.

INTRODUCTION

The global population is gradually aging. Aged patients visit the emergency department (ED) more frequently than young people do (1). The elderly typically presents to the ED with atypical complaints and findings. Due to comorbidities and polydrug use, the diagnosis and treatment of these individuals may be delayed (1, 2). Furthermore, older patients are at high risk of recurrent ED visits, hospitalization, morbidity, and mortality (3). Although numerous risk scores have been developed to identify at-risk individuals, none offer highly accurate predictions.

Infective parameters, such as neutrophil/lymphocyte ratio (NLR), C-reactive protein/albumin (CRP/Alb) ratio, monocyte/eosinophil ratio (MER), and platelet/lymphocyte ratio (PLR), are simple, rapidly accessible, and widely available markers of inflammatory status. NLR has been linked to the prognosis of infectious disorders, such as sepsis and bacteremia (4). NLR has also been associated with the clinical outcomes of noncommunicable diseases, such as acute myocardial infarction and stroke (5, 6). In a study of 5,166 elderly patients, CRP/Alb ratio was indicative of all-cause in-hospital mortality (7). Chen et al. reported that a low MER is linked to mortality and a poor prognosis in cases of acute ischemic stroke (8). Age-related chronic inflammation is a risk factor for morbidity and mortality in the elderly (9). Infective parameters, such as NLR, PLR, MER, and CRP/Alb ratios, may be predictive of mortality and morbidity in the elderly.

We investigated the predictive power of NLR, PLR, MER, and CRP/Alb serum administration at admission with respect to all-cause in-hospital mortality in elderly patients presenting to the ED.

MATERIALS AND METHOD

Ethics committee approval and patient consent

This study was conducted in accordance with the 1989 Declaration of Helsinki and was approved by the institutional review board of Haseki Research and Training Hospital, Istanbul, Türkiye (approval no. 2022/198). The institutional review board did not request patient consent to access medical records since there were no potentially identifiable markers or patient identifiers.

Study design and setting

This single-center, retrospective, and observational study enrolled 46,563 consecutive patients aged ≥ 65 years who presented to the ED from June 2019 to June 2022. Data on patients aged ≥ 65 years who visited the ED with any medical problem were collected from the hospital's automated records and archives. We assessed the patients' demographic information (age and sex), initial complaints and diagnoses, comorbidities, vital signs, laboratory parameters (leukocyte, neutrophil, lymphocyte, eosinophil, monocyte, and platelet counts and CRP and albumin levels), clinical outcomes (discharge, hospitalization, intensive care unit admission, and mortality), and Glasgow Coma Scale (GCS) and quick Sequential Organ Failure Assessment (Q-SOFA) scores. The patients were divided into survivors and nonsurvivors, and the serum systemic inflammatory markers of the two groups at admission were compared to identify factors associated with mortality.

Outcome definition

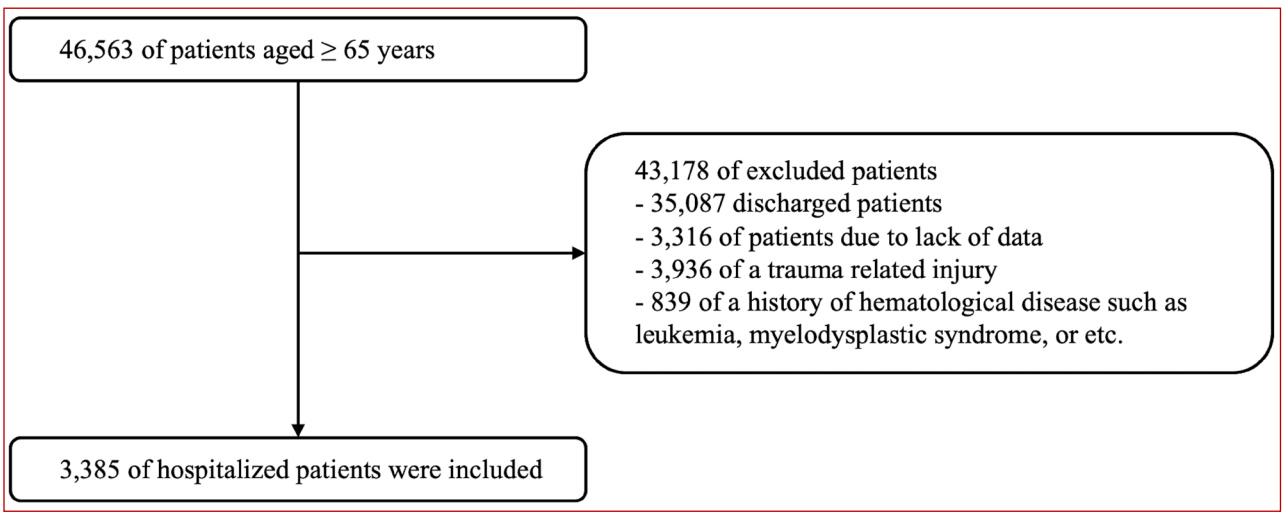
We evaluated the abilities of the NLR, PLR, MER, and CRP/Alb values to predict all-cause in-hospital mortality in elderly patients.

Study population and sampling

To reduce selection bias, all patients who met the eligibility criteria during the study period were included. We enrolled 46,563 consecutive adult patients aged ≥ 65 years who visited the ED with any medical problem. Of these individuals, 35,087 discharged patients were excluded. A further 3,316

were excluded because their data could not be accessed. A total of 3,936 patients were excluded because of trauma-related injuries and 839 patients because of a history of hematological diseases, such as leukemia or myelodysplastic syndrome. Ultimately, 3,385 patients were analyzed (Figure 1).

Figure 1. Flowchart.



Statistical analysis

Data analysis was conducted using SPSS software (version 15.0 for Windows; SPSS Inc., Chicago, IL). Categorical variables (sex and age) are expressed as numbers (n) and percentages (%). Numerical data are expressed as means, standard deviations, median, and interquartile range (IQR). Intergroup comparisons (survivors vs. non–survivors) were conducted by chi–squared and Student's independent t–tests for normally distributed variables (e.g., sex and age) and Mann–Whitney U–test for non–normally distributed variables (e.g., leukocyte, neutrophil, lymphocyte, and thrombocyte counts). Logistic Regression analysis was conducted to determine the factors associated with mortality. Receiver operating characteristic analysis was performed to determine the NLR, PLR, MER, and CRP/Alb cut–off values. The alpha significance level was set at $p < 0.05$.

RESULTS

This study involved 3,385 hospitalized patients, comprising 1,808 males (53.41%) and 1,577 females (46.59%), with an average age of 76.25 ± 7.35 years. The overall mortality rate was 11.73% (n = 397). Table 1 lists the patients' demographic and clinical characteristics. The sex and age of the survivors and nonsurvivors differed significantly ($p = 0.025$ and $p = 0.0001$, respectively). The nonsurvivors had a significantly higher Q-SOFA score and a lower GCS score than the survivors ($p = 0.0001$ for both comparisons). Moreover, the nonsurvivors had significantly elevated NLR, MER, PLR, and CRP/Alb values compared with the survivors ($p = 0.0001$ for all comparisons).

Multivariate logistic regression analysis identified increased age (odds ratio [OR]: 1.05, 95% confidence interval [CI]: 1.03–1.07; $p = 0.0001$), male gender (OR: 1.52, 95% CI: 1.14–2.01; $p = 0.009$), higher Q-SOFA (OR: 4.72, 95% CI: 3.68–6.03; $p = 0.0001$) score, and

Table 1. Comparison of demographic, clinical and laboratory characteristics in surviving and non–surviving patients.

		Survivors (n = 2,988)	Non–survivors (n = 397)	p*
Characteristic		**n (%)**	**n (%)**	
Sex	Male	1,575 (52.71)	233 (58.69)	0.025
	Female	1,413 (47.29)	164 (41.31)	
		mean ± SD	**mean ± SD**	
Age, years		75.97 ± 7.25	78.29 ± 7.85	0.0001
Lengths of stay		11.56 ± 6.00	8.62 ± 7.10	0.0001
Q-SOFA		0.62 ± 0.90	2.38 ± 0.73	0.0001
GCS		13.46 ± 2.80	7.95 ± 3.48	0.0001
Hemoglobin (g/dL)		13.37 ± 2.62	12.97 ± 2.81	0.004
WBC (10^3/uL)		11.14 ± 5.11	13.71 ± 6.77	0.0001
Neutrophil (10^3/uL)		8.44 ± 4.88	10.92 ± 6.46	0.0001
Lymphocyte (10^3/uL)		1.86 ± 1.25	1.88 ± 1.99	0.736
Thrombocyte (10^3/uL)		244.67 ± 87.12	236.69 ± 97.75	0.091
Monocyte (10^3/uL)		0.68 ± 0.37	0.77 ± 0.54	0.016
Eosinophil (10^3/uL)		0.12 ± 0.16	0.07 ± 0.13	0.0001
CRP (mg/L)		52.15 ± 77.54	99.99 ± 103.91	0.0001
		Median (IQR)	**Median (IQR)**	
NLR		4.41 (2.55–8.38)	8.02 (3.55–16.61)	0.0001
MER		8.60 (3.56–38.05)	44.37 (8.5–144.29)	0.0001
PLR		144.17 (98.47–220.7)	173.24 (98.1–314.95)	0.0001
CRP/Alb		4.16 (1.26–18.31)	17.70 (3.58–56.75)	0.0001

Note: Data are expressed as numbers (n) and percentages (%), means, standard deviations (SD), median, and interquartile range (IQR). *Intergroup comparisons (Survivors vs. non–survivors) were conducted using chi–squared and Student's independent t–tests for normally distributed data (e.g., sex and age) and the Mann–Whitney U test for non–normally distributed data (e.g., leukocyte, hemoglobin neutrophil, lymphocyte, thrombocyte counts, and etc.).

Abbreviations: Q–SOFA, quick Sequential Organ Failure Assessment; GCS, Glasgow Coma Scale; WBC, white blood cell; CRP, C–reactive protein; NLR, neutrophil/lymphocyte ratio; MER, monocyte/eosinophil ratio; PLR, platelet/lymphocyte ratio; CRP/Alb, C–reactive protein/albumin ratio.

Table 2. Multivariate logistic regression analysis to determine mortality.

	p	OR	95% CI
Age, years	0.0001	1.05	1.03–1.07
Sex (male)	0.009	1.52	1.14–2.01
Q-SOFA	0.0001	4.72	3.68–6.03
GCS	0.127	0.92	0.88–1.02
NLR	0.003	1.03	1.01–1.05
MER	0.004	1.00	1.00–1.01
PLR	0.241	1.00	0.98–1.01
CRP/Alb	0.0001	1.02	1.01–1.03

Abbreviations: OR, odds ratio; CI, confidence interval; Q–SOFA, quick Sequential Organ Failure Assessment; GCS, Glasgow Coma Scale; NLR, neutrophil/lymphocyte ratio; MER, monocyte/eosinophil ratio; PLR, platelet/lymphocyte ratio; CRP/Alb, C–reactive protein/albumin ratio.

elevated NLR (OR: 1.03, 95% CI: 1.01–1.05; p = 0.003) and CRP/Alb (OR: 1.02, 95% CI: 1.01–1.03; p = 0.0001) values as independent predictors of mortality in hospitalized patients aged ≥ 65 years admitted to the ED with any medical problem (Table 2).

An NLR ≥ 9.41 had 46.97% sensitivity and 79.99% specificity for predicting mortality, with an area under the curve (AUC) of 0.651 (95% CI: 0.635–0.667). While the positive predictive value (PPV) was 23.7%, the negative predictive value (NPV) was 91.9%. In addition, a CRP/Alb ≥ 13.18 was identified as the cutoff for mortality, with 57.07% sensitivity and 69.91% specificity (AUC: 0.769, 95% CI: 0.741–0.796). Its PPV and NPV were 20.1% and 92.5%, respectively (Table 3 and Figure 2).

Table 3. Systemic inflammatory parameters for determining mortality in elderly.

Criterion	AUC	SE	95% CI	Sensitivity	Specificity	PPV	NPV	LR (+)
NLR ≥ 9.41	0.651	0.016	0.635-0.667	46.97	79.99	23.7	91.9	2.35
MER ≥ 31.11	0.689	0.015	0.673-0.704	57.32	73.09	22.0	92.8	2.13
PLR ≥ 199.71	0.564	0.016	0.547-0.581	44.19	71.65	17.1	90.6	1.56
CRP/Alb ≥ 13.18	0.668	0.016	0.652-0.684	57.07	69.91	20.1	92.5	1.90

Abbreviations: AUC, Area under the curve; SE, Standard error; CI, Confidence interval; PPV, Positive predictive value; NPV, Negative predictive value; LR (+), Likelihood Ratio; NLR, neutrophil/lymphocyte ratio; MER, monocyte/eosinophil ratio; PLR, platelet/lymphocyte ratio; CRP/Alb, C–reactive protein/albumin ratio.

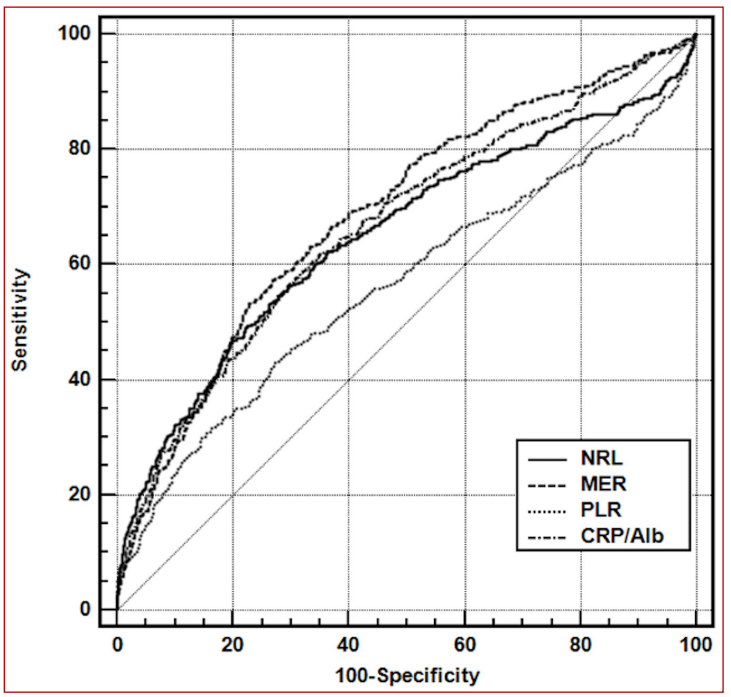


Figure 2. Specificity and sensitivity of the serum systemic inflammatory parameters including NLR, PLR, MER, and CRP/Alb values, for determining the mortality in hospitalized patients aged 65 and older using ROC curves.

Abbreviation: NLR, neutrophil/lymphocyte ratio; MER, monocyte/eosinophil ratio; PLR, platelet/lymphocyte ratio; CRP/Alb, C–reactive protein/albumin ratio.

DISCUSSION

Our findings demonstrate the possibility of using NLR, PLR, MER, and CRP/Alb to predict all-cause in-hospital mortality in elderly patients admitted to the ED.

Elderly patients frequently present to the ED with unusual symptoms, comorbidities, drug use, and delayed diagnosis (1, 2). Emergency physicians need fast, simple, low-cost, repeatable, and widely available markers of medical conditions in the elderly. Ratio indices are increasingly used to predict the clinical outcomes of patients who present to the ED. For example, NLR, PLR, MER, and CRP/Alb are easily calculated and predictive of clinical outcomes (4–11). The key finding of this study was that NLR and CRP/Alb values were independent predictors of mortality in hospitalized patients aged ≥ 65 years; however, their sensitivity and PPV values were relatively low.

NLR has been linked to the clinical outcomes of various diseases and may be a prognostic indicator of infectious disorders (4–6, 10, 11). NLR was independently associated with 28-day mortality in patients with severe sepsis and septic shock (10). In addition, NLR was associated with a high mortality rate in acute myocardial infarction cases (5). In a study with 5,056 patients, NLR was related to poor outcomes in unspecified critical illnesses (11). Similarly, our study demonstrated that NLR at ED admission was independently predictive of all–cause mortality in patients aged ≥ 65 years. The mechanism underlying the relationship between NLR and noncommunicable disease mortality is unclear. Song et al. hypothesized that NLR is associated with mortality because it represents an imbalance in the inflammatory response triggered by acute illness (9). Chronic inflammation, which has been linked to aging, is another possibility (12). Although NLR was found to be associated with mortality in the hospitalized elderly in our study, its sensitivity and PPV were relatively low. In a study by Song et al., an NLR > 6 demonstrated a sensitivity of 62.86% and a specificity of 69.93% for predicting mortality (9). Reflecting our findings, the sensitivity and specificity of NLR in their study were not sufficient for clinical decision-making.

PLR and MER values are associated with prognosis and clinical outcomes in various clinical conditions (8, 13–15). In a study involving 280 patients with acute ischemic stroke, a high MER was related to poor clinical outcomes and mortality (8). MER has been correlated with short- and long-term mortality in ST-elevation myocardial infarction (13). In addition, an elevated MER predicts long-term mortality in pulmonary embolism patients (14). Moreover, mortal patients with acute exacerbation of chronic obstructive pulmonary disease had elevated NLR and PLR values (15). Similarly, in our study, nonsurvivors had significantly elevated MER and PLR values compared with survivors, suggesting that these markers may be useful for predicting clinical outcomes. However, multivariate logistic regression analysis indicated that neither PLR nor MER can reliably and independently predict mortality in hospitalized elderly patients.

An elevated level of CRP, an acute-phase reactant, has been linked to the prognosis of ischemic diseases, infections, and malignancies (16). Serum albumin level is a sensitive indicator of nutritional status. Hypoalbuminemia is associated with increased hospital mortality among older patients (17). CRP and albumin are prognostic markers in various clinical scenarios, but their combination can provide inflammatory and nutritional information. Among 811 elderly patients, CRP/Alb ratio was found to be predictive of all-cause mortality (7). Kaplan et al. (18), Sogut et al. (19), and Bai et al. (20) reported that CRP/Alb value is a significant predictor of a poor clinical outcome in patients with acute pancreatitis, acute coronary syndrome, and neurocritical illness, respectively. In our study, a mean CRP/Alb ≥ 13.18 was identified as the cutoff for predicting mortality, with 57.07% sensitivity and 69.91% specificity among patients aged ≥ 65 years admitted to the ED with any medical condition.

The strength of our study is the large sample size (46,563 patients). However, this study also has several limitations. This was a retrospective observational study conducted at a single center, which increases the possibility of undiscovered confounding factors and restricts the generalizability of the findings. In addition, the primary outcome was all-cause in-hospital mortality. Despite the large sample size, there were only 397 mortalities, and we could not analyze the causes of mortality. These issues should be considered in future studies.

CONCLUSIONS

Our study identified elevated NLR and CRP/Alb values as potential systemic inflammatory parameters for predicting in-hospital mortality in patients aged ≥ 65 years. However, the PPV for both NLR and CRP/Alb was found to be low, suggesting that these parameters may not be strong indicators of mortality. Moreover, the sensitivity and specificity values for both parameters were not reliable enough for use in clinical decision-making. Nevertheless, the NPVs for NLR and CRP/Alb were significantly high. This implies that NLR values < 9.41 and CRP/Alb values < 13.18 might be safely used by clinicians to identify elderly patients at a lower risk of in-hospital mortality.

Statement of Ethics: This study was approved by the Institutional Review Board of Haseki Research and Training Hospital, Istanbul, Turkey (approval no. 2022/198).

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REFERENCES

1. Hofman MR, van den Hanenberg F, Sierevelt IN, et al. Elderly patients with an atypical presentation of illness in the emergency department. Neth J Med 2017; 75 (6): 241-246.
2. Samaras N, Chevalley T, Samaras D, et al. Older patients in the emergency department: a review. Ann Emerg Med 2010; 56 (3): 261-269. (DOI: 10.1016/j.annemergmed.2010.04.015).
3. Strange GR, Chen EH. Use of emergency departments by elder patients: a five–year follow–up study. Acad Emerg Med 1998; 5 (12): 1157-1162. (DOI: 10.1111/j.1553-2712.1998.tb02688.x).
4. Liu X, Shen Y, Wang H, Ge Q, Fei A, Pan S. Prognostic Significance of Neutrophil–to–Lymphocyte Ratio in Patients with Sepsis: A Prospective Observational Study. Mediators Inflamm 2016; 2016: 8191254. (DOI: 10.1155/2016/8191254).
5. Ayça B, Akın F, Celik O, et al. Neutrophil to Lymphocyte Ratio is Related to Stent Thrombosis and High Mortality in Patients with Acute Myocardial Infarction. Angiology 2015; 66 (6): 545-552. (DOI: 10.1177/0003319714542997).
6. Xue J, Huang W, Chen X, et al. Neutrophil–to–Lymphocyte Ratio is a Prognostic Marker in Acute Ischemic Stroke. J Stroke Cerebrovasc Dis 2017; 26 (3): 650-657. (DOI: 10.1016/j.jstrokecerebrovasdis.2016.11.010).
7. Oh J, Kim SH, Park KN, et al. High–sensitivity C–reactive protein/albumin ratio as a predictor of in–hospital mortality in older adults admitted to the emergency department. Clin Exp Emerg Med 2017; 4 (1): 19-24. (DOI: 10.15441/ceem.16.158).
8. Chen Y, Ren J, Yang N, et al. Eosinophil–to–Monocyte Ratio is a Potential Predictor of Prognosis in Acute Ischemic Stroke Patients After Intravenous Thrombolysis. Clin Interv Aging 2021; 16: 853-862. (DOI: 10.2147/CIA.S309923).
9. Song H, Kim HJ, Park KN, Kim SH, Oh SH, Youn CS. Neutrophil to lymphocyte ratio is associated with in–hospital mortality in older adults admitted to the emergency department. Am J Emerg Med 2021; 40: 133-137. (DOI: 10.1016/j.ajem.2020.01.044).
10. Hwang SY, Shin TG, Jo IJ, et al. Neutrophil–to–lymphocyte ratio as a prognostic marker in critically–ill septic patients. Am J Emerg Med 2017; 35 (2): 234-239. (DOI: 10.1016/j.ajem.2016.10.055)

11. Salciccioli JD, Marshall DC, Pimentel MA, Santos MD, Pollard T, Celi LA, et al. The association between the neutrophil–to–lymphocyte ratio and mortality in critical illness: an observational cohort study. Crit Care 2015; 19 (1): 13. (DOI: 10.1186/s13054-014-0731-6).

12. Bandeen–Roche K, Walston JD, Huang Y, Semba RD, Ferrucci L. Measuring systemic inflammatory regulation in older adults: evidence and utility. Rejuvenation Res. 2009; 12 (6): 403-410. (DOI: 10.1089/rej.2009.0883).

13. Deng X, Wang X, Shen L, et al. Association of eosinophil–to–monocyte ratio with 1–month and long–term all–cause mortality in patients with ST–elevation myocardial infarction undergoing primary percutaneous coronary intervention. J Thorac Dis 2018; 10 (9): 5449-5458. (DOI: 10.21037/jtd.2018.09.27).

14. Külahçıoğlu Ş, Tokgöz HC, Akbal ÖY, et al. Eosinophil–to–Monocyte Ratio as a Candidate for a Novel Prognostic Marker in Acute Pulmonary Embolism: Is it a Consumptive Mechanism? Anatol J Cardiol 2022; 26 (9): 717-724. (DOI: 10.5152/AnatolJCardiol.2022.1780).

15. Yao C, Liu X, Tang Z. Prognostic role of neutrophil–lymphocyte ratio and platelet–lymphocyte ratio for hospital mortality in patients with AECOPD. Int J Chron Obstruct Pulmon Dis 2017; 12: 2285-2290. (DOI: 10.2147/COPD.S141760).

16. Emerging Risk Factors Collaboration; Kaptoge S, Di Angelantonio E, et al. C–reactive protein concentration and risk of coronary heart disease, stroke, and mortality: an individual participant meta–analysis. Lancet 2010; 375 (9709): 132-140. (DOI: 10.1016/S0140-6736(09)61717-7).

17. Hannan JL, Radwany SM, Albanese T. In–hospital mortality in patients older than 60 years with very low albumin levels. J Pain Symptom Manage 2012; 43 (3): 631-637. (DOI: 10.1016/j.jpainsymman.2011.04.009).

18. Kaplan M, Ates I, Akpinar MY, et al. Predictive value of C–reactive protein/albumin ratio in acute pancreatitis. Hepatobiliary Pancreat Dis Int 2017; 16 (4): 424-430. (DOI: 10.1016/S1499-3872(17)60007-9).

19. Söğüt Ö, Akdemir T, Can MM. Prognostic value of the C–reactive protein to albumin ratio in patients undergoing primary percutaneous coronary intervention for ST–segment elevation myocardial infarction. Turk J Med Sci 2021; 51 (3): 1281-1288. (DOI: 10.3906/sag-2003-188).

20. Bai M, Wu Y, Ji Z, et al. Prognostic value of C–reactive protein/albumin ratio in neurocritically ill patients. Minerva Anestesiol 2019; 85 (12): 1299-1307. (DOI: 10.23736/S0375-9393.19.13625-5).

ORIGINAL ARTICLE

THE IMPACT OF MALNUTRITION AND FRAILTY ON MORBIDITY AND MORTALITY IN GERIATRIC INTERNAL INTENSIVE CARE PATIENTS: A PROSPECTIVE STUDY

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Abstract

Introduction: This study aims to assess the impact of malnutrition and frailty on morbidity and mortality in geriatric patients in the internal intensive care unit.

Materials and Method: The study is prospective, descriptive, and cross-sectional in design, conducted at intensive care unit. Demographic data, anthropometric measurements, clinical evaluations, and laboratory parameters are recorded for each patient. Various nutritional screening tools such as the modified NUTRIC score, Subjective Global Assessment, Nutritional Risk Screening, Mini Nutritional Assessment - Short Form, and frailty assessment scales like Edmonton Frailty Scale and Clinical Frailty Scale are used.

Results: The patients were divided into two groups: survivors and non-survivors. The mean Nutritional Risk Screening -2002 score was 5.20±0.70 for the survivors group and 6.15±0.57 for the non-survivors group ($p<0.001$). The mean Mini Nutritional Assessment - Short Form score was 8.20±0.82 for the survivors group and 6.46±1.02 for the non-survivors group ($p<0.001$). According to the modified NUTRIC score, 40 patients (97.6%) in the non-survivors group were at high risk of malnutrition ($p<0.001$). According to the Edmonton Frailty Score, in the non-survivors group, 1 patient (2.4%) was classified as light frail, 21 patients (51.2%) as mild frail, and 19 patients (46.3%) as severe frail ($p<0.001$). The mean Clinical Frailty Score was 5.89±0.99 for the survivors group and 8.0±0.0 for the non-survivors group ($p<0.001$).

Conclusion: Due to the significant prevalence of malnutrition and frailty in the critical patient population being monitored in the intensive care unit, both conditions should be regularly assessed.

Keywords: Intensive Care Unit; Malnutrition; Frailty; Mortality; Geriatrics.

INTRODUCTION

The global demographic landscape is undergoing a notable shift with a marked increase in the elderly population, as highlighted by data from the World Health Organization. Projections suggest that the proportion of individuals aged 60 and above will escalate from 12% in 2015 to 22% by 2050 (1). This demographic trend translates into a corresponding rise in admissions of vulnerable and frail elderly individuals to Intensive Care Units (ICU) (2). Notably, alongside the surge in patient numbers, there is a discernible elongation in the duration of ICU stays. Specifically, individuals aged seventy-five and older account for a staggering 70-fold increase in ICU bed days per annum compared to their counterparts under sixty-five years old (3). The utilization of substantial ICU resources, encompassing bed occupancy and financial outlays, by the elderly population underscores the persistent challenge confronting ICU personnel in managing geriatric patients (4).

In the elderly patient population, various factors such as cognitive impairment, comorbidities, polypharmacy, depression, and anorexia can compromise oral intake and disrupt nutrition (5). Moreover, this demographic is particularly susceptible to the detrimental effects of malnutrition, attributed to both the depletion of the body's homeostatic reserves due to chronic illnesses and the heightened stress levels associated with acute ailments (5). While elderly patients in ICU receive treatment for their primary conditions, the significance of adequate nutrition may be overlooked, exposing them to the risk of malnutrition upon ICU admission and throughout subsequent care periods (6). The catabolic processes induced by inadequate nutrition can exacerbate existing risks of morbidity and mortality (4). These factors underscore the necessity of conducting regular nutritional risk assessments in geriatric ICU patients.

Despite the availability of various nutrition screening tools to identify malnutrition risk, determining the "ideal choice" for assessing inadequate nutrition remains unclear (7). Nonetheless, the practical utility of these tools in clinical settings continues to be investigated, particularly in the elderly patient population, where challenges related to cooperation may arise (8).

Frailty stands out as a significant concern rendering the geriatric population vulnerable (9). It manifests as a multidimensional biological syndrome characterized by a decline in the organism's resilience to stress and physiological reserves due to cumulative impairment across multiple physiological systems (10) . Diagnosis of frailty in a patient necessitates meeting three criteria from decreased grip strength, diminished energy levels in daily activities, slowness in walking, reduced physical activity, and unintended weight loss (9). Despite extensive study, the relationship between frailty and inadequate nutrition in the elderly remains ambiguous (11). Regular assessments for both malnutrition and frailty in geriatric patients are crucial for early diagnosis and intervention for both conditions (11).

We have two main aims in this research. First; The aim is to determine before ICU malnutrition and frailty rates in patients who do not have surgical pathology and are admitted to the internal medicine ICU. Our second aim is to determine the relationship between malnutrition and frailty detected in the internal medicine patient group and mortality and morbidity. Thus, we aim to overcome the difficulties in assessing the impact of the pre-intensive care health status of geriatric patients on intensive care outcomes by assessing the risk of malnutrition and frailty.

MATERIALS AND METHOD

Study design

This study is a prospective, descriptive, and cross-sectional investigation. Approval for the study was obtained from the Local Ethics Committee (approval

number: 2022/40-02). Among the geriatric patients followed in a three-month period at the Faculty of Medicine, Internal Medicine ICU, ninety six patients who met the inclusion criteria were accepted into the study. Exclusion criteria comprised patients under 65 years old, individuals with psychiatric conditions or difficulties in cooperation, those unable to provide a nutritional history due to impaired consciousness, and patients receiving enteral or parenteral nutrition before ICU admission. Informed consent was obtained from eligible patients before their participation in the study. The cases were divided into two groups: survivors and non-survivors. Throughout their ICU stay, patients' nutritional regimens were administered in accordance with the primary physician's orders based on their clinical status, with no modifications made for the study.

Study population

Demographic information including age, gender, and comorbidities of consenting patients were documented. Patient heights were measured by the ICU team. Patients' weights upon ICU admission, weight fluctuations, and percentage changes over the previous six months were obtained from conscious patients directly and from their relatives in the case of unconscious individuals. The clinical status of each patient within the first 24 hours of ICU admission was assessed using the Acute Physiology and Chronic Health Evaluation II (APACHE II), Sequential Organ Failure Assessment (SOFA) scoring systems and Charlson comorbidity index. Additionally, pre-ICU hospitalization duration, ICU length of stay, and ICU mortality rates were recorded.

Evaluation of biochemical parameters and screening malnutrition

Hospital records and laboratory data for each patient were reviewed, and the following laboratory parameters upon initial admission to the ICU were documented: complete blood count, serum electrolyte levels (sodium, potassium, calcium), arterial blood gas analysis (including PaO_2, $PaCO_2$, FiO_2, PO_2/FiO_2, HCO_3, lactate levels, and SpO_2 values). Furthermore, C-Reactive Protein(CRP), procalcitonin, alanine aminotransferase (ALT), aspartate aminotransferase (AST), serum creatinine (Cr), and blood urea nitrogen (BUN) values were recorded.

In this study, in addition to anthropometric measurements, Modified NUTRIC score, Subjective Global Assesment (SGA), Nutritional Risk Screening (NRS-2002) and Mini Nutrition Evaluation Screening Form (MNA-SF) were used for screening patients for malnutrition.

The Edmonton Frailty Scale (EFS)

The Edmonton Frailty Scale comprises 9 components, encompassing cognitive function, overall health status, self-perception of health, functional independence, social support, polypharmacy, mood, urinary incontinence, and functional performance, with a maximum score of 17 (12). In our study, two components requiring patient performance were adapted to suit ICU patients. Unlike the frailty phenotype, it also assesses cognitive function. Based on the total score obtained, individuals were categorized regarding frailty as follows: 0-5 points: Robust, not frail; 6-7 points: Vulnerable; 8-9 points: Mildly frail, pre-frail; 10-11 points: Moderately frail; 12-17 points: Severely frail. The suitability and validity of the EFS for assessing frailty in hospitalized patients have been demonstrated (12).

Clinical Frailty Scale (CFS)

Frailty phenotype and cumulative frailty index models pose challenges for bedside evaluations and critical patients (13). One of the scales developed in response is the Clinical Frailty Scale,

which correlates with frailty assessment based on the Fried frailty phenotype criteria. Clinicians score elderly individuals from 1 (very fit) to 9 (terminally ill) based on their clinical judgment. As the score increases, the degree of frailty escalates. A score ≥5 indicates "frailty" (13).

Evaluation of complications

Following admission to the ICU, the presence, type, and severity of various complications occurring during patient follow-up were documented. These complications were defined based on objective criteria, including pulmonary complications (excluding pneumonia and atelectasis), sepsis (with positive culture), pneumonia (evidenced by infiltration on new chest X-ray, purulent sputum ± positive culture), and delirium (characterized by acute-onset neuropsychiatric symptoms and signs disrupting global brain function). Additionally, patients' ICU length of stay and ICU mortality were recorded.

Statistical analysis

SPSS 24.0 (Chicago, IL) software was utilized for statistical analysis. Data with categorical values (BMI, TSF, MAMC, age, weight, height) were presented as mean ± standard deviation (SD). The Mann-Whitney U test was employed to compare anthropometric and systemic evaluation methods in the study. Frequency data were presented as number and percentage (%), and the chi-square test was used to compare malnutrition status and frequency data. Spearman's correlation test was employed to determine correlations. A p-value <0.05 was considered statistically significant.

RESULTS

Ninety six patients who met the inclusion criteria were accepted into the study. In the survivors group, the mean age was 75.5±7.29, while in the non-survivors group, it was 78.6±8.36 (p=0.74). In terms of weight, the mean weight of the survivors group was 73.09±8.64, while the non-survivors group was 68.5±6.33 (p=0.004). The mean APACHE II score was 13±3.11 for the survivors group and 23.68±3.04 for the non-survivors group (p<0.001). Non-survivors had longer hospital stays before ICU admission and longer ICU length of stay (p=0.004, p=0.001, respectively). The characteristics of the entire cohort are given in Table 1. There was no statistically significant difference in laboratory findings between the survivors and non-survivors groups (Table 2).

Evaluation of anthropometric measurements

When both groups were evaluated in terms of anthropometric measurements, statistically significant differences were found in TSF (triceps skinfold thickness), MAC (mid-arm circumference), and MAMC (mid-arm muscle circumference) between the survivors and non-survivors groups (p<0.001) (Table 3).

Evaluation of nutritional tools

The mean NRS-2002 score was 5.20±0.70 for the survivors group and 6.15±0.57 for the non-survivors group (p<0.001). The mean MNA-SF score was 8.20±0.82 for the survivors group and 6.46±1.02 for the non-survivors group (p<0.001). The mean SGA score was 5.87±0.66 for the survivors group and 3.51±1.09 for the non-survivors group (p<0.001). The mean mNUTRIC score was 3.49±0.63 for the survivors group and 5.68±0.65 for the non-survivors group (p<0.001) (Table 1 and Table 3).

Evaluation of frailty assessment tools

The mean Edmonton Frailty Score was 8.22±1.95 for the survivors group and 11.37±0.88 for the non-survivors group (p<0.001). The mean Clinical Frailty Score was 5.89±0.99 for the survivors group and 8.0±0.0 for the non-survivors group (p<0.001) (Table 1 and Table 3).

Table 1. Characteristics of the patients, nutrition screening tools and frailty assessment index

Characteristic		All Patients (n =96)	Survivors (n = 55)	Non-survivors (n = 41)	p- value
Age (mean±standart deviation)		76.9±7.87	75.5±7.29	78.6±8.36	0.740*
Age (range)	Youngest old (65-74 years) Middle old (75-84 years) Oldest old (over 85 years)	45 (46.9%) 34 (35.4%) 17(17.7%)	30 (54.5%) 18 (32.7%) 7 (12.7%)	15 (36.6%) 16 (39%) 10 (24.4%)	0.159*
Weight (mean±standart deviation)		71.15±8.03	73.09±8.64	68.5±6.33	**0.004***
Height (cm) (mean±standart deviation)		167±5.47	166.75±5.73	167.61±5.12	0.432*
BMI (mean±standart deviation)		25.5±2.98	26.29±2.99	24.44±2.64	**0.002***
Sex	Female Male	48 (50 %) 48 (50 %)	27 (49.1%) 28 (50.9%)	21 (51.2%) 20(48.8%)	0.837*
APACHE II		17.56±6.21	13±3.11	23.68±3.04	**<0.001****
SOFA score		7.56±2.91	5.44±1.61	10.41±1.46	**<0.001****
Length of hospital stay before ICU (days)		5.81±3.37	4.95±3.45	6.98±2.92	**0.004****
Length of ICU days		11.31± 5.54	9.38±3.74	13.9±6.49	**<0.001****
BMI	< 25 25-30 > 30	47 (49%) 41 (42.7%) 8 (8.3%)	22(40%) 27 (49.1%) 6 (10.9%)	25 (61%) 14 (34.1%) 2 (4.9%)	0.109**
NRS malnutrition	Yes No	95 (99%) 1 (1%)	54 (98.2%) 1 (1.8%)	41 (100%) 0 (0%)	0.573**
MNA malnutrition	Yes No	46 (47.9%) 0 (52.1%)	9 (16.4%) 46 (83.6%)	37 (90.2%) -4 (9.8%)	**<0.001****
SGA	No malnutrition risk Mild malnutrition Severe malnutrition	42 (43.8%) 45 (46.9%) 9 (9.4%)	41 (74.5%) 14 (25.5%) 0 (0%)	1 (2.4%) 31 (75.6%) 9 (22%)	**<0.001****
mNutrıc score	Low risk High risk	55 (57.3%) 41 (42.7%)	54 (98.2%) 1 (1.8 %)	1 (2.4%) -40 (97.6%)	**<0.001****
Edmonton Frailty Scale	Non frail Prefrail Light frail Mild frail Severe frail	2 (2.1%) 18 (18.8%) 23 (24%) 33 (34.4%) 20 (20.8%)	2 (3.6%) 18 (32.7%) 22 (40%) 12 (21.8%) 1 (1.8%)	0 (0%) 0 (0%) 1 (2.4%) 21 (51.2%) 19 (46.3%)	**<0.001****
Clinic Frail Score	4 5 6 7 8	1 (1%) 23 (24%) 16 (16.7%) 11 (11.5%) 45 (46.9%)	1 (1.8%) 23 (41.8%) 16 (29.1%) 11 (20%) 4 (7.3%)	0 (0%) 0 (0%) 0(0%) 0 (0%) 41 (100%)	**<0.001****

All values are expressed as numbers (percentages) or median (interquartile range).
Abbreviations:BMI: Body mass index, 1. APACHE II: Acute physiology and chronic health evaluation II, 2. CCI: Charlson Comorbidity Index, SOFA:Sequential Organ Failure Assessment score, MNA-SF=Mini Nutritional Assessment—Screening Form, NRS-2002=Nutritional Risk Screening
1. On the day of ICU admission
2. Includes hematological and solid organ malignancies
*: Mann–Whitney U test, Data presented as median ± standard deviation
**: Chi Square test. Data presented as frequency and percentance

Table 2. Laboratory findings of patients

Laboratuary Findings	All Patients (n =96)	Survivors (n = 55)	Non-survivors (n = 41)	p- value*
White blood cell count, 10^3 /mL	12069.47±6131.84	11656.36±6653.53	12637.5±5370.7	0.086
Hemoglobin, g/dL	12.13±2.05	12.33±2.11	11.5±1.98	0.166
Platelet, 10^3 /mL	300812.5±205127.5	321690.9±256484.8	272804.88±98596.5	0.795
Sodium, mmol/L	142.9±6.85	142.7±6.65	143.1±7.20	0.758
Potassium, mmol/L	4.43±0.77	4.51±0.82	4.32±0.70	0.280
Calcium, mmol/L	7.86±0.62	7.84±0.60	7.89±0.66	0.719
AST, IU/L	82.85±102.29	86.05±114.44	78.56±84.48	0.932
ALT, IU/L	54.35±70.15	58.13±85.91	49.29±40.95	0.747
Blood urea nitrogen, mg/dL	42.19±30.91	41.4±30.16	43.24±32.23	0.994
Creatinine, mg/dL	2.09±0.98	1.06±0.65	3.37±1.12	0.356
Glucose, mg/dL	146.42±60.57	143.89±67.3	149.8±50.76	0.257
Albumin, g/dL	1.64±0.78	1.48±0.61	1.84±0.94	0.350
C-reative protein	165.68± 107.52	149.73±100.40	187.07± 114.16	0.108
Procalsitonin	3.82±11.25	3.91±10.74	3.70±12.06	0.131
pH	7.35±0.13	7.37±0.14	7.38±0.12	0.703
pO_2	70±27.63	71.38±32.75	68.66±18.99	0.813
pCO_2	38.01±13.14	36.93±11.48	39.46±15.13	0.830
Lactat	2.86±1.41	2.39±1.59	2.13±1.11	0.472
HCO_3	22.11±4.87	22.15±5.43	22.18±4.05	0.824
SpO_2	90.55±5.58	90.85±5.11	90.15±6.19	0.885

Abbreviations: ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, LDH:Lactate dehydrogenase. PaO2 : Arterial partial oxygen pressure, PaCO2:Arterial partial carbon dioxide pressure, HCO3: Serum Bicarbonate,

* (Mann–Whitney U test). Data presented as median ± standard deviation

Table 3. Values of Nutrition screening tools, Frailty assessment index, Anthropometric measurements.

	All Patients (n=96)	Survivors (n=55)	Nonsurvivors (n=41)	p value*
NRS	5.60±0.81	5.20±0.70	6.15±0.573	**<0.001**
MNA-SF	7.46±1.25	8.20±0.82	6.46±1.02	**<0.001**
SGA	4.86±1.46	5.87±0.66	3.51±1.09	**<0.001**
mNUTRIC score	4.43±1.20	3.49±0.63	5.68±0.65	**<0.001**
Edmonton Frailty score	9.56±2.23	8.22±1.95	11.37±0.88	**<0.001**
Clinic frailty score	6.79±1.28	5.89±0.99	8.0±0.00	**<0.001**
TSF	119.26±106.8	128.39±110.92	107.24±101.29	**<0.001**
MAC	27.60±3.96	29.50±3.10	25.03±3.54	**<0.001**
MAMC	202.23±28.61	214.8±23.99	202.23±28.61	**<0.001**
CCI	8.64±2.23	7.16±1.39	10.51±1.51	**<0.001**

MNA-SF=Mini Nutritional Assessment—Screening Form, NRS-2002=Nutritional Risk Screening, MAC=mid-arm circumference, MAMC=mid-arm muscle circumference (in cm), TSF=triceps skin fold.

*: Mann-whitney U test

Correlations of nutrition screening tools with complications

Positive correlations were found between NRS-2002 (r = 0.614), mNUTRIC score (r=0.866), Edmonton Frailty Score (r=0.763), Clinical Frailty Score (r = 0.848), APACHE II (r=0.854), and CCI (r=0.778) with ICU mortality, and a negative correlation was found between SGA (r=-0.312) and ICU mortality (p<0.05). ICU length of stay showed positive correlations with NRS-2002 (r = 0.322), mNUTRIC score (r=0.310), Clinical Frailty Score (0.303), APACHE II (r=0.403), SOFA (r=0.405), and CCI (r=0.397), and a negative correlation with SGA (r=-0.813) (p<0.05). Delirium showed positive correlations with mNUTRIC score (r=0.272), Edmonton Frailty Score (r=0.264), Clinical Frailty Score (r = 0.278), SOFA (r=0.208), and CCI (r=0.289), and a negative correlation with SGA (r=-0.813) (p<0.05). The correlations of nutrition screening tools, frailty assessment scores, and critical illness scores with ICU complications are given in Table 4.

Table 4. Corelations of Nutrition screening tools, Frailty assessment index with complications.

	Mortality in ICU	Length of Stay ICU	Delirium	Pressure Ulcer	ARF	Septic Shock	ARDS
NRS-2002	0.614**	0.322**	0.128	0.399**	0.246*	0.516*	0.243*
SGA	-0.312**	-0.813**	-0.251*	-0.496**	-0.307**	-0.574**	-0.381**
MNA-SF	0.000	0.002	0.014	0.000	0.002	0.000	0.000
mNUTRIC score	0.866**	0.310**	0.272**	0.494**	0.384**	0.617**	0.443**
Edmonton Frailty score	0.763**	0.194	0.264**	0.343**	0.283**	0.491**	0.387**
Clinic Frail score	0.848**	0.303**	0.278**	0.416**	0.329**	0.552**	0.387**
APACHE II	0.854**	0.403**	0.163	0.432**	0.350**	0.625**	0.361**
SOFA Score	0.841	0.405**	0.208*	0.420**	0.337**	0.602**	0.392**
CCI	0.778**	0.397**	0.289**	0.464**	0.311**	0.535**	0.393**

*p<0.05 (Spearman correlation test).
**p< 0.001 (Spearman correlation test).

Table 5. Corelations of Nutritional screening tools, Frailty assesment index and Critical ilness scores with each others.

	NRS-2002	SGA	MNA-SF	mNUTRIC Score	Edmonton Frailty Score	Clinic Frailty Score	APACHE II	SOFA scoe	CCI
NRS-2002	-----	-0.653**	-0.744**	0.598**	0.443**	0.500**	0.634**	0.537**	0.533**
SGA	-0.633**	-----	0.770**	-0.797**	-0.690**	-0.741**	-0.681**	-0.620**	-0.573**
MNA-SF	-0.744**	0.770**	-----	-0.716**	0.579**	-0.640**	-0.642**	-0.584**	-0.607**
mNUTRIC score	0.598**	-0.797**	-0.716**	----	0.667**	0.783**	0.802**	0.752**	0.674**
Edmonton Frailty score	0.443**	-0.690**	-0.579**	0.667**	----	0.786**	0.626**	0.620**	0.507**
Clinic Frailty score	0.500**	-0.741**	-0.640**	0.783**	0.786**	----	0.705**	0.727**	0.638**
APACHE II	0.634**	-0.681**	-0.642**	0.802**	0.626**	0.705**	-----	0.912**	0.653**
SOFA score	0.537**	-0.620**	-0.584	0.772	0.620**	0.727**	0.912**	-----	0.661**
CCI	0.533**	-0.573**	-0.607**	0.674**	0.507**	0.638**	0.653**	0.661**	-----

*p<0.05 (Spearman correlation test).
**p< 0.001 (Spearman correlation test).

Correlations of nutritional screening tools, Frailty assessment scores, and Critical illness scores with each other

NRS-2002 showed a positive correlation with mNUTRIC score (r=0.598) and negative correlations with SGA (r=-0.653) and MNA-SF (r=-0.744) ($p<0.05$). SGA showed positive correlations with MNA-SF (r=0.770) and negative correlations with mNUTRIC score (r=-0.797) ($p<0.05$). MNA-SF showed a negative correlation with mNUTRIC score (r=-0.716) ($p<0.05$). The Edmonton Frailty Score showed a positive correlation with the Clinical Frailty Score (r=0.786) ($p<0.05$). The correlations among nutrition screening tools, frailty assessment scores, and critical illness scores are presented in Table 5.

DISCUSSION

In this study, we explored the correlation between malnutrition and frailty scores with morbidity and mortality among 96 geriatric patients admitted to the internal medicine ICU for non-surgical reasons during a three-month period. Our findings revealed a statistically significant relationship between disease severity, body mass index, anthropometric measurements, and intensive care mortality rates. Moreover, we observed a significant association between malnutrition rates, as assessed by MNA-SF, SGA, and mNUTRIC score, and ICU mortality rates. Utilizing the Edmonton Frailty Scale, we identified a notable correlation between moderate and severe frailty and mortality rates. Likewise, there was a statistically significant association between increasing clinical frailty index scores and mortality rates. These results underscore the importance of considering both malnutrition and frailty assessments in the management and prognosis of geriatric patients in intensive care settings.

One of the primary objectives of this research was to ascertain the prevalence of malnutrition upon admission of elderly patients to ICU and to investigate its association with ICU mortality. Malnutrition has been linked to various adverse health outcomes, including declines in functional status, muscle strength, bone mass, immunity, cognitive function, wound healing, surgical recovery, as well as elevated hospital readmission rates and mortality (14). According to our study findings, 47.9% of geriatric patients admitted to the ICU were identified as malnourished based on the Mini Nutritional Assessment (MNA), 56.3% according to the Subjective Global Assessment (SGA), and 42.7% according to the modified Nutrition Risk in the Critically ill (mNUTRIC) score. Consistent with our findings, previous study reported malnutrition rates ranging from 37% to 50% among patients admitted to medical and surgical ICUs using SGA classifictions (3). However, it is noteworthy that this study encompassed a cohort with younger patients. Malnutrition rates can vary according to the clinical characteristics of patients followed ICU. In another previous study, they classified 26% of ICU patients as moderately malnourished and 11% as severely malnourished based on SGA and found SGA to be applicable in critically ill patients (15). One of the reasons for the different results between our study and this study is that the study population consisted of younger patients with predominantly surgical pathologies rather than geriatric internal medicine patients. Evaluating the nutritional status of elderly patients is challenging. In a study by Atalay et al. (16), the prevalence of malnutrition assessed using SGA in patients over 70 years old was found to be 33.6%. According to the authors' knowledge of the literature, no study has been found that demonstrates the prevalence of malnutrition in the geriatric patient group aged 65 and older who are admitted to the internal medicine ICU without any surgical pathologies. However, it is known that 20-50% of all hospitalized geriatric patients are affected by malnutrition (17). Unfortunately, the nutritional status of critical patients deteriorates rapidly after admission to the ICU, and the effects of inadequate nutrition are added to severe stress-

induced catabolism (17). This explains the high rate of malnutrition in geriatric patients in our study.

In our study, we observed a significant correlation between malnutrition rates assessed by the MNA, SGA, and mNUTRIC scores and ICU mortality rates. Similarly, a review encompassing 1168 articles investigating the relationship between malnutrition and adverse clinical outcomes in the ICU revealed that malnutrition was associated with an elevated risk of prolonged ICU length of stay, readmission, and hospital mortality (18). Furthermore, in critically ill COVID-19 patients diagnosed with malnutrition using SGA and NRS-2002, increased mortality rates were also observed (19). These findings underscore the clear association between inadequate nutrition and adverse clinical outcomes among hospitalized patients (5).

Another objective of our study was to ascertain the levels of frailty and their association with mortality among patients aged 65 and older presenting with internal pathologies upon admission to the ICU. The impact of frailty on elderly patients has predominantly been investigated in community-based studies, with fewer studies focusing on hospitalized or ICU-bound elderly individuals (20). A review analyzing studies examining frailty in community settings reported a prevalence ranging from 4% to 59.1% among a total of 61,500 patients (20). Frailty is often undiagnosed condition in hospitalized elderly patients, with prevalence ranging from 27% to 80% (21). Failure to consider and recognize frailty may contribute to the difficulty in diagnosing it.

Our study has demonstrated a lower prevalence of frailty compared to studies conducted in the community. Particularly among patients followed in the ICU, frailty appears to be more common, as observed this study. In the study we present, 20 patients (20.8%) were categorized as severely frail according to the Edmonton Frailty Scale, while 45 patients (46.9%) were classified as severely frail according to the Clinical Frailty Scale. Consistent with our findings, frailty is more commonly observed in patients under ICU monitoring. A meta-analysis investigating the impact of frailty on ICU outcomes reported a frailty prevalence of 33.1% among 3030 geriatric patients with internal and surgical pathologies, and 30% among all patients (9).

Assessing patients' frailty alongside critical illness assessment scores upon ICU admission can be advantageous in evaluating cognitive, mobility, functionality, and social aspects (22). In a study conducted among patients aged 60 and older in the ICU, the prevalence of frailty was measured at 21.3% using a frailty index (22). In the United States, among 52 intensive care patients aged 80 and over, the prevalence of frailty according to th e Clinical Frailty Scale (CFS) was 88.5%, with an average CFS score of 5.8 (23). While aging does not inherently imply frailty, the prevalence of frailty tends to increase with age (23). The inclusion of patients aged 80 and over may have contributed to the observed high prevalence. Moreover, the prevalence can vary depending on the frailty scale utilized. In a multicenter community study conducted in our country, the prevalence of frailty was 27.8% according to the frailty index and 10% according to the Frail scale (24). However, significant differences in prevalence among the same patient group were not observed between the Edmonton Frailty Scale and the Clinical Frailty Scale in our study; both scales exhibited statistically significant correlations.

In the presented study, we observed a statistically significant association between the presence of frailty upon admission to the ICU and an elevated risk of mortality. Among deceased patients, 46.3% exhibited severe frailty, and 51.2% displayed moderate frailty according to the Edmonton Frailty Scale ($p<0.001$). Similarly, in a review examining the relationship between frailty and mortality, being frail was demonstrated to increase the risk of hospital mortality by 1.71 times, long-term mortality risk by 1.53 times, and ICU mortality risk by 1.51 times (9). Previous studies have identified frailty as an

independent risk factor for ICU mortality, length of stay, and readmission (4). A study reporting an ICU mortality rate of 69% found a correlation between frailty and SOFA and APACHE II scores (25). Given the association between frailty and mortality, assessing frailty alongside ICU scores may be crucial in evaluating these patients.

Our study has certain limitations. Being conducted in a single center's ICU, the generalizability of the results may be limited. The utilization of malnutrition and frailty assessment tools in the geriatric population, which may exhibit less cooperation, and reliance on information provided by family members in cases of insufficient data could introduce bias.

Nonetheless, our study also possesses strengths. It was conducted in a highly homogeneous patient group admitted to the internal ICU without surgical pathology. We extensively evaluated this patient group using clinical, anthropometric measurements, and comprehensive screening tools. To the best of our knowledge, this study is the first to address this issue in this patient population.

Our findings indicate the prevalence of malnutrition and frailty in a significant portion of ICU-monitored patients. In ICU settings, the focus often centers on conditions such as respiratory failure, septic shock, and acute kidney injury, potentially overlooking malnutrition and frailty in elderly patients and their associated adverse outcomes. Both conditions may be as critical as or even more important than the acute issue leading to ICU admission.

In conclusion, evaluating the impact of pre-intensive care health status on ICU outcomes among elderly patients poses challenges. Assessing the risk of malnutrition and frailty could provide a method to address this challenge. Therefore, regular assessment of nutrition status and frailty in critically ill patients is imperative.

REFERENCES

1. World Health Organization. Global Health and Ageing (e-book) NIH Publication;2022. (internet). Available from:https://www.who.int/news-room/fact-sheets/detail/ageing-and-health. Accessed:13.04.2024
2. Sheean PM, Peterson SJ, Chen Y, et al. Utilizing multiple methods to classify malnutrition among elderly patients admitted to the medical and surgical intensive care units (ICU). Clin Nutr. 2013;32(5):752-7. (DOI:10.1016/j.clnu.2012.12.012).
3. Sheean PM, Peterson SJ, Gurka DP, Braunschweig CA. Nutrition assessment: the reproducibility of subjective global assessment in patients requiring mechanical ventilation. Eur J Clin Nutr. 2010;64(11):1358-64.(DOI:10.1038/ejcn.2010.154).
4. Bagshaw SM, Webb SA, Delaney A, et al. Very old patients admitted to intensive care in Australia and New Zealand: a multi-centre cohort analysis. Crit Care. 2009;13(2):R45.(DOI:10.1186/cc7768).
5. de Sire A, Ferrillo M, Lippi L, et al. Sarcopenic Dysphagia, Malnutrition, and Oral Frailty in Elderly: A Comprehensive Review. Nutrients. 2022;14(5). (DOI:10.3390/nu14050982).
6. Eraslan Doganay G, Cirik MO. Determinants of prognosis in geriatric patients followed in respiratory ICU; either infection or malnutrition. Medicine (Baltimore). 2021;100(36):e27159.(DOI:10.1097/md.0000000000027159).
7. Serón-Arbeloa C, Labarta-Monzón L, Puzo-Foncillas J, et al. Malnutrition Screening and Assessment. Nutrients. 2022;14(12).(DOI:10.3390/nu14122392).
8. Correia M, Perman MI, Waitzberg DL. Hospital malnutrition in Latin America: A systematic review. Clin Nutr. 2017;36(4):958-67.(DOI:10.1016/j.clnu.2016.06.025).
9. Muscedere J, Waters B, Varambally A, et al. The impact of frailty on intensive care unit outcomes: a systematic review and meta-analysis. Intensive Care Med. 2017;43(8):1105-22.(DOI:10.1007/s00134-017-4867-0).
10. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci. 2001;56(3):M146-56.(DOI:10.1093/gerona/56.3.m146).
11. Roberts S, Collins P, Rattray M. Identifying and Managing Malnutrition, Frailty and Sarcopenia in the Community: A Narrative Review. Nutrients. 2021;13(7).(DOI:10.3390/nu13072316).

12. Rolfson DB, Majumdar SR, Tsuyuki RT, Tahir A, Rockwood K. Validity and reliability of the Edmonton Frail Scale. Age Ageing. 2006;35(5):526-9.(DOI:10.1093/ageing/afl041).

13. Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. Lancet. 2013;381(9868):752-62.(DOI:10.1016/s0140-6736(12)62167-9).

14. Agarwal E, Miller M, Yaxley A, Isenring E. Malnutrition in the elderly: a narrative review. Maturitas. 2013;76(4):296-302.(DOI:10.1016/j.maturitas.2013.07.013).

15. Sungurtekin H, Sungurtekin U, Oner O, Okke D. Nutrition assessment in critically ill patients. Nutr Clin Pract. 2008;23(6):635-41.(DOI:10.1177/0884533608326137).

16. Atalay BG, Yagmur C, Nursal TZ, Atalay H, Noyan T. Use of subjective global assessment and clinical outcomes in critically ill geriatric patients receiving nutrition support. JPEN J Parenter Enteral Nutr. 2008;32(4):454-9.(DOI:10.1177/0148607108314369).

17. Dent E, Hoogendijk EO, Visvanathan R, Wright ORL. Malnutrition Screening and Assessment in Hospitalised Older People: a Review. J Nutr Health Aging. 2019;23(5):431-41.(DOI:10.1007/s12603-019-1176-z).

18. Lew CCH, Yandell R, Fraser RJL, et al. Association Between Malnutrition and Clinical Outcomes in the Intensive Care Unit: A Systematic Review [Formula: see text]. JPEN J Parenter Enteral Nutr. 2017;41(5):744-58.(DOI:10.1177/0148607115625638).

19. Martinuzzi ALN, Manzanares W, Quesada E, et al. Nutritional risk and clinical outcomes in critically ill adult patients with COVID-19. Nutr Hosp. 2021;38(6):1119-25.(DOI:10.20960/nh.03749).

20. Collard RM, Boter H, Schoevers RA, Oude Voshaar RC. Prevalence of frailty in community-dwelling older persons: a systematic review. J Am Geriatr Soc. 2012;60(8):1487-92.(DOI:10.1111/j.1532-5415.2012.04054.x).

21. Kahlon S, Pederson J, Majumdar SR, et al. Association between frailty and 30-day outcomes after discharge from hospital. Cmaj. 2015;187(11):799-804.(DOI:10.1503/cmaj.150100).

22. Ritt M, Schwarz C, Kronawitter V, et al. Analysis of Rockwood et Al's Clinical Frailty Scale and Fried et Al's Frailty Phenotype as Predictors of Mortality and Other Clinical Outcomes in Older Patients Who Were Admitted to a Geriatric Ward. J Nutr Health Aging. 2015;19(10):1043-8.(DOI:10.1007/s12603-015-0667-9).

23. Orsini J, Blaak C, Shamian B, et al. Assessing the utility of ICU admission for octogenarians. Aging Clin Exp Res. 2016;28(4):745-51.(DOI:10.1007/s40520-015-0462-9).

24. Akın S, Mazıcıoglu MM, Mucuk S, et al. The prevalence of frailty and related factors in community-dwelling Turkish elderly according to modified Fried Frailty Index and FRAIL scales. Aging Clin Exp Res. 2015;27(5):703-9.(DOI:10.1007/s40520-015-0337-0).

25. Kizilarslanoglu MC, Civelek R, Kilic MK, et al. Is frailty a prognostic factor for critically ill elderly patients? Aging Clin Exp Res. 2017;29(2):247-55.(DOI:10.1007/s40520-016-0557-y).

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ORIGINAL ARTICLE

A SINGLE-CENTER COMPARATIVE STUDY OF ENDARTERECTOMY AND STENTING FOR SYMPTOMATIC CAROTID ARTERY DISEASE: DECISION-MAKING PROCESSES AND EARLY TO MID-TERM OUTCOMES

Abstract

Introduction: Ischemic stroke constitutes a significant burden on global health. Carotid artery atherosclerosis is a significant contributor to the occurrence of ischemic strokes. Both carotid endarterectomy and stenting are viable treatment options for symptomatic carotid artery disease, yet the optimal choice between them remains debated, particularly in elderly patients with multiple comorbidities. This study aims to compare decision-making processes and early to mid-term outcomes between carotid endarterectomy and carotid artery stenting in elderly symptomatic carotid artery disease patients.

Materials and Method: A total of 88 symptomatic carotid artery disease patients (carotid endarterectomy: n=35, mean age: 71.72±7.87 years; carotid artery stenting: n=53, mean age: 70.64±7.46 years) were retrospectively analyzed.

Results: No significant differences were observed in demographic characteristics between carotid endarterectomy and stenting groups. Chronic renal disease was more prevalent in the carotid endarterectomy group. Carotid artery stenting patients had a higher prevalence of 50–69% stenosis and less plaque ulceration. Complication rates were comparable between groups, with longer intensive care and hospitalization durations in the carotid endarterectomy group. Mid-term mortality rates and major complications did not significantly differ between groups.

Conclusion: Both carotid endarterectomy and carotid artery stenting are effective treatments for symptomatic carotid artery disease. Despite differences in lesion characteristics, complication rates were similar between carotid endarterectomy and carotid artery stenting. This study emphasized the efficacy of a full cooperation between the cardiovascular surgery and neurology teams through an in-depth evaluation of each of the patients and the creation of individualized treatment strategies that optimized overall outcomes.

Keywords: Aged; Endarterectomy; Carotid; Carotid Stenosis; Stents.

INTRODUCTION

Stroke, the primary cause of permanent disability and mortality worldwide, predominantly arises from ischemic etiologies, which account for approximately 88% of cases, while hemorrhagic stroke constitutes the remaining 12% (1). Large vessel atherosclerosis, particularly in the extracranial internal carotid artery, is responsible for a considerable number of ischemic stroke cases. Indeed, approximately 20% of all ischemic strokes are caused by carotid artery disease (CAD) and the thromboembolism associated with atherosclerosis (2). The risk of stroke increases as the severity of the stenosis in the carotid arteries increases. Recent studies have found that in asymptomatic patients with 50% carotid artery stenosis, the occurrence of ipsilateral stroke was 4% in five years, while if the stenosis was 70%, the risk was doubled in the same period (3). High-risk patients have an advanced level of stenosis and multiple risk factors, which is why the treatment of stenoses above 50% is clinically important. Age (65 years and older), male gender, smoking, coronary artery disease, hypertension, and hyperlipidemia are the most important clinical risk factors for CAD (4, 5).

Medical treatment, balloon angioplasty, stent placement, and carotid endarterectomy (CEA) surgery are the current treatment options for CAD. Since the provision of medical treatment alone to symptomatic patients does not produce the desired result, surgical treatment has been a focus of interest, and given technological developments in recent decades, carotid artery stent (CAS) placement has become the treatment modality of choice. CAS was first used in the 1980s but has become quite common in recent years. The fact that other surgical treatment options have some known limitations, including wound infection, peripheral nerve injury, challenging anatomical localization, and difficult management of patients with additional comorbidities, has contributed to the popularization of CAS treatment.

Symptomatic carotid disease is defined as focal neurological symptoms that may be associated with atherosclerotic CAD and may include one or more transient ischemic attacks characterized by sudden onset focal neurological dysfunction, transient monocular vision loss, or non-specific neurological symptoms (6). The findings of randomized controlled trials indicate CEA to be a safe and effective treatment method for reducing the risk of ischemic stroke in patients with symptomatic CAD (6, 7). Thus, in recent years, as a result of technological advances, CAS has become a favored technique due to being less invasive than CEA and having fewer negative consequences in high-risk patients. In fact, a number of randomized controlled trials have compared the results of the CAE and CAS procedures in symptomatic CAD patients (8, 9).

Given the widespread prevalence of atherosclerosis in elderly people and the growing population of older adults worldwide, there will clearly be an increasing need for approaches to address carotid artery stenosis among this age group in the coming years. The presence of additional comorbidities, anatomical complexities, higher risk of perioperative complications, and greater frailty among elderly patient populations pose challenges when deciding on the suitability of endarterectomy, while technical difficulties, including lesions that are unsuitable for stenting and vascular access site issues, make it difficult to decide on stent placement. Currently, there is no clear strategy for choosing the best treatment option for elderly patients with symptomatic carotid artery stenosis and multiple comorbidities. However, ischemic stroke is a serious cause of both disability and mortality, especially in older populations, which means that the diagnosis and treatment of carotid stenosis are important for stroke prophylaxis. In this single-center study, we sought to present both our decision-making processes and the short- to medium-term outcomes in elderly patients with symptomatic carotid artery stenosis who underwent CEA and CAS through an approach that emphasizes interdisciplinary collaboration and patient-centric assessment.

MATERIALS AND METHOD

In this study, a total of 88 patients who underwent CAS (n=53) and CEA (n=35) for the treatment of CAD were retrospectively analyzed. All the patients enrolled in this study were symptomatic and were initially assessed using Doppler ultrasonography as the primary diagnostic modality. Afterwards, all the patients underwent evaluation by means of computed tomography (CT) angiography and/or conventional digital subtraction angiography (DSA) to ascertain the degree of stenosis and the anatomical extent of the lesion. The stenosis grade was determined according to the North American Symptomatic Carotid Endarterectomy Trial (NASCET) criteria (10). Symptomatic patients with 50–99% stenosis at the internal carotid artery according to the NASCET criteria were included in this study. Patients with totally occluded carotid artery lesions were excluded from this study. The patients' demographic characteristics, including age, gender, comorbid conditions, side and severity of the carotid artery lesion(s), symptom details, diameter and length of the stents, patch types used in endarterectomy, post-procedural complications, and durations of intensive care and hospital stay were obtained from hospital records. The patients' symptoms were classified as amaurosis fugax, dizziness, dysarthria, minor cerebrovascular disease (CVD), and/or major CVD.

The study protocol was approved by the Local Ethics Committee of Selçuk University's Faculty of Medicine (approval date: 30.12.2020; decision number: 2020/570). Prior to the procedure, every patient completed a written informed consent form. The study was conducted in accordance with the principles outlined in the Declaration of Helsinki.

Decision-making process

Our decision-making process regarding CEA and CAS, which emphasized interdisciplinary collaboration and patient-centric assessment, proceeded as follows. After each patient's DSA procedure, the invasive neurologist extended an invitation to the surgeon to join them in the angiography unit. In the meeting held in the angiography unit, the

Table 1. Potential challenges from both the surgeon's and interventionalist's perspectives when considering the optimal treatment strategy for the patient during the council.

Surgeon's perspective		Interventionalist's perspective	
Anatomical challenges: exposure problems	Lesion extending very distally High carotid bifurcation Spinal immobility of the neck Short neck	**Aortic arch problems**	Arch anomalies (including bovine arch) Tortuosity Aortic arch atheroma Angulated takeoffs from the arcus
Perioperative anesthesia issues	Poor general condition Recent major stroke Hemodynamic instability Severe pulmonary disease Cardiac problems	**Factors with carotid artery**	Tortuosity, elongation Angulation Severe calcification Long segment lesion Plaque with thrombus
Multiple comorbidities		Renal insufficiency	
Surgical difficulties	Prior neck surgery Neck radiotherapy Tracheostomy	**Femoral access issues**	Peripheral artery disease Leriche syndrome Iliac tortuosity
Hyperperfusion syndrome			
Distal embolism and procedure-related stroke			

patient's age, symptoms, comorbid conditions, carotid lesion characteristics (degree of stenosis, angulation, calcification, ulceration), arcus aorta anatomy, and contralateral carotid lesion were considered to make the best decision for the patient. The decision-making factors concerning surgery or stent implantation are summarized in Table 1. The table outlines the probable challenges that the surgeon and the interventional neurologist may encounter throughout the decision-making process, as considered from both their perspectives. A consensus-based decision was reached after the surgical and interventional teams had presented their arguments during the meeting. If stenting was decided upon, the procedure was performed during the same session, whereas if surgery was chosen, the procedure was completed within 3–5 days.

Carotid artery stenting procedure

CAS placement was performed in all patients for whom it was considered appropriate via the right common femoral artery. First, angiography of the arcus was performed and the aortic anatomy was determined. Bilateral selective carotid angiography and selective cerebral angiography were performed. Embolic protection devices (EPDs) were not routinely used. The positioning of the stent was adjusted immediately after passing the carotid artery lesion with the appropriate guide wire. Next, the stent was placed, and if required, balloon dilation was performed. Finally, control angiography images were obtained for both the carotid stent and the distal vascular area. Antiplatelet drugs, which were started prior to the procedure, were continued after the CAS placement for 1–3 months. Following this period, monotherapy was continued.

Surgical technique

CEA was performed under general or local anesthesia. Following the neck incision, the common carotid, external carotid, and internal carotid arteries were explored. The patient was then heparinized and vascular clamps were applied. Then, longitudinal arteriotomy was performed below the carotid bifurcation level, and the incision was extended both proximally and distally. The plaque inside the carotid artery was carefully separated and removed. Fixing sutures were placed at both the proximal and distal ends of the endarterectomy level to stabilize the incision line of the plaque and prevent any possible dissections that may have occurred after the flow was restored. Following the CEA procedure, the arteriotomy was repaired by means of patch angioplasty. The preferred choice of patch material was an autologous saphenous vein, but if that was not available, an expanded polytetrafluoroethylene (ePTFE) was used instead. Due to the slightly aneurysmatic character of the carotid artery, a patch was not applied in one patient included in this study. Finally, the vascular clamps were removed in the appropriate order and the blood flow was restored.

Statistical analysis

All the analyses in this study were performed using SPSS 22.0 (SPSS, Chicago, IL). The normal distribution of the variables was examined using the Kolmogorov-Smirnov test. Continuous variables with a normal distribution were presented as the mean ± standard deviation. Continuous variables that did not conform to a normal distribution were presented as the median (minimum–maximum). Categorical variables were expressed as the number and percentage. Independent groups with normally distributed continuous variables were compared using Student's t-test, while non-normally distributed variables were compared using the Mann-Whitney U test. Categorical variables were compared using the chi-square or Fisher's exact test. A p-value less than 0.05 was considered statistically significant.

RESULTS

The demographic characteristics of the 88 patients (mean age: 71.72±7.87 years) included in this study are presented in Table 2. The patients were divided into two groups: the CEA group (n=35, mean age: 71.72±7.87 years) and the CAS group (n=53, mean age: 70.64±7.46 years). There were no statistically significant differences between the CEA and CAS groups in terms of the patients' age, gender, concomitant hypertension, hyperlipidemia, diabetes

Table 2. Demographic data regarding the study population, endarterectomy, and stent groups and comparisons are given

		All patients (n=88)	Endarterectomy group (n=35)	Stent group (n=53)	p value
Age (year)		71.72±7.87	73.34±8.29	70.64±7.46	0.11
Gender	Male	61 (69.3%)	25 (71.4%)	36 (67.9%)	0.91
	Female	27 (30.7%)	10 (28.6%)	17 (32.1%)	
Hypertension		78 (88.6%)	33 (94.3%)	45 (84.9%)	0.30
Hyperlipidemia		41 (46.6%)	17 (48.6%)	24 (45.3%)	0.93
Diabetes mellitus		33 (37.5%)	13 (37.1%)	20 (37.7%)	1.00
Coronary artery disease		44 (50%)	18 (51.4%)	26 (49.1%)	1.00
COPD		27 (30.7%)	12 (34.3%)	15 (28.3%)	0.72
Chronic renal disease		9 (10.2%)	7 (20%)	2 (3.8%)	**0.026**
Active smoking		37 (42%)	18 (51.4%)	19 (35.8%)	0.22
Symptoms	Amaurosis fugax	7 (8%)	4 (11.4%)	3 (5.7%)	0.45
	Dizziness	22 (25%)	9 (25.7%)	13 (24.5%)	
	Dysarthria	4 (4.5%)	3 (8.6%)	1 (1.9%)	
	Minor CVD	37 (42%)	12 (34.3%)	25 (47.2%)	
	Major CVD	18 (20.5%)	7 (20%)	11 (20.8%)	
Imaging methods	CT Angiography	73 (83%)	26 (74.3%)	47 (88.7%)	0.14
	DSA	86 (97.7%)	33 (94.3%)	53 (100%)	0.15
Aortic arch type	I	34 (38.6%)	11 (31.4%)	23 (43.4%)	**0.03**
	II	38 (43.2%)	13 (37.1%)	25 (47.2%)	
	III	16 (18.2%)	11 (31.4%)	5 (9.4%)	
Bovine arch		11 (12.5%)	5 (14.3%)	6 (11.3%)	0.75
Lesion side	Right	37 (42%)	12 (34.3%)	25 (47.2%)	0.35
	Left	32 (36.4%)	13 (37.1%)	19 (35.8%)	
	Bilateral	19 (21.6%)	10 (28.6%)	9 (17%)	
Degree of stenosis, %*		79.99±15.18	82.74±13.35	78.17±16.14	0.15
Lesion grade	50-69%	21 (23.9%)	3 (8.6%)	18 (34%)	**0.008**
	70-89%	28 (31.8%)	16 (45.7%)	12 (22.6%)	
	≥90%	39 (44.3%)	16 (45.7%)	23 (43.4%)	
Plaque ulceration		33 (37.5%)	20 (57.1%)	13 (24.5%)	**0.004**
Contralateral carotid	>%50 stenosis	11 (12.5%)	8 (22.9%)	3 (5.7%)	0.06
	Total occlusion	8 (9.1%)	2 (5.7%)	6 (11.3%)	

COPD: Chronic obstructive pulmonary disease, CT: Computed tomographic, CVD: Cerebrovascular disease, DSA: Digital subtraction angiography *Based on North American Symptomatic Carotid Endarterectomy Trial (NASCET) criteria

mellitus, coronary artery disease, chronic obstructive pulmonary disease, active smoking, symptom characteristics, preoperative imaging modality, side and degree of the carotid artery lesion, and contralateral carotid lesion (p=0.11, p=0.91, p=0.30, p=0.93, p=1.00, p=1.00, p=0.72, p=0.22, p=0.45, p=0.14, p=0.15, p=0.35, p=0.15, and p=0.06, respectively). However, chronic renal disease was found to be significantly elevated in the patients who underwent CAE (n=7, 20%) when compared with the patients who underwent CAS (n=2, 3.8%) (p=0.026). The prevalence of a type III aortic arch was also higher in the CEA group when compared with the CAS group (p=0.03). The lesion grade distribution significantly varied between the two groups (p=0.008), with the CAS group having a higher prevalence of stenosis in the 50–69% range. Moreover, the plaque ulceration exhibited a statistically significant increase in the CEA group (p=0.004).

The characteristics of the CEA and CAS procedures are provided in Table 3. The mean proximal diameter of the stents used in the CAS

Table 3. Procedural and post-procedural data are provided for CEA and CAS groups

		Endarterectomy group (n=35)	Stent group (n=53)	p value
Stent size	Proximal diameter (mm)	-	8.96±0.92	-
	Distal diameter (mm)	-	6.79±0.88	
	Length (mm)	-	36.6±4.78	
Type of anesthesia	General	31 (88.6%)	-	-
	Local	4 (11.4%)	-	
Localization of endarterectomy	Isolated ICA	7 (20%)	-	-
	ICA+CCA	28 (80%)	-	
Side of procedure	Right	18 (51.4%)	26 (49.1%)	1.00
	Left	17 (48.6%)	27 (50.9%)	
Type of patch	Saphenous vein	30 (85.7%)	-	-
	ePTFE	4 (11.4%)	-	
	No patch	1 (2.9%)	-	
Shunt usage		4 (11.4%)	-	-
X-clamp time (min.)		20.69±6.53	-	-
Complications	Death	-	3 (5.7%)	0.36
	Myocardial infarction	1 (2.9%)	1 (1.9%)	
	Minor CVD	1 (2.9%)	3 (5.7%)	
	Intracranial hemorrhage	-	2 (3.8%)	
	Hyperperfusion syndrome	2 (5.9%)	7 (13.2%)	
	Postoperative bleeding	2 (5.9%)	-	
	Hypoglossal nerve injury	2 (5.9%)	-	
Intensive care unit duration (day)		1 (1-57)	1 (0-9)	**<0.001**
Hospitalization duration (day)		4 (2-90)	3 (2-27)	**<0.001**

CCA: Common carotid artery, ECA: External carotid artery, ePTFE: Expanded polytetrafluoroethylene, ICA: Internal carotid artery, CVD: Cerebrovascular disease

procedure was 8.96±0.92 mm, while the mean distal diameter was 6.79±0.88 mm and the mean length was 36.6±4.78 mm. The mean X-clamp time for the CEA procedure was 20.69±6.53 minutes. There was no statistically significant difference between the CEA and CAS groups in terms of the complications seen after the procedures (p=0.36). Two patients (5.9%) in the CEA group required surgical revision on the first postoperative day due to local hematoma. The durations of the intensive care and hospitalization periods were found to be statistically significantly longer in the CEA group when compared with the CAS group (p<0.001). There was no procedural mortality or myocardial infarction in either group. However, in the CAS group, three deaths (5.7%) and one myocardial infarction (1.9%) occurred during the intensive care unit follow-up after the procedure, whereas one myocardial infarction (1.9%) was observed in the CEA group following the operation.

The median follow-up period was 28.83 (range 0–61) months. Within this follow-up period, two patients in the CAS group required reintervention due to restenosis. Additionally, CVD occurred in three patients in the CEA group and five patients in the CAS group during the follow-up period. These events were not attributed to the vessel that previously underwent intervention; rather, they were associated with either the contralateral side or embolism of cardiac origin. At our mid-term follow-up, the mortality rates were found to be comparable between the CAS and CEA groups, with 34 patients (64.2%) in the CAS group and 23 patients (65.7%) in the CEA group experiencing death (p=0.88). The leading causes of death were cardiac and pulmonary issues, while cancer, general debility, infection, diabetes complications, and renal and hepatic failure were among the other contributing factors.

In the subgroup analyses of patients below and above 75 years of age, no significant difference was observed between the CEA and CAS groups regarding the major cumulative complications, including permanent disability and death.

DISCUSSION

CEA and CAS are two effective treatment modalities for the management of symptomatic CAD. Although endovascular treatments have made significant progress in recent years, the easy accessibility of the cervical carotid artery and the low risk of complications associated with the surgery have resulted in the continued preference for surgical approaches as the primary treatment modalities.

When considering the suitability of CEA for a patient, the surgeon must conduct a comprehensive evaluation that encompasses various dimensions. This entails more than merely executing the CEA procedure, as it necessitates a holistic assessment of both the patient and the pathology. Factors such as the presence of multiple comorbidities, anatomical complexities, anesthetic challenges, and other potential surgical intricacies must all be carefully considered. With the aging population and the increasing prominence of geriatric patients worldwide, healthcare professionals are increasingly encountering individuals who present with such complexities. However, there appears to be a paradigm shift favoring stent placement in the management of symptomatic CAD, as CAS is less invasive and is now commonly performed in numerous centers. While guidelines offer extensive information on the topic, it is prudent to approach real-life situations based on the principle that "there is no disease, there is only the patient." This is because each patient presents with a multitude of unique conditions beyond CAD. Therefore, during the patient evaluation, both the surgeon and the neurologist must strive to make the optimal decision by considering the factors outlined in Table 1 and beyond. In this study, no attempt was made to demonstrate the superiority of one procedure over the other; rather, it was recognized that both procedures may be more appropriate, depending

on the individual patient and their specific situation. Instead, this study highlighted the achievement of comprehensive collaboration between the neurology and cardiovascular surgery teams by meticulously evaluating each patient and devising a treatment plan that was tailored to optimize the outcomes in all aspects.

The CEA and CAS groups were similar in terms of the patients' demographic characteristics, comorbidities, and symptoms, although patients with chronic kidney disease were statistically more prevalent in the CEA group. This trend may have arisen due to a preference for surgery, potentially influenced by patients with chronic kidney disease opting to avoid additional contrast agent use during the procedure. While contralateral carotid stenosis or occlusion may influence the decision-making process regarding stenting or surgery due to perceived impacts on procedural outcomes, our patient cohort exhibited comparable occurrences between the two groups (p=0.06). Additionally, the study by Deser et al. similarly suggests that the presence of contralateral severe internal carotid artery stenosis does not elevate the risk of postoperative stroke, mortality rates, or blood pressure fluctuations (11).

Table 1 outlines the factors that present challenges from both the surgeon's and the interventionalist's perspectives when determining the optimal treatment strategy for a patient. Aortic arch issues represent significant limiting factors for CAS because the aortic arch is an important cause of cerebral embolization during both diagnostic and interventional procedures involving supra-aortic vessels (12). The presence of a complex aortic arch anatomy, such as a type III arch or bovine arch, can render CAS more challenging and increase the likelihood of neurological problems when using the femoral access route (12-14). Indeed, in our study, a statistically significant difference was found between the CEA and CAS groups in terms of the aortic arch structure. More specifically, a type III arch was observed more frequently in the CEA group. We suggest that the preference for surgery in patients with a type III arch may stem from concerns about the risk of cerebral embolization attributed to the existing anatomy, as discussed during the decision-making meetings. Still, the lesion severity and plaque morphology also play crucial roles when deciding between stenting and surgery. In our cohort, patients with greater levels of stenosis and ulcerated plaque tended to undergo CEA.

Two different methods can be used in CEA—namely, conventional and eversion endarterectomy. When applying the conventional technique, following the longitudinal arteriotomy of the internal carotid artery, endarterectomy is performed and the arteriotomy is repaired or patch angioplasty is performed. The patch angioplasty technique is most commonly applied and has been demonstrated to offer better results in some studies (15, 16). When applying the eversion technique, after the internal carotid artery is obliquely transected from its origin, the artery is turned inside out, plaque excision is performed, and the internal carotid artery is reimplanted into the bulbus. Additionally, various modifications to the eversion method have been described and found to offer satisfactory results (17). Several studies have reported that both the conventional method and the eversion method are associated with similar efficacy and reliability (18-20). All the patients enrolled in our study underwent longitudinal arteriotomy followed by conventional endarterectomy. Patch angioplasty was utilized for the arteriotomy repair in all the patients except one, where the primary repair approach was chosen due to the mildly aneurysmal artery structure.

Another key point that should be emphasized procedurally in terms of CAS is the usage of a distal EPD. The use of EPDs has been limited in the initial studies concerning CAS. In accordance with this situation, an EPD was not used in the CAVATAS trial, where higher rates of stroke and restenosis were

found after eight years of follow-up and only 26% of patients were treated with stent implantation (21). By contrast, as a combined primary endpoint, an EPD was used in every technically feasible case in the CREST study, where no significant difference was found between CAS and CEA with regard to myocardial infarction, stroke, 30-day mortality, and ipsilateral stroke in the first four days (22). In our study, the utilization of EPDs was not favored.

In the vast majority of randomized controlled trials conducted in the last decade to compare CAS and CEA, the results obtained using the two methods have largely been consistent. Among these trials, the CEA results were found to be better when compared with the CAS results in the EVA-3S study, which was one of the first studies in this area where the use of more sophisticated devices was limited (23). Although the CAVATAS study did not have sufficient power for the evaluation of the efficacy and reliability, the SAPPHIRE, CREST, and ICSS studies met the non-inferiority criteria for CAS when compared with CEA, while very similar results were also obtained in the SPACE study (8, 9, 22, 24). When sub-group analyses of these studies were analyzed to facilitate patient selection, it was noteworthy that while the same results were obtained in general terms, myocardial infarction was more common in patients who underwent CEA and stroke was more common in patients who underwent CAS. The greater occurrence of myocardial infarction during CEA has been linked to the emotional stress created by the surgery for the patient, as well as to possible alterations in the antiplatelet treatment regimen, whereas the higher incidence of stroke in CAS has been attributed to the patients' more advanced age. In our study, no difference was detected between the two groups in terms of the complications, including myocardial infarction and stroke, during the hospital stay.

Interestingly, in this study, CAS, which represents a less invasive technique for patients over 70 years of age, was significantly associated with an increased incidence of stroke when compared with CEA. It has previously been stated that this situation might be primarily due to the increased vascular tortuosity that occurs with advancing age. The subgroup analysis in the NASCET study revealed that patients aged 75 years and older, and with 50–99% stenosis, experienced greater benefits following CEA when compared with younger individuals (25). However, our subgroup analyses of patients aged below and over 75 years old did not reveal any significant difference between the CEA and CAS groups when it came to the major cumulative complications. We suggest that the lack of significant findings in our subgroup analyses may be attributed to the limited sample size, which potentially constrained our ability to conduct robust subgroup evaluations.

Despite the limited patient population, there was no significant difference between the two groups in terms of the patients' demographic data, post-procedural complications, and mid-term outcomes, indicating that the two treatment approaches were used successfully in the appropriate patient groups in our study. Advancements in stent technology and the use of sophisticated materials may alter treatment choices in the future, although surgery will retain its indispensable role. Large randomized prospective trials are still required to determine the most appropriate treatment, particularly for asymptomatic individuals, including symptomatic patients.

Conflict of Interest: The authors state that the study was conducted without any commercial or financial relationships that could be seen as a potential conflict of interest.

REFERENCES

1. Brott TG, Halperin JL, Abbara S, et al. ASA/ACCF/AHA/AANN/AANS/ACR/ASNR/CNS/SAIP/ SCAI/SIR/SNIS/SVM/SVS guideline on the management of patients with extracranial carotid and vertebral artery disease. Stroke 2011; 42(8): e542. (DOI: 10.1161/STR.0b013e3182112cc2).

2. Petty GW, Brown RD Jr, Whisnant JP, et al. Ischemic stroke subtypes: a population-based study of incidence and risk factors. Stroke 1999; 30(12): 2513-2516. (DOI:10.1161/01.str.30.12.2513).

3. Longstreth WT Jr, Shemanski L, Lefkowitz D, et al. Asymptomatic internal carotid artery stenosis defined by ultrasound and the risk of subsequent stroke in the elderly. The Cardiovascular Health Study. Stroke 1998; 29(11): 2371-2376. (DOI:10.1161/01.str.29.11.2371).

4. Fine-Edelstein JS, Wolf PA, O'Leary DH, et al. Precursors of extracranial carotid atherosclerosis in the Framingham Study. Neurology 1994; 44(6): 1046-1050. (DOI:10.1212/wnl.44.6.1046).

5. Wilson PW, Hoeg JM, D'Agostino RB, et al. Cumulative effects of high cholesterol levels, high blood pressure, and cigarette smoking on carotid stenosis. N Engl J Med 1997; 337(8): 516-522. (DOI:10.1056/NEJM199708213370802).

6. North American Symptomatic Carotid Endarterectomy Trial Collaborators, Barnett HJM, Taylor DW, et al. Beneficial effect of carotid endarterectomy in symptomatic patients with high-grade carotid stenosis. N Engl J Med 1991; 325(7): 445-453. (DOI:10.1056/NEJM199108153250701).

7. Randomised trial of endarterectomy for recently symptomatic carotid stenosis: final results of the MRC European Carotid Surgery Trial (ECST). Lancet 1998; 351(9113): 1379-1387. (DOI: 10.1159/000078753).

8. Bonati LH, Dobson J, Featherstone RL, et al. Long-term outcomes after stenting versus endarterectomy for treatment of symptomatic carotid stenosis: The International Carotid Stenting Study (ICSS) randomised trial. Lancet 2015; 385(9967): 529-538. (DOI: .1016/S0140-6736(14)61184-3).

9. Ringleb PA, Allenberg J, Bruckmann H, et al. 30 day results from the SPACE trial of stent-protected angioplasty versus carotid endarterectomy in symptomatic patients: a randomised non-inferiority trial. Lancet 2006; 368(9543): 1239-1247. (DOI: 10.1016/S0140-6736(06)69122-8).

10. North American Symptomatic Carotid Endarterectomy Trial. Methods, patient characteristics, and progress. Stroke 1991;22 (6): 711-720. (DOI: 10.1161/01.str.22.6.711).

11. Deser BS, Demirağ KM, Kolbakır F. Does severe contralateral carotid artery stenosis affect the outcomes of carotid endarterectomy? Turk Gogus Kalp Damar 2019; 27: 035-042. (DOI: 10.5606/tgkdc.dergisi.2019.15878).

12. Faggioli GL, Ferri M, Freyrie A, et al. Aortic arch anomalies are associated with increased risk of neurological events in carotid stent procedures. Eur J Vasc Endovasc Surg 2007; 33(4): 436-441. (DOI: 10.1016/j.ejvs.2006.11.026).

13. Barbiero G, Cognolato D, Casarin A, et al. Carotid artery stenting in difficult aortic arch anatomy with or without a new dedicated guiding catheter: preliminary experience. Eur Radiol 2013; 23(5): 1420-1428. (DOI: 10.1007/s00330-012-2708-7).

14. Montorsi P, Galli S, Ravagnani PM, et al. Carotid Artery Stenting with Proximal Embolic Protection via a Transradial or Transbrachial Approach: Pushing the Boundaries of the Technique While Maintaining Safety and Efficacy. J Endovasc Ther 2016; 23(4): 549-560. (DOI: 10.1177/1526602816651424).

15. Mannheim D, Weller B, Vahadim E, et al. Carotid endarterectomy with a polyurethane patch versus primary closure: a prospective randomized study. J Vasc Surg 2005; 41(3): 403-408. (DOI: 10.1016/j.jvs.2004.11.036).

16. Orrapin S, Benyakorn T, Siribumrungwong B, et al. Patch angioplasty versus primary closure for carotid endarterectomy. Cochrane Database Syst Rev 2022; 8(8): CD000160. (DOI: 10.1002/14651858).

17. Abud B, Talay S, Ünal CS et al. Comparison of the Modified Eversion Carotid Endarterectomy Technique with the Conventional Carotid Endarterectomy Technique: Early Results. World Journal of Cardiovascular Diseases 2015; 5(4): 87-94. DOI: (10.4236/wjcd.2015.54012).

18. Ballotta E, Renon L, Da Giau G, et al. A prospective randomized study on bilateral carotid endarterectomy: patching versus eversion. Ann Surg 2000; 232(1): 119-125. (DOI:10.1097/00000658-200007000-00017).

19. Cao P, Giordano G, De Rango P, et al. A randomized study on eversion versus standard carotid endarterectomy: study design and preliminary results: The Everest Trial. J Vasc Surg 1998; 27(4): 595-605. (DOI: 10.1016/s0741-5214(98)70223-x).

20. Katras T, Baltazar U, Rush DS, et al. Durability of eversion carotid endarterectomy: comparison with primary closure and carotid patch angioplasty. J Vasc Surg 2001; 34(3): 453-458. (DOI: 10.1067/mva.2001.117885).

21. Bonati LH, Ederle J, McCabe DJ, et al. Long-term risk of carotid restenosis in patients randomly assigned to endovascular treatment or endarterectomy in the Carotid and Vertebral Artery Transluminal Angioplasty Study (CAVATAS): long-term follow-up of a randomised trial. Lancet Neurol 2009; 8(10): 908-917. (DOI:10.1016/S1474-4422(09)70227-3).

22. Brott TG, Hobson RW 2nd, Howard G, et al. Stenting versus endarterectomy for treatment of carotid-artery stenosis. N Engl J Med 2010; 363(1): 11-23. (DOI: 10.1056/NEJMoa0912321).

23. Mas JL, Trinquart L, Leys D, et al. Endarterectomy Versus Angioplasty in Patients with Symptomatic Severe Carotid Stenosis (EVA-3S) trial: results up to 4 years from a randomised, multicentre trial. Lancet Neurol 2008; 7(10): 885-892. (DOI:10.1016/S1474-4422(08)70195-9).

24. Yadav JS, Wholey MH, Kuntz RE, et al. Protected carotid-artery stenting versus endarterectomy in high-risk patients. N Engl J Med 2004; 351(15): 1493-1501. (DOI:10.1056/NEJMoa040127).

25. Alamowitch S, Eliasziw M, Algra A, et al. Risk, causes, and prevention of ischaemic stroke in elderly patients with symptomatic internal-carotid-artery stenosis. Lancet 2001; 357(9263):1154-1160. (DOI: 10.1016/S0140-6736(00)04332-4).

ORIGINAL ARTICLE

IS RED CELL DISTRIBUTION WIDTH CORRELATED WITH MORTALITY IN GERIATRIC PATIENTS UNDERGOING HIP FRACTURE SURGERY: A PROSPECTIVE OBSERVATIONAL STUDY

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Abstract

Introduction: Our study aimed to determine the impact of preoperative red blood cell distribution width on length of intensive care unit and hospital stays, and short- and long-term mortality in elderly patients undergoing hip fracture surgery.

Materials and Method: This prospective cohort study included 414 patients aged 65 and older who presented with hip fractures between November 2021 and November 2022. Patients' demographic characteristics, American Society of Anesthesiologists score, Revised Cardiac Risk Index, comorbidities, and preoperative complete blood counts (hemoglobin, red blood cell distribution width, platelet count, etc.) were recorded at the preoperative visit. Length of intensive care unit and hospital stays were documented postoperatively. Patients were followed for one year after surgery in terms of mortality.

Results: Patients with high red blood cell distribution width levels (≥14.25%) were older, had more comorbidities, and had higher American Society of Anesthesiologists score and Revised Cardiac Risk Index scores ($p<0.001$). In the high red blood cell distribution width group, length of hospital stays was longer ($p<0.001$). There was no significant difference between red blood cell distribution width groups in terms of intensive care unit stay duration and readmissions ($p=0.304$ and $p=0.664$, respectively). According to the multivariate logistic regression analysis, an red blood cell distribution width of ≥14.25 was found to increase the risk of 30-day mortality by 4.7 times and 1-year mortality by 2.74 times.

Conclusion: Red blood cell distribution width is a useful, practical, and cost-effective indicator of short- and long-term mortality in elderly patients undergoing hip fracture surgery.

Keywords: Aged; Anemia; Hip fracture; Mortality.

INTRODUCTION

Hip fracture, a common problem in geriatric patients, is linked to significant mortality and morbidity rates (1). Over 1 million hip fractures occur annually, imposing a burden on society (1). Even with treatment, 1-year mortality after hip fracture is between 8.4% and 36.0% (2). Therefore, a definitive prognostic parameter is crucial for effective risk stratification. Comorbidities, age, perioperative complications, and various risk prediction models (such as the Charlson Comorbidity Index and the orthopedic version of the Physiologic and Operative Severity Score) are recognized factors influencing mortality in hip fracture patients (3). Nevertheless, these models are time-consuming, requiring further calculations, so a need exists for a simple, cost-effective laboratory parameter associated with postoperative mortality (1).

Red cell distribution width (RDW) measures heterogeneity in erythrocyte sizes and is a routine parameter of a complete blood count (CBC) test. It is calculated automatically or manually with this formula: (standard deviation of mean corpuscular volume / mean corpuscular volume) × 100 (4). Generally used to investigate hematological disorders, RDW has recently been proposed as a long-term inflammatory biomarker (5). An association between increased RDW and mortality has been reported in many diseases, such as diabetes mellitus (DM), hypertension (HT), coronary artery disease (CAD), acute pancreatitis, and sepsis (6). In this study, evaluate the impact of RDW on 30-day and 1-year mortality in geriatric patients undergoing hip fracture surgery.

MATERIALS AND METHOD

The hospital ethics committee approved the research on October 4, 2021 (reference no: 121/05), and a prospective observational study was planned to include patients aged 65 and older with a diagnosis of hip fracture confirmed by imaging examinations from November 1, 2021, to November 1, 2022. Written consent was obtained from all patients. The exclusion criteria included declining participation in the study, absence of preoperative CBC test, indefinite fracture time, and recent history of blood transfusion, as exogenous red blood cells could alter the RDW (7). The patients in the study were visited preoperatively by an anesthesiologist, and their demographic data (age, gender, body mass index [BMI]) comorbidities (such as DM, HT, congestive heart failure [CHF], and chronic renal failure [CRF]), American Society of Anesthesiologists (ASA) score, and Revised Cardiac Risk Index (RCRI) were recorded.

Blood samples were collected from the patients, and CBC parameters were analyzed (hemoglobin, RDW, platelet count, etc.). The CBC was conducted with the Symex XN-550 automated hematology analyzer (Sysmex Corp., Kobe, Japan), with reference values for RDW coefficients of variation ranging between 12.2% and 16.5%. Other biochemical tests were performed using standard techniques with the Beckman Coulter LH 780 device (Beckman Coulter Inc., Brea, New York, USA). Anemia was classified as follows: mild (11.0-11.9 g/dL for women, 11.0-12.9 g/dL for men), moderate (8.0-11.0 g/dL), and severe anemia (< 8.0 g/dL) (5). At the time of discharge, records were taken of the anesthesia method (general or local anesthesia), surgery duration, postoperative first-day CBC (RDW and hemoglobin levels), in-hospital complications (including hypoxemia, pneumonia, acute coronary syndrome, arrhythmia, stroke, severe bleeding, infection, and acute renal failure), and length of intensive care unit (ICU) and hospital stays. Patients were contacted by phone 1 year after discharge. The last phone call was conducted on November 1, 2023. The primary endpoint of the study was to investigate the impact of RDW on 30-day and 1-year mortality, and the secondary endpoint focused on the effect of RDW on readmission and length of ICU and hospital stays.

Statistical analysis

The data were statistically analyzed using IBM SPSS Statistics for Windows, version 20.0. The study examining the effect of RDW on mortality used as a reference the study of Wei-Hsiang et al. (1). The sample size to detect a significant difference of 1 unit in RDW averages between deceased and surviving groups was calculated with a 5% error level and a minimum 80% power using the two-sided t-test. Accordingly, the study was planned with a minimum of 87 patients in the mortality group and 114 patients in the surviving group over 1 year.

To determine the statistical methods to be applied, the Shapiro-Wilk normality test was initially conducted. If the assumption of normality was not met in any of the groups, non-parametric test methods were selected. In this context, Student's t-test and/or the Mann-Whitney U test were used to compare variables obtained through measurements between two independent groups. Mean, standard deviation, and median (minimum–maximum) values were provided to summarize continuous variables, and Fisher's exact test and chi-squared test results were presented as frequency distributions and percentages for categorical variables.

The area under the receiver operating characteristic (ROC) curve provides an estimate of the overall accuracy of alternative tests. An area of 0.50 indicates that the variable adds no information. For an alternative test, areas under the ROC and 95% confidence intervals (CIs) were calculated as defined by Hanley and McNeil (8). For the variables whose diagnostic powers were found to be statistically significant, the cutoff points determined according to the Youden index are given together with the relevant sensitivity and selectivity points. All variables with statistical significance in the univariate analyses were considered eligible for inclusion in the multiple analysis and were tested for collinearity. Cutoff points determined by the Youden index for variables with statistically significant diagnostic power are provided along with relevant sensitivity and specificity scores. Multiple logistic regression analyses were conducted using the backward logistic regression approach. Variables that remained significant ($p < .05$) in the multivariate model were considered independent predictors. Hosmer-Lemeshow goodness-of-fit statistics were used to evaluate the model fit. Odds ratios (ORs) and 95% CIs were calculated for each predictor.

RESULTS

Figure 1 illustrates the flowchart of patient selection. A total of 414 geriatric patients with hip fractures, 165 males and 249 females, were included in the study. The mean age of the patients was 76.37 ± 8.52 years, and mean RDW was 14.5 ± 2.07%. Table 1 presents the patients' basic characteristics.

Table 2 summarizes the study group's clinical characteristics, comorbidities, and complications according to RDW levels. Patients with higher RDW levels were older and had higher ASA and RCRI scores ($p < .001$). The percentage of anemia in the RDW ≥14.25% group was higher than in the RDW <14.25% group (79.13% vs. 48.28%, respectively; $p < .001$). The most common complications in-hospital were acute kidney injury and pneumonia in the group with high RDW (4/182, 2.19%, for both). The length of hospital stays was longer for patients in the high RDW group ($p<.001$). No statistically significant difference was observed between the two groups regarding the length of ICU stay and readmissions within the 1-year hospital ($p= .304$, $p=.664$, respectively).

The area under the curve (AUC) for both 30-day and 1-year mortality were found to be statistically significant in higher RDW patients ($p < .001$). The AUC was 0.732 (95% CI: 0.671–0.793) for 30-day mortality and 0.709 (95% CI: 0.654–0.765) for 1-year mortality. Accordingly, RDW values of ≥14.25 were determined to predict 30-day mortality, whereas values of ≥14.05 were found to predict mortality at 1 year. Figure 2 shows ROC curves illustrating the AUC for both mortality rates.

Figure 1. Study cohort flow diagram

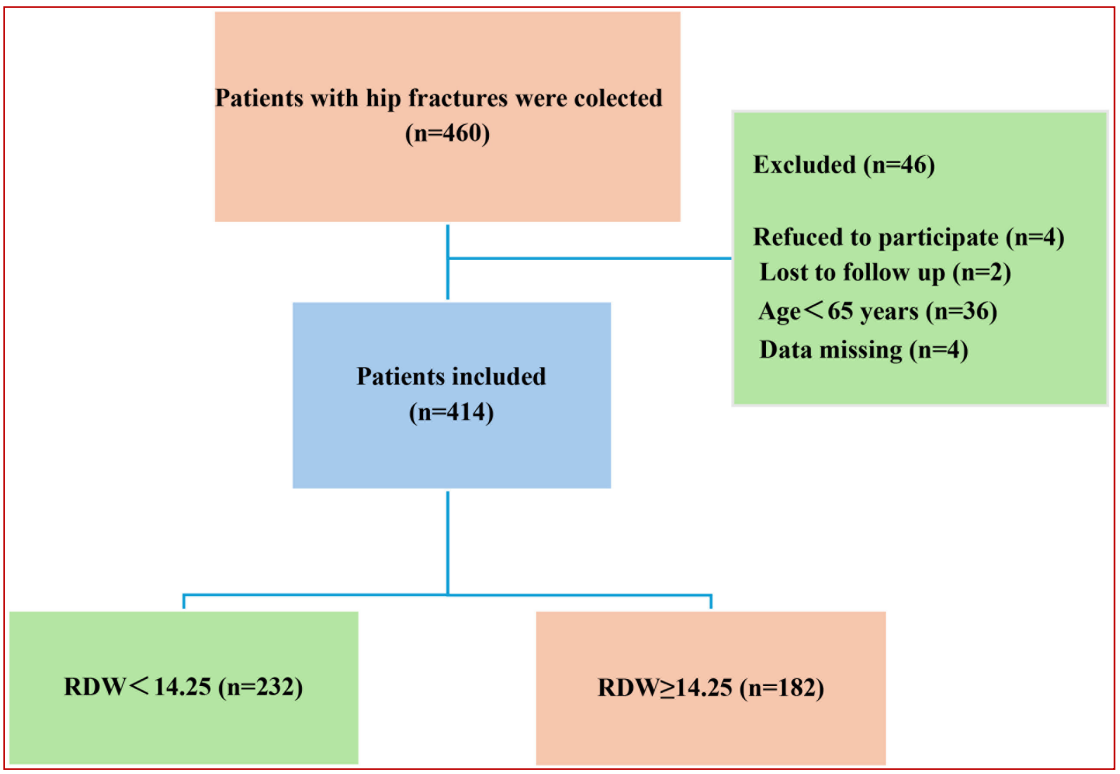

Table 1. Demographic and Clinical Characteristics of Patients

Preoperative characteristics of patients (n = 414)	Values
Age (year)	76.37±8.52
Sex, male, n (%)	165 (39.86)
BMI (kg/m2)	26.99±3.37
RDW (%)	14.5±2.07
Length of hospital stay (days)	5.78±8.85
Length of ICU stay (days)	2.14±6.86
Readmission n (%)	22 (5.31)
30-day mortality n (%)	65 (15.7)
1 year mortality n (%)	94 (22.71)

Values are given as mean ± SD or number (percentage). BMI, body mass index; RDW, red blood cell distribution width; ICU, intensive care unit

Table 2. Characteristics of the study population by RDW group (n = 414)

RDW value		RDW <14.25% (n=232)	RDW ≥14.25% (n=182)	p value
Age (years)		75.03±7.97	78.08±8.91	<0.001
Male n (%)		93 (40.08)	72 (39.56)	0.914
BMI (kg/m^2)		26.82±3.3	27.2±3.46	0.261
Comorbidity n (%)		152 (65.51)	151 (82.96)	<0.001
	Diabetes mellitus	59 (25.43)	70 (38.46)	0.004
	Systemic Hypertension	115 (49.56)	105 (57.69)	0.1
	Hyperlipidemia	8 (3.44)	4 (2.19)	0.452
	Heart failure	5 (2.15)	13 (7.14)	0.014
	Coronary artery disease	37 (15.94)	45 (24.72)	0.026
	Peripheral artery disease	1 (0.43)	2 (1.09)	0.585
	Atrial fibrillation	14 (6.03)	25 (13.73)	0.008
	Asthma	14 (6.03)	10 (5.49)	0.815
	COPD	11 (4.74)	15 (8.24)	0.145
	Cerebrovascular disease	18 (7.75)	17 (9.34)	0.566
	History of malignancy	5 (2.15)	15 (6.5)	0.004
	Chronic renal failure	8 (3.44)	18 (8.24)	0.007
	Alzheimer's disease	16 (6.89)	21 (11.53)	0.1
	Thyroid dysfunction	18 (7.75)	21 (11.53)	0.191
	Chronic liver disease	0	3 (1.64)	0.084
	Rheumatoid arthritis	6 (2.58)	7 (3.84)	0.466
	Parkinson's disease	7 (3.01)	2 (1.09)	0.309
	Heart valve disease	0	2 (1.09)	0.193
	Epilepsy	2 (0.86)	1 (0.54)	1
Anesthesia type n (%)	General anesthesia	96 (53.33)	84 (46.67)	0.331
	Regional anesthesia	136 (58.12)	98 (41.88)	
Complication n (%)		15 (6.46))	17 (9.34)	0.565
	Acute kidney failure	1 (0.43)	4 (2.19)	
	Acute coronary syndrome	2 (0.86)	3 (1.64)	
	Infection	5 (2.15)	3 (1.64)	
	Pneumonia	3 (1.29)	4 (2.19)	
	Atrial fibrillation	2 (0.86)	0	
	Embolism	1 (0.43)	1 (0.54)	
	Bleeding	0	1 (0.54)	
	Hypoxemia	1 (0.43)	1 (0.54)	
RCRI n (%)	Low risk	142 (61.20)	72 (39.56)	<0.001
	Medium risk	60 (25.86)	64 (35.16)	
	High risk	30 (12.93)	46 (25.27)	

Table 2. *Continued*

RDW value		RDW <14.25% (n=232)	RDW ≥14.25% (n=182)	p value
ASA physical status n (%)	1	67 (28.87)	24 (13.18)	<0.001
	2	111 (47.84)	85 (46.70)	
	3	47 (20.25)	55 (30.21)	
	4	7 (3.01)	18 (9.89)	
Preoperative anemia n (%)	No anemia	120 (51.72)	38 (20.87)	<0.001
	Mild anemia	106 (45.68)	121 (66.48)	
	Moderate anemia	4 (1.72)	8 (4.39)	
	Severe anemia	2 (0.86)	15 (8.24)	
Hemoglobin (g/dL)		12.39±1.82	10.91±2.05	<0.001
Hematocrit, %		36.94±5.33	33.64±5.72	0.001
Platelet (10^9/L)		222.91±76.87	250.95±101.05	<0.001
MCV (fL)		88.03±4.24	83.97±8.95	0.168
WBC (10^9/L)		10.06±4.15	10.61±4.62	<0.001
Lymphocyte (10^9/L)		1.61±0.82	1.38±0.85	0.001
Monocytes (10^9/L)		0.64±0.27	0.72±0.3	0.040
Neutrophil (10^9/L)		7.74±3.94	8.5±4.24	0.004
RBC (10^9/L)		4.22±0.67	4.02±0.74	<0.001
MCH (pg)		29.64±1.56	27.35±3.55	<0.001
MCHC (g/dL)		33.67±1.39	32.42±1.58	<0.001
Albumin (g/dL)		39.81±9.8	34.95±9.8	0.034
Alkaline phosphatase (IU/L)		97.33±42.74	120.28±76.19	<0.001
C reactive protein (mg/dL)		38.95±67.85	83.22±88.29	0.001
Urea (mg/dl)		41.43±21.71	49.95±29.68	0.009
Serum creatine (umol/L)		0.87±0.37	1.13±1.08	0.314
Sodium (mEq/L)		138.73±3.78	138.7±3.71	0.243
Potassium (mEq/L)		4.26±0.45	4.34±0.55	0.009
Calcium (mg/dL)		8.79±0.72	8.59±0.83	<0.001
INR		1.04±0.1	1.17±0.49	<0.001
Length of hospital stay (days)		4.55±3.78	7.34±12.49	<0.001
Length of ICU stay (days)		1.24±2.56	3.27±9.83	0.304
Readmission n (%)		10 (45.45)	12 (54.55)	0.664
Operation duration (min)		75.47±27.15	74.07±22.44	0.664
30-day mortality n (%)		14 (21.54)	51 (78.46)	<0.001
1 Year mortality n (%)		29(30,85)	65(69,15)	<0.001

Values are given as mean ± SD or number (percentage). RDW, Red blood cell distribution width; BMI, Body mass index; COPD, chronic obstructive pulmonary disease; RCRI, Revised Cardiac Risk Index, ASA, American Society of Anesthesiologists; MCV, Mean corpuscular volume, WBC, White blood count, RBC, Red blood cells; MCH, Mean corpuscular hemoglobin, MCHC, Mean corpuscular hemoglobin concentration, INR, International normalized ratio; ICU, Intensive care unit

Figure 2. Receiver Operating Curve of Red Blood Cell Distribution Width in predicting 30-day mortality (A) and 1-year mortality (B)

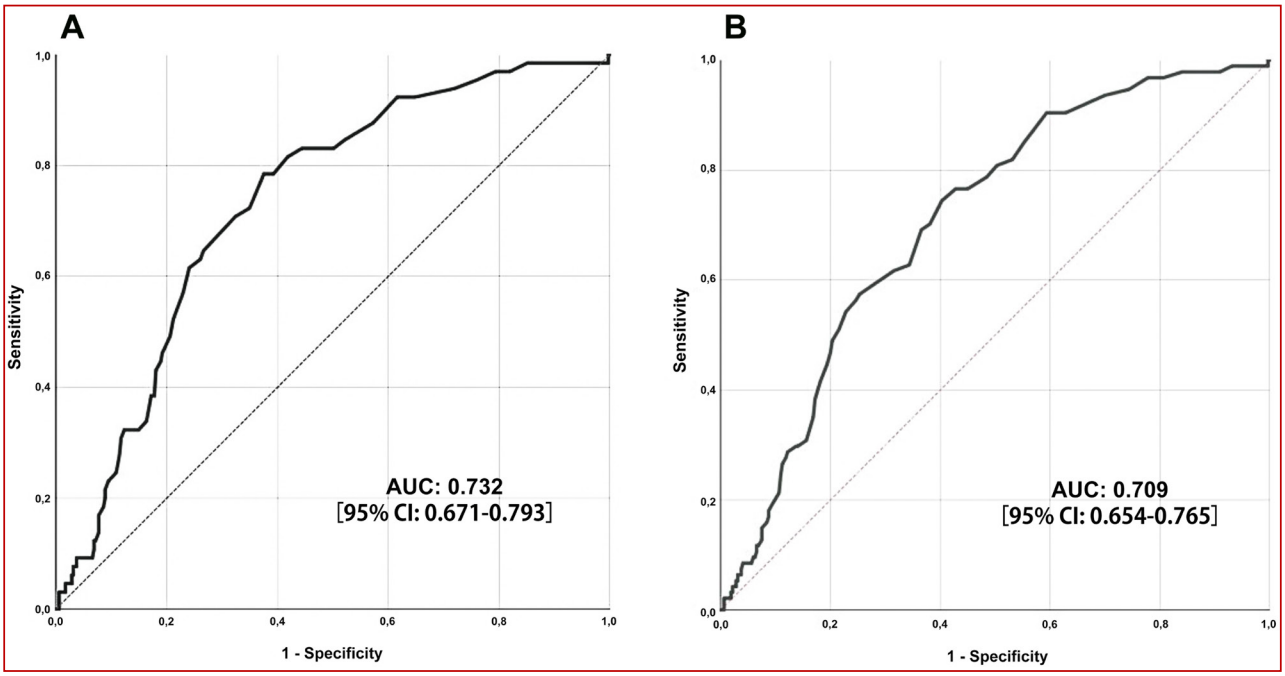

Table 3. Multivariate analysis to identify factors associated with 30–day mortality

	OR (95% C.I.) (Univariate)	p	OR (95% C.I.) (Multivariate)	p
RDW ≥14,25	6.06 (3.22-11.38)	<0.001	4.68 (2.35-9.33)	<0.001
Age	1.18 (1.08-1.15)	<0.001	1.09 (1.05-1.14)	<0.001
Atrial fibrillation	3.55 (1.76-7.29)	0.001	2.64 (1.14-6.11)	0.023
Alzheimer's disease	5.10 (2.49-10.43)	<0.001	2.98 (1.27-6.97)	0.012
CRF	3.78 (1.63-8.76)	0.002	3.42 (1.30-9.03)	0.013

RDW, Red blood distribution width; Chronic renal failure, CRF

According to the multivariate logistic regression analysis, high preoperative RDW levels were independent risk factors for postoperative 30-day and 1-year mortality. A RDW of ≥14.25 increased the risk of death within 30 days by approximately 4.7 times; for 1-year mortality, it increased the risk by 2.74 times. Other independent determinants of 30-day mortality included advanced age (OR 1.09 [1.05–1.14], p<.001), atrial fibrillation (OR 2.64 [1.14–6.11], p=.023), Alzheimer's disease (OR 2.98 [1.27–6.97], p=.012), and chronic kidney disease (OR 3.42 [1.30–9.03], p=.013), (Table 3). Other independent determinants of 1-year mortality included advanced age (OR 1.09 [1.05–1.13], p<.001), Alzheimer's disease (OR 5.35 [2.29–12.46], p=.012), high RCRI (OR 3.02 [1.45–6.30], p=.003), and uremia (OR 1.01 [1.00–1.02], p=.01).

DISCUSSION

Our study demonstrated that high RDW (>14.25%) in aged patients who have hip surgery correlates with age and comorbidity burden. This condition did not increase the duration of ICU stay or risk of readmission. Nevertheless, we observed an independent increase in mortality risk over both short and long periods in patients with a postoperative RDW >14.25%.

It is claimed that RDW levels increase by approximately 1% per year in individuals aged 60 and above (9). In our study, patients with RDW >14.25 were older compared to those with RDW ≤14.25. Therefore, the age distribution between our groups confirms the association between high RDW and age. This phenomenon is explained by the natural decline in the physiological functions of erythropoiesis with aging (10). Yet, it remains uncertain whether the elevated RDW in these patient groups is a result of aging itself or a consequence of critical illness. Therefore, we are inclined to believe that the reason for high RDW in these patients is not attributable to age alone.

The causes of elevated RDW are multifactorial. Several studies suggest that RDW can serve as a biomarker for assessing mortality risk in comorbidities such as heart disease and cancer (5,11). Nevertheless, it remains unclear whether the relationship between elevated RDW and mortality is causal or consequential. In light of all these findings, we believe that RDW to be an indicator that reflects the prognosis of frail patients. Therefore, we emphasize the importance of clinicians considering RDW when assessing prognosis during preoperative examinations.

In our study, comorbidities such as DM, CRF, and CHF were more frequently observed in patients with high RDW values. Our findings, in conjunction with previous studies, support the potential relationship of RDW with adverse outcomes in chronic diseases (12,13). Although the pathophysiological mechanisms between high RDW and poor prognosis remain uncertain, it has been proposed that various systemic factors such as oxidative stress, inflammation, and inadequate nutrition (deficiencies in iron, folate, vitamine B12, etc.) could explain this relationship (6,14). Oxidative stress occurring in chronic illnesses may lead to increased production of reactive oxygen radicals, disruption of erythrocyte homeostasis, and an increase in mortality (15). Additionally, inflammation can affect bone marrow function and disrupt iron metabolism, thereby influencing the erythropoiesis process (5).

Although we found an association between high RDW and length of hospital stay, we did not observe a difference in terms of postoperative complications, length of ICU stays, or risk of readmission. In this regard, our findings contradict previous studies (6,16). In our study, patients with elevated RDW were older than in other studies, and they had a higher burden of comorbidities. This may have affected the clinical decision-making process of clinicians and created a reflex to keep patients in the hospital for a longer period (17). However, we observed that more objective decisions, such as ICU stay duration and readmission, were not influenced by RDW values. Although we could not demonstrate the significance of RDW in terms of complications, pneumonia was the most frequently observed complication in the high RDW group. This also supports the findings of previous studies (18,19).

In our study, we showed that high RDW is independently correlated with postoperative mortality at both 30-day and 1-year periods. Hung Wei-Hsiang et al. reported that RDW>13.35% caused an increase in the risk of 30-day mortality in patients (1). However, this increase in 30-day mortality is quite slight and contradicts our findings. This difference may be attributed to variations in the composition of populations or matching disparities between the two studies. Similarly, in a randomized

controlled trial involving heart failure patients, Felker and colleagues report a twofold increase in the risk of mortality with RDW values above 15.8% compared to those with RDW values below 13.3% (20). Tonelli et al., meanwhile, reported a twofold higher probability of mortality in patients with CAD with RDW greater than 13.8% compared to those with RDW less than 12.6% (21). However, Michael Berry and colleagues assessed the effect of RDW on mortality in emergency laparotomy patients aged 65 and older and could not establish an association between anisocytosis and 30-day mortality (14). In our study, it was observed that an RDW >14.25 was correlated with 4.7 times increased 30-day mortality and 2.74 times increased 1-year mortality. The selection of younger patients in comparison to our study and the inclusion of patients with specific comorbidities in these studies may have caused these differences. However, none of these studies considered robust adjustment factors such as nutritional status, immune status, hemoglobin levels, and multiple diseases that reduce the risk of confusing factors based on a conceptual model. Finally, although studies support the relationship between high RDW and mortality, the difference in RDW cut-off values affected the mortality risk prediction rate. This is because there is currently no standardized threshold value to define high RDW levels. Formun AltıTherefore, despite the indication of clinically significant associations between high RDW and mortality, we believe that future studies are needed to determine an optimal threshold value.

While attempting to predict postoperative mortality rates following hip fracture surgery, there is a need for tests that clinicians can easily apply. Previous studies have found an association between high RCRI scores and 30-day mortality in patients undergoing hip fracture surgery (22). Additionally, Yin et al. suggested that evaluating RDW and ASA scores together may provide a more powerful and effective strategy for predicting mortality in hip fracture patients (23). The findings of our study suggest that mortality increases as ASA and RCRI scores increase. However, the availability of RDW in automated CBC results is a factor that increases its value. Additionally, RDW assessment is practical and cost-effective. Nevertheless, there are various factors that can affect RDW values. Therefore, we believe that RDW alone may not be used as an effective and independent factor in predicting prognosis. However, combining RDW with other known prognostic indicators may enhance the power of risk models. Therefore, in preoperative assessment, RDW, when used in conjunction with other scoring systems, can facilitate resource allocation, potentially providing a practical contribution to the current risk classification strategy.

The strengths of this study are its prospective design, unbiased inclusion criteria, and long-term follow-up of patients. However, various potential limitations should be considered. Firstly, patients were treated and followed up in a single tertiary center, which may not represent other healthcare centers and ethnicities. Secondly, while the assessment of RDW is quick, straightforward, and doesn't demand specialized skills or equipment, there are various methods available for measuring red cell size (e.g., impedance or optical techniques) and RDW (24). This can lead to variations in reference values depending on the device and population. Finally, there was no common opinion on the optimum threshold value for the prognostic aim of RDW (25).

This prospective study revealed a strong association between preoperative RDW and short-term and long-term mortality in geriatric patients who have hip surgery. Due to its routine reporting in CBC, lack of additional cost, and easy interpretability, RDW may provide a practical contribution to predicting patient prognosis.

REFERENCES

1. Wei-Hsiang H, Zhu Y, Zhang J, Zhang Y. Pretreatment red blood cell distribution width as an efficient predictor of survival in older patients undergoing hip fracture surgery. Int J Clin Pract. 2021;75(12):e14791. (DOI:10.1111/ijcp.14791)
2. Lv H, Zhang L, Long A, et al. Red Cell Distribution Width as an Independent Predictor of Long-Term Mortality in Hip Fracture Patients: A Prospective Cohort Study. J Bone Miner Res. 2016;31(1):223-33. (DOI:10.1002/jbmr.2597)
3. Toson B, Harvey LA, Close JC. New ICD-10 version of the Multipurpose Australian Comorbidity Scoring System outperformed Charlson and Elixhauser comorbidities in an older population. J Clin Epidemiol. 2016;79:62-9. (DOI:10.1016/j.jclinepi.2016.04.004)
4. Liu C, Zhang K, Zhang T, et al. Higher Preoperative Red Blood Cell Distribution Width Increases the Risk of Myocardial Injury After Noncardiac Surgery in Advanced-Age Patients: A Retrospective Cohort Study. Clin Interv Aging. 2023;18:169-79. (DOI:10.2147/CIA.S392778)
5. Abdullah HR, Sim YE, Sim YT, et al. Preoperative Red Cell Distribution Width and 30-day mortality in older patients undergoing non-cardiac surgery: a retrospective cohort observational study. Sci Rep. 2018;8(1):6226. (DOI: 10.1038/s41598-018-24556-z)
6. Olafsson HB, Sigurdarson GA, Christopher KB, Karason S, Sigurdsson GH, Sigurdsson MI. A retrospective cohort study on the association between elevated preoperative red cell distribution width and all-cause mortality after noncardiac surgery. Br J Anaesth. 2020;124(6):718-25. (DOI:10.1016/j.bja.2020.02.009)
7. Havens JM, Seshadri AJ, Salim A, Christopher KB. Red cell distribution width predicts out of hospital outcomes in critically ill emergency general surgery patients. Trauma Surg Acute Care Open. 2018;3(1):e000147. (DOI:10.1136/tsaco-2017-000147)
8. Hanley JA, McNeil BJ. The meaning and use of the area under a receiver operating characteristic (ROC) curve. Radiology. 1982;143(1):29-36. (DOI:10.1148/radiology.143.1.7063747)
9. Phillips R, Wood H, Weaving G, Chevassut T. Changes in full blood count parameters with age and sex: results of a survey of almost 900 000 patient samples from primary care. Br J Haematol. 2021;192(4):e102-e105. (DOI:10.1111/bjh.17290)
10. Pilling LC, Atkins JL, Duff MO, et al. Red blood cell distribution width: Genetic evidence for aging pathways in 116,666 volunteers. PLoS One. 2017;12(9):e0185083. (DOI:10.1371/journal.pone.0185083)
11. Chan DXH, Sim YE, Chan YH, Poopalalingam R, Abdullah HR. Development of the Combined Assessment of Risk Encountered in Surgery (CARES) surgical risk calculator for prediction of postsurgical mortality and need for intensive care unit admission risk: a single-center retrospective study. BMJ Open. 2018;8(3):e019427. (DOI:10.1136/bmjopen-2017-019427)
12. Borné Y, Smith JG, Melander O, Engström G. Red cell distribution width in relation to incidence of coronary events and case fatality rates: a population-based cohort study. Heart. 2014;100(14):1119-24. (DOI:10.1136/heartjnl-2013-305028)
13. Sim YE, Wee HE, Ang AL, Ranjakunalan N, Ong BC, Abdullah HR. Prevalence of preoperative anemia, abnormal mean corpuscular volume and red cell distribution width among surgical patients in Singapore, and their influence on one year mortality. PLoS One. 2017;12(8):e0182543. (DOI:10.1371/journal.pone.0182543)
14. Berry M, Gosling JL, Bartlett RE, Brett SJ. Exploring red cell distribution width as a potential risk factor in emergency bowel surgery-A retrospective cohort study. PLoS One. 2022;17(5):e0266041. DOI:10.1371/journal.pone.0266041)
15. Salvagno GL, Sanchis-Gomar F, Picanza A, Lippi G. Red blood cell distribution width: A simple parameter with multiple clinical applications. Crit Rev Clin Lab Sci. 2015;52(2):86-105. (DOI:10.3109/10408363.2014.992064)
16. Aali-Rezaie A, Alijanipour P, Shohat N, Vahedi H, Foltz C, Parvizi J. Red Cell Distribution Width: An Unacknowledged Predictor of Mortality and Adverse Outcomes Following Revision Arthroplasty. J Arthroplasty. 2018;33(11):3514-9. (DOI:10.1016/j.arth.2018.06.035)
17. O'Leary F, Flood VM, Petocz P, Allman-Farinelli M, Samman S. B vitamin status, dietary intake and length of stay in a sample of elderly rehabilitation patients. J Nutr Health Aging. 2011;15(6):485-9. (DOI:10.1007/s12603-010-0330-4)
18. Zhang D, Zhang Y, Yang S, Sun L, Zhang N, Huang S. Relationship between preoperative red blood cell distribution width and postoperative pneumonia in elderly patients with hip fracture: a retrospective cohort study. J Orthop Surg Res. 2023;18(1):253. (DOI:10.1186/s13018-023-03732-6)

19. Lv H, Yin P, Long A, et al. Clinical characteristics and risk factors of postoperative pneumonia after hip fracture surgery: a prospective cohort study. Osteoporos Int. 2016;27(10):3001-9. (DOI:10.1007/s00198-016-3624-5)

20. Felker GM, Allen LA, Pocock SJ, et al. Red cell distribution width as a novel prognostic marker in heart failure: data from the CHARM Program and the Duke Databank. J Am Coll Cardiol. 2007;50(1):40-7. (DOI:10.1016/j.jacc.2007.02.067)

21. Tonelli M, Sacks F, Arnold M, et al. Relation Between Red Blood Cell Distribution Width and Cardiovascular Event Rate in People With Coronary Disease. Circulation. 2008;117(2):163-8. (DOI:10.1161/CIRCULATIONAHA.107.727545)

22. Forssten MP, Mohammad Ismail A, Sjolin G, et al. The association between the Revised Cardiac Risk Index and short-term mortality after hip fracture surgery. Eur J Trauma Emerg Surg. 2022;48(3):1885-92. (DOI:10.1007/s00068-020-01488-w)

23. Yin P, Lv H, Zhang L, Long A, Zhang L, Tang P. Combination of red cell distribution width and American Society of Anesthesiologists score for hip fracture mortality prediction. Osteoporos Int. 2016;27(6):2077-87. (DOI:10.1007/s00198-015-3357-x)

24. Fava C, Cattazzo F, Hu ZD, Lippi G, Montagnana M. The role of red blood cell distribution width (RDW) in cardiovascular risk assessment: useful or hype?. Ann Transl Med. 2019;7(20):581. (DOI:10.21037/atm.2019.09.58)

25. Cheung YN, Shum HP, Chan KC, Yan WW. Preoperative red cell distribution width: Not a useful prognostic indicator for 30-day mortality in patients who undergo major- or ultra-major noncardiac surgery. Indian J Crit Care Med. 2016 Nov;20(11):647-52. (DOI: 10.4103/0972-5229.194008)

ORIGINAL ARTICLE

VARIABLES AFFECTING MORTALITY IN PATIENTS IN PALLIATIVE CARE UNITS: OR IS IT STILL JUST ALBUMIN?

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Abstract

Introduction: This study aimed to evaluate the relationship between biomarkers, clinical prognostic indexes, and mortality in patients without malignancy.

Materials and Method: This retrospective study included patients who were followed up in palliative care units between January 2020 and January 2024. Data were collected from patients' digital database records. Demographic characteristics, clinical features, comorbidities, main reasons, and length of hospital stay were recorded. Laboratory parameters were measured at admission. Patient outcomes were also documented.

Result: The study included 416 patients. The mortality rate was 28.36% (n=118). When survivors and nonsurvivors were compared, variables including albumin, protein, white blood cells, neutrophils, C-reactive protein, procalcitonin, CRP/albumin, CRP/protein, neutrophil/lymphocyte, and platelet/lymphocyte ratios significantly affected mortality. Logistic regression analysis revealed that only the albumin level was statistically significant (0.010). It was found significant that the albumin value was below 2.76 g/dL (odds ratio 3.688; the area under the curve (AUC)=0.670, and P<.000). The sensitivity and specificity of an albumin cutoff value of 2.05 g/dL were 85% and 97%, respectively.

Conclusion: Our study highlights the pivotal role of hypoalbuminaemia as the most significant predictor of mortality in patients on the palliative care unit (PCU) without malignancy. To optimise patient care in palliative settings and better tailor therapeutic interventions, we must recognise the vital role of hypoalbuminaemia as a critical risk factor.

Keywords: Palliative Care; Mortality; Albumin.

INTRODUCTION

Palliative care (PC) is a multidisciplinary approach that improves the quality of life of patients with life-threatening diseases and their families. The need for palliative care units (PCU) is rapidly increasing worldwide owing to the ageing population and rising prevalence of cancer and comorbidities (1,2). Despite this need, PC applications have still not been developed at the desired level in many parts of the world, such as our country.

The standard protocol is unclear in our country, although PC protocols have been established in many countries worldwide, such as the United States, Canada and Germany (3). One of the most important reasons is that PC is not a specific medical speciality in Turkey. Physicians from various medical specialities, such as Anaesthesiology and Reanimation, Family Medicine, Neurology, and Internal Medicine, provide services. Palliative care and its features are not well-known to society or general health professionals (1,4).

This study aimed to conduct a descriptive analysis by evaluating patients admitted to the PCU. This study also aimed to determine factors affecting mortality. Our research effectively uses a limited number of PCU beds. We assume this will help us create a PCU management protocol for our hospital.

MATERIALS AND METHOD

After obtaining approval from the local ethics committee (2024/1684), this single-centre retrospective study was conducted at Karabuk University Hospital in Karabuk, Turkey. This study was conducted in accordance with the principles of the Declaration of Helsinki.

All patients admitted to the PCU between 1 January 2020 and 1 January 2024 were evaluated. Data were obtained by scanning patients' hospital digital database records. Patients who were hospitalised with a diagnosis of COVID-19, stayed ≤ 24 hours, were under the age of 17, and had insufficient file information were excluded. Only the first admission was considered for patients with recurrent PCU. Patients diagnosed with malignancy were excluded based on the study design.

The PCU is a 14-bed unit staffed by a family medicine anaesthesiologist on a 24-hour-per-day, 7-days-a-week basis. The following data were recorded: age, sex, place of admission, including from home, intensive care unit (ICU), emergency department (ED), and other services; feeding style; respiratory pattern, including spontaneous breathing, tracheostomy, home invasive mechanical ventilation; decubitus status, and comorbidities. Patient comorbidities were retrospectively analysed by scanning their ICD-10 (International Statistical Classification of Diseases) codes. They were categorised as cardiovascular disease, including hypertension, heart failure, and arrhythmia; neurological disease, including cerebrovascular disease, epilepsy, Alzheimer disease, and Parkinson disease; respiratory disease, including asthma and chronic obstructive pulmonary disease; metabolic disease, including diabetes mellitus, hypo/hyperthyroidism, renal failure, and cirrhosis; psychiatric disease, including depression, bipolar disorder, schizophrenia, and other diseases such as peptic ulcer, gastroesophageal reflux disease, Schögren scleroderma, Behçet disease, benign prostatic hyperplasia, and osteoporosis.

Charlson Comorbidity Index (CCI) was used as a clinical prognostic index. Charlson Comorbidity Index (CCI) is used as an index of survival and prognosis, like other prognostic scoring such as the APACHE II, Palliative Prognostic Index or the Karnofsky Performance Scale (5,6). We preferred to use CCI. This index was calculated using the MDcalc website (https://www.mdcalc.com/calc/3917/charlson-comorbidity-index-cci) with comorbidities.

The feeding style was classified as parenteral, nasogastric tube (NG), percutaneous endoscopic gastrostomy (PEG), or oral and percutaneous

endoscopic jejunostomy (PEJ). The main reasons for PCU admission (palliation, nutritional difficulty, decubitus, and pain) and the length of hospital stay were recorded. The laboratory values of each patient were recorded, including haemogram — haemoglobin, platelet count, neutrophils, and lymphocytes; biochemistry — liver and kidney function tests, electrolytes, albumin, and protein values; infection markers — C-reactive protein (CRP) and procalcitonin). CRP/albumin ratio (CAR), CRP/protein ratio (CPR), neutrophil/lymphocyte ratio (NLR), and platelet/lymphocyte ratio (PLR) were calculated. Additionally, the discharge status of the patients was evaluated, and the mortality rate was calculated.

Data analysis

In this study, variables that were the primary reasons for hospital admission and comorbidities were proportionally assigned according to the number of admissions. Descriptive statistics of the variables used in the data set, number of observations (N), and mean ± SD are given. To determine mortality rates, data obtained for those who lived and died were compared. Before comparison, normality tests were performed using the Kruskal–Wallis and Shapiro-Wilk methods. For comparison, the t-test was used for parametric data, whereas the Mann–Whitney U test was used for non-parametric data. The significance level was set at $P<.05$. Logistic regression analysis was performed to determine the variables affecting mortality. Therefore, we attempted to explain the variables that caused these deaths. The Wald test was applied for model selection in logistic regression. In addition, the Receiver Operating Characteristic (ROC) curve method was applied to distinguish between deceased and living individuals based on the determining factors. The SPSS 22 V statistical programme was used for all analyses.

RESULTS

During the study period, 934 patients were admitted to a PCU. Data from 269 patients were excluded due to recurrent PCU admissions other than the first admission. A total of 249 patients were excluded for the following reasons: 128 patients were diagnosed with COVİD, 90 patients were diagnosed with malignancy, 17 patients had missing data, and 8 patients stayed ≤24 hours. Six patients still hospitalised were excluded from the study.

A total of 416 patients were included in this study. The mean age of the patients was 74.65± 13.58 years, and 228 were men (54.81%). Most patients were admitted to the ICU and ED. The clinical and demographic characteristics of patients are presented in Table 1. The mean length of stay was 15.84 ± 13.37 days. The mortality rate was 28.36% (n = 118).

The most common comorbidities were cardiovascular and neurological disease; 293 patients had three or more comorbidities (Table 1).

Education of patients' relatives (for patients admitted from the ICU for nutrition or home mechanical ventilator training), malnutrition, decubitus, and pain were the main reasons for admission to the PCU.The most common reason for admission was palliation with 43.27%. Other reasons were malnutrition in 25.24%, decubitus in 19.23%, pain in 6.25% and other in 6.01%.

Among them, 118 died, with a mortality rate of 28.36%. There were significant differences in albumin, protein, WBC, neutrophil, CRP, procalcitonin, CAR, CPR, NLR, and PLR between survivors and nonsurvivors. The data obtained from the *t* test of mortality analysis conducted according to the characteristics examined in this study are shown in Table 2.

Logistic regression analysis was applied to all the significant parameters, and the results are presented in Table 3. The table shows that only the albumin level was statistically significant among the

Table 1. The demographic and clinical features of the patients

Age		**n**	**Mean ± SD**
	Total	416	74.65 ± 13.58
	Women	188	77.16 ± 12.95
	Men	228	72.57 ± 13.75
Sex		**n**	**%**
	Women	188	54.81%
	Men	228	45.19%
Place of acceptance	ICU	159	38.22%
	ED	109	26.20%
	Service	75	18.03%
	Home	73	17.55%
Tracheostomy	Yes	88	21.15%
	No	328	78.85%
Home mechanical ventilator	Yes	79	18.99%
	No	337	81.01%
Feeding style	Parenteral	81	19.47%
	NG	132	31.73%
	PEG	124	29.81%
	Oral	78	18.75%
	PEJ	1	0.24%
Decubitus	Yes	285	68.51%
	No	131	31.49%
			Mean ± SD
LOS			15.84 ± 13.37
CCI			7.45 ± 2.60
Comorbidity			**n**
	Neurological disease		366
	Cardiovascular disease		438
	Pulmonary disease		68
	Metabolic disease		217
	Psychiatric disease		36
	Postoperative		9
	Others		107
Number of Comorbidity	1 and less		43
	2		80
	3		110
	4		102
	5 and more		81

ICU: Intensive Care Unit, ED: Emergency Department, NG: Nasogastric Tube, PEG: Percutaneous Endoscopic Gastrostomy, PEJ: Percutaneous Endoscopic Jejunostomy, LOS: Length of Stay, CCI: Charlson Comorbidity Index.

Table 2. A comparison of survivors and nonsurvivors

	Mortality analysis		*P* values
	Survivors (n=298)	Nonsurvivors (n=118)	
Age, years	74.45 ± 14.25	75.12 ± 11.74	.624
LOS, day	15.04 ± 11.39	17.92 ± 17.30	.097
Sodium, mEq/L	138.34 ± 5.17	138.21 ± 6.52	.838
Albumin, mg/dL	3.12 ± 0.62	2.76 ± 0.52	.000*
Protein, mg/dL	5.85 ± 0.97	5.44 ± 1.05	.000*
WBC, 10'9/L	8.96 ± 4.27	10.57 ± 6.12	.010*
Haemoglobin, g/dL	10.34 ± 2.11	9.91 ± 1.95	.051
Platelet, 10'9/L	283.69 ± 127.77	258.99 ± 144.76	.107
Neutrophil count, 10'9/L	8.69 ± 12.32	13.53 ± 18.56	.010*
Lymphocyte count, 10'9/L	1.77 ± 2.53	2.08 ± 4.59	.502
CRP, mg/L	75.74 ± 73.61	114.26 ± 72.09	.000*
Procalcitonin, ng/mL	0.69 ± 1.55	1.57 ± 4.23	.030*
CAR	26.84 ± 27.99	42.32 ± 25.80	.000*
CPR	13.79 ± 14.06	21.42 ± 13.27	.000*
NLR	6.42 ± 5.87	10.94 ± 10.70	.000*
PLR	245.04 ± 176.17	301.66 ± 281.02	.043*

* Statistically significant; WBC: white blood cell; CRP: C-reactive protein; CAR: C-reactive protein/albumin ratio; CPR: C-reactive protein/protein ratio; NLR: neutrophil/lymphocyte ratio; PLR: platelet/lymphocyte ratio.

Table 3. Logistic regression mortality analysis of all parameters

Parameters	B	SE	Wald	Sig.	Odds Ratio
Albumin	1.305	0.667	3.828	0.010	3.688
Protein	-0.388	0.412	0.888	0.346	0.678
WBC	-0.043	0.050	0.732	0.392	0.958
Neutrophil	0.002	0.025	0.005	0.945	1.002
CRP	-0.018	0.017	1.188	0.276	0.982
Procalcitonin	-0.041	0.103	0.155	0.694	0.960
CAR	0.102	0.412	2.662	0.105	0.981
CPR	0.089	0.090	0.982	0.322	1.093
NLR	-0.012	0.029	0.163	0.686	0.988
PLR	0.156	0.389	1.093	0.518	0.771

WBC: white blood cell; CRP: C-reactive protein; CAR: C-reactive protein/albumin ratio; CPR: C-reactive protein/protein ratio; NLR: neutrophil/lymphocyte ratio; PLR: platelet/lymphocyte ratio.

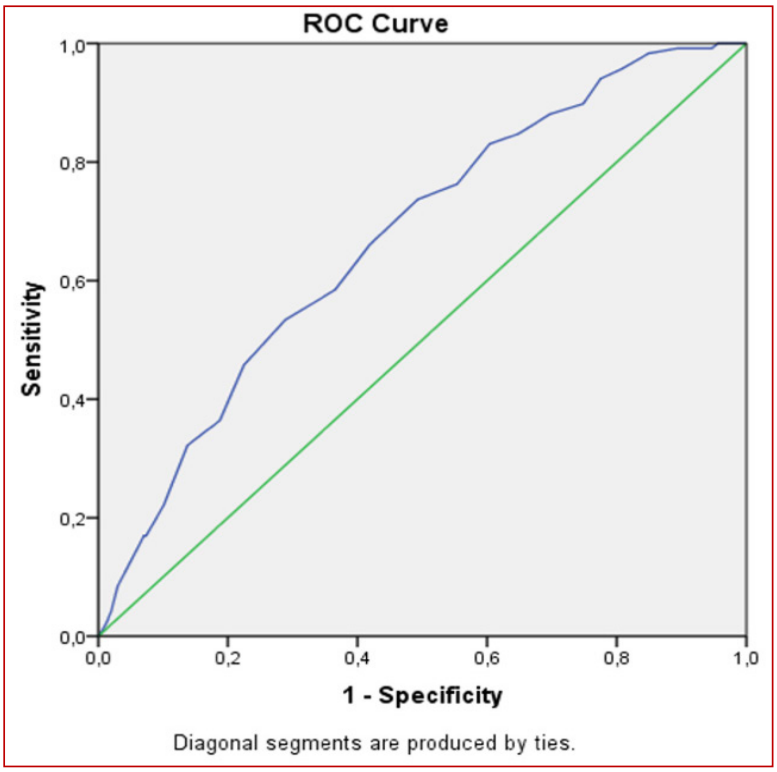

Figure 1. Receiver Operating Characteristic (ROC) curve for mean albumin value

Table 4. Cut off between survivor and nonsurvivor groups and albumin values based on ROC analysis.

Area Under the curve						
Test Result Variable(s): Albumin						
	Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval		Cuttoff Value
				Lower Bound	Upper Bound	
Albumin	.670	.028	.000	.614	.726	2.05
Positive Likelihood Ratio			2.81			1.56-4.12
Negative Likelihood Ratio			0.01			0.00-0.015
Sensitivity			0.85			0.77-0.93
Specificity			0.97			0.91-0.99

mortality variables (*P*=.010). The other variables were not significant. Accordingly, albumin levels were the main variable that explained mortality.

The receiver operating characteristic (ROC) curve method was applied to distinguish between survivors and nonsurvivors based on albumin level, which was significant after logistic regression analysis. The results are shown in Figure 1, and the other test results for albumin are shown in Table 4. According to the ROC analysis, the cutoff value for mean albumin was 2.05 mg/dL. The sensitivity and specificity of the albumin cutoff value of 2.05 mg/dL were 85% and 77%, respectively.

DISCUSSION

In this study, we concurrently evaluated laboratory values and clinical prognostic indexes that affect mortality rates in PCU patients without malignancy. The mortality rate in this study was 28.36%. We found that only hypoalbuminaemia was strongly associated with mortality.

The majority of patients were men, and their mean age was 74.65 ± 13.58 years. Most patients were admitted to the ICU and ED; the majority were administered NG and PEG, and 88 patients underwent a tracheostomy. Our patients' demographic and clinical features were consistent with those reported in the literature (2, 7-10).

Factors affecting mortality rates in PCUs have been reported in various studies. Several laboratory values and ratios, such as protein, sodium, WBC, CRP, procalcitonin, CAR, CPR, and NLR, have been widely studied as prognostic markers in patients on the PCU (1, 7, 9-11).

C reactive protein (CRP) is a classical acute phase protein that increases rapidly. There are many factors (infection, rheumatological disease, cancer, etc.) that affect the CRP value. It is a laboratory parameter whose relationship with mortality and prognosis has been studied in the literature (1,12, 13). It has been shown in studies that high serum CRP concentrations are associated with organ failure and mortality. (14, 15) Karaşahin et al. stated in their study that evaluating CRP in the first 24 hours of hospitalization would be important in determining prognosis (16).

The CRP/albumin ratio, a combination of systemic inflammation and nutritional status markers, has been studied as an independent prognostic marker in critically ill patients (17-18). Oh et al. reported that a one-unit increase in CAR resulted in an 11% increase in the risk of 30-day mortality in critically ill ICU patients (19). Ranzani et al. conducted a study in an intensive care unit and found that CRP level and CAR were independent risk factors for mortality (12). In their study, Sargın et al. analysed laboratory values (such as neutrophils, PLT, CRP, CAR, and NLR) that affect patient mortality (1). None of these factors was significant.

Neutrophil-lymphocyte ratio (NLR) is a marker that shows systemic inflammation in clinical practice and can be easily measured and repeated with a blood count device. Increased NLR has been shown to be an independent prognostic risk factor in many types of cancer and its association with mortality rate (17, 20). However, studies conducted on patients followed in the palliative service are limited.

However, the results of these studies remain controversial. There are significant differences between survivors and nonsurvivors regarding protein, WBC, neutrophil, CRP, procalcitonin, CAR, CPR, and NLR. However, when logistic regression analysis was applied, we found that only the effect of hypoalbuminaemia on mortality rates was significant.

Hypoalbuminaemia is associated with short-term mortality, hospital stay, and other complications (21, 22). In a study conducted by Akirov et al., mortality was 12% in patients with mild hypoalbuminaemia and 34% in those with significant hypoalbuminemia (23). Sargın et al. reported in their study that hypoalbuminaemia is a risk factor for mortality (1). However, they did not use a clinical index in their study and presented this as a limitation. Taşar et al. stated that hypoalbuminaemia is an independent risk factor for mortality (24). Aung et al. found that albumin values < 3.1 mg/dL were the most important determinant of mortality (25). We studied mortality markers in a specific group of patients without malignancy. In our study, albumin values < 2.76 mg/dL were significant in mortality, and the sensitivity and specificity values were 85% and 97%, respectively.

Current studies have focused on determining the factors affecting mortality, especially in critically ill patients who are followed up in the ICU and PCU (1, 2, 11, 13, 22, 26-28). Apart from the

laboratory values of the patients, comorbidities also affect mortality. The scoring systems used in the ICU and PCU were based on organ failure and comorbidities such as APACHE II, SOFA, PPI and CCI. The Charlson Comorbidity Index (CCI) is a widely used comorbidity index for critically ill patients (29, 30). Vural et al. They determined high CCI, high APACHE II score and low albumin values as indicators of mortality. However, they studied a heterogeneous patient group (31). We used this to evaluate effects on mortality but it did not affect on mortality.

Palliative care requires a multidisciplinary approach. It is still essential as a health policy to develop PCU services both in our country and globally.

Our study was conducted in a specific patient group and included a relatively large number of patients. Additionally, the effects of laboratory parameters and clinical features on the mortality rate of the patients were investigated. We believe these are the strengths of the present study.

This study had several limitations. The most important limitations of our study are its retrospective and single-centre nature, and the fact that the study was conducted in a patient group with a high average age and high comorbidities. We did not use other widely used and accepted prognostic scales for PCU patients, such as the Palliative Prognostic Index or the Karnofsky Performance Scale.

We believe more prospective studies should be conducted by grouping patients according to age and main disease. In particular, we plan to evaluate patients diagnosed with malignancy.

CONCLUSION

Our study highlights the pivotal role of hypoalbuminaemia as the most significant predictor of mortality in PCU patients without malignancy. By recognising and addressing this critical risk factor, healthcare providers can better tailor therapeutic interventions and optimise patient care in palliative settings. Further research is warranted to elucidate the underlying mechanisms linking hypoalbuminemia to adverse outcomes, and to explore targeted therapeutic strategies aimed at mitigating its detrimental effects on patient survival.

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REFERENCES

1. Sargin M, Demirel H. Relationship Between Mortality and The Laboratory Values at Admission to Palliative Care Unit in Geriatric Patients with No Diagnosis of Malignancy. Turkish Journal of Geriatrics 2019;22 (4): 434-442. (DOI:10.31086/Tjgeri.2020.122)
2. Çadirci D, Ayazoz Y, Koçakoğlu Ş. Evaluation of Patients Followed in A Palliative Care Unit in Turkey. Turkish Journal of Geriatrics 2021;24 (2): 227-234. (DOI:10.31086/Tjgeri.2021.219)
3. Aslan Y. Overview of Palliative Care Models in Turkey and the World. Anatolian Current Medical Journal 2020;2 (1): 19-27. (DOI:10.38053/Agtd.632674) (in Turkish)

4. Kabalak A, Öztürk H, Erdem AT, Akın S. M.H. Comprehensive Palliative Care Center Application at Ulus State Hospital. Journal of Contemporary Medicine 2012;2(2):122-126. (in Turkish)

5. Özkaya Sağlam B, Küçükgüçlü Ö, Ozcan M, Öztop İ. The Relationship Between Frailty and Sarcopenia in Older Adults with Cancer. Turkish Journal of Geriatrics 2021;24 (4): 478-489. (DOI:10.31086/tjgeri.2021.245)

6. Ünlü E, Geyik F, Yuce Y, Kart J, Cevik B, Saraçoğlu K. Comparison of The Modified 5-Item Frailty Index with The American Society of Anesthesiologists Classification and Charlson Age Comorbidity Index for Predicting Postoperative Outcomes in Geriatric Patients: A Prospective Observational Study Research. Turkish Journal of Geriatrics 2022;25 (4): 611-621. (DOI:10.31086/tjgeri.2022.320)

7. Utebey G, Ergil J. Evaluation of The Factors Prolonging the Discharge Home of Patients in A Palliative Care Center. Turkish Journal of Geriatrics 2021;24 (3): 342-350. (DOI:10.31086/Tjgeri.2021.231)

8. Kaya ZI. Evaluation of The Multidisciplinary Approaches Provided with Consultations in Palliative Care Service. Journal of Geriatric Sciences 2022;5 (2): 28-37. (DOI:10.47141/Geriatrik.1159488)

9. Dincer M, Kahveci K, Doger C. An Examination of Factors Affecting the Length of Stay in A Palliative Care Center. J Palliat Med 2018;21 (1): 11-15. (DOI:10.1089/Jpm.2017.0147)

10. Yürüyen M, Tevetoğlu IÖ, Tekmen Y, et al. Prognostic Factors and Clinical Features in Palliative Care Patients. Konuralp Medical Journal 2018;10 (1): 74-80. (DOI:10.18521/Ktd.368570)

11. Dişli ZK, Boyraz Ö. The Relationship between Biochemical Parameters and Survival of Patients Admitted to the Palliative Care Unit. Journal of Anesthesia(Jarss) 2018;26(4):229. (in Turkish)

12. Ranzani OT, Zampieri FG, Forte DN, Azevedo LC, Park M. C-Reactive Protein/Albumin Ratio Predicts 90-Day Mortality of Septic Patients. Plos One 2013;8 (3): E59321. (DOI:10.1371/Journal.Pone.0059321)

13. Ho KM, Lee KY, Dobb GJ, Webb SA. C-Reactive Protein Concentration as A Predictor of In-Hospital Mortality After ICU Discharge: A Prospective Cohort Study. Intensive Care Med 2008;34 (3): 481-487. (DOI:10.1007/S00134-007-0928-0)

14. Lobo SM, Lobo FR, Bota DP, et al. C-reactive protein levels correlate with mortality and organ failure in critically ill patients. Chest 2003;123 (6): 2043-2049. (DOI:10.1378/chest.123.6.2043)

15. Prieto MF, Kilstein J, Bagilet D, Pezzotto SM. C-reactive protein as a marker of mortality in intensive care unit. Med Intensiva 2008;32 (9): 424-430. (DOI:10.1016/s0210-5691(08)75719-x)

16. Karaşahin Ö, Tosun Taşar P, Timur Ö, et al. The diagnostic and prognostic value of laboratory biomarkers for infections in geriatric patients in palliative care. Anatolian Journal of General Medical Research 2016;26 (3): 238-242 (DOI:10.5222/terh.2016.238)

17. Mao M, Wei X, Sheng H, et al. C-Reactive Protein/Albumin and Neutrophil/Lymphocyte Ratios and Their Combination Predict Overall Survival in Patients with Gastric Cancer. Oncology Letters 2017;14 (6): 7417-7424. (DOI:10.3892/Ol.2017.7179)

18. Liu B, Lv D. Prognostic value of C-reactive protein to albumin ratio for mortality in acute kidney injury. BMC Nephrol 2023;24 (1): 44. (DOI:10.1186/s12882-023-03090-9)

19. Oh TK, Song IA, Lee JH. Clinical Usefulness of C-Reactive Protein to Albumin Ratio in Predicting 30-Day Mortality in Critically Ill Patients: A Retrospective Analysis. Sci Rep 2018;8 (1): 14977. (DOI:10.1038/S41598-018-33361-7)

20. Zhao W, Wu Z, Li Y, et al. Pretreatment neutrophil-to-lymphocyte ratio and its dynamic changes are associated with the overall survival in advanced cancer patients undergoing palliative care. Sci Rep 2016;6 (8): 31394. (DOI:10.1038/srep31394)

21. Lyons O, Whelan B, Bennett K, O'riordan D, Silke B. Serum Albumin As An Outcome Predictor In Hospital Emergency Medical Admissions. Eur J Intern Med 2010;21 (1): 17-20. (DOI:10.1016/J.Ejim.2009.10.010)

22. Hannan Jl, Radwany SM, Albanese T. In-Hospital Mortality in Patients Older Than 60 Years With Very Low Albumin Levels. J Pain Symptom Manage 2012;43 (3): 631-637. (DOI:10.1016/J.Jpainsymman.2011.04.009)

23. Akirov A, Masri-Iraqi H, Atamna A, Shimon I. Low Albumin Levels Are Associated with Mortality Risk in Hospitalized Patients. Am J Med. 2017;130 (12): 1465.E11-1465.E19. (DOI:10.1016/J.Amjmed.2017.07.020)

24. Tasar PT, Karasahin O, Timur O, Yıldırım F,Sahin S. Factors Determining Mortality In Geriatric Palliative Care Patients. International Journal of Gerontology 2020;14 (2): 104-108. (DOI:10.6890/Ijge.202005_14(2).0003)

25. Aung A, Alqudihy S, Rybicki L, Platt A, Davis Mp. Does Serum Albumin And Creatinine Predict Survival Of Inpatient Palliative Care Patients? Am J Hosp Palliat Care 2014;31 (8): 862-866. (DOI:10.1177/1049909113501851)

26. Park JE, Chung KS, Song JH, et al. The C-Reactive Protein/Albumin Ratio As A Predictor Of Mortality In Critically Ill Patients. J Clin Med 2018;7 (10): 333. (DOI:10.3390/Jcm7100333)

27. Aydın A, Kaçmaz O, Öterkuş M, Miniksar ÖH. Relationship Between MPV, RDW, Lactate, Na and Albumin Levels and Intensive Care Patient Mortality. Diclemedj 2022;49 (1): 168-175.(DOI:10.5798/Dicletip.1086353) (in Turkish)

28. Özkan Kuşcu Ö, Aktay M, Destegül D, Kuşcu F, Özcengiz D. Use of Inflammation Markers in Mortality Prediction in Intensive Care Unit Patients. Kırıkkale University Medical Journal 2021;23 (1): 75-82. (DOI:10.24938/Kutfd.817743) (in Turkish)

29. Charlson Me, Pompei P, Ales Kl, Mackenzie Cr. A New Method of Classifying Prognostic Comorbidity in Longitudinal Studies: Development And Validation. J Chronic Dis 1987;40 (5): 373-383. (DOI:10.1016/0021-9681(87)90171-8)

30. Roffman CE, Buchanan J, Allison GT. Charlson Comorbidities Index. J Physiother 2016;62 (3): 171. (DOI:10.1016/J.Jphys.2016.05.008)

31. Vural MF, Taşar P, Karasahin O, Sevinc C, Sahin S. Investigation of Parameters Associated with Mortality in A Palliative Care Unit. Medycyna Paliatywna/Palliative Medicine 2023;15 (4): 181-187. (DOI:10.5114/Pm.2023.132897)

ORIGINAL ARTICLE

TURKISH ADAPTATION, VALIDITY AND RELIABILITY STUDY OF TREATMENT BURDEN QUESTIONNAIRE IN GERIATRIC PATIENTS

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Abstract

Introduction: This study aimed to adapt the Turkish Treatment Burden Questionnaire, test its validity and reliability, and predict the treatment burden in the geriatric population.

Materials and Method: This methodological study included individuals aged 65 years and older from the geriatric population attending routine outpatient clinic examinations at the Ankara Bilkent City Hospital Geriatrics Department between June 1, 2022, and June 1, 2023. The sample consisted of 150 geriatric individuals who spoke and understood Turkish, could managed their illness, had no disease complications, were communicative, and did not have any physical or mental illnesses that would hinder their participation. The study data were collected using the 'Individual Information Form' and the Turkish version of the 'Treatment Burden Questionnaire.' Descriptive and confirmatory factor analysis were performed, and Cronbach's α coefficient was calculated for the Turkish version of the scale.

Results: Analyzing the factor structure of the Treatment Burden Questionnaire, a three-factor, 11-item structure with an eigenvalue above 1 explained 53.227% of the variance. In the assessment of the internal consistency of the scale, four items were eliminated because of low item-total correlations and inter-item correlations. The reliability analysis for the 11-item Treatment Burden Scale yielded a Cronbach's α coefficient of 0.645.

Conclusion: The Turkish adaptation of the Treatment Burden Questionnaire demonstrated validity and reliability in for assessing the extent of treatment burden in the geriatric population.

Keywords: Treatment; Geriatrics; Chronic Disease; Questionnaire.

INTRODUCTION

Non-communicable diseases (NCDs), also called chronic illnesses, are characterized by a gradual and progressive deviations in various physiological functions that do emerge suddenly, often featuring remissions and relapses and necessitating irreversible medical care and treatment (1,2). Globally, 76.4% of all deaths are attributed to NCDs. NCDs, encompass a broad range of conditions, including cardiovascular diseases, cancer, respiratory diseases, and metabolic disorders (3). According to the World Health Organization (WHO) 2014 NCD data for Turkiye, cardiovascular diseases account for 47% of deaths, cancer for 22%, respiratory diseases for 8%, diabetes for 2%, and other diseases for 21% (4). The proportion of these deaths in geriatric individuals is 38% due to circulatory system diseases, 19% due to malignant tumours, and 12% due to respiratory system diseases (3).

Considering epidemiological research conducted in Turkiye, it is evident that the incidence of chronic diseases increases with age, particularly in the geriatric population, requiring enhanced treatment, specialized care, and rehabilitation (5). Risk factors such as poverty, poor living conditions, unhealthy nutrition, exposure to ultraviolet rays, viruses, physical inactivity, tobacco and alcohol use, overweight/obesity, and high blood sugar and pressure create a conducive environment for the development of chronic diseases (3). As individuals age in the geriatric population, various structural changes occur in the chest cavity and lung parenchyma, abnormalities in lung function tests, ventilation and gas exchange abnormalities, decreased exercise capacity, decreased respiratory muscle strength (6), reduction in lean mass such as muscles and bones, increase in fat mass, decrease in muscle functions, strength, and mass (7), decreased blood flow in the liver, decreased activity of liver enzymes, increased stiffness in the vascular wall, impaired circulation, structural changes in the heart, increased insulin resistance, decreased beta-adrenergic response leading to decreased vasodilation of catecholamines, decreased glomerular filtration rate, renal artery stenosis, and decreased renin levels are among the many factors contributing to the increased prevalence of chronic diseases (8).

The burden of treatment encompasses the impact of the disease, specific treatments, and their side effects, as well as the functioning of healthcare services and their effects on patient well-being (9). Another definition involves the patients' efforts to access and use healthcare services and perform self-care activities, expressing the adverse effects of these efforts on patients. In short, the treatment burden focuses on the individualized load of treatment and care experienced by individuals with chronic illnesses during treatment, excluding any consideration of the burden on the healthcare system (10). Based on these definitions, the burden of treatment encompasses all the healthcare activities undertaken by patients to maintain their health. These include doctor visits, blood pressure monitoring, self-monitoring, laboratory tests, treatment management, the use of medical devices, bearing certain costs in particular situations, access to care, and the ability to coordinate care. Treatment burden in the context of an acute illnesses may be temporary. The patient could easily tolerate it while temporarily achieving a healthcare goal. Likewise, the burden of multiple oral medications may be acceptable in chronic diseases. However, self-injection, taking new medications, undergoing additional laboratory tests, and making lifestyle changes will begin to increase the burden of treatment and care on patients (11). Harmony between geriatric individuals and healthcare professionals is crucial during treatment. In geriatric patients, in addition to the pharmacological treatment approach to manage the disease, avoid disability, and maintain their quality of life, lifestyle

changes such as diet, exercise, smoking cessation, and alcohol abstinence are also recommended. These care activities increase the burden on geriatric patients (12).

Regular monitoring of elderly individuals at appropriate intervals, as specified by healthcare professionals, should be performed using appropriate techniques and documentation. The importance of paying attention to regular health check-ups (eye, kidney, cardiovascular, etc., and organ/system examinations) in this patient group should be emphasized. The group of medications used by these patients as well as the possible side effects of these medications should be discussed (8). There may be differences in the skills of individuals to manage health problems, defined as health capacity, and follow these treatments. Factors such as geriatric individuals' medication use, treatment follow-up situations, sociocultural status, cognitive functions, and overall health status need to be considered, especially the presence of problems such as the excessive use of medications (13). When the number of healthcare activities required to manage chronic diseases increases, the treatment burden on patients will also increases. As a result, a decrease in therapeutic adherence, an increase in hospitalization rates, and mortality may occur. These conditions indicate that patients must invest effort, attention, and time in managing their diseases (9,11).

In the literature, a measurement tool for assessing the burden experienced by individual patients during treatment in Turkiye has yet to be developed. This study was conducted to determine the content validity, construct validity, and internal consistency reliability coefficient of the Treatment Burden Questionnaire AU1.1 version and to contribute to the literature by establishing its characteristics for the valid and reliable measurement of the treatment burden and predicting the treatment burden in the geriatric population.

MATERIALS AND METOD

Study design

This is a methodological study.

Participants

The study population was comprised of geriatric patients aged 65 years and older who attended routine outpatient clinic examinations at the Geriatrics Department of Ankara City Hospital, Bilkent Campus, between June 2022 and June 2023. The sample size was determined based on the recommendation in the literature that at least 5-10 times the number of items in validity and reliability studies should be included (14). Considering this, 150 geriatric individuals were included in the study, ten times the number of items in the 15-item scale. The sample was selected using a non-probability random sampling method, and participants were required to be aged 65 years or above, able to manage their disease, free of disease complications, physically and mentally healthy enough to participate, speak and understand Turkish, and willing to participate in the study.

Data collection

Research data, along with patient demographic characteristics, were collected using face-to-face interviews with the Treatment Burden Questionnaire. Each Scale took approximately 15-20 minutes to complete.

Data collection tools

The data collection form included the Individual Introduction Form and the Treatment Burden Questionnaire.

Individual Introduction Form: The Individual Introduction Form, consisting of 12 questions in a single section, was designed by the researchers inspired by the studies of Değer and Ordu (2022) (15). It included demographic information such as

age, gender, marital status, education, occupation, income status, smoking and alcohol use, exercise, and diet-related characteristics (lifestyle and habits); disease and disease durations (disease characteristics) were also queried for each geriatric individual.

Treatment Burden Questionnaire: The Treatment Burden Questionnaire (TBQ-AU1.0 version), developed in France, consists of 15 items and a single dimension. There are no reverse items on the scale. Each item on the scale is scored on a scale ranging from '0-10' ('not a problem' to, 'a significant problem'). The lowest possible score on the scale was '0,' and the highest score ranged between '0' and '150.' A high score indicated that an individual was experiencing a high level of treatment burden. The Cronbach's α coefficient for the scale was found to be 0.89 (16). As no validity and reliability studies have been conducted for the TBQ-AU1.1 version in Turkiye, the Turkish language and context adaptation for this version were translated, and validity and reliability tests were performed within the scope of this study.

Language and content validity

The translation-back-translation method was used to test the language validity of the Treatment Burden Questionnaire. In the first stage, the researchers appropriately adapted the English version of the Treatment Burden Questionnaire into Turkish. The English form and the Turkish-translated form of the scale were presented to seven expert faculty members in the nursing field who were both familiar with the scale and fluent in English. After adjustments were made based on expert opinions, the entire scale was reviewed again. The translation based on the original version was then presented to the researchers, and the final Turkish version of the scale was created according to their suggestions. A pilot study was conducted with 50 patients in this study.

Internal consistency

The Treatment Burden Questionnaire showed homogeneous relationships, and Cronbach's α coefficients were examined.

Construct validity

'Explanatory and Confirmatory Factor Analysis' was performed to determine the construct validity of the Treatment Burden Questionnaire. The Kaiser-Meyer-Olkin (KMO) value and Bartlett's sphericity test were used for the exploratory factor analysis. After determining the suitability of the data for exploratory factor analysis, the fit criteria for confirmatory factor analysis, including root mean square error of approximation (RMSEA), comparative fit index (CFI), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), incremental fit index (IFI), non-normed fit index (TLI), and chi-square/degrees of freedom (x^2/df) tests, were evaluated, and varimax rotation methods were used.

Statistical analysis

The data and analyses of the scale were performed using IBM SPSS (Statistical Package for Social Sciences) version 27.0 and Amos 26.0 statistical package program. Continuous data were calculated as mean, standard deviation, minimum, and maximum, whereas categorical data were calculated as percentages. Kolmogorov-Smirnov, skewness, and kurtosis tests were used to investigate the normal distribution of the data. Since the data showed a normal distribution, one-way analysis of variance (ANOVA) and independent sample T test were used. Statistical significance was set at $p < 0.05$.

Ethical dimension

Official permissions to conduct this study was obtained by signing a license agreement via email with the authors who developed the scale and its owner. This study was conducted in accordance with

the principles of the Declaration of Helsinki. This study was reviewed and approved by the Clinical Research Ethics Committee of the Ministry of Health of Ankara City Hospital 1 (Approval Number: E. Kurul-E1-22-2671). Informed consent was obtained from the geriatric individuals participating in the research in advance to provide information about the study procedures at each stage.

RESULT

Sociodemographic Characteristics of Geriatric Individuals

The average age of geriatric individuals (n=150) was 77.79 ± 8.19 years (min=65, max=98), 54% were female, 83.3% were married, 34.7% had elementary school education, and 80.7% had income matching their expenses. It was found that 5.3% of geriatric individuals used cigarettes, and 0.7% used alcohol. While 22.7% of the geriatric patients engaged in physical activity, 27.3% followed a diet. The most common diseases among geriatric individuals were a combination of cardiovascular and endocrine diseases (40.0%). The average duration of geriatric individuals' diseases was 8.31 ± 4.76 years (min=1, max=20).

Treatment Burden Questionnaire Results

The treatment burden score for geriatric individuals was calculated as 45.68±15.83 (min=2, max=95), indicating that they experienced a low level of treatment burden. Among the components contributing to treatment burden in geriatric patients, the most significant feature was the financial burden (7.57±2.62). In contrast, the least impactful factor on treatment burden was the burden related to appointments (frequency of visits, problems encountered when going to visits, inability to undergo examination after attending the appointment) (0.40±1.39).

When evaluating the Treatment Burden Questionnaire scores based on gender, a statistically significant difference was found between females (42.77±16.24) and males (49.10±14.72) (p=0.014).

Assessing the Treatment Burden Questionnaire scores based on chronic diseases revealed no significant differences between the diseases (p=0.386). Upon examining the scores, it was determined that patients with respiratory system diseases (58.00±18.57) experienced the highest burden.

Validity of the Treatment Burden Questionnaire

Data were collected from a study group of 150 individuals to assess the validity and reliability of the Treatment Burden Questionnaire. Initially, the KMO Index and Bartlett's tests were employed to assess the adequacy of the sample size and the appropriateness of the data. The KMO value was found to be 0.661, and the results of the Bartlett Sphericity test were x2=278.372, p=0.000 (Table 1).

Exploratory Factor Analysis (EFA)

EFA was applied to a 15-item scale within the scope of the study. After confirming the suitability of the data for analysis, a varimax rotation was performed using principal components analysis to examine the scale's factor structure. Rotation was applied to the scale, and a five-factor structure was identified by reviewing the results. However, four scale items that overlapped and had low factor loadings were excluded from the analysis. After excluding these items, factors with eigenvalues exceeding one were included in the study. A three-factor structure emerged using a Scree Plot (Figure 1).

For factors with eigenvalues exceeding 1, the factorization of the scale was considered appropriate for the study, and as a result of the Exploratory Factor Analysis (EFA), a three-factor factor matrix was obtained, explaining 53.227% of the total variance. According to the EFA results, the Treatment Burden Questionnaire yielded a

Figure 1. Slope gradient graph of the EFA result

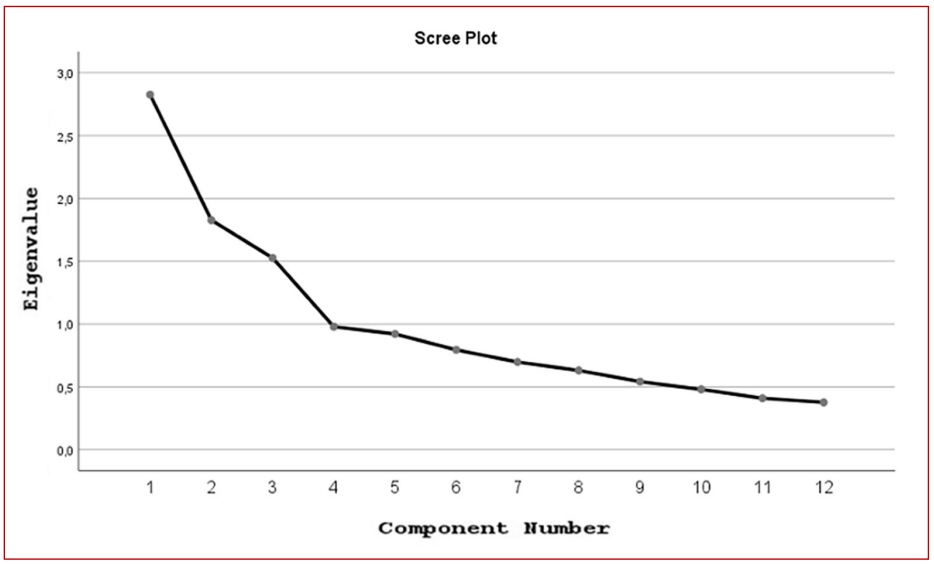

Table 1. Factor Analysis Results of Treatment Burden Questionnaire Items

Treatment Burden Questionnaire (TBQ) Items:	TBQ 1 (Economic and Social Context)	TBQ 2 (Treatment)	TBQ 3 (Medical Follow-ups)
1. Financial burden related to your healthcare	0.815		
2. Administrative burden related to healthcare	0.747		
3. Burden related to diet changes	0.621		
4. Burden related to engaging in physical activity	0.579		
5. Daily medication intake burden		0.721	
6. Burden related to the taste, shape, etc., of tablets/medications		0.715	
7. Burden related to laboratory tests		0.625	
8. Burden related to the need for regular medical care		0.562	
9. Burden related to doctor appointments			0.843
10. Burden related to interactions with healthcare professionals			0.662
11. Burden related to self-monitoring			0.657
Eigenvalue	2.825	1.826	1.525
Explained Variance Ratio	19.079	17.741	16.408
KMO = 0.661, X2 = 278.372; Bartlett Sphericity Test (p) = 0.000 Total Explained Variance Ratio = 53.227			

three-factor structure comprising 11 items. In this study, factor loadings ranged from 0.562 to 0.843 in the factor analysis. All items gathered from the factor, Factor 1 (TBQ 1), with an eigenvalue of 2.825, consisted of four items and explained 19.079% of the variance. Factor 2 (TBQ 2), with an eigenvalue of 1.826, comprised of four items and explained 17.741% of the variance. Factor 3 (TBQ 3), with an eigenvalue of 1.525, consisted of three items and explained 16.408% of the variance (see Table 1).

Confirmatory Factor Analysis (CFA)

CFA was applied to determine the fit indices of the structure consisting of 11 items and three factors obtained from the results of the EFA, and to assess its appropriateness. The fit indices obtained from the CFA results of the Treatment Burden Questionnaire are presented in Table 2.

The Treatment Burden Questionnaire CFA results yielded the following goodness-of-fit indices: x2/

Table 2. CFA Results of the Treatment Burden Questionnaire

Index	Excellent Fit Criterion	Acceptable Fit Criterion	Treatment Burden Questionnaire
/sd	$0 \leq \chi^2/df \leq 3$	$3 \leq \chi^2/df \leq 5$	1.792
RMSEA	0.000.05	0.05	0.073
CFI	0.95≤CFI	0.85≤CFI	0.863
GFI	0.90≤GFI	0.85≤GFI	0.922
AGFI	0,90≤AGFI	0.85≤AGFI	0.871
IFI	0.901.00	0.80	0.872
TLI	0.90≤TLI	0.80≤TLI	0.812

Chi-Square/Degrees of Freedom (X^2/df), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Non-Normed Fit Index (NNFI) or Tucker-Lewis Index (TLI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI)

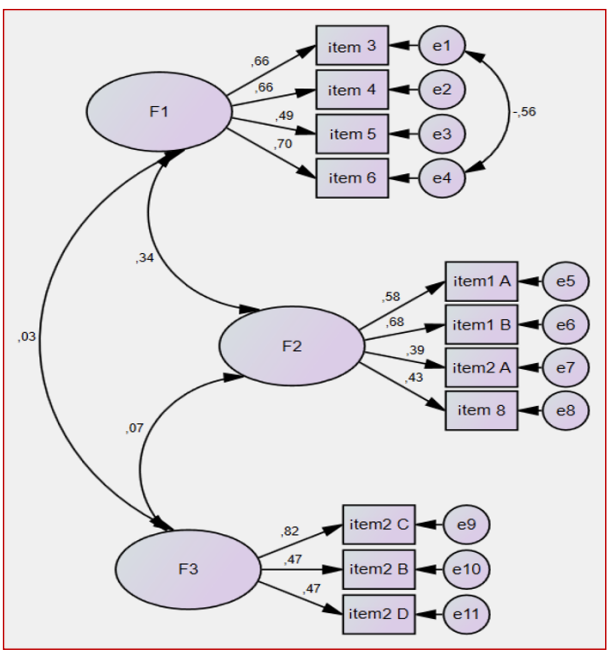

Figure 2. Path Diagram for the Treatment Burden Questionnaire

Table 3. Total Correlations and Cronbach a Coefficients of the Burden of Treatment Questionnaire (n=150)

Scale and Subdimension	Cronbach α coefficient
TBQ 1	0.673
TBQ 2	0.589
TBQ 3	0.549
Treatment Burden Questionnaire	0.645

df=1.792, RMSEA=0.073, CFI=0.863, GFI=0.922, AGFI=0.871, IFI=0.872, TLI=0.812. In this instance, Figure 2 shows a Path Diagram tailored to the Treatment Burden Questionnaire.

Reliability Analysis of the Treatment Burden Questionnaire

The Cronbach's α coefficient was calculated based on the data obtained from 150 geriatric individuals in this study. The analysis resulted in a Cronbach's α internal consistency coefficient of 0.645 for the Treatment Burden Questionnaire (Table 3).

DISCUSSION

This study aimed to translate and adapt a scale measuring the treatment burden of individuals into Turkish and conduct reliability and validity analyses to determine the dimensions in which geriatric individuals experience treatment burden. Language and content validity were assessed according to these objectives, and EFA was applied. After the EFA, four overlapping items were excluded, and the validity and reliability findings of the scale consisting of 11 items with three factors were discussed.

Discussion of Language and Content Validity

According to the literature, it is recommended to consult expert opinions, with at least three experts, to determine the language and content validity. The opinions of seven faculty members were obtained for this study. Using the Davis technique, the scale was sent to experts, who evaluated the clarity and cultural appropriateness of the questions, providing scores as follows: "1 point: Not appropriate; 2 points: Slightly appropriate (items/expressions need to be shaped appropriately); 3 points: Quite appropriate (appropriate, but minor changes are needed); 4 points: Very appropriate (no need for changes, can remain as is)" (17). Kappa's coefficient of agreement (K.G.I.) was used to evaluate each question by dividing the number of experts who scored three and four points by the total number of experts (18). The K.G.I. for the 15 items on the scale was greater than 0.80. The scale was reviewed in its entirety based on expert suggestions. Following the analysis of expert recommendations, necessary adjustments were made to the scale without removing any items.

In scale adaptation studies, conducting a pilot application with at least 30-40 people is recommended to test the understandability of the questions (17). In the planned study, a pilot application was conduct with 50 participants to assess their language, expression, comprehensibility, and application difficulties. At the end of the application, the questionnaire items were found to be understandable and did not require correction.

Discussion of the Construct Validity of the Treatment Burden Questionnaire

KMO value and Bartlett's sphericity tests were used to evaluate the appropriateness of the data and adequacy of the sample size. The literature

suggests that the KMO value should be> 0.60, and the Bartlett's test should be significant, indicating good factor analysis and a sufficient sample size (19). According to this information, our study's sample size was sufficient (KMO = 0.661) (Bartlett sphericity test; x2 = 278.372, p = 0.000).

Discussion of the Reliability Analysis of the Treatment Burden Questionnaire

Reliability is the first condition that must be satisfied in scaled studies. The most important method to assess the reliability is to calculate Cronbach's α coefficient. This allowed us to determine the scale's degree of consistency. If this α value is below 0.40, the scale is not reliable. Values between 0.40 and 0.60 indicate low reliability, 0.60 and 0.80 are moderately reliable, and 0.80 and 1.00 are highly reliable (19). In the study, the Cronbach's α internal consistency coefficient of the Treatment Burden Questionnaire was found to be 0.645, indicating that the scale is moderately reliable.

EFA

The literature emphasizes that the total explained variance should be 40-60% (20). Consistent with the literature, the 3-factor scale structure explained 53.227% of total variance. This finding is further supported by a similar 3-factor structure obtained in a Spanish validity and reliability study where the Treatment Burden Questionnaire (TBQ_AU1.1 version) was administered to patients with Multiple Sclerosis (10).

When selecting scale items in EFA, the factor loads should be at a certain level. Tabacknick and Fidell defined this threshold value as 0.32 (21). Another study stated that the factor loads of scale items should be at least 0.30 or higher (22). In our study, when examining the factor loads in the EFA, it was observed that they varied between 0.562 and 0.843. According to the results, the factor loadings of the included items were sufficient.

CFA

The critical values that CFA must satisfy are x2/df, RMSEA, CFI, GFI, AGFI, IFI, and TLI, which are shown in Table 2 (20). In our study, the obtained fit indices were calculated as x2/df = 1.792, RMSEA = 0.073, CFI = 0.863, GFI = 0.922, AGFI = 0.871, IFI= 0.872, TLI = 0.812. These results showed that the fit indices examined with CFA were at sufficient levels, confirming the 3-factor 11-item structure.

Limitations of the study

In our study, the KMO values and Bartlett's sphericity tests were applied, and it was observed that the sample size needed to be at a sufficient level but not excellent (20). This situation led to the Cronbach's α coefficient being 0.645 (quite reliable) which is not a high level of reliability (0.80-1.00).

CONCLUSION

As a result of this research,

- Geriatric individuals experience a low treatment burden.

- There was a statistically significant difference in treatment burden between female (42.77±16.24) and male (49.10±14.72) geriatric individuals (p=0.014).

- When evaluated according to chronic diseases, there was no significant difference in the treatment burden questionnaire scores (p=0.386).

- Among the chronic diseases, it was determined that patients with respiratory system diseases (58.00±18.57) experienced the highest-burden according to treatment burden scores.

Validity and reliability analyses of the Turkish version of the Treatment Burden Questionnaire (Version A.U1.1) indicated sufficient validity and reliability. Based on the results obtained at the end of the study, it can be clearly stated that the 3-factor 11-item Treatment Burden Questionnaire is high-

ly reliable for evaluating the treatment burden on geriatric individuals in Turkey. We recommend conducting this validity and reliability studies in other sample groups with a larger sample sizes.

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REFERENCES

1. Aydemir T, Cetin S. Chronic Diseases and Psychosocial Care. Journal of Anatolian Medical Research 2019; 4(3): 109-115. (in Turkish).
2. Akpinar NB, Ceran MA. Chronic Diseases and Rehabilitation Nursing. Journal of Adnan Menderes University Health Sciences Faculty 2019; 3(2): 140-152. (in Turkish).
3. Republic of Turkey Ministry of Health General Directorate of Public Health [e-book]; 2021. [Internet]. Avaible from: https://hsgm.saglik.gov.tr/depo/birimler/kronik-hastaliklar-engelli-db/hastaliklar/kalpvedamar/raporlar_ist/v9s_NCD.kohort._27.10.2021.pdf. Accessed date:12.09.2023.
4. World Health Organization. Global Status Report [e-book]; 2014. [Internet]. Available from: http://apps.who.int/iris/bitstream/10665/148114/1/9789241564854_eng.pdf?ua=1. Accessed date: 12.09.2023.
5. Sengul S, Akpolat T, Erdem Y, et al. On Behalf of the Turkish Society of Hypertension and Renal Diseases. Changes in Hypertension Prevalence, Awareness, Treatment, and Control Rates in Turkey from 2003 to 2012. Journal of Hypertension 2016; 34: 1208-17. (DOI: 10.1097/HJH.0000000000000901).
6. Lee SH, Yim SJ, Kim HC. Aging of the Respiratory System. Kosin Medical Journal 2016; 31(1): 11- 18. (DOI: 10.7180/kmj.2016.31.1.11).
7. Agar A. Psychological Changes in the Elderly. Journal of Geriatric Science 2020; 3(2): 75-80. (DOI: 10.47141/geriatrik.744968).
8. Balcı Alparslan G, Akdemir N, Babadag B. Adult and elderly hypertension and care, In: Balcı Alparslan G (Eds). Care in Hypertension. 2th edition, Vize publishing, Ankara, Turkiye 2019, pp 7-45.
9. Tran VT, Harrington M, Montori VM, et al. Adaptation and Validation of the Treatment Burden Scale (TBS) in English Using an Internet Platform. BMC Medicine 2014; 12(1): 1-9. (DOI: 10.1186/1741-7015-12-109).
10. Ysrraelit MC, Fiol MP, Peña FV, et al. Adaptation and Validation of a Spanish Version of the Treatment Burden Scalein Patients with Multiple Sclerosis. BMC Neurol 2019; 19(1): 209. (DOI: 10.1186/s12883-019-1441-0).
11. Sheehan OC, Leff B, Ritchie CS, et al. A Systematic Literature Review of the Assessment of Treatment Burden Experienced by Patients and Their Caregivers. BMC Geriatr 2019; 19(1): 262. (DOI: 10.1186/s12877-019-1222-z).
12. Oguz S, Yanmıs S, Yılmaz B, Kol R. Levels Compliance to Medication and Diet Therapy of Patients with Hypertension. Turk J Cardiovasc Nurs 2019; 10(21): 1-7. (DOI: 10.5543/khd.2019.63644).
13. Hu XJ, Wang HHX, Li YT, et al. Healthcare Needs, Experiences and Treatment Burden in Primary Care Patients with Multimorbidity: An Evaluation of Process of Care From Patients' Perspectives. Health Expect 2022; 25(1): 203-213. (DOI: 10.1111/hex.13363).
14. Erkuş A. The Mismatch Between the Meanings of Psychometric Terms and Their Turkish Equivalents. Journal of Measurement and Evaluation in Education and Psychology 2010; 1(2): 72-77. (in Turkish)
15. Deger TB, Ordu Y. Factors Affecting Quality of Life in the Elderly: A Rural Example. Gümüşhane University Journal of Health Sciences 2022; 11(2): 574-585. (DOI: 10.37989/gumussagbil.958202).
16. Tran VT, Montori VM, Eton DT, et al. Development and Description of Measurement Properties of an Instrument to Assess Treatment Burden among Patients with Multiple Chronic Conditions. BMC Med 2012; 10: 68. (DOI:10.1186/1741-7015-10-68).
17. Capık C, Gozum S, Aksayan S. Intercultural Scale Adaptation Stages, Language and Culture Adaptation: Updated Guideline. Florence Nightingale Journal of Nursing 2018; 26(3): 199–210. (DOI: 10.26650/FNJN397481).
18. Tavşancıl E. Measurement of Attitudes and Data Analysis with SPSS. 6th edition, Nobel Medical Bookstore, Ankara, Turkiye 2018, pp 93-124.
19. Demir GT, Cicioğlu Hİ. Attitude Scale for Healthy Nutrition (ASHN): Validity and Reliability Study. Gaziantep University Journal of Sport Sciences 2019; 4(2): 256-274. (DOI: 10.31680/gaunjss.559462).

20. Caz Ç, Paktaş Y, Yazıcı O. The Validity and Reliability Study of the Health Belief Model Scale for Exercises. JEUNF 2023; 39(1): 115-124. (DOI:10.53490/egehemsire.1147705).

21. Özdamar K. Scale and Test Development Structural Equation Modeling IBM SPSS, IBM SPSS AMOS and MINTAB Applied. 1st edition, Nisan Bookstore Publishing, Eskisehir, Turkiye 2017, pp 78-79.

22. Seçer, İ. Psychological Test Development and Adaptation Process: SPSS and LISREL Applications. 2th edition, Anı Publishing, Ankara, Turkiye 2021, pp 1-152.

ORIGINAL ARTICLE

TRENDS IN CARBAPENEM RESISTANCE FROM 2018-2023 IN HOME HEALTH CARE: THE BOTTOM OF THE ICEBERG

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Abstract

Introduction: There has been a shift in the care of older patients from hospital settings to home healthcare. Older patients are more susceptible to infections, and infections associated with home healthcare are often understudied. This study aimed to investigate the changing trends in carbapenem resistance in these infections over time.

Materials and Method: Microbiological data of home healthcare patients between 2018 and 2023 were analyzed using hospital records.

Results: The rate of carbapenem resistance increased significantly from 4.17% to 19.53% between 2018 and 2023, particularly in Klebsiella spp. and Pseudomonas spp. Additionally, an increase in the number of respiratory and wound tissue samples was observed.

Conclusion: Carbapenem resistance is a growing problem not only in hospitals but also in home healthcare settings. Effective infection prevention and control measures should be implemented, given the complexities of managing these infections, especially in geriatric populations.

Keywords: Home Care Services; Carbapenem-Resistant Enterobacteriaceae; Pseudomonas Aeruginosa; Acinetobacter Baumannii.

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INTRODUCTION

Healthcare-associated infections (HAI) are among the most common adverse events and serious public health threats. This results in prolonged hospitalization, expensive diagnostic methods, increased treatment costs, and reduced quality of life (1,2). The geriatric population is disproportionately affected by HAIs owing to predisposing factors such as age-related changes, geriatric syndromes, and comorbidities (3). Additionally, non-hospital HAIs are frequently overlooked (2). In recent years, there has been a shift from inpatient to home care in Europe. Home care involves healthcare workers taking care of individuals to provide a range of services, from routine checkups to post-mortem care. While home care offers benefits such as an improved quality of life and reduced healthcare costs, it also carries risks such as the potential for infection (2,4). Studies on infections linked to home healthcare services are limited. Infections that arise 48 hours after hospital discharge are defined as home HAI (5).

Patients receiving home healthcare services include those with various underlying medical conditions, invasive procedures, frequent hospitalizations, and intensive care admissions. Bacterial colonization, including that of resistant bacteria, is frequently observed in these patients. Consequently, they are more susceptible to infections caused by resistant bacteria (6, 7). One of these is carbapenem-resistant Gram-negative bacteria such as *Klebsiella pneumoniae*, *Acinetobacter baumannii*, and *Pseudomonas aeruginosa* (8). In cases of non-hospitalized infections selecting an appropriate antibiotic can be challenging because of bacterial resistance (9). In cases of serious infections requiring hospitalization, empirical antibiotics should be initiated with a broader spectrum for this population than for other patients (7).

The objective of this study was to investigate changes in carbapenem resistance rates in samples collected from patients followed up at home healthcare clinics. Additionally, this study analyzed the types of samples and changes in the microbiological epidemiology of these patients over time. The data from our study can aid in determining empirical treatment approaches for patients, both at home and during hospitalization. In addition, it can facilitate the rapid implementation of infection control measures during hospitalization.

MATERIALS AND METHOD

This retrospective study analyzed the microbiological samples of patients who were followed up in the home healthcare clinics of Yildirim Beyazit University Yenimahalle Training and Research Hospital between August 15, 2018, and August 15, 2023. Data were obtained from the electronic medical records of the hospital.

Patients who were followed up at the Home Health Care Clinic and whose samples were sent to the microbiology laboratory were included in this study. Isolates from these samples were identified using an automated microbial identification system (Vitek 2, Biomerieux, France) and conventional methods, such as oxidase, catalase, indole, methyl red, citrate, mobility, citrate, and urease tests. Susceptibility testing was performed using the disc diffusion method and interpreted according to current EUCAST guidelines (10).

All samples collected from the patients were retrospectively examined for microorganisms without distinguishing between infection and colonization. Microorganisms and their resistance status were analyzed, with a focus on carbapenem resistance. Sample types were recorded. Microorganisms and their carbapenem resistance statuses were classified annually, and differences in species and resistance statuses were compared.

SPSS 29.00 software was used for statistical analysis. Descriptive statistics is used to demonstrate the study population, clinical sample, and bacterial distribution. Differences in bacterial species,

carbapenem-resistant bacteria, and culture types over the years were analyzed using the Chi-Square test. The Kruskal -Wallis test was used to analyze the relationship between age and carbapenem resistance rates.

RESULTS

A total of 1243 samples taken from patients followed up at home health care clinics at Yenimahalle Training and Research Hospital were analyzed in this study. No microbial growth was detected in any of the 321 samples. The mean patient age was 71.3 ± 14.8 (26-102) years.

Of the 922 samples containing growing microorganisms, 119 showed carbapenem resistance.

The incidence of carbapenem-resistant bacteria increased in parallel with age (p 0.02). Specifically, there were 77 urine cultures, 15 pressure ulcers, 26 tracheal aspirates, and one sputum sample. Changes in carbapenem resistance rates and microorganisms are shown in Table 1. The samples were grouped into five periods in Figure 1: August 2018-2019, August 2019-2020, August 2020-2021, August 2021-2022, and August 2022-2023. Carbapenem resistance rates showed a statistically significant increase over the years ($p < 0.01$).

Table 1. The change in carbapenem resistance rates between 2018 and 2023.

Date	Carbapenem resistance rate n (%)	*Klebsiella* spp. n (%)	*Pseudomonas* spp. n (%)	*Acinetobacter* spp. n (%)
2018-2019	4 (4,17)	1 (1,04)	2 (2,08)	1 (1,04)
2019-2020	1 (2,32)	1 (2,32)	-	-
2020-2021	4 (7,14)	1 (1,18)	3 (5,36)	-
2021-2022	61 (12,68)	28 (5,94)	23 (4,88)	10 (2,12)
2022-2023	49 (19,53)	33 (12,89)	15 (5,86)	1 (0,39)
Total	119	64	43	12

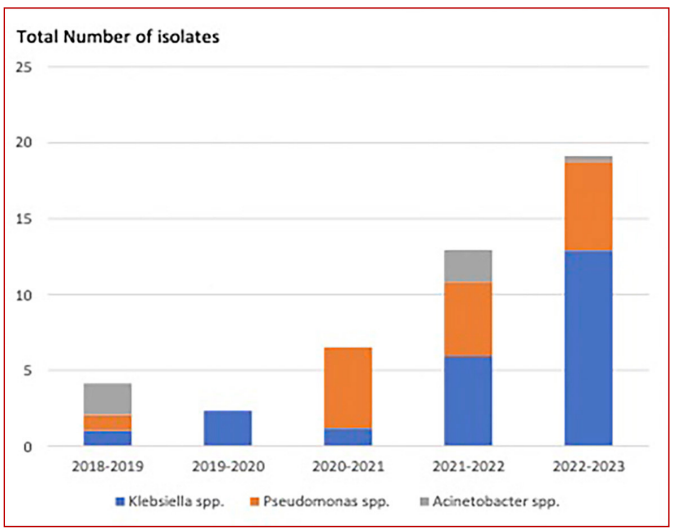

Figure 1. Change in carbapenem resistance over time.

Table 2. The change in sample types between 2018 and 2023.

Date	Urine n (%)	Wound n (%)	Aspirate n (%)	Sputum n (%)	Total n (%)
2018-2019	104 (97.20)	1 (0.93)	0	2 (1.87)	107
2019-2020	84 (96.55)	1 (1.15)	1 (1.15)	1 (1.15)	87
2020-2021	76 (90.48)	7 (8.33)	1 (1.19)	0	84
2021-2022	482 (81.97)	65 (11.05)	40 (6.80)	1 (0.17)	588
2022-2023	259 (82.48)	34 (10.83)	20 (6.37)	1 (0.32)	314
Total	1005 (85.17)	108 (9.15)	62 (5.25)	5 (0.42)	1180*

* other samples (n=63) were not included in the table

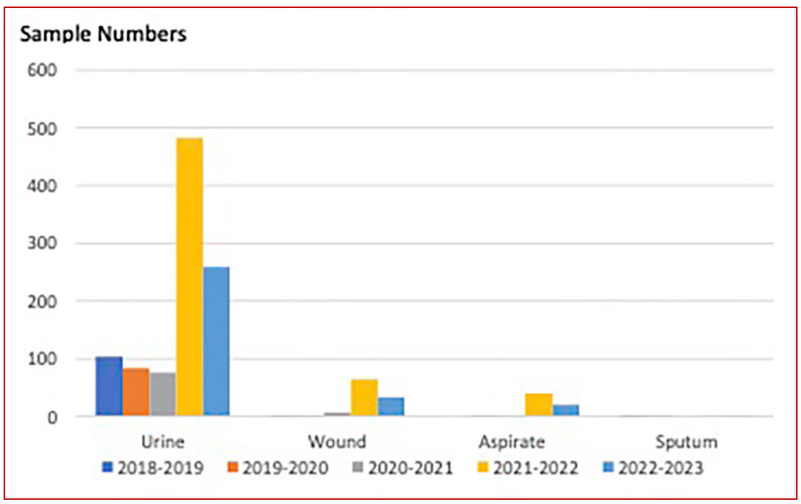

Figure 2. Change in sample types over time.

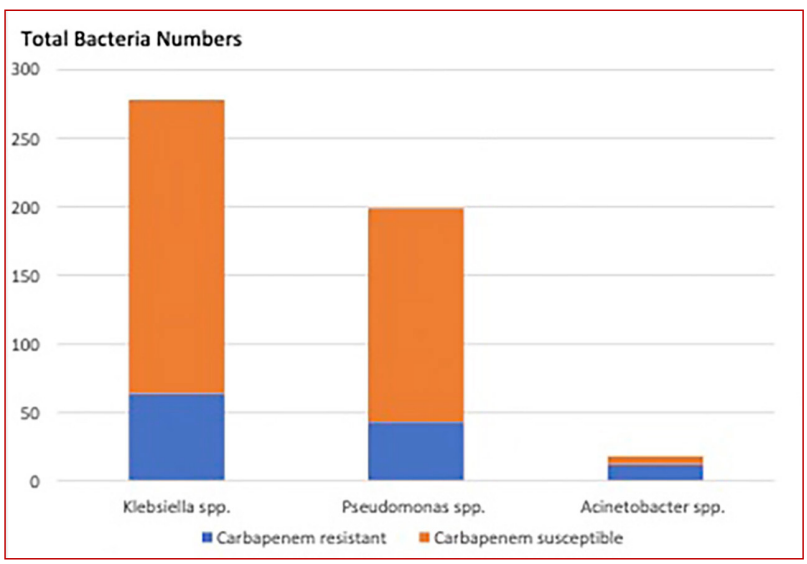

Figure 3. Carbapenem resistance rates in home health care patients.

Table 2 and Figure 2 summarize the distribution of samples received by the laboratory and their changes over the years. The majority of the samples from home healthcare patients sent to the microbiology laboratory were urine cultures (85.17%). The rest of the samples were wound (9.15%), tracheal aspirated (5.25%), sputum (0.42%), and other (n=63). Wound and tracheal aspirate samples showed an increasing trend over time $p < 0.01$.

The resistance rates are summarized in Figure 3. Carbapenem resistance rates were 23.02 % (64/278) for *Klepsiella spp.*, 66.67 % (12/18) for *Acinetobacter spp.*, and 21.60 % (43/199) for *Pseudomonas spp.* in all samples. Distribution of the carbapenem-resistant bacteria type between the years wasn't statistically significant *p* 0.09.

DISCUSSION

Our study detected an increase in carbapenem resistance, particularly in *Klebsiella* and *Pseudomonas* spp. in-home HAI. We also observed a significant change after the COVID-19 pandemic and an increase in the number of pressure ulcers and tracheal aspirate samples. This increase could be attributed to an increase in the number of bedridden and intubated patients receiving home healthcare services. The worldwide incidence and prevalence of carbapenem-resistant Gram-negative bacteria have increased alarmingly over the past decade. In Europe, in 2015, population-weighted means of carbapenem resistance for *P. aeruginosa, K. pneumonia,* and *A. baumanii* were 17.8%, 8.1%, and 0.1%, respectively (11). The national healthcare-associated infection surveillance report for 2022 reveals that the carbapenem resistance rate in *A. baumanii* was 92.18%, *K. pneumonia* was 66.56%, and *P. aeruginosa* was 67.60% among HAI (12). In 2018, the *A. baumanii* rate was 70.90% and the *P. aeruginosa* rate was 33.99% (13). As seen in these two reports, there has been a very significant increase in the incidence of carbapenem-resistant bacteria in HAIs over the past several years. A study reported even higher rates of carbapenem resistance than reported for 2018; carbapenem resistance was *A. baumanii* 93%, *K. pneumonia* 78%, and *P. aeruginosa* 76% (14). Another study examined bloodstream infections in the ICUs of 24 hospitals in Turkey in 2021, highlighting the rise in carbapenem-resistant bacteria and high mortality rates despite the initiation of appropriate treatment (15). A simulation study reported that carriers of carbapenem-resistant Gram-negative bacteria had a 1.8-fold higher possibility of re-admission within 1 year. Additionally, 30% of carriers sustain life-long infections. Implementing contact precautions can reduce transmission risk by 40%, yet only 10% of carriers adhere to these precautions (16).

Older people are much more likely to suffer from infectious diseases than younger people. Organ dysfunctions that increase with age, changes in the immune system, nutritional problems, and underlying diseases that increase over the years lead to an increased risk of infection among older patients. Infections in older people are one of the primary causes of death (17). A very large proportion of home healthcare patients are geriatric patients with multiple hospitalizations and even ICU stays (18). Previous studies have shown that advanced age is an important risk factor for carbapenem-resistant bacteria. Some studies reported a 20–30% mortality rate increase with carbapenem-resistant bacteria infections (17, 19). Our study, like other studies, observed a significant increase in carbapenem resistance with increasing age.

These results suggest that carbapenem resistance is a growing problem not only in hospital settings but also in long-term care facilities. Older adults are particularly susceptible to colonization by carbapenem-resistant Gram-negative bacteria because of extended hospital stays, catheter or mechanical ventilation use, and comorbidities (3,19). Following discharge, these colonizing bacteria can cause outbreaks in long-term care facilities. A report

from West Virginia identified a long-term care facility as the primary source of a carbapenem-resistant *K. pneumoniae* outbreak (20). Furthermore, the rates of carbapenem-resistant Gram-negative bacteria were found to be significantly higher in long-term care facilities than in communities and hospitals (21). However, despite the lack of research on patients followed up in home healthcare settings, our study highlights the need for epidemiological studies on these infections as well as infection prevention and control strategies.

Infection rates among patients who received home healthcare have been reported to range from 5% to 80%. Common infections reported in these patients include respiratory tract infections, urinary tract infections, skin and soft tissue infections, and those associated with intravenous catheters (6). The samples analyzed in our study were predominantly from the urinary system, with respiratory tract samples obtained through tracheal aspiration being less frequent. This discrepancy may stem from the possibility patients with tracheostomies were more prone to having respiratory tract specimens collected, whereas other patients might not have undergone sputum culture assessments. However, an increase in the number of respiratory and wound samples was observed in this study. Infections are the leading cause of hospitalization in these patients, with respiratory tract infections being the most common. Infection was detected in 45% of patients who required admission in a previous study (6, 22). The rise in respiratory and wound infections over time is noteworthy for home healthcare patients, considering the need for re-admission because of these infections.

This study found a significant increase in the rate of carbapenem-resistant bacteria in the samples, particularly after the COVID-19 pandemic. Post-pandemic era studies have demonstrated an increase in carbapenem-resistant Gram-negative bacteria due to impaired infection prevention and control practices resulting from a high workload (23-26). It is worth noting that the significant rise in the use of polymixin antibiotics, particularly in empirical cases, may have exerted selection pressure on these species (26-28). The high antibiotic use rates, the highest among the region, at hospitals and outpatients caused one of the highest resistance rates in the region, especially carbapenem resistance (29, 30).

Treatment options for carbapenem-resistant bacterial infections are limited, particularly in cases that do not require hospitalization and can be managed on an outpatient basis (31). Therefore, when considering empirical treatment options, it is crucial to be aware of the resistance profile, particularly the likelihood of carbapenem-resistant bacteria in patients being managed at home, when considering empirical treatment options (9,31). Data on the epidemiology of home healthcare infections are scarce, and this study highlights the need for epidemiological research on home healthcare infections to develop better management strategies.

Owing to the increasing rates of resistance in these patients, it is crucial for the healthcare staff to implement precautionary measures to prevent infection transmission among patients. Additionally, they should monitor the growth of resistant bacteria and the onset of infections in patients. Healthcare personnel should demonstrate equal vigilance to inpatients in isolating patients, separating equipment, practicing hand hygiene, and using protective gear (32,33). Home healthcare workers must receive training in infection control procedures to prevent outbreaks among patients (22,32). However, in cases where patients are admitted to a hospital without prior information on their bacterial growth, such as those transferred from another hospital, it is advisable to place them in contact isolation until culture results are available. This measure helps ensure infection control within the hospital. Additionally, upon discharging patients with nosocomial infections to home healthcare facilities, there should be a mechanism in place to

promptly notify home healthcare workers about infection control measures (33,34).

The limitations of this study include the absence of patient clinical data and the lack of differentiation between infection and colonization as the cause in our laboratory data. However, we aimed to demonstrate changes in carbapenem resistance trends among home healthcare patients, regardless of whether the microorganism was a cause of infection or colonization, or if it was clinically relevant. This is because infection prevention and control practices should be implemented regardless of the clinical relevance to prevent the spread of these microorganisms.

This study showed an increasing trend in carbapenem resistance rates among home healthcare patients, particularly after the COVID-19 pandemic. The incidence of carbapenem resistance increases in parallel with age. The negative contribution of this increasing prevalence to morbidity and mortality in older patients has also increased. Therefore, prevention and control strategies should be implemented in home healthcare settings to manage these infections. These infections are challenging to manage, especially in geriatric patients, and may cause hospital readmission or outbreaks in vulnerable older patients.

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Ethics approval: This study was approved by the Yildirim Beyazit University Clinical Studies Ethical Committee with the registration number E-2023-40.

REFERENCES:

1. World Health Organization. Report on the burden of endemic health care-associated infection worldwide [e-book] WHO Press; 2011. [Internet]. Available from: https://www.who.int/publications/i/item/report-on-the-burden-of-endemic-health-care-associated-infection-worldwide. Accessed: 12.02.2024.
2. Hoxha A, Duysburgh E, Mortgat L. Healthcare-associated infections in home healthcare: an extensive assessment, 2019. Euro Surveill 2021; 26(5):1900646. (DOI: 10.2807/1560-7917.ES.2021.26.5.1900646).
3. Tesini BL, Dumyati G. Health Care-Associated Infections in Older Adults: Epidemiology and Prevention. Infect Dis Clin North Am 2023; 37(1):65-86. (DOI: 10.1016/j.idc.2022.11.004).
4. Landers S, Madigan E, Leff B et al. The Future of Home Health Care: A Strategic Framework for Optimizing Value. Home Health Care Manag Pract 2016; 28(4):262-278. (DOI: 10.1177/1084822316666368).
5. Embry FC, Chinnes LF. APIC - HICPAC Surveillance Definitions for Home Health Care and Home Hospice Infections [e-book] APIC; 2008. [Internet]. Available from: https://www.apic.org/Resource_/TinyMceFileManager/Practice_Guidance/HH-Surv-Def.pdf. Accessed: 08.02.2024.
6. Harrison JM, Dick AW, Stone PW et al. Infection trends in home health care, 2013-2018. Infect Control Hosp Epidemiol 2021; 42(11): 1388-1390. (DOI: 10.1017/ice.2021.248).
7. Ding X, Lian H, Qi X et al.Changes of Klebsiella pneumoniae infection and carbapenem resistance in ICU elderly infected patients before and after the COVID-19 pandemic in Zhengzhou, China. J Infect 2023; 86(3): 256-308.(DOI: 10.1016/j.jinf.2023.01.008).
8. World Health Organization. WHO, Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, Acinetobacter baumannii and Pseudomonas aeruginosa in health care facilities [e-book] WHO; 2017. [Internet]. Available from: https://www.who.int/publications/i/item/9789241550178. Accessed: 12.02.2024
9. Tamma PD, Aitken SL, Bonoma RA et al. Infectious Diseases Society of America 2023 Guidance on the Treatment of Antimicrobial Resistant Gram-Negative Infections. Clin Infect Dis 2023; 18:ciad428. (DOI: 10.1093/cid/ciad428).
10. The European Committee on Antimicrobial Susceptibility Testing. Breakpoint tables for interpretation of MICs and zone diameters, version 14 EUCAST; 2024. [Internet]. Available from: http://www.eucast.org/clinical_breakpoints/. Accessed: 06.02.2024.
11. European Center for Disease Control and Prevention. Antimicrobial resistance surveillance in Europe [e-book] ECDC; 2015. [Internet]. Available from: https://www.ecdc.europa.eu/en/publications-data/antimicrobial-resistance-surveillance-europe-2015. Accessed: 22.01.2024.

12. National Healthcare-associated Infections Surveillance Network (USHIESA) Summary Report 2022. [Internet]. Available from: https://hsgm.saglik.gov.tr/depo/birimler/bulasici-hastaliklar-ve-erken-uyari-db/Dokumanlar/Raporlar/USHIESA_OZET_RAPORU_2022.pdf. Accessed: 18.03.2024.

13. National Healthcare-associated Infections Surveillance Network (USHIESA) Summary Report 2018. [Internet]. Available from: https://hsgm.saglik.gov.tr/depo/birimler/bulasici-hastaliklar-ve-erken-uyari-db/Dokumanlar/Raporlar/UHESA_Ozet_Raporu_2018.pdf. Accessed: 18.03.2024.

14. Aydın M, Azak E, Bilgin H etal. Changes in antimicrobial resistance and outcomes of health care–associated infections. Europ J Clin Microb & Infect Dis 2021; 40(8):1737-42.(DOI: 10.1007/s10096-020-04140-y).

15. Aslan AT, Tabah A, köylü B et al. Epidemiology and risk factors of 28-day mortality of hospital-acquired bloodstream infection in Turkish intensive care units: a prospective observational cohort study. J Antimicrob Chemother 2023; 78: 1757–68.(DOI: 10.1093/jac/dkad167).

16. Lee BY, Barthsch SM, Wong KF et al. Tracking the spread of carbapenem-resistant Enterobacteriaceae (CRE) through clinical cultures alone underestimates the spread of CRE even more than anticipated. Infect Control Hosp Epidemiol 2019; 40(6): 731-734. (DOI: 10.1017/ice.2019.61).

17. Çölkesen F, Tarakçı A, Eroğlu E et al. Carbapenem-Resistant Klepsiella pneumonia Infections and Its Risk Factors in Older Adult patients. Clin Intervention in Aging 2023; 18:137-45.(DOI:10. 2147/CI A. S406214).

18. Kıskaç N, Hacıoğlu B, Güven M et al. Profile of Home Healthcare Patients and Evaluation of Health Service Provided to patients-Istanbul province Example. IGUSABDER 2023;20:409-18. (DOI:10.38079/igusabder.1301138).

19. Gümüş HH, Köksal F. Carbapenem-Resistant Klebsiella pneumoniae: Resistance Mechanisms, Epidemiology, and Mortality. FLORA 2023;28(2):131-143. (DOI: 10.5578/flora.20239913).

20. CDC. Carbapenem-resistant Klebsiella pneumoniae associated with a long-term care facility. West Virginia, 2009-2011. MMWR Morb Mortal Wkly Rep 2011; 60(41): 1418-20.

21. Chen HY, Jean SS, Lee YL et al. Carbapenem-Resistant Enterobacterales in Long-Term Care Facilities: A Global and Narrative Review. Front Cell Infect Microbiol 2021; 11: 601968. (DOI: 10.3389/fcimb.2021.601968).

22. Hoffman GJ, Minn LC, Liu H et al. Role of Post-Acute Care in Readmissions for Preexisting Healthcare-Associated Infections. J Am Geriatr Soc 2020; 68(2): 370-378. (DOI: 10.1111/jgs.16208).

23. Perez S, Innes GK, Walters MS et al. Increase in Hospital-Acquired Carbapenem-Resistant Acinetobacter baumannii Infection and Colonization in an Acute Care Hospital During a Surge in COVID-19 Admissions - New Jersey, February-July 2020. MMWR Morb Mortal Wkly Rep 2020; 69(48): 1827-1831. (DOI: 10.15585/mmwr.mm6948e1).

24. Cieslinski JM, Arend L, Tuan FF et al. Molecular epidemiology characterization of OXA-23 carbapenemase-producing Acinetobacter baumannii isolated from 8 Brazilian hospitals using repetitive sequence-based PCR. Diagn Microbiol Infect Dis 2013; 77(4): 337-40. (DOI: 10.1016/j.diagmicrobio.2013.07.018).

25. Arend LN, Toledo P, Pilonetto M, Tuon FF. Molecular epidemiology of Klebsiella pneumoniae carbapenemase-producing Enterobacteriaceae in different facilities in Southern Brazil. Am J Infect Control 2015; 43(2): 137-40. (DOI: 10.1016/j.ajic.2014.11.003).

26. de Carvalho Hessel Dias VM, Tuon F, de Jesus Capelo P et al. Trend analysis of carbapenem-resistant Gram-negative bacteria and antimicrobial consumption in the post-COVID-19 era: an extra challenge for healthcare institutions. J Hosp Infect 2022; 120: 43-47. (DOI: 10.1016/j.jhin.2021.11.011).

27. Tuon FF, Rymsza AM, Pentheado-Filho SR et al. Should polymyxin be used empirically to treat infections in patients under high risk for carbapenem-resistant Acinetobacter?. J Infect 2011; 62(3): 246-9. (DOI: 10.1016/j.jinf.2011.01.005).

28. Tuon FF, Rocha JL, Merlini AB. Combined therapy for multi-drug-resistant Acinetobacter baumannii infection--is there evidence outside the laboratory?. J Med Microbiol 2015; 64(9): 951-959. (DOI: 10.1099/jmm.0.000144).

29. Isler B, Keske S, Aksoy M et al. Antibiotic overconsumption and resistance in Turkey. Clinical Microbiology and Infection 2019:25:651e653.(DOI: 10.1016/j.cmi.2019.02.024).

30. Torumkuney P, Aktas Z, Unal S et al. Country data on AMR in Türkiye in the context of community-acquired respiratory tract infections: links between antibiotic susceptibility, local and international antibiotic prescribing guidelines, access to medicine and clinical outcome. J Antimicrob Chemother 2022; 77 Suppl 1: i51–i60. (DOI:10.1093/jac/dkac217).

31. Dylis A, Boureau AS, Coutant A et al. Antibiotics prescription and guidelines adherence in elderly: impact of the comorbidities. BMC Geriatr 2019; 19(1): 291. (DOI: 10.1186/s12877-019-1265-1).

32. Shang J, Larson E, Liu J, Stone P. Infection in home health care: Results from national Outcome and Assessment Information Set data. Am J Infect Control 2015; 43(5): 454-9. (DOI: 10.1016/j.ajic.2014.12.017).

33. Shang J, Ma C, Poghosyan L et al. The prevalence of infections and patient risk factors in home health care: a systematic review. Am J Infect Control 2014; 42(5): 479-84. (DOI: 10.1016/j.ajic.2013.12.018).

34. Bowles KH, Murtaugh CM, Jordan L et al. Sepsis Survivors Transitioned to Home Health Care: Characteristics and Early Readmission Risk Factors. J Am Med Dir Assoc 2020; 21(1): 84-90.e2. (DOI: 10.1016/j.jamda.2019.11.001).

ORIGINAL ARTICLE

A POPULATION-BASED CROSS-SECTIONAL STUDY ON PHYSICAL INTIMATE PARTNER VIOLENCE AFFECTING OLDER WOMEN IN A PROVINCE OF NORTHERN TURKEY: PREVALENCE, ASSOCIATED FACTORS, AND INTERGENERATIONAL TRANSMISSION OF VIOLENCE

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Abstract

Introduction: This study aimed to estimate the prevalence of physical intimate partner violence among older women, identify factors associated with victimization, and gather information on the intergenerational transmission of violence.

Materials and Method: This population-based cross-sectional study was conducted in Karabuk Province and included 399 ever-married women aged 65 years and older. The dependent variable was exposure to physical violence by a current or former spouse. Independent variables included women's sociodemographic and reproductive characteristics, their experience of violence in childhood, and some characteristics of their husbands and parents. The crude and adjusted prevalence ratios were estimated to explore the relationship between the dependent and independent variables using robust Poisson regression analysis.

Results: The prevalence of physical intimate partner violence was 62.9% for the lifetime and 7.6% for the past year. Lifetime prevalence increased 1.2-fold with low household income, 1.4-fold with seven or more pregnancies, 1.3-fold with daily or weekly alcohol consumption by the husband, 1.3-fold with witnessing father-to-mother violence in childhood, and 1.5-fold with experiencing physical violence by parents in childhood. Women were more likely to use violence against their children if they had experienced violence in childhood and adulthood.

Conclusion: This study's finding of high lifetime and past-year prevalence of exposure to intimate partner violence highlights the need for more efforts to address intimate partner violence among older women. More research is needed to better understand older women's experiences of intimate partner violence and identify health and social policy approaches to meet their support and assistance needs.

Keywords: Intimate Partner Violence; Domestic Violence, Physical Abuse; Prevalence; Aged; Women.

INTRODUCTION

Intimate partner violence (IPV) against women is a global public health problem and human rights violation with a wide range of short- and long-term health consequences and high economic costs (1). IPV is defined as behaviors that cause physical, psychological, or sexual harm, including acts of physical assault, sexual coercion, emotional abuse and controlling behaviors by a current or former partner (2). Target 5.2 of the United Nations Sustainable Development Goals calls for ending all forms of violence against women and girls. One of the indicators defined to monitor progress toward this target is the measurement of IPV among ever-partnered women aged 15 and over (5.2.1) (3). Although this indicator includes older women, most studies on IPV focus on women aged 15-49 years. Inadequate knowledge about older women's experiences of IPV leads to the invisibility and neglect of violence-related problems. Around the world, older women face discrimination due to rigid gender norms and cultural values that place a premium on youth and women's reproductive functions. This discrimination can make older women more vulnerable to age- and gender-based violence. Violence against older women not only harms them but also undermines their ability to contribute to their families and communities (4). Understanding older women's experiences with IPV is critical for identifying and addressing this problem and developing effective social policy responses. This is particularly important because of the risk of social isolation, cognitive and functional decline, deteriorating health, and potential dependence on a spouse or caregiver for care in old age (5).

Physical violence, a common and visible form of IPV, refers to any aggressive behavior aimed at causing physical harm using force. The limited evidence on the physical IPV experiences of women aged 65 and older comes from high-income countries. According to a 2013 World Health Organization (WHO) study, the lifetime prevalence of physical and/or sexual IPV in ever-partnered women aged 15 and over was 30%; violence increased with age, reaching its highest level (38%) in the 40–44 age group, and then decreased at older ages (20% in the 60–64 age group, 22% in the 65–69 age group). The WHO study emphasizes that the available data on IPV against older women are limited to a small number of studies from high-income countries and that the low frequency of IPV should not be interpreted as indicating that older women are less exposed to partner violence but, rather, as patterns of violence among older women being less understood (6). According to a meta-analysis of the WHO Global Database on Prevalence of Violence Against Women, 23% of women aged 65 years and older had experienced physical, sexual, or both forms of IPV in their lifetime, with 4% having experienced it in the past year. This study also highlights the need for more research to fully understand the prevalence, as estimates for older women were based on a limited number of studies (7). Although there are differences in the measurement of physical violence among studies, the lifetime prevalence of physical IPV among older women is approximately 36% in Spain (8), 17% in the United States (9), and 7% in Canada (10). In Germany, the lifetime prevalence of physical and sexual IPV was 23% for women aged 50-65 and 10% for women aged 66-86 (11). Studies have reported that 0.3-4% of older women had been exposed to physical IPV in the past year (7, 9, 11). According to nationwide surveys in Turkey, the prevalence of physical IPV among women ranges from 30–39% lifetime (12, 13, 14, 15) and 8–10% in the past year (14, 15). These surveys did not provide information on IPV exposure among older women. Additionally, population-based domestic studies have focused primarily on elder neglect and abuse rather than IPV. A study conducted in Canakkale found that 4% of women aged 65 years and older had experienced physical violence in the past year, with husbands being the perpetrators in 43% of cases (16).

IPV is a socially produced phenomenon and is fueled by poverty, social and gender inequalities and patriarchal ideology. In low- and middle-income countries, women may be more vulnerable to IPV due to various factors, such as economic insecurity, gender inequalities, social stigma, inadequate legal regulations, and insufficient social support services, which are shaped by social, economic and political determinants (7). Studies have shown that exposure to IPV among older women is associated with several factors, including educational level (11), spousal alcohol use (11, 17), a history of childhood abuse (11, 17, 18), inadequate social support (17, 19), financial difficulties (18, 19), ethnic minority status, cognitive or physical impairment, dependence on one's partner, and caregiving stress (18). Gerinio et al. (2018) reported that social support, help-seeking behavior, and community-based services addressing abuse are major protective factors against IPV in elderly people (18).

The global elderly population is growing, which may lead to an increase in the incidence of IPV and IPV-related adverse health outcomes. Currently, there is insufficient evidence on the experience of IPV among older women in Turkey, and no studies on this topic have been conducted in Karabuk Province. Therefore, this study aimed to estimate the prevalence of physical IPV among women aged 65 years and older, identify factors associated with IPV victimization, and collect information on the intergenerational transmission of violence.

MATERIALS AND METHOD

Study design and setting

This population-based cross-sectional study was conducted in 2022 in Karabuk Province, which is located in the Black Sea region of Turkey. According to 2021 data from the Turkish Statistical Institute, Karabuk has a population of 249,287 people, 14% of whom are over 65 years old and 22% of whom live in rural areas.

Study population and sampling

The sample size was calculated to be 377 women based on a population size of 19652 (women aged 65 and older living in Karabuk in 2021), an expected proportion of lifetime physical IPV of 50% (we assumed that lifetime exposure in older women would be higher than the prevalence (36-39%) found in younger women in national studies (14, 15) using the same method of measuring physical violence as in this study), a 95% confidence interval, and a 5% margin of error. A multistage sampling procedure was used to select the women who composed the sample group. First, the study sample was proportionally distributed among the rural (village) and urban (city and district centers) populations. Urban neighborhoods and villages were listed. Eight urban neighborhoods and 12 villages were then randomly selected. Households were visited every ten houses, starting with a random household on a street in the selected settlements. If there was more than one ever-married older woman in the household, only one woman was interviewed. If there was no older woman in the household or if the woman refused to participate in the study, the researchers moved on to the next house.

Measures

Dependent variable: The dependent variable was women's exposure to physical violence from intimate partners. We measured physical violence using the acts of physical violence identified in the WHO Multi-country Study (20) and asked women if they had experienced any of the following acts by their current or former spouse: a) slapped her or thrown something at her that could hurt her; b) pushed or shoved her or pulled her hair; c) hit her with his fist or something else that could hurt her; d) kicked, dragged, or beaten her up; e) choked or burned her on purpose; and f) threatened to use or used a gun, knife, or another weapon against her.

The lifetime prevalence of physical IPV was calculated as the proportion of ever-married women who reported experiencing at least one act of physical violence by a current or former spouse at any point in their lives. We also determined the 1-year prevalence of IPV among currently married women by calculating the proportion of women who reported at least one act of physical violence that occurred in the 12 months before the interview. The acts of physical violence were categorized into two groups based on their severity: 'slapping or throwing something that could hurt' and 'pushing, shoving, or pulling hair' were classified as moderate, while all other acts were considered severe violence (20). A woman who experienced both moderate and severe violence was classified as having experienced severe violence. Additionally, the frequency of physical violence was classified as occurring once or twice, occasionally, or frequent.

Independent variables: The independent variables included women's sociodemographic characteristics (age, marital status, place of residence, level of education, monthly household income); women's reproductive characteristics (age at first marriage, total number of pregnancies, abortions, number of living children); some characteristics of their husbands and parents (level of education, husband's alcohol consumption); and childhood (aged ≤15) experiences of violence (childhood witnessing of physical violence from father-to-mother and childhood victimization of parental physical violence).

Data collection tool and method

The data were collected through face-to-face interviews using a questionnaire that included 45 questions. The questionnaire was pretested on ten older women in the city center who were not part of the study population. Before the data collection stage, a meeting was held with all the researchers to clarify the rules and ethical precautions to be followed during the interviews. The interviews lasted approximately 35 minutes in an isolated place, mostly in the women's homes. Some women requested that a family member (daughter or daughter-in-law) be present during the interview. Therefore, a few interviews could not ensure an isolated atmosphere (n= 8). Informed consent was obtained from all women for their voluntary participation in the study. Data collection was completed between June and September 2022.

Data analysis

The characteristics of the study group were summarized as frequency and percentage distributions. Chi-squared tests were used to compare the proportions of lifetime physical IPV among the categories of explanatory variables. Prevalence ratios (PRs) were calculated for the variables found to be significant according to the chi-square test. Crude and adjusted prevalence ratios (CPR and APR) and corresponding 95% confidence intervals (CIs) were estimated to explore the relationships between dependent and independent variables using univariable and multivariable robust Poisson regression analyses. Due to the small number of women exposed to physical IPV in the past year, separate analyses were not performed for them. All analyses were performed using SPSS v20. For all comparisons, $p < 0.05$ was considered to indicate statistical significance.

Ethical approval: Ethical approval for the conduct of the study was granted by Karabuk University (date: 07.06.2022, No. 2022/916).

RESULTS

Data were collected from 399 ever-married older women in the study. The study's results are presented under three headings: 1) the prevalence of physical IPV; 2) characteristics of the study group and factors associated with lifetime physical IPV; and 3) intergenerational transmission of physical violence.

1) The prevalence of physical intimate partner violence

The lifetime prevalence of physical IPV was 62.9%, with 30.3% experiencing only moderate violence and 32.6% experiencing severe violence. The prevalence of physical IPV among currently married women in the past year was 7.6%. All of these women reported being subjected to severe violence (Figure 1).

Figure 2 shows the frequency of physical violence acts. Women were most frequently subjected to 'slapping or throwing things' and least frequently to 'threatening or using a weapon'. As the severity of the violence increased, its frequency decreased. Women reported that most acts of violence were occasional and frequent (Figure 2).

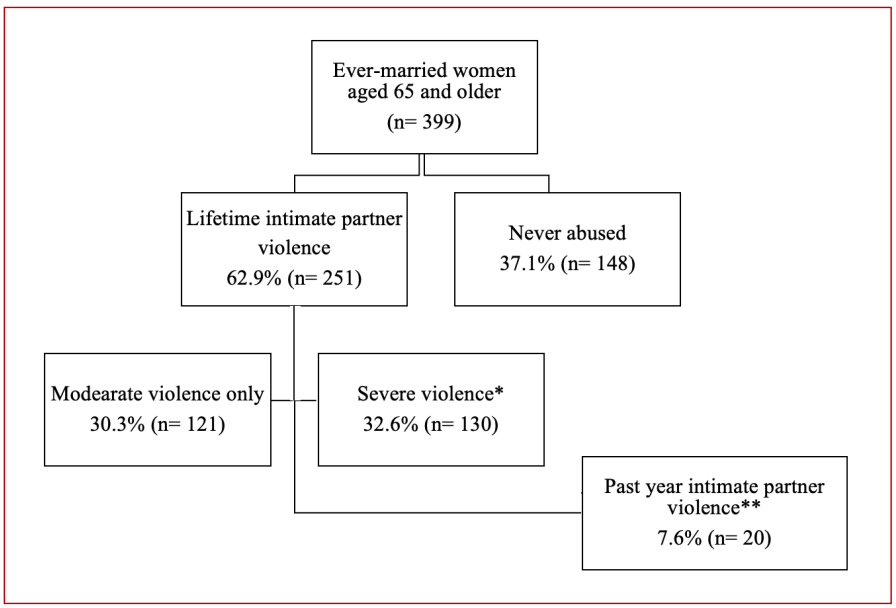

Figure 1. Women's experiences of physical intimate partner violence in Karabuk, Turkey

* If both moderate and severe physical violence were reported, these cases were classified as severe violence.

**The denominator is currently married women (n= 264).

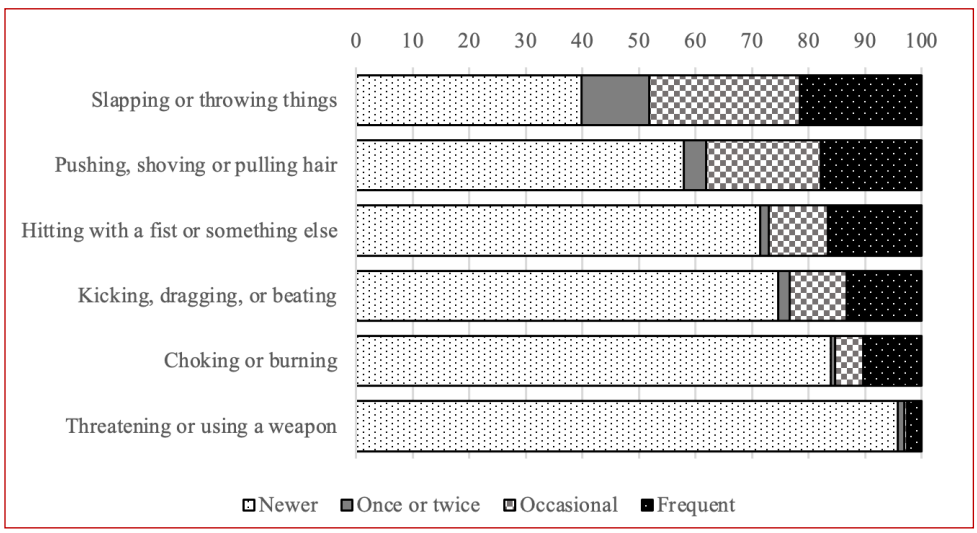

Figure 2. Frequency of physical violence acts

b) Characteristics of the study group and factors associated with lifetime physical intimate partner violence

More than half of the women (54.6%) were aged 65-69 years, and 9.0% were aged 80 years or older. The marital status of the women was 66.2% married, 32.6% widowed and 1.3% divorced. The proportion of households with a monthly income less than $200 was 39.1%. Most women (45.1%) were married during adolescence, and one in five (20.1%) had seven or more pregnancies. Almost half of the women (46.4%) and 10.8% of their husbands had no formal education. Most of the women's parents also had no formal education (84.7% of mothers and 59.1% of fathers). The proportion of women who witnessed physical violence from father-to-mother during childhood was 47.1%. More than half of the women (56.9%) reported experiencing physical violence from their parents during childhood (Table 1).

All variables examined were associated with lifetime physical IPV exposure ($p < 0.05$), except for four variables (woman's age, place of residence,

Table 1. Characteristics of the study group according to exposure to lifetime physical intimate partner violence

Variable		Total n (%)*	Lifetime physical intimate partner violence		Chi-square test
			Yes n (%)**	No n (%)**	
Age group	65-69	218 (54.6)	129 (59.2)	89 (40.8)	χ^2= 3.546 p = 0.315
	70-74	87 (21.8)	56 (64.4)	31 (35.6)	
	75-79	58 (14.5)	41 (70.7)	17 (29.3)	
	≥ 80	36 (9.0)	25 (69.4)	11 (30.6)	
Place of residence	Urban	299 (74.9)	188 (62.9)	111 (37.1)	χ^2= 0.000 p = 0.982
	Rural	100 (25.1)	63 (63.0)	37 (37.0)	
Current marital status	Married	264 (66.2)	163 (61.7)	101 (38.3)	χ^2= 0.454 p = 0.501
	Widow or divorced	135 (33.8)	88 (65.2)	47 (34.8)	
Education level	No formal education	185 (46.4)	137 (74.1)	48 (25.9)	χ^2= 20.649 **p <0.001**
	Primary school	173 (43.4)	93 (53.8)	80 (46.2)	
	Secondary school and above	41 (10.3)	21 (51.2)	20 (48.8)	
Household monthly income (USD)#	≤ 199	156 (39.1)	119 (76.3)	37 (23.7)	χ^2= 19.637 **p <0.001**
	≥ 200	243 (60.9)	132 (54.3)	111 (45.7)	
First marriage age	≤ 17	180 (45.1)	126 (70.0)	54 (30.0)	χ^2= 17.281 **p <0.001**
	18-24	201 (50.4)	121 (60.2)	80 (39.8)	
	≥ 25	18 (4.5)	4 (22.2)	14 (77.8)	
Total number of pregnancies	≤ 3	127 (31.8)	54 (42.5)	73 (57.5)	χ^2= 38.114 **p <0.001**
	4-6	192 (48.1)	131 (68.2)	61 (31.8)	
	≥ 7	80 (20.1)	66 (82.5)	14 (17.5)	
Abortion (at least one)	Yes	184 (46.1)	132 (71.7)	52 (28.3)	χ^2= 11.415 **p <0.001**
	No	215 (53.9)	119 (55.3)	96 (44.7)	
Number of living children	≤ 3	247 (61.9)	140 (56.7)	107 (43.3)	χ^2= 14.789 **p = 0.001**
	4-6	134 (33.6)	94 (70.1)	40 (29.9)	
	≥ 7	18 (4.5)	17 (94.4)	1 (5.6)	

Table 1. *Continued.*					
Variable		**Total n (%)***	**Lifetime physical intimate partner violence**		**Chi-square test**
			Yes n (%)**	**No n (%)****	
Diagnosed chronic disease	Yes	342 (85.7)	217 (63.5)	125 (36.5)	χ^2= 0.303
	No	57 (14.3)	34 (59.6)	23 (40.4)	p= 0.582
Husband's education level	No formal education	43 (10.8)	31 (72.1)	12 (27.9)	χ^2= 14.693 **p = 0.002**
	Primary	227 (56.9)	156 (68.7)	71 (31.3)	
	Secondary school and above	129 (32.3)	64 (49.6)	65 (50.4)	
Husband's alcohol usage	Every day/every week	92 (23.1)	72 (78.3)	20 (21.7)	χ^2= 16.849 **p < 0.001**
	1-2 times a month or less frequently	110 (27.6)	73 (66.4)	37 (33.6)	
	Never	197 (49.4)	106 (53.8)	91 (46.2)	
Mother's education level	No formal education	338 (84.7)	222 (65.7)	116 (34.3)	χ^2= 7.287 **p = 0.007**
	Primary school and above	61 (15.3)	29 (47.5)	32 (52.5)	
Father's education level	No formal education	236 (59.1)	164 (69.5)	72 (30.5)	χ^2= 11.485 **p = 0.003**
	Primary school and above	163 (40.9)	87 (53.4)	76 (46.6)	
Childhood witnessing of father-to-mother physical violence	Yes	188 (47.1)	146 (77.7)	42 (22.3)	χ^2= 33.157 **p < 0.001**
	No	211 (52.9)	105 (49.8)	106 (50.2)	
Childhood victimization of parental physical violence	Yes	227 (56.9)	177 (78.0)	50 (22.0)	χ^2= 51.226 **p < 0.001**
	No	172 (43.1)	74 (43.0)	98 (57.0)	
Total		**399 (100.0)**	**251 (62.9)**	**148 (37.1)**	

*Column percentage. **Row percentage. #Calculated according to the exchange rate of the Central Bank of the Republic of Turkey on 01/08/2022.

marital status, and diagnosed chronic disease). Women with low education and low household income were more exposed to physical IPV. Exposure to violence gradually decreased as marriage age declined but increased as the number of pregnancies and living children increased. Women who had at least one abortion were more likely to have experienced physical IPV than those who had never had an abortion (71.7% and 55.3%, respectively). The low levels of education of the women, their husbands and their parents increased the likelihood of exposure to physical IPV. While the physical IPV percentage was 53.8% among women whose husbands had never consumed alcohol, it rose to 78.3% among women whose husbands were current or former daily or weekly drinkers. Lifetime exposure to physical IPV was greater among women who had witnessed father-to-mother violence and those who had experienced physical violence from their parents (Table 1). Although not shown in the table, 29.1% of all women and 75% of women who experienced violence in the past year reported being injured by physical violence at least once in their lifetime.

Multivariable analysis revealed a greater lifetime prevalence of physical IPV among women with a

Table 2. Factors associated with exposure to lifetime physical intimate partner violence

Variable		Univariable analysis			Multivariable analysis		
		CPR	95%CI	p	APR	95%CI	p
Education level	No formal education	**2.1**	**1.0-4.2**	**0.043**	1.1	0.6-2.1	0.756
	Primary school	1.5	0.7-3.1	0.263	1.0	0.5-1.9	0.961
	Secondary school	1.7	0.8-3.6	0.197	1.4	0.8-2.7	0.268
	High school and above (ref)	1.0	-	-	1.0	-	-
Household monthly income (USD)	≤ 199	**1.4**	**1.2-1.6**	**<0.001**	**1.2**	**1.1-1.4**	**0.005**
	≥ 200 (ref)	1.0	-	-	1.0	-	-
First marriage age	≤ 17	**3.1**	**1.3-7.5**	**0.010**	2.4	0.8-7.1	0.113
	18-24	**2.7**	**1.1-6.5**	**0.025**	2.2	0.8-6.5	0.137
	≥ 25 (ref)	1.0	-	-	1.0	-	-
Total number of pregnancies	≤ 3 (ref)	1.0	-	-	1.0	-	-
	4-6	**1.6**	**1.3-2.0**	**<0.001**	1.3	1.0-1.6	0.060
	≥ 7	**1.9**	**1.5-2.4**	**<0.001**	**1.4**	**1.1-1.9**	**0.012**
Abortion (at least one)	Yes	**1.3**	**1.1-1.5**	**0.001**	1.1	0.9-1.2	0.421
	No (ref)	1.0	-	-	1.0	-	-
Number of living children	≤ 3 (ref)	1.0	-	-	1.0	-	-
	4-6	**1.2**	**1.1-1.4**	**0.007**	1.0	0.9-1.2	0.939
	≥ 7	**1.7**	**1.4-1.9**	**<0.001**	1.2	0.9-1.6	0.134
Husband's education level	No formal education	**1.5**	**1.1-2.0**	**0.014**	1.0	0.7-1.4	0.823
	Primary	**1.4**	**1.1-1.9**	**0.011**	1.2	0.9-1.5	0.332
	Secondary	1.0	0.7-1.5	0.789	1.0	0.7-1.4	0.840
	High school and above (ref)	1.0	-	-	1.0	-	-
Husband's alcohol usage	Every day/every week	**1.5**	**1.2-1.7**	**<0.001**	**1.3**	**1.1-1.6**	**<0.001**
	1-2 times a month or less frequently	**1.2**	**1.0-1.5**	**0.027**	1.2	0.9-1.4	0.059
	Never (ref)	1.0	-	-	1.0	-	-
Mother's education level	No formal education	**1.4**	**1.0-1.8**	**0.021**	1.0	0.8-1.4	0.754
	Primary school and above (ref)	1.0	-	-	1.0	-	-
Father's education level	No formal education	1.1	0.8-1.6	0.513	0.7	0.5-1.1	0.125
	Primary school	0.8	0.6-1.2	0.363	0.7	0.4-1.0	0.050
	Secondary school and above (ref)	1.0	-	-	1.0	-	-
Childhood witnessing of physical violence from father-to-mother	Yes	**1.6**	**1.3-1.8**	**<0.001**	**1.3**	**1.1-1.5**	**0.002**
	No (ref)	1.0	-	-	1.0	-	-
Childhood victimization of parental physical violence	Yes	**1.8**	**1.5-2.2**	**<0.001**	**1.5**	**1.3-1.8**	**<0.001**
	No (ref)	1.0	-	-	1.0	-	-

ref: reference value. CPR: crude prevalence ratio. APR: adjusted prevalence ratio.

monthly household income of less than $200 (APR= 1.2), women with seven or more pregnancies (APR= 1.4), and women whose husbands used alcohol daily or weekly (APR= 1.3). In addition, lifetime prevalence was significantly greater among women who had witnessed father-to-mother violence (APR= 1.3) and those who had experienced physical violence from their parents (APR = 1.5) during childhood than among those who had no such experiences (Table 2).

Table 3. Intergenerational transmission of physical violence

Experience with physical violence		Total n	Childhood victimization of parental physical violence		Victimization of physical IPV		Inflicting physical violence on own child	
			Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
Childhood witnessing of physical violence from father-to-mother	Yes	188	150 (79.8)	38 (20.2)	146 (77.7)	42 (22.3)	131 (69.7)	57 (30.3)
	No	211	77 (36.5)	134 (63.5)	105 (49.8)	106 (50.2)	94 (44.5)	117 (55.5)
Chi-square test			χ^2= 75.984 **p<0.001**		χ^2= 33.157 **p<0.001**		χ^2= 25.533 **p<0.001**	
Childhood victimization of parental physical violence	Yes	227			177 (78.0)	50 (22.0)	168 (74.0)	59 (26.0)
	No	172			74 (43.0)	98 (57.0)	57 (33.1)	115 (66.9)
Chi-square test					χ^2= 51.226 **p<0.001**		χ^2= 66.464 **p<0.001**	
Victimization of physical IPV	Yes	251					174 (69.3)	77 (30.7)
	No	148					51 (34.5)	97 (65.5)
Chi-square test							χ^2= 46.016 **p<0.001**	

IPV: Intimate partner violence.

c) Intergenerational transmission of physical violence

Any experience of physical violence in childhood or adulthood increased the likelihood of a subsequent experience of violence. Women who witnessed and were exposed to parental violence in childhood were more likely to perpetrate violence against their children, in addition to being exposed to IPV ($p < 0.001$). The majority of women (69.3%) exposed to physical IPV perpetrated physical violence against their children ($p < 0.001$) (Table 3).

DISCUSSION

In this study, the experiences of physical IPV among older women in a province in northern Turkey was examined using the WHO standard definitions of violence. Our findings indicate that IPV among older women is a significant public health problem that requires serious attention. We found that almost two out of three (62.9%) of the ever-partnered women aged 65 years and older had experienced physical violence from a current or former intimate partner at least once in their lifetime, and 7.6% of the currently married women had experienced it in the past year. Most women were victims of severe physical violence and were subjected to repeated acts of violence. This study also provides important insights into the intergenerational transmission of violence and highlights the need for long-term, life-course policies to prevent violence against women.

The prevalence of both lifetime and past-year physical IPV found in this study is much greater than that reported in high-income countries. In the 2014

nationwide survey in Turkey, the lifetime prevalence of physical IPV increased with age, while the past-year prevalence decreased with increasing age. It is an expected finding that the lifetime prevalence of physical IPV found in this study is greater than that in the national study due to the age-related cumulative effect. In addition, the women in our study group, who had reached a certain age and approximately a third of whom were widowed, may have been more likely to report their past experiences. However, the past-year prevalence, which would be expected to be lower in older women, is almost the same as that reported in younger women in the national survey (8%). The high past-year prevalence in the study might have been affected by the ongoing effects of the COVID-19 epidemic in the year before data collection. The pandemic has had negative socioeconomic and psychological effects on society, including a dramatic increase in cases of domestic violence. On the other hand, all women who reported experiencing violence in the past year reported that they had been exposed to violence many times, and 15 of them reported being injured by violence at least once in their lives. Therefore, our findings can be interpreted as indicating that women's past exposure to violence continues into old age. A systematic review of 52 qualitative studies investigating advanced-age women's experiences of violence revealed that IPV is often experienced in the context of a lifetime of exposure to IPV, that physical and mental health effects are cumulative, that health effects are exacerbated by aging processes, and that age-related changes in social status are often exacerbated (5).

Despite the process of modernization that Turkey has undergone since the establishment of the republic, patriarchal values that determine the subordinate position of women are still entrenched in society. Patriarchal control over women is exercised through restrictive codes of behavior, gender segregation and the association of family honor with female virtue (21). Islamic religious beliefs reinforce patriarchal ideology, and power relations based on widespread gender inequalities expose women of all ages to various forms of violence. In Turkey, however, women's access to education and employment opportunities has increased over the years, and the issue of women's rights has begun to feature more prominently on the public agenda. These changes are also reflected in women's attitudes toward violence. For example, the level of agreement with the statement that a husband can beat his wife for some reason was 39.9% in 2003 (22) and 9% in 2018 (23); the percentage of women who agreed that children can be beaten for education was 42.4% in 1995 (12) and 27.3% in 2014 (15). It is more difficult for older women to access modern values than for younger women, and the acceptance of violence may be more prevalent among older women. Women with no formal education, early marriage and excess fertility composed most of our study group. The gender roles and norms that give men more power and expect women to be self-sacrificing and obedient may shape the lifetime violence experiences of our study group, reflecting the more traditional face of Turkey.

In this study, exposure to lifetime physical IPV increased 1.3-fold with daily or weekly alcohol consumption by the husband, 1.2-fold with low household income, and 1.4-fold with seven or more pregnancies. Similar associations between low income and alcohol consumption and IPV have been found in other studies (11, 17, 18, 19). Heavy alcohol use can lead to spousal violence by increasing marital conflict, increasing individual levels of aggression, and impairing cognitive functioning (11). Traditional and patriarchal values may contribute to greater exposure to IPV among women with seven or more pregnancies. These values confine women to traditional family roles, encourage excessive fertility, and may increase the risk of exposure to violence to control women.

Our findings on the intergenerational transmission of violence confirm that "violence

begets violence". Women who witnessed IPV from father-to-mother and women who experienced violence from their parents in childhood had a high prevalence of IPV (APR= 1.3 and 1.5, respectively). Women's violent experiences in childhood and adulthood increased the likelihood of violence against their children. Children who witness violence between parents may perceive it as a normal part of family life, leading to greater acceptance of such violence and aggression. In this way, boys learn to use violence, and girls learn to tolerate violence or at least to tolerate aggressive behavior (24). Other studies have also shown that negative childhood experiences, particularly witnessing violence from father-to-mother, increase the risk of becoming an IPV victim in adulthood (11, 24, 25).

Limitations

This study has limitations. First, due to the cross-sectional design of this study, causality cannot be proven. Second, the study asked women retrospectively about their lifetime experiences of violence based on women's self-reports. Retrospective reporting may lead to underreporting or overreporting. In addition, older women's willingness and ability to disclose violence perpetrated by their husbands may also be influenced by their perceptions of their current economic and social status. Finally, complete privacy was not assured in all interviews. A family member was present during a small number of interviews. Despite these limitations, this study contributes to the limited body of literature highlighting IPV in older women as an issue that requires greater attention. In addition, the standard WHO definition of physical violence used in the study allows comparisons between studies, representing an additional contribution of this study.

CONCLUSION

In conclusion, this study showed that the prevalence of lifetime and past-year physical IPV among women aged 65 and older was 62.9% and 7.6%, respectively. The lifetime prevalence increased with low income, seven or more pregnancies, husband's alcohol use, witnessing physical violence from father-to-mother in childhood, and exposure to physical violence from parents in childhood. In addition, women's exposure to physical violence in childhood and adulthood increased the likelihood of physical violence against their children. First and foremost, eliminating violence against women requires political commitment and multisectoral action to address social and gender inequalities. Older women should be systematically screened for exposure to violence, and psychosocial support programs should be established for those affected. Primary health care facilities are particularly important for identifying victims and meeting their service needs. Further research focusing on other forms of IPV and health outcomes is needed to better understand older women's experiences of IPV.

REFERENCES

1. Devries KM, Mak JY, García-Moreno C et al. The global prevalence of intimate partner violence against women. Science 2013; 340: 1527-1528. (DOI: 10.1126/science.1240937).
2. World Health Organization. Violence Info, Intimate partner violence. World Health Organization; 2022 [Internet]. Available from: https://apps.who.int/violence-info/intimate-partner-violence/ Accessed: 28.04.2024.
3. United Nations. Goal 5: Achieve gender equality and empower all women and girls. [Internet]. Available from: https://sdgs.un.org/goals/goal5 Accessed: 15.03.2024.
4. Crockett C, McCleary-Sills JD, Cooper B et al. Violence against women and girls resource guide: Brief on violence against older women [Working Paper] World Bank Group; 2016. [Internet]. Available from: http://documents.worldbank.org/curated/en/995591611122468396/Violence-Against-Women-and-Girls-Resource-Guide-Brief-on-Violence-Against-Older-Women Accessed: 28.04.2024.

5. Meyer SR, Lasater ME, Garcı´a-Moreno C. Violence against older women: A systematic review of qualitative literature. PLoS ONE 2020; 15(9): e0239560. (DOI: 10.1371/journal.pone.0239560).

6. World Health Organization. Global and regional estimates of violence against women: prevalence and health effects of intimate partner violence and nonpartner sexual violence [Situation report] World Health Organization; 2013. [Internet]. Available from: https://www.who.int/publications/i/item/9789241564625 Accessed: 28.04.2024.

7. Sardinha L, Maheu-Giroux M, Stöckl H, Meyer SR, García-Moreno C. Global, regional, and national prevalence estimates of physical or sexual, or both, intimate partner violence against women in 2018. Lancet 2022; 399: 803-813. (DOI: 10.1016/ S0140-6736(21)02664-7).

8. Charro-Baena B, Rúa-Vieites A, Meneses-Falcón C. Intimate partner violence among older women and men in Spain: Prevalence and types. Partner Abuse 2023; 14(2): 277-290. (DOI: 10.1891/PA-2022-0048).

9. Bonomi AE, Anderson ML, Robert J. Reid RJ et al. Intimate partner violence in older women. Gerontologist 2007; 47(1): 34-41. (DOI: 10.1093/geront/47.1.34).

10. Miszkurka M, Steensma C, Phillips SP. Correlates of partner and family violence among older Canadians: a life-course approach. Health Promot Chronic Dis Prev Can 2016; 36(3): 45-53. (DOI: 10.24095/hpcdp.36.3.01).

11. Stöckl H, Watts C, Penhale B. Intimate partner violence against older women in Germany: Prevalence and associated factors. Journal of Interpersonal Violence 2012; 27(13): 2545-2564. (DOI: 10.1177/0886260512436390).

12. Prime Ministry Family Research Institute. The reasons and consequences of domestic violence [State report] Prime Ministry Family Research Institute Publication; 1995. [Internet]. Available from: https://dspace.ceid.org.tr/xmlui/handle/1/356 Accessed: 28.04.2024.

13. Altinay AG, Arat Y. Violence against women in Turkey: A nationwide study [Monograph] Punto Publishing Solutions; 2009. [Internet]. Available from: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://research.sabanciuniv.edu/id/eprint/11418/1/Violence_Against_Women_in_Turkey.pdf Accessed: 28.04.2024.

14. Turkish Republic Prime Ministry Directorate General on the Status of Women, Hacettepe University Institute of Population Studies. National research on domestic violence against women in Turkey 2008 [Main report] Republic of Turkey Prime Ministry Directorate General on the Status of Women; 2009. [Internet]. Available from: https://hips.hacettepe.edu.tr/en/analysis_and_report-320 Accessed: 28.04.2024.

15. Republic of Turkey Ministry of Family and Social Policies, Hacettepe University Institute of Population Studies. National research on domestic violence against women in Turkey 2014 [Main report] Republic of Turkey Ministry of Family and Social Policies; 2015. [Internet]. Available from: https://hips.hacettepe.edu.tr/en/analysis_and_report-316 Accessed: 28.04.2024.

16. Yalçın Gürsoy M, Kara F. Prevalence of violence against older adults and associated factors in Çanakkale, Turkey: A cross-sectional study. Geriatr Gerontol Int 2020; 20(1): 66-71. (DOI: 10.1111/ggi.13819).

17. Pathaka N, Dhairyawanc R, Tariq S. The experience of intimate partner violence among older women: A narrative review. Maturitas 2019: 121: 63-75. (DOI:10.1016/j.maturitas.2018.12.011).

18. Gerino E, Caldarera AM, Curti L, Brustia P, Rollè L. Intimate partner violence in the golden age: Systematic review of risk and protective factors. Frontiers in Psychology 2018; 9: 1595. (DOI: 10.3389/fpsyg.2018.01595).

19. Montero I, Martín-Baena D, Escribà-Agüir V, RuizPérez I, Vives-Cases C, Talavera M. Intimate partner violence in older women in Spain: Prevalence, health consequences, and service utilization. Journal of Women & Aging 2013; 25(4): 358-371. (DOI: 10.1080/08952841.2013.838854).

20. World Health Organization. WHO multi-country study on women's health and domestic violence against women: summary report of initial results on prevalence, health outcomes and women's responses [Situation report] World Health Organization; 2005. [Internet]. Available from: https://www.who.int/publications/i/item/9241593512 Accessed: 20.04.2024.

21. Ökten Ş. Domestic violence and patriarchy in Turkey. European Journal of Social Science Education and Research 2019; 6(3): 102-110. (DOI: 10.26417/ejser.v11i2.p365-369).

22. Hacettepe University Institute of Population Studies. Turkey Demographic and Health Survey, 2003 [Main

report] Hacettepe University Institute of Population Studies, Ministry of Health General Directorate of Mother and Child Health and Family Planning, State Planning Organization and European Union; 2004. [Internet]. Available from: https://hips.hacettepe.edu.tr/en/analysis_and_report-275 Accessed: 28.04.2024.

23. Hacettepe University Institute of Population Studies. 2018 Turkey Demographic and Health Survey [Main report] Hacettepe University Institute of Population Studies, T.R. Presidency of Turkey Directorate of Strategy and Budget and TUBITAK; 2019. [Internet]. Available from: https://hips.hacettepe.edu.tr/en/2018_tdhs_analysis_and_report-262 Accessed: 28.04.2024.

24. Vung ND, Krantz G. Childhood experiences of interparental violence as a risk factor for intimate partner violence: A population based study from northern Vietnam. J Epidemiol Community Health 2009; 63: 708-714. (DOI:10.1136/jech.2008.076968).

25. Rada C. Violence against women by male partners and against children within the family: prevalence, associated factors, and intergenerational transmission in Romania, a cross-sectional study. BMC Public Health 2014; 14: 129. (DOI: 10.1186/1471-2458-14-129).

ORIGINAL ARTICLE

THE PREVALENCE OF SKIN DISEASES AMONG THE ELDERLY PATIENTS APPLYING A TERTIARY DERMATOLOGY OUTPATIENT CLINIC: A RETROSPECTIVE ANALYSIS OF 2400 PATIENTS

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Abstract

Introduction: As the population ages, particular health issues affect this susceptible age group. The aim of this study was to evaluate the incidence, frequency, age, gender, and season-of-year distribution of dermatological disorders among geriatric patients.

Materials and Method: This was a retrospective, descriptive study. Skin diseases were categorized into 12 different groups and analyzed according to the age groups, gender, and season of the application.

Results: The study included 2431 patients (1203 were female and 1228 were male). The mean age of the patients was 74.02±7.07(65-100) years. For 23.1% of these patients, the problems were acute, and for 76.9%, they were chronic. The ratio of patients with one, two, and more than three complaints was 81.0%, 13.9%, and 5.1%, respectively. The most frequent diagnoses were pruritus (n=424, 17.4%); eczematous dermatitis (n=395, 16.2%); fungal infections (n=372, 15.3%); premalign and malign skin disorders (n=247, 10.2%); bacterial infections (n=147, 6%); viral infections (n=118, 4.9%); papulosquamous diseases (n=95, 3.9%); urticaria and adverse drug reactions (n=96, 3.9%); benign skin tumors (n=79, 3.2%); acneiform disorders (n=40, 1.6%); and vesiculobullous disorders (n=22, 0.9%).

Conclusion: The majority of skin diseases among the elderly are not life-threatening, and they are preventable. Knowing the prevalence and distribution of skin diseases seen in the elderly can help prevent these disorders and develop policies for better management of elderly-related health issues.

Keywords: Aged; Skin Diseases; Preventive Medicine; Skin Aging.

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INTRODUCTION

Improvements in health care and the management of chronic conditions have led to longer life expectancies, which, in addition to declining fertility rates, have contributed to population aging (1, 2). It has been estimated that by 2025, the global population will comprise approximately 1,2 billion individuals aged 60 and over, and this number is projected to increase to 1,9 billion individuals by 2050 (3).

According to the Turkish Statistical Institute, from 2020–2022, life expectancy at birth in Turkey was 77.5 years (4). The elderly population, including those 65 years of age and older, has increased by 22.6% in the last five years. In 2030, the percentage of the population aged 65 years and over has been projected to be 12.9%, 16.3% in 2040, 22.6% in 2060, and 25.6% in 2080 (5).

Because aging is an ongoing biological process, it causes a wide range of changes in all organs, including the skin (6, 7). Aging causes decreased epidermal hydration and increased transepidermal water loss, which leads to dry, xerotic skin. The epidermal turnover rate and the production of lipids and filaggrin also decline with aging. Consequently, the epidermal barrier function does not function properly. Moreover, the immune system, which enables the body to repair DNA and wounds, as well as manintain thermoregulatory mechanisms, sweat production, sebum production, and vitamin D production, weakens with age (2, 8). In addition to these changes, reduced functional capacity, associated chronic conditions, polypharmacia, and poor skin care and personal hygiene practices, increase the susceptibility of elderly patients to skin diseases and issues (9–11).

This study aimed to evaluate the incidence, frequency, age, gender, and seasonal distribution of dermatological disorders among geriatric patients admitted to the outpatient dermatology clinic at a university hospital in the city of Ordu, Turkey.

MATERIALS AND METHOD

This retrospective descriptive study was conducted in the Department of Dermatology at the University of Ordu, Turkey. All patients over 65 years of age who attended the dermatology outpatient clinic from June 2019 to June 2021 were included in the study. The study was conducted in accordance with the Helsinki Declaration and was approved by the Ordu University Training and Research Hospital Ethics Review Board (Number: 2023/214). According to the World Health Organization classification, the patients in this study were grouped by gender and age group: 65–74 years, 75–84 years, and 85 years or older.

Skin diseases were categorized into 12 different groups, including pruritus, eczematous dermatitis, papulosquamous diseases, bacterial infections, viral infections, fungal infections, benign neoplasms, precancerous, and malignant lesions, urticaria, and adverse drug reactions, vesiculobullous diseases, acne, and related diseases, and other diseases (disorders of physical agents, hair disorders, nail disorders, mucosal disorders, vascular diseases, granulomatous disorders, pigmentation disorders, and connective tissue diseases, metabolic skin diseases, panniculitis, kserosis cutis, and parasitic infestations).

Statistical Analysis

Categorical data were expressed as frequency (n) and percentage (%). Pearson's chi-square test was used to determine the relationships between the categorical variables. Continuous variables were expressed as mean±standard deviation (minimum-maximum value). In the chi-square tests, if the expected frequencies were below 5, the likelihood ratio test statistic was calculated instead of Pearson's test statistic. All statistical analyses were performed using SPSS v28 (IBM Inc., Chicago, IL, USA) statistical software.

RESULTS

This retrospective cross-sectional study used a sample of 2,431 patients who presented to the Ordu University Training and Research Hospital Dermatology Polyclinic between 2019 and 2021. Of these patients, 49.5% (n = 1203) were female, and 50.5% (n = 1228) were male. The distribution of the patients according to the seasons showed that the highest number of applications were in winter (n = 787, 32.4%), followed by autumn (n = 670, 27.6%), summer (n = 632, 26.0%), and spring (n = 342, 14.1%). The mean age of the patients was 74.02±7.07 (65–100) years; 1,412 (58.1%) patients were in the 65–74 age group, 940 (38.7%) patients were in the 75–89 age group; and 79 (3.2%) patients were in the ≥ 90 age group.

Of the patients in the study sample, 23.1% presented with an acute complaint, and 76.9% presented with a chronic complaint. Only 11.2% of the patients had xerosis. Overall, the most frequent diagnoses were pruritus (n = 424, 17.4%); eczematous dermatitis (n = 395, 16.2%); fungal infections (n = 372, 15.3%); premalign and malign skin disorders (n = 247, 10.2%); bacterial infections (n = 147, 6%); viral infections (n = 118, 4.9%); papulosquamous diseases (n = 95, 3.9%); urticaria and adverse drug reactions (n = 96, 3.9%); benign skin tumors (n = 79, 3.2%); acneiform disorders (n = 40, 1.6%); and vesiculobullous disorders (n = 22, 0.9%). The group with other disorders included the following: vascular disorders (n = 95, 3.9%); disorders due to physical agents (n = 83, 3.4%); parasitic infestations (n = 92, 3.8%); mucosal disorders (n = 12, 0.7%); hair disorders (n = 12, 0.5%); nail disorders (n = 6, 0.2%); and pigmentation disorders (n = 8, 0.3%). The frequency distribution of the disease diagnoses of the patients is shown in Table 1.

Table 1. The distribution of diagnosis of the patients' according to gender, age groups, and seasons

			Pruritus	Eczematous dermatitis	Papulosquamous diseases	Bacterial infections	Viral infections	Fungal infections	Other disorders	Benign skin tumors	Premalign and malign diseases	Urticaria and adverse drug reactions	Vesiculobullous diseases	Acneiform disorders
Gender	Female	n	212	167	43	79	57	200	215	41	101	56	14	18
		%	17.6	13.9	3.6	6.6	4.7	16.6	17.9	3.4	8.4	4.7	1.2	1.5
	Male	n	212	228	52	68	61	172	181	38	146	40	8	22
		%	17.3	18.6	4.2	5.5	5.0	14.0	14.7	3.1	11.9	3.3	0.7	1.8
Age groups	65-74	n	185	252	64	85	72	242	255	41	121	60	9	26
		%	13.1	17.8	4.5	6.0	5.1	17.1	18.1	2.9	8.6	4.2	0.6	1.8
	75-89	n	216	135	28	57	45	122	131	33	113	36	10	14
		%	23.0	14.4	3.0	6.1	4.8	13.0	13.9	3.5	12.0	3.8	1.1	1.5
	≥90	n	23	8	3	5	1	8	10	5	13	0	3	0
		%	29.1	10.1	3.8	6.3	1.3	10.1	12.7	6.3	16.5	0.0	3.8	0.0
Seasons	Spring	n	60	63	18	15	24	50	41	10	33	16	4	8
		%	17.5	18.4	5.3	4.4	7.0	14.6	12.0	2.9	9.6	4.7	1.2	2.3
	Summer	n	118	104	15	46	23	116	97	17	57	20	6	13
		%	18.7	16.5	2.4	7.3	3.6	18.4	15.3	2.7	9.0	3.2	0.9	2.1
	Autumn	n	112	109	19	48	38	102	112	20	73	24	6	7
		%	16.7	16.3	2.8	7.2	5.7	15.2	16.7	3.0	10.9	3.6	0.9	1.0
	Winter	n	134	119	43	38	33	104	146	32	84	36	6	12
		%	17.0	15.1	5.5	4.8	4.2	13.2	18.6	4.1	10.7	4.6	0.8	1.5
Total		n	424	395	95	147	118	372	396	79	247	96	22	40
%		%	17.4	16.2	3.9	6.0	4.9	15.3	16.3	3.2	10.2	3.9	0.9	1.6

Table 2. The difference in the diagnosis of the disease of the patients according to the gender

Diagnosis of the disease	Gender				Total	
	Female		Male			
	n	%	n	%	n	%
Pruritus	212	17.6	212	17.3	424	17.4
Eczematous dermatitis	167	13.9	228	18.6	395	16.2
Papulosquamous diseases	43	3.6	52	4.2	95	3.9
Bacterial infections	79	6.6	68	5.5	147	6.0
Viral infections	57	4.7	61	5.0	118	4.9
Fungal infections	200	16.6	172	14.0	372	15.3
Benign skin tumors	41	3.4	38	3.1	79	3.2
Premalign and malign diseases	101	8.4	146	11.9	247	10.2
Urticaria and adverse drug reactions	56	4.7	40	3.3	96	3.9
Vesiculobullous diseases	14	1.2	8	0.7	22	0.9
Acneiform disorders	18	1.5	22	1.8	40	1.6
Other disorders	215	17.9	181	14.7	396	16.3
Total	1203	100.0	1228	100.0	2431	100.0
p	0.002 (χ^2: 29.020)					

χ^2: Pearson's chi-square test statistic

Table 3. The difference in the diagnosis of the disease of the patients according to the age groups

Diagnosis of the disease	Age groups						Total	
	65-74		75-89		≥90			
	n	%	n	%	n	%	n	%
Pruritus	185	13.1	216	23.0	23	29.1	424	17.4
Eczematous dermatitis	252	17.8	135	14.4	8	10.1	395	16.2
Papulosquamous diseases	64	4.5	28	3.0	3	3.8	95	3.9
Bacterial infections	85	6.0	57	6.1	5	6.3	147	6.0
Viral infections	72	5.1	45	4.8	1	1.3	118	4.9
Fungal infections	242	17.1	122	13.0	8	10.1	372	15.3
Benign skin tumors	41	2.9	33	3.5	5	6.3	79	3.2
Premalign and malign diseases	121	8.6	113	12.0	13	16.5	247	10.2
Urticaria and adverse drug reactions	60	4.2	36	3.8	0	0.0	96	3.9
Vesiculobullous diseases	9	0.6	10	1.1	3	3.8	22	0.9
Acneiform disorders	26	1.8	14	1.5	0	0.0	40	1.6
Other disorders	255	18.1	131	13.9	10	12.7	396	16.3
Total	1412	100.0	940	100.0	79	100.0	2431	100.0
p	<0.001 (LRχ^2:91.800)							

LRχ^2: Likelihood Ratio chi-square test statistic

The analysis of disease distribution according to gender showed statistically significant differences between the groups ($p = 0.002$), as shown in Table 2. The female patients were predominantly diagnosed with other disorders, pruritus, and fungal infections. The male patients were predominantly diagnosed with eczematous dermatitis, pruritus, and other disorders. Premalignant and malignant diseases were more prevalent among males, accounting for 11.9% and 8.4%, respectively. The incidence of benign skin tumors was comparable in both females and males.

The disease distribution varied according to age group, which was statistically significant ($p < 0.001$), as shown in Table 3. As expected, there was a notable increase in the prevalence of premalignant and malignant diseases as the age of the patients increased. Additionally, benign skin tumors were the most frequently observed in patients older than 90 years. In contrast, eczematous dermatitis, viral infections, fungal infections, urticaria, adverse drug reactions, acneiform disorders, and other disorders became less frequent as the age group increased. The disease group with other disorders was the most frequently encountered in the 64–74 age group. Patients between 75 and 89 years and patients over 90 years were diagnosed with pruritus.

The prevalence of some diseases variee according to season (Table 4). Eczematous dermatitis was the most frequently observed disease in the spring, followed by pruritus in the summer and fall, and other disorders in the winter. Fungal infections were the most frequently diagnosed in the summer, while viral infections were the most frequent in the spring.

The rate of patients with only one complaint was 81.0%, the rate of patients with two complaints was 13.9%, and the rate of patients with more than three complaints was 5.1%. When a patient presented with multiple complaints, the primary diagnosis related to the primary complaint was taken into account. The differences in the number

Table 4. The difference in the diagnosis of the disease of the patients according to the seasons

Diagnosis of the disease	Seasons								Total	
	Spring		Summer		Autumn		Winter			
	n	%	n	%	n	%	n	%	n	%
Pruritus	60	17.5	118	18.7	112	16.7	134	17.0	424	17.4
Eczematous dermatitis	63	18.4	104	16.5	109	16.3	119	15.1	395	16.2
Papulosquamous diseases	18	5.3	15	2.4	19	2.8	43	5.5	95	3.9
Bacterial infections	15	4.4	46	7.3	48	7.2	38	4.8	147	6.0
Viral infections	24	7.0	23	3.6	38	5.7	33	4.2	118	4.9
Fungal infections	50	14.6	116	18.4	102	15.2	104	13.2	372	15.3
Benign skin tumors	10	2.9	17	2.7	20	3.0	32	4.1	79	3.2
Premalign and malign diseases	33	9.6	57	9.0	73	10.9	84	10.7	247	10.2
Urticaria and adverse drug reactions	16	4.7	20	3.2	24	3.6	36	4.6	96	3.9
Vesiculobullous diseases	4	1.2	6	0.9	6	0.9	6	0.8	22	0.9
Acneiform disorders	8	2.3	13	2.1	7	1.0	12	1.5	40	1.6
Other disorders	41	12.0	97	15.3	112	16.7	146	18.6	396	16.3
Total	342	100.0	632	100.0	670	100.0	787	100.0	2431	100.0
p	0.023 (χ^2: 51.035)									

χ^2: Pearson's chi-square test statistic

Table 5. The differences in number of patients' complaints according to gender, age groups, and seasons

		Number of complaints						p
		1		2		≥3		
		n	%	n	%	n	%	
Gender	Female	976	81.1	169	14.0	58	4.8	0.858
	Male	994	80.9	169	13.8	65	5.3	(χ^2: .306)
Age groups	65-74	1143	80.9	203	14.4	66	4.7	0.421
	75-89	768	81.7	121	12.9	51	5.4	(χ^2: 3.888)
	≥90	59	74.7	14	17.7	6	7.6	
Seasons	Spring	273	79.8	48	14.0	21	6.1	0.004
	Summer	535	84.7	75	11.9	22	3.5	(χ^2:19.420)
	Autumn	547	81.6	100	14.9	23	3.4	
	Winter	615	78.1	115	14.6	57	7.2	

χ^2 : Pearson's chi-square test statistic

of patients' complaints according to gender, age groups, and seasons are examined in Table 5. The number of patients' complaints did not significantly change according to gender (p = 0.858). The rates of complaints were similar for women and men. The number of complaints increased as age increased, but this increase was not statistically significant (p = 0.421). The number of patients' complaints showed a statistically significant change according to the seasons (p = 0.004). The rate of those with ≥3 complaints was approximately 2 times higher in spring and winter than in summer and fall (6.1% and 7.2% vs. 3.5% and 3.4%, respectively).

DISCUSSION

In this study, there was a similar number of female and male patients. In some previous studies, female patients outnumbered male patients (7, 12, 13). In other previous studies, there were more male patients than female patients (14-17). In this current study, the majority of the patients were between the ages of 65 and 74 years, similar to other studies (7, 13-15, 17). Our findings showed that, the most frequent diagnoses were in the winter, followed by the autumn. In a study conducted by Yaldız et al., patients attended to the hospital in the winter, followed by the spring (14). Another previous study found that patients most frequently visited the hospital in the autumn and spring (17).

Pruritus, eczematous dermatitis, fungal infections, premalignant skin diseases, and bacterial diseases were the most frequently diagnosed in this study, similar to the previous studies (14, 15, 17, 18). Bilgili et al. reported the same most common disease groups as found in our study, with the exception that urticaria-angioedema was the fourth most common disease, which was as common in our cohort. Moreover, there were no patients over 90 years of age diagnosed with urticaria (16). Sarac et al. reported the same most common disease groups as in our study, but their patients were diagnosed with a greater number of papulosquamous diseases (7). In our study, more than 75% of the patients had chronic complaints, and four out of five patients had only one complaint. In a previous study, more than 90% of the patients had only one complaint in a study with 209 patients (13).

As people age, their sebaceous and sweat glands produce less sebum and less sweat, which leads to the development of xerosis. The water

content of the stratum corneum decreases when older people are immobile. Additionally, xerosis may be caused by the latter stage of renal illness, a lack of zinc and critical fatty acids, thyroid conditions, and medications (12). In our study group, xerosis was present in 11.2% of the patients. Kılıç et al. conducted a study on elderly patients in nursing homes, and they reported that 45.3% of these patients had xerosis. In a study conducted by Yaldız et al., 7092 elderly patients were retrospectively examined, and the ratio of xerosis was found to be 8.17%, similar to our findings (14). In another study, the authors analyzed 7722 patients over 65 years, and the prevalence of xerosis was reported to be 13.8% (15). In another study, 4.7% of the 877 patients had xerosis (7).

In our study, pruritus was the most frequently observed in both genders. Its prevalence increased with advancing age and was not affected by season. Similar to our study, in (7), the prevalence of pruritus prevalence was found to be the same in both genders, and its prevalence increased with advancing age. In the same study, pruritus was the third most common disease in the patient group (7). In another study conducted in Turkey, pruritus was the third most common disease, and its prevalence increased with advancing age (19). Most cases of pruritus in the elderly population have been reported to be related to xerosis and aging (12, 17). Systemic illnesses, as well as psychological issues, can also contribute to pruritus. Metabolic illnesses that might produce pruritus include diabetes mellitus (DM), iron-deficient anemia, infections, medications, renal, and hepatic insufficiency, thyroid, and parathyroid disorders, and malignancies (12).

The prevalence of eczematous dermatitis steadily declines with age. The reason may be that there is more contact with environmental and physical factors in the younger individuals (7, 17). In this study, eczematous dermatitis was the second leading cause of elderly attendance at outpatient clinics, although its prevalence decreases with advancing ages. Eczematous dermatitis was more common in the 65–74 age group in both genders (7). Yıldız et al. reported that eczematous dermatitis was the most common disorder seen in elderly patients. The elderly have increased sensitivity to allergens and irritants because of a malfunctioning of the epidermal barrier (15). In this study, eczematous dermatitis is the most frequently observed in spring. Yaldız et al. reported that eczematous dermatitis was the most common disease in their patient group, and it was more common in patients ages 65–75 years, in the winter, and in females (14).

Bacterial infections were observed in all age groups, with a prevalence of 6%. Bacterial infections were more common in females and in the summer and autumn, but the difference was not significant. The healing process can be delayed for several reasons, including reduced blood flow, compromised immunological function, thinning and dryness of the skin, related systemic disorders, epidermal damage brought on by itching, and diminished personal care, all of which contribute to infections. In a previous study by Yıldız et al. (15), the prevalence of bacterial infections was 5.9 in the study conducted by Yıldız et al. (15). The authors reported that the prevalence of bacterial infections was 7.3%, and they were observed in all age groups and in both genders (17).

In this study, fungal infections were found to be the third most common skin disorder in this study. The frequency of these infections declined with age. They were more common in the summer than in the other seasons. In this study, the female patients had more fungal infections than the male patients. However, in Yalçın et al., fungal infections were found to be more common in males and in the summer (17). In another study, similar to the study conducted by Yalçın et al. the authers found that the fungal infections were more common in males (12). Yaldız et al. reported that fungal infections were more common in males, in the summer, and

in older patients (14). Humidity and temperature may be the reasons for the increased prevalence of fungal infections in the summer (12, 14, 17).

In this study, it was observed that the rate of premalignant and malignant diseases increased gradually as patient age increased. Aging is accompanied by an increasing prevalence of malign illnesses due to mutations, a decline in DNA repair ability, and lifelong exposure to carcinogens and sun exposure. Malign diseases are known to be more common in male patients (14). In line with this knowledge, in this study, more males than females were affected by premalignant and malignant diseases. However, a previous study found that premalignant and malignant skin diseases were more common in females and people over the age of 75 years (7).

Limitations

This study has the following limitations. First of all, because of its retrospective design, the diagnoses were taken from hospital record. Second, because the study was conducted in a tertiary health care hospital, the results cannot be generalized to all populations. Third, although some patients had more than one complaint, only the complaint based on which they were admitted to the hospital was assessed.

CONCLUSION

As the percentage of geriatric patients is increases, special attention should be paid to this age group. Fortunately, the majority of frequent illnesses among the elderly are not life-threatening, and they are preventable. This study fovused on dermatological conditions in the elderly. Further epidemiological studies are needed to assess the prevalence of skin diseases, skin care, treatment, and prevention strategies for skin disorders in geriatric patients.

REFERENCES

1. Ansorge C, Miocic JM, Schauer F. Skin diseases in hospitalized geriatrics: a 9-year analysis from a university dermatology center in Germany. Archives of Dermatological Research 2022;314(5):427-437. (DOI: 10.1007/s00403-021-02244-9)
2. Darjani A, Mohtasham-Amiri Z, Mohammad Amini K, Golchai J, Sadre-Eshkevari S, Alizade N. Skin disorders among elder patients in a referral center in Northern Iran (2011). Dermatol Res Pract. 2013;2013:193205. (DOI: 10.1155/2013/193205)
3. Kumar D, Das A, Bandyopadhyay D, et al. Dermatoses in the elderly: clinico-demographic profile of patients attending a tertiary care centre. Indian J Dermatol 2021;66(1):74-80. (DOI: 10.4103/ijd.IJD_245_20)
4. Turkish Statistical Institute (TURKSTAT). Life Tables, 2020–2022. . [Internet]. Accessed: 18.09.2023. ID: 49726 Available from: https://data.tuik.gov.tr/Bulten/Index?p=Life-Tables-2020-2022-49726
5. Turkish Statistical Institute (TURKSTAT). Elderly Statistics, 2022. [Internet]. Accessed: 17.03. 2023. ID: 49667. Available from: https://data.tuik.gov.tr/Bulten/Index?p=Elderly-Statistics-2022-49667
6. Jindal R, Jain A, Roy S, Rawat SD, Bhardwaj N. Skin disorders among geriatric population at a tertiary care center in Uttarakhand. J Clin Diagn Res. Research 2016;10(3):WC06-8. (DOI: 10.7860/JCDR/2016/17015.7500)
7. Aksoy Sarac G, Emeksiz MAC, Acar O, Nazlican E, Tanacan E, Nayir T. Retrospective analysis of dermatological diseases in geriatric patients during dermatology outpatient department visits. Dermatol Pract Concept. 2022;12(3):e2022145. (DOI: 10.5826/dpc.1203a145)
8. Uprety S, Paudel S, Thapa P. Pattern of skin diseases in geriatric population: our year-long experience from Nepal. Indian Dermatol Online J. 2021 Nov 22;12(6):888-891. (DOI: 10.4103/idoj.IDOJ_65_21)
9. Darjani A, Alizadeh N, Rafiei E, et al. Skin diseases among the old age residents in a nursing home: a neglected problem. Dermatol Res Pract 2020:8849355. Published 2020 Nov 5. (DOI: 10.1155/2020/8849355)
10. Blume-Peytavi U, Kottner J, Sterry W, et al. Age-associated skin conditions and diseases: current perspectives and future options. Gerontologist 2016;56 Suppl 2:S230-42. (DOI: 10.1093/geront/gnw003)

11. Kandwal M, Jindal R, Chauhan P, Roy S. Skin diseases in geriatrics and their effect on the quality of life: a hospital-based observational study. J Family Med Prim Care. 2020;9(3):1453-1458. (DOI: 10.4103/jfmpc.jfmpc_1188_19)
12. Kilic A, Gul U, Aslan E, Soylu S. Dermatological findings in the senior population of nursing homes in Turkey. Arch Gerontol Geriatr. 2008;47(1):93-98. (DOI: 10.1016/j.archger.2007.07.007)
13. Polat M, Yalcin B, Caliskan D, Alli N. Complete dermatological examination in the elderly: an exploratory study from an outpatient clinic in Turkey. Gerontology 2009;55(1):58-63. (DOI: 10.1159/000129683)
14. Yaldiz M. Dermatological diseases in the geriatric age group: Retrospective analysis of 7092 patients. Geriatr Gerontol Int. 2019 Jul;19(7):582-585. (DOI: 10.1111/ggi.13665)
15. Yıldız H. Prevalence of geriatric dermatoses among elderly patients treated at the dermatology outpatient clinic in Eskisehir, Turkey. South. Clin. Ist. Euras. 2019;30(1):47-51 (DOI: 10.14744/scie.2019.46855)
16. Bilgili SG, Karadag AS, Ozkol HU, Calka O, Akdeniz N. The prevalence of skin diseases among geriatric patients in Eastern Turkey. J Pak Med Assoc. 2012;62(6):535-539. PMID: 22755334.
17. Yalcin B, Tamer E, Toy GG, Oztaş P, Hayran M, Alli N. The prevalence of skin diseases in the elderly: analysis of 4099 geriatric patients. Int J Dermatol. 2006;45(6):672-676. (DOI: 10.1111/j.1365-4632.2005.02607.x)
18. Polat M, Ilhan MN. Dermatological complaints of the elderly attending a dermatology outpatient clinic in turkey: a prospective study over a one-year period. Acta Dermatovenerol Croat. 2015;23(4):277-281.
19. Bas Y, Kalkan G, Seckin HY, Takci Z, Sahin S, Demir AK. Analysis of dermatologic problems in geriatric patients. Turk J Dermatol. 2014;8(2):95-100. (DOI: 10.4274/tdd.1905)

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ORIGINAL ARTICLE

COMPARISON OF THE EFFICACY OF LUMBAR ERECTOR SPINAE PLANE BLOCK FOR CHRONIC AXIAL LOW BACK PAIN IN GERIATRIC AND YOUNGER PATIENTS: RESULTS OF A RETROSPECTIVE STUDY

Abstract

Introduction: The lumbar erector spinae plane block is one of the interventional procedures for chronic low back pain. This study aimed to compare the efficacy of lumbar erector spinae plane block for chronic axial low back pain due to disc protrusion/bulging in geriatric and younger patients and to evaluate clinical, demographic, and radiological characteristics that may be associated with treatment success.

Materials and Method: The clinical and demographic data of patients who underwent ultrasound-guided lumbar erector spinae plane block for chronic axial low back pain between November 2022 and July 2023 were retrospectively evaluated. Patients were divided into two groups, ≥65 and <65 years of age, and treatment efficacy at the third month after the procedure was evaluated and compared.

Results: A total of 147 patients (75 patients aged <65 years and 72 patients aged ≥65 years) were included in the analysis, and a successful treatment response (at least 50% pain relief) was achieved in 44.4% of geriatric patients and 62.6% of younger patients (p=0.027). In addition BMI, comorbidity, opioid use, and lumbar paraspinal fatty infiltration were significantly higher in geriatric patients than in younger patients (p<0.05).

Conclusion: The results of this study demonstrate that lumbar erector spinae plane block for chronic axial low back pain provides significantly less pain relief in geriatric patients than in younger patients at three-month follow-up.

Keywords: Lower back pain; Aged; Injection; Ultrasound imaging

INTRODUCTION

With a prevalence of 21-75%, chronic low back pain (CLBP) is a common health problem in the geriatric population, frequently leading to disability and functional impairment (1). While most cases of low back pain resolve within a few months, advanced age is a significant risk factor for chronic pain (1) Herniated intervertebral discs, facet joint degeneration and spinal canal stenosis are the most common causes of CLBP in elderly patients (2). Medical treatment and physical therapy modalities are primarily employed for these patients. Interventional pain procedures and surgical treatment are required for patients who do not respond to these modalities (3).

Lumbar erector spinae plane block (ESPB) is an effective interventional pain procedure performed under ultrasound (US) guidance in patients with axial and/or radicular CLBP refractory to medical and physical therapy (4). ESPB was first defined as a treatment technique for thoracic pain in 2016 and has since been widely used for acute and chronic spinal pain, including pain in the lumbar region (5). US-guided lumbar ESPB involves injecting local anesthetic (LA) around the paraspinal muscles attached to the transverse process of the vertebrae. This method is effective for pain treatment as the drug spreads to the paravertebral planes and neural foramens (6).

The structure of the lumbar paraspinal muscles has a significant effect on the stability of the lumbar spine, and increased fat infiltration in the paraspinal muscles, which are the target sites of lumbar ESPB, has been associated with sarcopenia, low back pain, and loss of patient function (7, 8). Recent studies have associated increased fat infiltration in the lumbar paraspinal region with poor outcomes after epidural injections and surgery (8, 9).

To the best of our knowledge, the effectiveness of lumbar ESPB in the treatment of chronic axial LBP in geriatric patients compared with younger patients has not been investigated, nor have the factors influencing treatment success. This study aimed to investigate the effectiveness of lumbar ESPB in geriatric patients (≥65 years) compared with younger patients and to examine the impact of patient demographic and clinical characteristics, including the degree of paraspinal fat infiltration, on treatment success.

MATERIALS AND METHOD

Study design and participants

This study, designed retrospectively, received approval from the local ethics committee (number 2023-600) and registered at ClinicalTrials.gov (registration number NCT06208865). Medical records were retrospectively retrieved and analyzed from the hospital data of patients who underwent US-guided lumbar ESPB for axial CLBP between November 2022 and July 2023. The inclusion criteria were as follows: (1) patients aged ≥ 18 years, (2) patients with chronic axial low back pain due to lumbar disc bulging/protrusion without compression of the spinal nerve root; (3) no response to medical treatment and physical therapy for ≥ 3 months; (4) Lomber magnetic resonance imaging (MRI) within 1 year before injection, (5) no previous lumbar interventional procedure and (6) no paravertebral lumbar facet tenderness and no neurological deficit on examination (patients without sensory/motor deficit, deep tendon reflex abnormality). The exclusion criteria were as follows: (1) clinically and radiologically (patients whose MRI images or reports could not be accessed from patient records) inadequate medical records; (2) lost to follow-up within three months after the procedure; (3) history of surgery for lumbar disc herniation or interventional procedure; (4) severe spinal stenosis (vertebral canal diameter <10 mm in the sagittal plane) and/or foraminal stenosis (foraminal height <15 mm in the axial plane); (5) extruded, sequestered, or migrated hernias on lumbar MRI, (6) facet hypertrophy on lumbar MRI

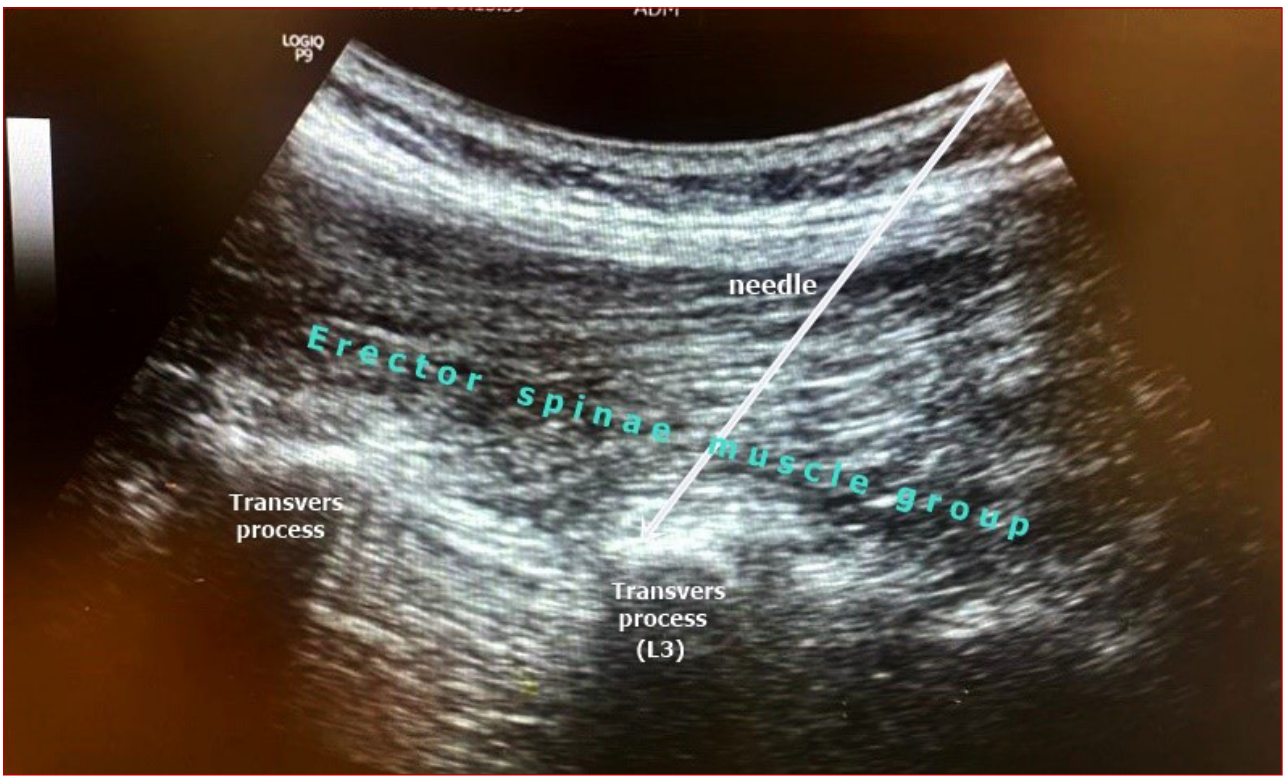
(7) radicular low back pain, (8) paravertebral lumbar facet tenderness and neurological examination findings such as sensory/motor deficit, deep tendon reflex abnormality and (8) history of malignancy.

Lumbar erector spinae plane block (ESPB)

All procedures were performed under US guidance. The patient was placed in the prone position and sterile conditions ensured. The intervention was performed by two pain specialists with similar experience of at least three years.

A 2-6 MHz convex US probe (LOGIQ P9, GE Ultrasound, Sunhwan-ro, Jungwon-gu, Seongnamsi, Gyeonggi-do, Korea) was used during the procedure. After visualizing the transverse processes of the lumbar vertebrae which are the attachment sites of the paraspinal muscles (erector spinae muscle group), a 22-gauge spinal needle was inserted into the transverse process of the L3 vertebra using the in-plane method (Figure 1). After contacting the transverse process of the L3 vertebra, 10 mL of drug containing 2 mL dexamethasone, 4 mL 0.025% bupivacaine, and 4 mL saline was injected. Lumbar ESPB was performed unilaterally in all patients using this method and drug volume. In patients with bilateral axial pain, the procedure was performed on the side with the predominant pain. The patients were followed up for possible adverse events, and no adverse events occurred in any of the patients.

Figure 1. The ultrasound section shows the visualization of the transverse process and needle in lumbar erector spinae plane block

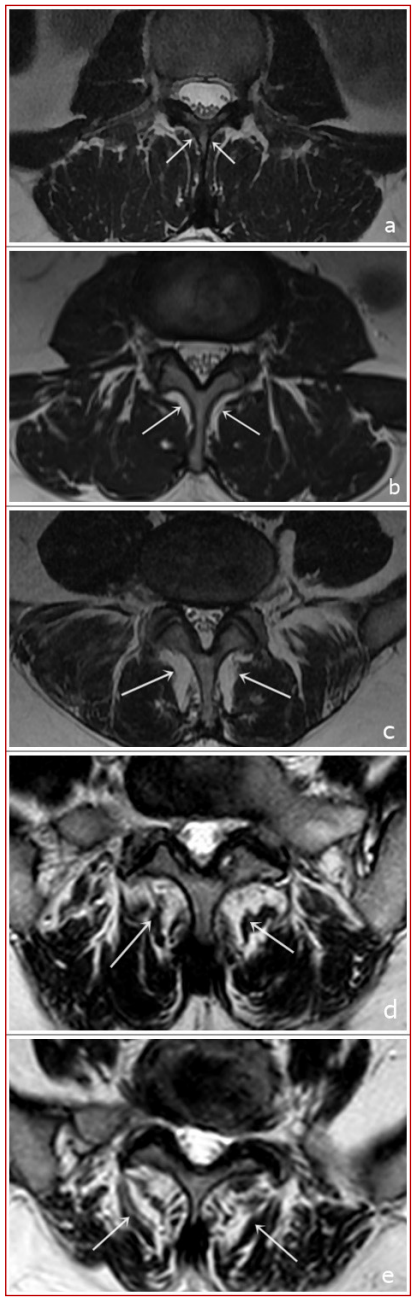


Data collection and outcome measures

The intensity of the pain was assessed using a numerical rating scale (NRS) both before and one-month and three-months after the treatments. The NRS is defined as ranging from 0 (no pain) to 10 (the worst pain imaginable). Consistent with similar studies (10), treatment was considered successful in one patient who experienced a ≥50% reduction in the NRS score at three months post-treatment. Patients were divided into two age groups, < 65 years and ≥ 65 years, and analyzed appropriately.

In addition, demographic data such as gender, comorbidities (diabetes mellitus (DM), hypertension (HT) and coronary artery disease (CAD)), body mass index (BMI)kg/m2), pain duration and opioid use were obtained from patient data. NRS scores before and 3 months after the lomber ESPB were collected from patient data and recorded. Pre-procedure lumbar magnetic resonance images were obtained from the patient's data. Lumbar pathologies causing chronic axial low back pain (lumbar disc bulging/ protrusion without spinal nerve root compression) was evaluated by a experienced radiologist. Fat infiltration in the paraspinal muscles was evaluated at the L3 vertebral level. Paraspinal fatty infiltration was evaluated using T2-weighted MRI scan, employing methodologies established in previously published studies, and the Goutallier classification was used for grading (11). The grading of fatty infiltration in the paraspinal muscles on a lumbar MRI was performed by a experienced radiologist. As we applied lumbar EPSB at the L3 level, we preferred to perform MRI evaluation at the same level. The Goutallier Classification is defined as follows: The Goutallier classification system assesses the amount of fat present in the muscle. Goutallier 0 indicates no visible fat streaks, Goutallier 1 indicates minimum fat streaks, Goutallier 2 indicates more muscle than fat, Goutallier 3 indicates equivalent amounts of fat and muscle, and Goutallier 4 indicates more fat than muscle (Fig 2).

Figure 2. Bilateral paraspinal muscles were assessed for fat infiltration on T2-weighted axial sections at the L3 level. The Goutallier grading was defined as follows: (a) Goutallier 0, no visible fat streaks; (b) Goutallier 1, minimal fat streaks; (c) Goutallier 2, more muscle than fat; (d) Goutallier 3, equal fat and muscle; (e) Goutallier 4, more fat than muscle.



Statistical analysis

All analyses were conducted using the Jamovi project (2022, Jamovi Version 2.3, Computer Software). The findings of this study are expressed as frequencies and percentages. Normality analysis was performed using the Shapiro–Wilk test, skewness-kurtosis, and histograms. Categorical variables were presented as absolute numbers with percentages. Continuous variables were compared between age groups using the Mann–Whitney U-test and Kruskal–Wallis H-test and were presented as medians with interquartile ranges. Categorical variables were compared using the chi-square test or Fisher's exact test. Statistical significance was set at $P < 0.05$.

RESULTS

A total of 196 patients underwent US-guided lumbar ESPB during the study period, and 49 patients were excluded in line with the exclusion criteria. There were 147 patients in the analysis between the ages of 20 between 77 years, including 75 patients aged <65 years and 72 patients aged ≥65 years. The treatment response at the post-procedural third month was successful in 62.6% of patients aged <65 years and 44.4% of patients aged ≥ 65 years (Fig 3) and the difference was statistically significant (p=0.027). The comparison of the NRS changes at basal and at the first and third month after the procedure is shown in Fig. 4.

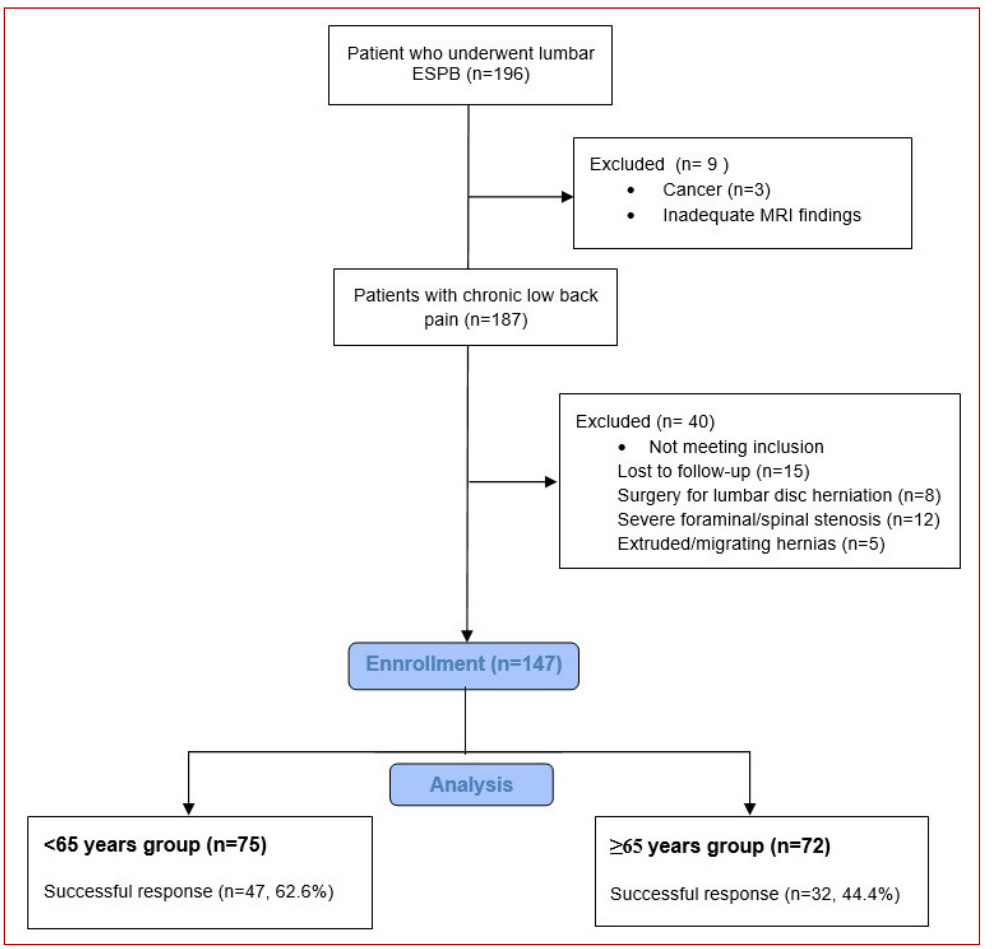


Figure 3. Study design and follow-up

Figure 4. Comparison of the effect of time on NRS in geriatric and younger patients

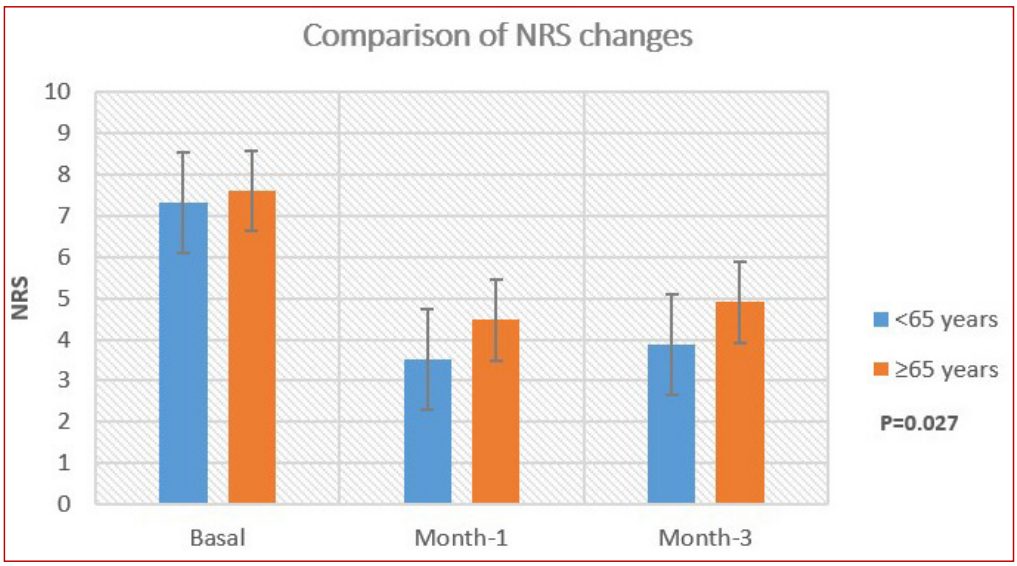


Table 1. Baseline demographic and clinical characteristics according to age groups (<65 years and ≥65 years)

Variables		<65 years (n=75)	≥65 years (n=72)	p-value
		median(min-max)	median(min-max)	
BMI (kg/m2)		27(19-37)	29(19-37)	**0.002***
Basal NRS		7(6-9)	8(5-9)	**0.020***
Three-month NRS		3(1-9)	5(1-9)	**0.030***
Duration of pain (months)		24(4-120)	27(4-120)	0.988*
		n(%)	**n(%)**	**p-value**
Sex	Female	36 (44.4)	45 (55.6)	0.077**
	Male	39 (59.1)	27 (40.9)	
Successful treatment responce	Yes	47 (59.4)	32 (40.6)	**0.027****
	No	28 (41.1)	40 (58.6)	
Comorbid medical disease	Yes	14 (21.5)	51 (78.5)	**<0.001****
	No	61 (75.3)	21 (24.7)	
Opioid use	Yes	17 (33.3)	34 (66.7)	**0.003****
	No	58 (60.4)	38 (39.6)	
Fat infiltration grade (Goutallier Classification)	Mild (Grade 0,1)	56 (83.5)	11 (16.5)	**<0.001****
	Moderate(Grade 2)	12 (29.2)	29 (70.8)	
	Severe (Grade 3,4)	7 (17.9)	32 (82.1)	

BMI: Body mass index, NRS: numerical rating scale, *: Mann Whitney U Test,**: Chi Square Test

The values are presented as median (minimum-maximum) and numbers of patients. P values that are written in bold represent statistical. P<0.05 is considered statistically significant

Table 1 presents the basic demographic and clinical characteristics and the degree of paraspinal fatty infiltration, for each patient group categorized by age. Successful treatment response was significantly lower in the geriatric patients (p=0.027). The baseline NRS scores were high in both age groups (<65 and ≥65 years; median scores of 7 and 8, respectively), indicating severe pain, and both the baseline and three-month NRS scores were significantly higher in the geriatric group (p=0.020 and p=0.030, respectively). The patients aged ≥65 years had significantly higher BMI values and more comorbid medical diseases (diabetes mellitus, hypertension, and coronary artery disease) than the younger patients (p=0.002 and p<0.001, respectively). The patients in the geriatric group used more opioids (p=0.003), and the grade of paraspinal fat infiltration, determined according to the Goutallier classification at the L3 level on lumbar MRI, was significantly higher in these patients (p<0.001). Sex (gender), and pain duration were similar between the patient groups (p>0.05)

DISCUSSION

In this study, we found significantly less pain relief with lumbar ESPB for chronic axial low back pain due to lumbar disc bulging/protrusion in geriatric patients than in younger patients. Geriatric patients also have higher BMI, comorbidity, pain severity, opioid use, and degree of lumbar paraspinal fat infiltration compared to younger patients. There is limited information in the literature regarding the outcomes of geriatric patients undergoing lumbar ESPB and these clinical characteristics.

In ESPB, LA applied to the erector spinae plane and multifidus muscle groups (paraspinal muscles) can reach the craniocaudal region, paravertebral muscles, and neural foramen (6). Therefore, lumbar ESPB is a suitable interventional procedure for the treatment of CLBP. In a study by Durmus et al., lumbar ESPB was applied to 96 patients with CLBP aged 25–79 years, and a significant decrease in pain scores was reported in the first month (4). Another study found that patients who underwent lumbar ESPB before and one month after lumbar disc surgery had significantly less persistent low back pain in the sixth postoperative month than the patients who did not undergo lumbar ESPB (12). In our study, 147 patients aged 20–77 years with chronic axial LBP underwent US-guided lumbar ESPB; 62.6% of the patients aged <65 years and 44.4% of the patients aged ≥65 years showed a significant reduction in their third-month pain scores. Our study is the first to investigate the effectiveness of lumbar ESPB in older patients compared to younger patients. Treatment success was significantly lower in the geriatric patients (p=0.027).

With aging, the number and size of muscle fibers decrease, and resulting in loss of muscle mass. Sarcopenia is characterized by age-related decreases in muscle strength and physical performance and is common in geriatric patients. This leads to loss of mobility and increases the risk of mortality (13). Sarcopenia is thought to develop through various mechanisms, including mitochondrial dysfunction, protein imbalance, and motor neuron loss (14). When our patients were analyzed according to age group, the presence of paraspinal fat infiltration, in addition to advancing age, which may facilitate the development of sarcopenia, was significantly higher in the patient group aged ≥65 years. Similarly, studies of patients undergoing lumbar epidural steroid injections for CLBP have reported that younger patients had more successful pain relief (8, 15). The lumbar paraspinal muscles consist of the multifidus, erector spinae, and psoas muscles, and their integrity ensures normal spinal function, alignment, and stability (9). Paraspinal muscles contain a high proportion of type 1 fibers, which help maintain posture and joint stability owing to their low tonicity and resistance to fatigue (16). Fatty infiltration of these muscles is a sign of atrophy and thus sarcopenia, and has been associated with low back pain (7). Several studies have examined

changes in the paraspinal muscles with age in healthy adults and have found that fat infiltration increases with age (17-19). Studies have shown that increased paraspinal fat infiltration is associated with loss of muscle strength, poor functioning, and reduced mobility (16, 17). Dahloqvist et al. studied fat replacement in the paraspinal and lower limb muscles of healthy adults and found that the paraspinal muscles had significantly higher mean fat content and increased fat replacement with aging than the lower limb muscles (20). Similarly, previous research has investigated the effect of paraspinal fat infiltration on the efficacy of lumbar and cervical interventional pain treatment. Kim et al. performed fluoroscopy-guided lumbar epidural steroid injections in 245 patients aged ≥65 years with low back pain and found that severe paraspinal fat infiltration was associated with poor treatment outcomes (8). The relationship between the degree of paraspinal fat infiltration and treatment response has also been evaluated for lumbar disc surgery, and increased fat infiltration in the erector spinae muscles has been found to be associated with poor clinical outcomes following lumbar discectomy (9). In our study, we found that paraspinal fat infiltration in older patients (≥65 years) was significantly higher than that in younger patients (<65 years), consistent with existing findings. This supports the physiopathological evidence that aging reduces skeletal muscle mass and replaces it with fat and connective tissue (21).

In this study, BMI was significantly higher in the ≥65 years age group (p=0.002). In addition, comorbidities, such as diabetes mellitus, hypertension, and coronary artery disease, were significantly more common in the patients aged ≥65 years than in the younger patients (p<0.001). This may be related to the increased risk of comorbidities and metabolic syndrome with advancing age, increased sedantary life, less exercise, and increased sarcopenia due to these factors. In addition, opioid use was significantly higher in the geriatric patients (p=0.003). A recent study found a negative association between the analgesic efficacy of lumbar epidural steroid injections in geriatric patients and pre-injection opioid use at three months, but it is unclear whether opioid use affects the long-term analgesic efficacy of the procedure (8).

This study had several limitations. First, our study was retrospectively designed, and NRS scores three months after injection were available, so it does not fully reflect the patients' long-term clinical outcomes. In addition, no clinical data on disability, opioid use, or quality of life were available from the patient records. In addition, the degree of fatty infiltration in the paraspinal muscles was assessed only in a single multifidus muscle at the L3 level, making it impossible to draw conclusions about the degeneration of other lumbar muscles.

CONCLUSION

This study demonstrated that US-guided lumbar ESPB for chronic axial LBP due to lumbar disc bulging/protrusion is less successful in geriatric patients than in younger patients. Geriatric patients were found to have significantly higher levels of high-grade paraspinal fat infiltration associated with sarcopenia and clinical features such as high BMI, comorbidity, opioid use and high disease severity than younger patients. This is the first study to evaluate the effectiveness of lumbar ESPB in geriatric patients, and the clinical, demographic and radiological characteristics associated with treatment success. Prospective evaluation with larger participants and longer follow-up is needed to assess the long-term outcomes in geriatric patients and their associated factors.

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Conflicts of Interest: All the authors have no conflicts of interest.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

REFERENCES

1. de Souza IMB, Sakaguchi TF, Yuan SLK, Matsutani LA, do Espírito-Santo AS, Pereira CAB, et al. Prevalence of low back pain in the elderly population: a systematic review. Clinics (Sao Paulo). 2019;74:e789.
2. Tarulli AW, Raynor EM. Lumbosacral radiculopathy. Neurol Clin. 2007;25(2):387-405.
3. Wong AYL, Karppinen J, Samartzis D. Low back pain in older adults: risk factors, management options and future directions. Scoliosis Spinal Disord. 2017;12:14.
4. Durmus IE, Surucu S, Muz A, Takmaz SA. The effectiveness of erector spinae plane block in patients with chronic low back pain. Eur Rev Med Pharmacol Sci. 2023;27(1):138-43.
5. Forero M, Adhikary SD, Lopez H, Tsui C, Chin KJ. The Erector Spinae Plane Block: A Novel Analgesic Technique in Thoracic Neuropathic Pain. Reg Anesth Pain Med. 2016;41(5):621-7.
6. Tulgar S, Selvi O, Senturk O, Ermis MN, Cubuk R, Ozer Z. Clinical experiences of ultrasound-guided lumbar erector spinae plane block for hip joint and proximal femur surgeries. J Clin Anesth. 2018;47:5-6.
7. Teichtahl AJ, Urquhart DM, Wang Y, Wluka AE, Wijethilake P, O'Sullivan R, et al. Fat infiltration of paraspinal muscles is associated with low back pain, disability, and structural abnormalities in community-based adults. Spine J. 2015;15(7):1593-601.
8. Kim HJ, Rho M, Yoon KB, Jo M, Lee DW, Kim SH. Influence of cross-sectional area and fat infiltration of paraspinal muscles on analgesic efficacy of epidural steroid injection in elderly patients. Pain Pract. 2022;22(7):621-30.
9. Carvalho V, Santos J, Santos Silva P, Vaz R, Pereira P. Relationship between fatty infiltration of paraspinal muscles and clinical outcome after lumbar discectomy. Brain Spine. 2022;2:101697.
10. Olgun Y, Sacaklidir R, Okumus Y, Şencan S, Guenduez O. Efficacy Of Epidural Steroid Injection In Elderly Patients: Does Diagnosis Affect Treatment Success? Turkish Journal Of Geriatrics-Turk Geriatri Dergisi. 2023;26(1).
11. Mandelli F, Nüesch C, Zhang Y, Halbeisen F, Schären S, Mündermann A, et al. Assessing Fatty Infiltration of Paraspinal Muscles in Patients With Lumbar Spinal Stenosis: Goutallier Classification and Quantitative MRI Measurements. Front Neurol. 2021;12:656487.
12. Akyuz ME, Firidin MN. Bilateral ultrasound-guided erector spinae plane block for postoperative persistent low back pain in lumbar disc surgery. Eur Spine J. 2022;31(7):1873-8.
13. Cruz-Jentoft AJ, Bahat G, Bauer J, Boirie Y, Bruyère O, Cederholm T, et al. Sarcopenia: revised European consensus on definition and diagnosis. Age Ageing. 2019;48(1):16-31.
14. Morley JE. Sarcopenia in the elderly. Fam Pract. 2012;29 Suppl 1:i44-i8.
15. Cosgrove JL, Bertolet M, Chase SL, Cosgrove GK. Epidural steroid injections in the treatment of lumbar spinal stenosis efficacy and predictability of successful response. Am J Phys Med Rehabil. 2011;90(12):1050-5.
16. He K, Head J, Mouchtouris N, Hines K, Shea P, Schmidt R, et al. The Implications of Paraspinal Muscle Atrophy in Low Back Pain, Thoracolumbar Pathology, and Clinical Outcomes After Spine Surgery: A Review of the Literature. Global Spine J. 2020;10(5):657-66.
17. Kalichman L, Carmeli E, Been E. The Association between Imaging Parameters of the Paraspinal Muscles, Spinal Degeneration, and Low Back Pain. Biomed Res Int. 2017;2017:2562957.
18. Crawford RJ, Filli L, Elliott JM, Nanz D, Fischer MA, Marcon M, et al. Age- and Level-Dependence of Fatty Infiltration in Lumbar Paravertebral Muscles of Healthy Volunteers. AJNR Am J Neuroradiol. 2016;37(4):742-8.
19. Fortin M, Videman T, Gibbons LE, Battié MC. Paraspinal muscle morphology and composition: a 15-yr longitudinal magnetic resonance imaging study. Med Sci Sports Exerc. 2014;46(5):893-901.
20. Dahlqvist JR, Vissing CR, Hedermann G, Thomsen C, Vissing J. Fat Replacement of Paraspinal Muscles with Aging in Healthy Adults. Med Sci Sports Exerc. 2017;49(3):595-601.
21. Tamai K, Chen J, Stone M, Arakelyan A, Paholpak P, Nakamura H, et al. The evaluation of lumbar paraspinal muscle quantity and quality using the Goutallier classification and lumbar indentation value. Eur Spine J. 2018;27(5):1005-12.

Turkish Journal of Geriatrics
2024; 27(2)