

Comparison of the Course and Prognosis of Geriatric Patients Admitted to the Intensive Care Unit According to BMI and Albumin Values

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Abstract

Background: Elderly patients constitute the majority of patients undergoing treatment in the intensive care unit (ICU). Patients over the age of 65 account for 42%–52% of admission to ICU. Previous studies have shown that malnutrition is an important factor influencing the prognosis in intensive care.

Objectives: In this study, the effect of body mass index (BMI) and albumin values at first admission to the ICU on the course and prognosis of geriatric patients were investigated.

Patients and Methods: Patients over the age of 65 who were admitted to the anesthesia ICU were included in the study. Demographic and clinical data were recorded retrospectively. Major outcome variables were length of ICU and hospital stay, mortality rate, BMI, and albumin values. APACHE II and SOFA scores at admission were evaluated.

Results: Overall, 113 patients were included in the study. Mean BMI (kg/m²) value was found to be lower in the died group than in the discharged and transferred groups ($P < 0.001$). Albumin levels were lower in the died group than in the discharged and transferred groups ($P < 0.001$). An inverse relation was found between Apache and BMI and albumin values, whereas a significant direct relation was found between Apache and mechanical ventilation day ($P < 0.05$). A significant negative correlation was found between SOFA and BMI and albumin, values, respectively, and a positive correlation was found between SOFA and mechanical ventilation duration ($P < 0.005$).

Conclusions: In this study, a low albumin level (≤ 3 mg/dL) was an indicator of nutritional status. Patients' albumin levels, BMI, nutritional status, APACHE II score, and SOFA score were associated with mortality. Age in itself did not predict mortality in the elderly.

Keywords: Elderly, Intensive Care Unit, Mortality, Serum Albumin, Body Mass Index

1. Background

Elderly people over the age of 65 are a rapidly increasing group in the United States, and elderly patients constitute the majority of those undergoing treatment in intensive care units (ICU). Patients older than 65 also account for 42% - 52% of admissions to the ICU. Age is an important prognostic factor and is one of the main components of scoring systems used in intensive care patients (1, 2). Many studies have investigated the effect of age on the course of diseases (3-5). Although age is considered closely related to treatment outcomes in the ICU, the prognostic effect of age may be influenced by acute physiological impairment and differences in intensive care practices (6, 7). If the effect of these factors is not considered in the prediction of the prognosis, the results may be interpreted as being dependent solely on age.

Malnutrition is a common condition associated with high mortality (8, 9). In previous studies, various nutritional indicators, such as body mass index (BMI), albumin, total cholesterol, and percentage of lymphocytes, have been used to assess malnutrition (10, 11). These stud-

ies have shown that malnutrition has an important influence on the prognosis in intensive care. The nutritional status of patients can be easily and noninvasively measured with these nutritional indicators without the need for invasive devices (12).

2. Objectives

In this study, the effect of BMI and albumin values and APACHE II and SOFA scores at first admission to the ICU on the course and prognosis of geriatric patients was investigated.

3. Patients and Methods

After the approval of the ethics committee was obtained, the medical records of patients over the age of 65 who were admitted to the anesthesia ICU from 2010 to 2011 and remained there for at least three days were reviewed retrospectively.

Demographic data (age, sex, body weight, and 'height'

and patients' BMI, albumin values, cause of admission to the ICU, and primary diagnoses (the presence of cardiac, respiratory, renal, hepatic, neurological, and hematological dysfunction and infection) were obtained from the records. The BMI (calculated by weight in kilograms divided by height in meters squared) is a useful sign of malnutrition (13). Hypoalbuminemia (≤ 3 mg/dL) is also an effective clinical biomarker of malnutrition (14). The severity of malnutrition was evaluated with APACHE II and SOFA scores. APACHE II scoring includes 11 routine physiological measurements, Glasgow Coma Score, age, and previous health status. This scoring has been shown to predict hospital mortality, with a higher APACHE II score denoting greater risk (15). The SOFA scale evaluates six organ systems (neurology, cardiovascular, respiratory, renal, hepatic, and hematological) and assigns a score between 0 and 4. The maximum overall score is 24. A score of 3 denotes the presence of a deficiency in the involved organ system (15). The following outcome variables were assessed: duration in the hospital, duration in the ICU, mortality rates, and BMI and albumin values at admission.

4. Results

Overall, 113 patients were included in the study. Among the patients, 68 were female, and 45 were male. The mean age of the patients was 80.2 years, mean BMI was 23.2, mean albumin value was 3.05, mean APACHE II score was 25.09, mean SOFA score was 9.5, and mean duration of time spent on a mechanical ventilator (MV) was 3.8 days. Thirty-six patients were admitted to the ICU due to respiratory causes, 22 patients due to intracranial bleeding, and 21 due to postoperative care. Thirty-one patients died,

34 were discharged, and 48 were transferred to a clinic. At the time of admission, 73 patients had diabetes mellitus or hypertension, 49 had coronary heart disease, 13 had renal failure, 28 had chronic obstructive pulmonary disease, and 3 had malignancies. Thirty-seven patients were intubated during a part or in their entire stay in the ICU.

No statistically significant difference was found among the died, discharged, and transferred patient groups in terms of gender distribution ($P = 0.275$). The rate of intubated patients was statistically significantly higher in the died group than in the discharged and transferred groups, and the rate of patients with CPAP was found to be higher in the discharged group than in the died and discharged groups, and rate of the extubated patients was found to be statistically significantly higher in the transferred group than in the died and discharged groups ($P < 0.001$).

The rate of patients administered with adrenalin plus dopamine was statistically significantly higher in the died group than in the discharged and transferred groups ($P < 0.001$). The mean BMI (kg/m^2) value was found to be lower in the died group than in the discharged and transferred groups ($P < 0.001$). The mean MV day was significantly higher in the died group than in the discharged and transferred groups ($P = 0.019$ and $P < 0.001$, respectively). In addition, the mean MV day was found to be statistically significantly higher in the discharged group than in the transferred patients group ($P < 0.001$).

No statistically significant difference was observed among the died, discharged, and transferred patient groups in terms of the duration of stay in the ICU ($P = 0.476$). Albumin levels were lower in the died group than in the discharged and transferred groups ($P < 0.001$) (Table 1).

Table 1. Demographic and Clinical Features According to the Final Status of the Patients

Variables	Exitus (n = 31)	Discharged (n = 34)	Transferred (n = 48)	P-Values
Gender				.275
“0” (female)	17 (54.8)	18 (52.9)	33 (68.8)	
“1” (male)	14 (45.2)	16 (47.1)	15 (31.3)	
BMI	18.4 \pm 2.8 ^{a,b}	25.4 \pm 4.3 ^a	24.8 \pm 4.5 ^b	<.001
Mechanical Ventilator				<.001
Extubated	0 ^{a,b}	7 (20.6) ^{a,c}	35 (72.9) ^{b,c}	
Intubated	30 (96.8) ^{a,b}	1 (2.9) ^a	6 (12.5) ^b	
CPAP	1 (3.2) ^a	26 (76.5) ^{a,c}	7 (14.6) ^c	
MV Days	5 (1-47) ^{a,b}	3 (0-10) ^{a,c}	0 (0-15) ^{b,c}	<.001
ICU Duration	5 (2-47)	6 (2-21)	6 (3-20)	.476
Albumin	2.4 (1.8-3.6) ^{a,b}	3.5 (2.2-4.2) ^a	3.3 (2.1-4.2) ^b	<.001
Complication	29 (93.5) ^{a,b}	1 (2.9) ^a	6 (12.5) ^b	<.001
Inotrope				<.001
No	2 (6.5%) ^{a,b}	33 (97.1) ^{a,c}	35 (72.9) ^{b,c}	
Dopamine	0 ^b	0 ^c	13 (27.1) ^{b,c}	
Dopamine + Adrenalin	29 (93.5) ^{a,b}	1 (2.9) ^a	0 ^b	

^aThe difference between died and discharged groups was statistically significant ($P < 0.05$).

^bThe difference between died and transferred groups was statistically significant ($P < 0.01$).

^cThe difference between discharged and transferred groups was statistically significant ($P < 0.01$).

Table 2. Correlation Coefficients and Significance Levels of APACHE and SOFA Scoring Systems With BMI, ICU Duration, MV Duration, and Albumin

Variables	APACHE		SOFA	
	Correlation Coefficient	P Values	Correlation Coefficient	P Values
BMI	-0.191	.043	-0.305	< .001
ICU Duration	0.164	.082	0.197	.037
MV Duration	0.469	< .001	0.444	< .001
Albumin	-0.422	< .001	-0.500	< .001

Table 3. APACHE and SOFA Scores According to the Demographic and Clinical Features of the Patients

Variables	APACHE	P-Values	SOFA	P-Values
Gender		.167		.039
“0”(female)	25 (12 - 35)		9 (7 - 14)	
“1”(male)	28 (11 - 36)		9 (7 - 15)	
Mechanical Ventilator		< .001		< .001
Extubated	24 (11 - 31) ^a		9 (7 - 12) ^a	
Intubated	31 (16 - 35) ^{a,b}		11 (7 - 14) ^{a,b}	
CPAP	24 (12 - 36) ^b		9 (7 - 15) ^b	
Complication		< .001		< .001
No	24 (11 - 36)		9 (7 - 15)	
Yes	30.5 (14 - 35)		11 (7 - 14)	
Inotrope		< .001		< .001
No	23 (11 - 31) ^{c,d}		9 (7 - 12) ^{c,d}	
Dopamine	29 (24 - 34) ^c		10 (9 - 12) ^{c,e}	
Dopamine + Adrenalin	31.5 (22 - 36) ^d		12 (9 - 15) ^{d,e}	

^aThe difference between the extubated and intubated groups was statistically significant ($P < 0.001$).

^bThe difference between the intubated and CPAP groups was statistically significant ($P < 0.001$).

^cThe difference between the group of patients who did not receive inotropes and the dopamine group was statistically significant ($P < 0.001$).

^dThe difference between the group of patients who did not receive inotropes and the dopamine + adrenalin group was statistically significant ($P < 0.001$).

^eThe difference between the dopamine group and the dopamine + adrenalin group was statistically significant ($P < 0.001$).

No significant difference was found between the gender groups in terms of APACHE scores. The SOFA score coded with gender 1 (male) was statistically significantly higher than the SOFA score coded with gender 0 (female) ($P = 0.039$).

An inverse relation was found between Apache and BMI and albumin values, and a significant direct relation was found between Apache and MV day ($P < 0.05$). A significant negative correlation was found between SOFA and BMI and albumin, respectively, and a positive correlation was observed between SOFA and MV duration ($P < 0.005$) (Table 2).

Both Apache and SOFA scores were significantly higher in the intubated group than in the extubated and CPAP groups ($P < 0.001$).

Both Apache and SOFA scores of the adrenalin + dopamine group were statistically significantly higher than those in the group of patients who were not administered with inotrope and dopamine ($P < 0.001$). In addition, the SOFA score of the dopamine group was found to

be significantly higher than that of the group of patients who were not administered with inotrope ($P = 0.044$) (Table 3).

5. Discussion

Around 37% - 40% of the elderly eat too little to meet their daily energy requirements. One in every two elderly people skip one of their meals. This condition has recently been called “anorexia of aging.” Conditions that have an adverse effect on nutritional status include physiological changes of aging, acute and chronic diseases, teeth and oral health problems, polypharmacy, economic problems, not being able to do shopping by oneself, not being able to prepare meals, and not being able to eat (16). The present study demonstrates that nutritional evaluation is a good predictor of the clinical course in patients over the age of 65 admitted to the ICU. The results suggest that BMI and albumin values are prognostic factors aside from the APACHE II and SOFA scores, which are well-known prognostic indicators. The results also indicate

that age and sex are independent prognostic factors.

Age is not an unfavorable factor by itself (17, 18, 19). Hoekstra et al. (20) reported that age does not have a negative effect on outcomes in cancer patients and that the increased risk of mortality and morbidity in the elderly is associated with the presence of co-morbid diseases, malnutrition, and immune system deficiency. Similarly, in the present study of different age groups, age is not an adverse factor per se. As noted in one study, the rate of malnutrition is 5% in healthy individuals in the community, but this rate increases to 15% in the elderly and 30% - 65% in hospitalized elderly individuals (20). These high rates illustrate the importance of the nutritional status of the elderly. Malnutrition influences morbidity and mortality by adversely affecting various organ functions, the immune system, and wound healing (21). Research has shown that malnutrition increases postoperative complications by delaying wound healing and increasing infection rates (21). Various proteins found in serum, such as prealbumin and throxin-binding protein, may be used as indicators of nutritional status. An albumin level lower than 3.0 mg/dL is an important marker of malnutrition. Chronic deficiency in protein intake in the elderly may impair immune function, delay wound healing, reduce muscular strength, and lead to the emergence of pressure ulcers. Elderly patients are unable to meet the increased energy demand incurred by stress, trauma, infection, tissue trauma, chronic disease, and admission to the ICU. To compensate for energy deficits and to improve protein-energy malnutrition, patients' protein intake should be increased (22). As reported elsewhere, the mortality rate of the elderly increases by 9% - 38% following 1-2.5 years of weight loss start due to any reason (23). In the study of Kaiser et al. (24) the rate of malnutrition was 5.8% in the elderly living in the community, 13.8% in those residing in nursing homes, and 38.75% in those admitted to the hospital. These authors also reported a significant relation between malnutrition and dementia and sarcopenia (24). According to the recommendations of the European society of clinical nutrition and metabolism (ESPEN) issued in 2002, all individuals over the age of 65 should undergo screening routinely for nutritional status (25). Similar recommendations are found in all ESPEN guides issued subsequently (25). On the basis of the data above, we suggest that the nutritional status of elderly individuals in the community, geriatric clinics, and the ICU should be screened and that treatment plans should be developed for at-risk individuals.

Our study has some limitations. First, patients' albumin, Apache II, SOFA, and BMI values were compared on the basis of the values at the time of admission. We believe that this study would be more valuable if the values could be compared on a daily basis. Second, the number of cases was limited. In the case of a multicenter study, the number of patients could be increased, and the factors caused by the physical conditions of the ICU that might affect the study could be ruled out.

In conclusion, a low albumin level (≤ 3 mg/dL) was an indicator of nutritional status in this study. Patients' albumin levels, BMI, nutritional status, Apache II score, and SOFA score were associated with mortality. Age in itself did not predict mortality in the elderly.

Footnote

Authors' Contribution:Acquisition of data: Ozkan Onal; analysis and interpretation of data: Ozkan Onal; drafting of the manuscript: Ozkan Onal; critical revision of the manuscript for important intellectual content: Gulden Ozgun; statistical analysis: Ozkan Onal; administrative, technical, and material support: Gulden Ozgun; study supervision: Gulden Ozgun.

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