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Determinants of Outcomes in Older Adult Patients Admitted to The Intensive Care Unit from The Emergency Department

Acil Servislerden Yoğun Bakım Ünitesine Kabul Edilen Yaşlı Erişkin Hastaların Sonuç Belirleyicileri

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Öz

Klinisyenler arasında yaşlı hastaların yoğun bakım ünitesine(YBÜ) kabulüne ilişkin kriterler konusunda fikir birliği bulunmamaktadır. Bu çalışmada, Acil servisten(AS) YBÜ'ye yatırılan yaşlı hastalarda AS'ye kabul sırasında değerlendirilen risk faktörlerinin mortaliteye etkisini belirlemeyi amaçladık. 1 Ocak 2019-31 Aralık 2019 tarihleri arasında YBÜ'ye kabul edilen 65 yaş ve üzeri hastalar retrospektif olarak alındı. Hastalar yaşlarına göre iki gruba ayrıldı: 65-74 yaş, 75 yaş ve üzeri. Klinik ve demografik verileri değerlendirilmiştir; hastalar yaş gruplarına göre analiz edildi. Risk faktörlerinin YBÜ'deki mortalitesine etkisi lojistik regresyon analizi kullanılarak belirlendi. Çalışmaya dahil edilen 839 hastanın %66.3'ü 65-74 yaş grubu, %33.7'si ≥75 yaş grubu idi. Hastaların %24.7'si (n=207) öldü. Mortaliteyi etkileyen risk faktörlerinin düşük ortalama arteriyel basınç (OR=0.98, 95%CI:0.97-0.99), düşük Glasgow Koma Skoru (OR=0.73, 95% CI:0.66-0.80), entübasyon ihtiyacı (OR=12.58, 95%CI:6.02–26.30), altta yatan bir kanser tanısı (OR = 7.23, 95% CI: 2.60-20.16), ve AS'de uzun kalış süresi (OR=1.65, 95% CI:1.46–1.87) olduğunu saptadık. Yaşın tek başına yoğun bakımda mortalite ile ilişkili olmadığını tespit ettik (p=0.122). Mortaliteyi etkileyen risk faktörleri göz önünde bulundurularak AS'den YBÜ'ye kabulü düşünülmelidir.

Anahtar Kelimeler: Acil Servis, Mortalite, Yaşlı Erişkin Hastalar, Yoğun Bakım Ünitesi

Abstract

There is no consensus among clinicians on the criteria for admission of older adult patients to the intensive care unit (ICU). In this study, we aimed to determine the impact of risk factors assessed during admission to the emergency department (ED) in older adult patients admitted to the ICU from the ED on ICU mortality. Patients aged 65 years or older, who were admitted to the ICU between January 1, 2019, and December 31, 2019, were retrospectively evaluated. Patients were divided into two groups according to their age: 65–74 years old and 75 years and older. Clinical and demographic data were evaluated and patients were analyzed according to the age groups. The association of risk factors on ICU mortality was determined using logistic regression analysis. Of the 839 patients included in the study, 66.3% were in the 65–74 age group and 33.7% were in the ≥75 age group. A proportion of 24.7% of the patients (n=207) died. The risk factors associated with ICU mortality were low mean arterial pressure (OR=0.98, 95% CI:0.97-0.99), low Glasgow Coma Scale score (OR=0.73, 95% CI:0.66-0.80), intubation requirement (OR=12.58, 95% CI:6.02–26.30), underlying cancer diagnosis (OR = 7.23, 95% CI: 2.60-20.16), and long stay in the ED (OR=1.65, 95% CI:1.46–1.87).Age alone was not associated with ICU mortality (p=0.122). Admission to the ICU from the ED should consider the risk factors associated with ICU mortality.

Keywords: Emergency Department, Intensive Care Unit, Older Adult Patients, Mortality

Introduction

The intensive care unit (ICU) is a specialized unit for close follow-up and comprehensive treatment of critically ill patients with rapidly deteriorating clinical parameters. As the population ages, the demand for medical resources continues to increase, and the number of older adult patients presenting to the emergency department (ED) and are admitted to the ICU is increasing (1). However, there remains no consensus among clinicians on the criteria for the admission of older adult patients to the ICU. Many clinicians are reluctant to admit older adult patients to the ICU because these patients benefit less from the ICU, have increased morbidity and mortality with intensive treatment, are more exposed to iatrogenic complications, and have lower quality of life, and the efficiency of medical resources is reduced (2,3). Another view is that the abovementioned problems are not associated with age but with the severity of the underlying disease (4,5). This discrepancy is due to the lack of proven criteria that accurately identify older adult patients who can benefit most from admission to the ICU (6). Despite the fact that the need for intensive care is higher in older adult patients, a study investigating ICU admissions of older adult patients, revealed that 27.9% of patients in the 75–84-year age group were admitted to the ICU, and this ratio decreased to 21.1% in patients over 85 years of age (7). A study conducted in 15 emergency units, demonstrated that intensive care physicians were extremely reluctant to admit patients to the ICU who were aged above 80 years and met the criteria for admission to the ICU (8).

Although guidelines on the admission of critically ill patients to the ICU have been developed, these guidelines do not contain sufficient information on which patients should be admitted to the ICU, which patients should be admitted to an acute care ward, and which patients should be

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admitted to a palliative care ward (9). In the present study, we evaluated the clinical characteristics of patients aged 65 years and older who presented to the ED and were admitted to the ICU. We aimed to determine the ICU mortality rate in these patients and the association of risk factors assessed during admission to the ED on ICU mortality.

Material and Method

This retrospective study was conducted between January 1, 2019, and December 31, 2019 in the tertiary ED of our hospital, and local ethics committee approval was obtained for the study (Ethical Committee of Aksaray University Faculty of Medicine with a protocol number of 2020/03-56 and conducted in accordance with the Declaration of Helsinki and Good Clinical Practices). A total of839 patients aged 65 years and older who presented to the ED and were admitted to the ICU were included in the study.

Patients aged less than 65 years, with a history of trauma, whose records were not accessible, who were transferred to another hospital without conclusion of treatment for any reason, or who were admitted to the ICU after cardiac arrest and underwent cardiopulmonary resuscitation were excluded from the study. In addition, read mission to the ICU is associated with unfavorable results, such as longer hospital stays, higher in-hospital mortality and increased adverse events (10). Therefore, for patients with multiple ICU stays during the study period, only the data from the first ICU stay were used in the study. The flow diagram of patient selection is shown in Figure 1.

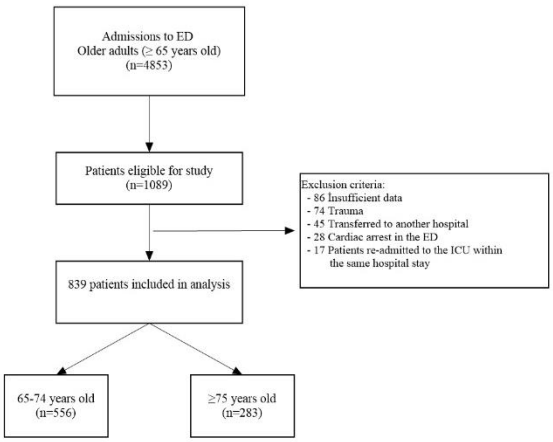

Figure 1. Flow chart of the study selection process.

Patients were divided into two groups according to their age: 65–74 years and75 years and older. The clinical and demographic characteristics of the patients in each age group and ICU mortality rates were compared. In addition, the association of patients' clinical characteristics at admission to the ED on ICU mortality were assessed.

Comorbidities were evaluated using the Charlson Comorbidity Index (CCI) (11). The length of ED stay was defined as the period from patient triage and admission to the ED until admission to the ICU.

The primary outcome measure was mortality of patients who were admitted from the ED to the ICU. This measure was used to determine ICU mortality rates of patients aged 65 years and older who were admitted to the ICU. The secondary outcome was measuring the association that the clinical features present at the time of admission to the ED had on ICU mortality. Therefore, risk factors that associated with ICU mortality in older adult patients were identified.

Statistical analysis was performed using SPSS 17.0 program (SPSS Inc, Chicago, IL, USA). Continuous variables were presented as mean±standard deviation and median (25th–75th percentile), and categorical variables were expressed as frequency (percentage). Conformity to normal distribution was tested using Kolmogorov–Smirnov test. Student's t-test was used for comparing normally distributed data, Mann–Whitney U test was used for comparing non-normally distributed data and Pearson's chi-square or Fisher's test was used for comparing categorical variables. Univariate and multivariate logistic regression analyses were performed to determine the relationship between ICU mortality after admission to the ICU and possible clinical variables. Statistically significant variables ($p<0.05$) in the univariate analysis were further analyzed with multivariate logistic regression using the forward stepwise method. Odds ratios and 95% confidence intervals were used to predict the relationship between independent determinants of ICU mortality. $P<0.05$ was considered statistically significant for multivariate logistic regression analysis and other tests.

Results

Our study included 839 patients of whom, 66.3% were65–74 years of age and 33.7% were≥75 years of age. The mean age of the patients was 76±5 years, with 48% (n=402) being males and 52% (n=437) females. The demographic and clinical characteristics of the patients according to the age groups are shown in Table 1. There was no statistically significant difference between the two age groups in terms of genders ($p>0.05$). There was also a statistically significant difference between the age groups in terms of GCS, mean arterial pressures and systolic and diastolic blood pressures at the time of admission to the ED ($p<0.05$).

In terms of the concomitant comorbidities of the patients, there were higher rates of hypertension, diabetes mellitus, and chronic respiratory system diseases in the 65–74-year-old age group than in the age group ≥75 years (51.3%, 31.5%, 31.3%, respectively) (Table 2). There was no statistically significant difference between the age groups in terms of comorbidities ($p>0.05$), but there was a

significant difference between the CCI scores (p=0.020). The most common complaint at admission among both groups was dyspnea (65–74-year-old age group: 33.3%; ≥75-years age group: 35.7%). There was no significant difference between the age groups in terms of complaints at admission (p>0.05).

The diagnoses on admission to ICU and clinical outcomes of the patients in both age groups are shown in Table 3. Among all the patients, the most common reason for admission to the ICU was diseases of the respiratory system (22.1%). There was no significant difference between the age groups in terms of reasons for hospitalization (p>0.05). When all patients were evaluated, it was found that 9.1% (77) needed noninvasive mechanical ventilation and 7.2% (61) needed endotracheal intubation.

The median duration of the ED stays among patients admitted to the ICU was 2.93 (2.1–3.6) hours. In terms of the age groups, the durations of the ED stays were shorter among the 65–74-year-old age group with a median time of 2.7 (2–3.4) hours in comparison to the ≥75-years age group in which there was a median time of 3.3 (2.3–3.9) hours (p<0.001). There was no significant difference between the groups in terms of the durations of the ICU stays(p=0.143). In addition, 64.1% of the patients, who were followed in the ICU then went to patient wards, 11.2% were discharged, and 24.7% died.

ICU mortality rates were 23.9% in the 65–74-year-old age group and 26.1% inthe≥75-years age group(p=0.479). Multivariate logistic regression analyses were performed to identify the factors associated with ICU mortality and to determine the degree to which these factors increased the risk of ICU mortality (Table 4). Regression analysis revealed that low MAP sat admission to the ED (OR=0.98, 95% CI:0.97-0.99), low GCSs (OR=0.73, 95% CI:0.66-0.80), underlying cancer diagnoses (OR = 7.23, 95% CI: 2.60-20.16), intubation at the ED(OR=12.58, 95% CI:6.02–26.30), and prolonged stays at the ED (OR=1.65, 95% CI:1.46–1.87) increased ICU mortality. Age and other variables did not show significant correlations with the increased risk of ICU mortality (p>0.05).

Discussion

To the best of our knowledge, this is the first study to investigate the relationship between ICU mortality and risk factors assessed during admission to the ED in patients aged 65 years and older. We observed significant differences between many clinical characteristics and ICU mortality in patients aged 65 and older transferred from the ED to the ICU. The ICU mortality rate during intensive care stay was 24.7% overall, 23.9% in the 65–74-year-old age group, and 26.1% in the ≥75-years age group. We found that the most important risk factors for ICU mortality were low MAP, and GCS, the need for intubation, underlying cancer diagnosis, and prolonged stay in the ED.

Studies investigating the association of age on ICU mortality rates have reported contradictory results. Vosylius et al. (12), reported higher morbidity and mortality rates in older patients compared with younger patients admitted to the ICU, with a mortality rate in patients aged over 75 years twice that of patients aged under 65 years. Furchet al. (13) found that the ICU mortality rate increased in patients over 75 years of age and that age was an independent risk factor for mortality. Conversely, Somme et al. (14) found no difference between 75–79, 80–84, and ≥85 years in terms of ICU survival. Similarly, many other studies have suggested that age alone is not associated with ICU mortality (15,16). In line with these studies, our study found that age is not a key risk factor and that physiological condition had a more significant effect on ICU mortality. Therefore, age alone is not a reliable indicator for the use of intensive care resources.

Studies evaluating older adult patient mortality in ICUs have shown that age, gender, mechanical ventilation, cardiogenic shock, and underlying diseases are associated with poor outcomes (17,18). Hwang et al. (19) showed that risk factors associated with mortality in older adult patients admitted to the ICU included an age>85 years and transfer from the ED, suggesting that more attention should be paid to patients who were referred to the ICU by the ED. Another study on ICU patients emphasized the importance of acute physiological disorders, severe cognitive impairment and activity status at admission in terms of hospital prognosis (20).

The commonly used ICU scoring systems include patient age but do not include the patient's pre-hospital functional status or functional insufficiency, comorbidities (21,22). Indices such as the Acute Physiology and Chronic Health Evaluation II score and Simplified Acute Physiology Score II are frequently used to predict hospital mortality of patients in ICUs (21,22). However, these indices require evaluation of laboratory data based on physiological disorders in the first 24 hours of ICU stay and therefore may not be appropriate assessment methods for patients treated in the ED. For this reason, these scoring systems were not used in this study. We used the CCI based on anamnesis information upon admission to the hospital (11). Studies comparing the prognostic value of this comorbidity index with standard indices for intensive care patients have shown that it can be used as an alternative method (23). In our study, although there was no significant difference between age groups in terms of comorbidities, there was a significant difference in CCI scores. However, multiple regression analysis revealed that the CCI

Table 1. Baseline characteristics of patients according to age group and survival status

Variable	Age group			Survival status		
	65-74 years (n=556)	≥75 years (n=283)	p value	Survivors (n=632)	Non-survivors (n=207)	p value
Age (years)†	71(67-72)	79(77-83)	<0.001	82(78-86)	82(78-86)	0.849
Gender, n (%)			0.070			0.406
Female	302(54.3%)	135(47.7%)		324(51.3)	113(54.6)	
Male	254(45.7%)	148(52.3%)		308(48.7)	94(45.4)	
Vital sign†						
Systolic BP (mmHg)	120(100-143)	110(100-130)	0.008	120(100-143)	100(94-120)	**<0.001**
Diastolic BP (mmHg)	74(60-90)	70(60-85)	0.019	80(60-90)	63(58-80)	**<0.001**
HR (beats/min)	96(86-112)	102(87-112)	0.175	96(87-112)	98(87-111)	0.860
RR (breath/min)	20 (20–23)	20(20–24)	0.118	20 (20–22)	20(20–24)	0.122
Body temperature (°C)	36.9(36.7-37.0)	36.9(36.6-37.0)	0.653	36.9(36.6-37.0)	37.0(36.7-37.1)	0.064
Oxygen saturation (%)	94(89-96)	94(89-96)	0.921	94(89-96)	93(89-95)	0.143
MAP	90(73-106)	83(73-97)	0.023	91(76-106)	76(68-93)	**<0.001**
GCS at admission†	14(12-15)	13(11-14)	0.001	14(13-15)	12(11-14)	**<0.001**

† Median and 25–75 percentiles; BP: blood pressure; HR: heart rate; RR, respiratory rate; MAP: mean arterial pressure; GCS: Glasgow Coma Scale; ED: emergency department

Table 2. Comorbidities and chief complaints of patients according to age group and survival status

Variable	Age group			Survival status		
	65-74 years (n=556)	≥75 years (n=283)	p value	Survivors (n=632)	Non-survivors (n=207)	p value
Comorbidities						
Hypertension	285(51.3%)	129(45.6%)	0.120	313(49.5%)	101(48.8%)	0.855
Diabetes mellitus	175(31.5%)	84(29.7%)	0.595	186(29.4%)	73(35.3%)	0.115
Coronary artery disease	77(13.8%)	31(11%)	0.237	75(11.9%)	33(15.9%)	0.129
Congestive heart failure	128(%23%)	55(19.4%)	0.234	137(21.7%)	46(22.2%)	0.869
Cerebrovascular disease	49(8.8%)	31(11%)	0.318	61(9.7%)	19(9.2%)	0.841
Chronic respiratory disease	174(31.3%)	93(32.9%)	0.645	208(32.9%)	59(28.5%)	0.237
Chronic kidney disease	73(13.1%)	32(11.3%)	0.451	84(13.3%)	21(10.1%)	0.235
Chronic liver disease	16(2.9%)	9(3.2%)	0.807	22(3.5%)	3(1.4%)	0.136
Alzheimer's / Dementia	83(14.9%)	31(11%)	0.112	80(12.7%)	34(16.4%)	0.170
Cancer	17(3.1%)	6(2.1%)	0.432	7(1.1%)	16(7.7%)	**<0.001**
Admission complaints						
Abdominal pain or discomfort	141(25.4%)	86(30.4%)	0.121	180(28.5%)	47(22.7%)	0.104
Dyspnea of chief compliant	185(33.3%)	101(35.7%)	0.485	231(36.6%)	55(26.6%)	**0.009**
Chest pain or discomfort	139(25%)	75(26.5%)	0.637	163(25.8%)	51(24.6%)	0.741
Nausea / vomiting	103(18.5%)	47(16.6%)	0.493	116(18.4%)	34(16.4%)	0.530
Fever	134(24.1%)	64(22.6%)	0.632	141(22.3%)	57(27.5%)	0.124
Dizziness	43(7.7%)	19(6.7%)	0.593	51(8.1%)	11(5.3%)	0.188
Headache	40(7.2%)	13(4.6%)	0.145	43(6.8%)	10(4.8%)	0.307
Gastrointestinal bleeding	22(4%)	10(3.5%)	0.762	26(4.1%)	6(2.9%)	0.428
Mental change	70(12.6%)	31(11%)	0.491	65(10.3%)	36(17.4%)	**0.006**
Motor weakness	79(14.2%)	30(10.6%)	0.142	85(13.4%)	24(11.6%)	0.491
Dysarthria	36(6.5%)	12(4.2%)	0.188	39(6.2%)	9(4.3%)	0.327
Other	41(7.4%)	18(6.4%)	0.587	50(7.9%)	9(4.3%)	0.082

Table 3. Clinical outcome of patients according to age group and survival status

Variable	Age group			Survival status		
	65-74 years (n=556)	≥75 years (n=283)	p value	Survivors (n=632)	Non-survivors (n=207)	p value
ICU admission diagnoses			0.225			**0.001**
Respiratory disease	149(26.8%)	87(30.7%)		165(26.1%)	71(34.3%)	
Infectious disease	134(24.1%)	64(22.6%)		163(25.8%)	35(16.9%)	
Cardiovascular disease	73(13.1%)	27(9.5%)		72(11.4%)	28(13.5%)	
Cerebrovascular diseases	47(8.5%)	18(6.4%)		55(8.7%)	10(4.8%)	
Endocrine-metabolic diseases	42(7.6%)	17(6%)		51(8.1%)	8(3.9%)	
Renal disease	39(7%)	32(11.3%)		50(7.9%)	21(10.1%)	
Gastrointestinal diseases	37(6.7%)	17(6%)		31(4.9%)	23(11.1%)	
Hematologic disease	7(1.3%)	8(2.8%)		12(1.9%)	3(1.4%)	
Oncologic disease	9(1.6%)	4(1.4%)		9(1.4%)	4(1.9%)	
Other	19(3.4%)	9(3.2%)		24(3.8%)	4(1.9%)	
Charlson comorbidity index	2(1-3)	2(1-3)	0.020	2(1-3)	2(1-3)	**0.024**
Non-invasive MV n (%)	56(10.1%)	21(6.7%)	0.107	53(8.4%)	22(10.6%)	0.326
Intubation at ED	40(7.2%)	21(7.4%)	0.905	12(1.9%)	49(23.7%)	**<0.001**
Length of stay in the ED (hour)	2.7(2-3.4)	3.3(2.3-3.9)	<0.001	2.7(2.-3.4)	3.4(2.4-5.2)	**<0.001**
Length of stay in the ICU, days	2(1-5)	2(1-6)	0.143	2(1-5)	3(1-11)	**<0.001**
ICU mortality, n, (%)	133(23.9%)	74(26.1%)	0.479			
Transfer to in-patient services	360(64.7%)	178(62.9%)	<0.001			
Treated and discharged	63(11.3%)	31(11.0%)	0.001			

ICU: intensive care unit; MV: mechanical ventilation; ED: emergency department

Table 4. Multivariate analysis of predictive factors for ICU mortality.

Variables	Multivariate logistic regression		
	OR	95% CI	p value
MAP	0.978	0.967-0.988	<**0.001**
GCS at admission	0.727	0.664-0.797	<**0.001**
Dyspnea of chief compliant	0.648	0.426-1.087	0.053
Cancer	7.233	2.595-20.160	**0.001**
Charlson comorbidity index	1.436	0.902-2.415	0.158
Intubation at ED	12.582	6.019-26.300	<**0.001**
Length of stay in the ED	1.649	1.458-1.865	<**0.001**

MAP: mean arterial pressure; GCS:Glasgow Coma Scale; ED: emergency department; CI: confidence interval; OR: odds ratios.

scores had no significant effect on mortality rates. Contrarily, underlying cancer diagnosis was a statistically significant predictor of mortality. In older adult patients with cancer, factors such as radiotherapy, chemotherapy and an increased risk of infection can be important risk factors for ICU mortality.

Many studies have shown that prolonged stay of critically patients in the ED and delayed admission to the ICU increase mortality (24,25). In our study, the ICU mortality rate was 2.4 times higher when patients transferred to the ICU and had stayed in the ED longer than24 hours. A multicenter study in the United States involving 50,000 critically ill patients found that in-hospital mortality was 1.5 times higher in patients with more than six hours of ED stay (24). Cardoso et al. found that each hour of ED stay resulted in a 1.5% increase in ICU mortality (25). Likewise, in our study, there was a significant relationship between the duration of ED stay and ICU mortality. Each hour of ED stay increased the ICU mortality rate 1.66 times. Multiple concomitant diseases in older adult patients, difficulty in self-expression, admission to the ED for nonspecific reasons, a higher probability of serious underlying illness requiring differential diagnosis, and the need for consultation can lead to prolonged stay of these patients in the ED. Prolonged monitoring of critically ill patients in the ED negatively affects the quality of ED patient care (26).

This study has some limitations. First, the retrospective nature of the study restricted data to those routinely collected. Our retrospective study design may be related to selection biases, because this study only included patients admitted to the ICU. Second, this was a single center study. Third, this study focused on patients' initial diagnosis. The initial clinical picture may be ambiguous in older patients therefore, there may be differences between intensive care admission diagnosis and recent diagnosis. Further studies involving a large number of centers are needed to confirm our results.

In conclusion, although older adult patients have high ICU mortality, age is not an independent factor associated with ICU mortality. MAP, GCS, the need for intubation, underlying cancer diagnosis, and the duration of the ED stay should all be considered when establishing prognoses. The presence of one or more of the identified risk factors can help clinicians make decisions regarding the admissions of older adult patients to the ICU.

Ethics Committee Approval: Ethical Committee of Aksaray University Faculty of Medicine with a protocol number of 2020/03-56 and conducted in accordance with the Declaration of Helsinki and Good Clinical Practices.

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