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ORIGINAL ARTICLE

Age is not a risk factor in survival of severely ill patients with co-morbidities in a medical intensive care unit

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Abstract

Background The individuals over 65 years old constitute an important patient population of medical intensive care units (ICUs).
Aim To evaluate the risk factors for mortality in a medical ICU consisting a group of patients with a large number of co-morbidities.
Methods This is a retrospective study involving patients who were followed for more than 48 h. The cohort was divided into two groups according to age: (1) young, < 65 years old, and (2) elderly, ≥ 65 years old.
Results A total of 693 patients (303 F, 390 M) were included. The median age was 68 years (18–97). There were 279 (40.3%) young and 414 (59.7%) elderly patients. There was no difference between the groups in gender and mortality ($p = 0.436$, $p = 0.932$, respectively). Most of the co-morbid diseases were more common in the elderly except solid malignancies which were more common in young patients ($p = 0.033$). Long ICU stay, long hospital stay before ICU, high APACHE II and Charlson co-morbidity index scores, pneumonia, acute hepatic failure/coma, malignancy, acute hemodialysis, need for vasopressors, and invasive mechanical ventilation were independent predictors of ICU mortality.
Conclusion Age and gender were not found to be predictors of mortality. There was no survival advantage between young and elderly patients. Co-morbid diseases, apart from malignancy, had no effect on mortality. In developing countries, where patients with terminal illness and multiple co-morbid diseases are treated in the ICU, age should not be a determining factor in patient selection for ICU or in the treatment decisions to be applied to patients.

Keywords Age · Co-morbid diseases · Intensive care unit · Malignancy · Mortality

Introduction

The World Health Organization defined elderly as being at least 65 years old [1]. Due to developing technology, early diagnosis, and better patient care, the number of individuals over 65 years old is increasing in the population. The number of people aged 65 or older in the global population was 703 million in 2019. It is estimated that it will increase to approximately 1.5 billion in 2050, mostly in developing countries [2]. By 2050, one in six people in the world will be over 65 years old (16%), compared with one in 11 (9%) in 2019 [2]. Concomitant diseases increase with age, and elderly individuals constitute an important patient population of medical intensive care units (ICUs) [3].

The mortality rates observed in patients followed up in the ICU vary widely in accordance with the patient profiles monitored. In particular, the mortality rates of medical ICUs are higher than those of surgical ICUs. There are several scoring systems for the evaluation of disease severity and mortality rates of patients in ICUs, such as the simplified acute physiology score II (SAPS II), the acute physiology and chronic health evaluation II (APACHE II), the OMEGA score system, and the sequential organ failure assessment (SOFA) [3]. Some studies have reported higher mortality rates than calculated by these various scoring systems, and there is no scoring system suitable for every patient group yet [4–6].

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Studies related to mortality in elderly patients have yielded different results. For this reason, it has been questioned whether elderly patients should even be admitted to the limited number of ICU beds [7–9]. Co-morbid diseases are also one of the contributing factors in this situation. There are publications from various countries related to ICU patient profile, factors affecting mortality, and evaluation of the elderly patient population [3–9]. However, these studies have been conducted with different methodologies, and different results have been found. The effect of age and co-morbid diseases on mortality has not been clearly established yet. In this study, we aimed to evaluate the patient profile, the factors affecting mortality, and the effect of age on mortality in a medical ICU.

Methods

This study was conducted in the Ondokuz Mayıs University, Faculty of Medicine. Patients who followed up more than 48 h in a 16-bedded medical ICU between October 2016 and March 2019 were included in the study. Only the first ICU admissions of the patients were included in the study. Patients under 18 years of age were excluded. Data were collected for all patients and evaluated retrospectively. The patient profile was defined by recording the age, gender, admission diagnosis, concomitant diseases, reasons for hospitalization, length of stay (LOS) in the ICU and in the hospital before ICU, mortality, need for vasopressors, and invasive procedures (invasive mechanical ventilation, central venous catheterization, and hemodialysis).

The disease severity of hospitalized patients was evaluated with APACHE II [10] and SOFA [11] scores, which were calculated according to the clinical and laboratory values in the first 24 h. Since age is a factor affecting the APACHE II score by up to 6 points, we also used an APACHE II (age excluded) score, which was calculated by subtracting patients' age score from their calculated APACHE II score. We evaluated the baseline health statuses of our patients using the Charlson co-morbidity index (CCI), which is a classification of co-morbid chronic diseases [12]. In the CCI, the patients were given a score between 0 and 33 according to their co-morbid diseases. In previous studies, the prognostic value of the scores obtained with the CCI has been compared with standard scoring systems, and it has been shown that it can be used as an alternative method in ICU patients [13, 14].

This study was performed in line with the principles of the Declaration of Helsinki and approved by the Ethics Committee of Ondokuz Mayıs University (2019/330). The patients were divided into two groups according to their age (< 65 years old vs. ≥ 65 years old) and mortality (surviving vs. non-surviving), and compared.

Statistical analysis

Statistical Package for Social Sciences (SPSS), version 25.0, is used for statistical analysis. Frequency distributions and percentages are given. Because of non-parametric distribution of continuous parameters, median, inter-quartile range (IQR), and minimum-maximum values are given. Groups were compared using the chi-square test for categorical parameters and the Mann-Whitney U test for continuous parameters. Comparison of survival between groups is evaluated by using Kaplan-Meier curves with the log-rank test. Logistic regression analysis (with the backward elimination method) is used including variables which were significant in bivariate analysis for mortality. The odds ratios (ORs) and their 95% confidence intervals (95% CIs) are given. A p value of < 0.05 is defined as significant.

Results

A total of 693 patients were included in the study. Clinical characteristics and scorings of the patients are presented in Table 1 and Table 2. There were 303 (43.7%) female and 390 (56.3%) male patients. The median age was 68 ($R = 18$–97). The median values for ICU LOS and hospital LOS before ICU were 7 ($R = 2$–115) and 3 ($R = 0$–127) days, respectively. The median values for SOFA, APACHE II, APACHE II (age excluded), and CCI scores were 9 ($R = 1$–21), 23 ($R = 4$–46), 19 ($R = 2$–41), and 4 ($R = 0$–12), respectively. The overall ICU mortality rate was 58.6%. The most common admission diagnoses were acute renal failure (58.6%) and respiratory insufficiency (55.8%). In co-morbid diseases, the rate of malignancy was very high (51.4%). The rate of invasive procedures was also high. Invasive mechanical ventilation, central venous catheter, and acute hemodialysis were used in 426 (61.5%), 446 (64.4%), and 266 (38.4%) patients, respectively. There was a need for vasopressor treatment in 457 (65.9%) patients.

The cohort was divided into two groups according to age: (1) young, < 65 years old, and (2) elderly, ≥ 65 years old (see Table 1 and Table 2). There were 279 (40.3%) patients in the young group and 414 (59.7%) patients in the elderly group. There was no difference between the groups in gender and mortality ($p = 0.436$, $p = 0.932$, respectively). Urinary tract infection, sepsis/septic shock, and acute renal failure were all more common in the elderly group ($p < 0.001$, $p = 0.01$, $p = 0.001$, respectively). Most of the co-morbid diseases, apart from solid malignancies, were more common in elderly patients. The elderly had hypertension, diabetes mellitus, cardiovascular disease, chronic pulmonary disease, chronic renal failure, and cerebrovascular events more than the young group ($p < 0.001$, $p = 0.014$, $p < 0.001$, $p = 0.001$, $p = 0.04$, $p < 0.001$, respectively). Solid malignancies were more

Table 1 Clinical characteristics of the all patients and groups according to age

	All patients (*n*: 693)		Young (< 65 years) (*n*: 279)		Elderly (≥ 65 years) (*n*: 414)		*p* value[a]
	n	%	*n*	%	*n*	%	
Gender (female)	303	43.7	117	41.9	186	44.9	0.436
Mortality (exitus)	406	58.6	164	58.8	242	58.5	0.932
Admission diagnosis							
Acute congestive heart failure	52	7.5	15	5.4	37	8.9	0.081
Respiratory insufficiency	387	55.8	155	55.6	232	56.0	0.9
Pulmonary embolism	20	2.9	6	2.2	14	3.4	0.342
Pulmonary edema	124	17.9	47	16.8	77	18.6	0.555
Pneumonia	369	53.2	143	51.3	226	54.6	0.388
Skin infection/abscess	74	10.7	25	9.0	49	11.8	0.229
Urinary tract infection	121	17.5	29	10.4	92	22.2	< 0.001
Sepsis/septic shock	359	51.8	128	45.9	231	55.8	0.01
Acute renal failure	406	58.6	143	51.3	263	63.5	0.001
Acute hepatic failure/coma	79	11.4	33	11.8	46	11.1	0.771
GIS hemorrhage	78	11.3	26	9.3	52	12.6	0.185
Acute cerebrovascular event	63	9.1	38	13.6	25	6.0	0.001
Respiratory arrest	133	19.2	57	20.4	76	18.4	0.497
Cardiac arrest	86	12.4	38	13.6	48	11.6	0.428
Postoperative period	25	3.6	15	5.4	10	2.4	0.04
Co-morbid diseases							
Hypertension	349	50.4	88	31.5	261	63.0	< 0.001
Diabetes mellitus	205	29.6	68	24.4	137	33.1	0.014
Cardiovascular disease	246	35.5	56	20.1	190	45.9	< 0.001
Chronic pulmonary disease	135	19.5	37	13.3	98	23.7	0.001
Chronic liver failure	66	9.5	26	9.3	40	9.7	0.88
Chronic renal failure	183	26.4	62	22.2	121	29.2	0.04
Chronic cerebrovascular event	104	15.0	25	9.0	79	19.1	< 0.001
Malignancy	356	51.4	156	55.9	200	48.3	0.049
Solid malignancy	212	30.6	98	35.1	114	27.5	0.033
Solid malignancy with metastasis	139	20.1	72	25.8	67	16.2	0.002
Hematological malignancy	158	22.8	63	22.6	95	22.9	0.91
Invasive procedures							
Invasive mechanical ventilation	426	61.5	176	63.1	250	60.4	0.474
Central venous catheter	446	64.4	184	65.9	262	63.3	0.473
Hemodialysis (acute)	266	38.4	100	35.8	166	40.1	0.259
Hemodialysis (chronic)	48	6.9	24	8.6	24	5.8	0.154
Need for vasopressors	457	65.9	181	64.9	276	66.7	0.625

[a] Chi-square test was used for comparison of categorical variables

common in young patients (35.1%, $p = 0.033$). There were no differences between groups in rates of invasive procedures or need for vasopressors ($p > 0.005$, for all).

As presented in Table 2, there were no differences between the young and elderly groups in terms of ICU LOS (6 vs. 7 days), hospital LOS before ICU (4 vs. 3 days), SOFA score (9 vs. 9), APACHE II score (age excluded) (19 vs. 19), Glasgow coma score (GCS) (10 vs. 10), and CCI score (4 vs. 4) ($p > 0.05$, for all). The only parameter that differed between age groups was APACHE II score (21 vs. 25) ($p < 0.001$).

In the Kaplan-Meier survival analysis, there was no survival advantage between the young and elderly groups, as shown in Fig. 1 ($p = 0.527$).

The cohort was divided into two groups according to mortality (surviving vs. non-surviving) (see Table 2 and Table 3). There were 287 (41.4%) patients in the surviving group and 406 (58.6%) patients in the non-surviving group. There were

Table 2 Comparison of clinical characteristics and scorings of patients between groups of intensive care unit mortality and age

	All patients (*n*: 693)	Age			Mortality		
		Young (*n*: 279)	Elderly (*n*: 414)	*p* value[a]	Non-surviving (*n*: 406)	Surviving (*n*: 287)	*p* value[a]
Age (years)	68 (21) (18–97)	55 (15) (18–64)	77 (12) (65–97)	< 0.001	68 (20) (18–94)	69 (22) (18–97)	0.589
ICU LOS (day)	7 (9) (2–115)	6 (8) (2–61)	7 (10) (2–115)	0.301	8 (12) (2–115)	6 (7) (2–64)	< 0.001
Hospital LOS before ICU (day)	3 (12) (0–127)	4 (14) (0–127)	3 (10) (0–108)	0.077	6 (18) (0–127)	1 (6) (0–120)	< 0.001
SOFA score	9 (5) (1–21)	9 (6) (1–21)	9 (5) (1–20)	0.238	10 (5) (2–21)	7 (5) (1–18)	< 0.001
APACHE II score	23 (11) (4–46)	21 (10) (4–44)	25 (12) (7–46)	< 0.001	26 (11) (8–46)	19 (10) (4–37)	< 0.001
APACHE II score (age excluded)	19 (11) (2–41)	19 (10) (4–41)	19 (11) (2–40)	0.934	22 (10) (4–41)	15 (10) (2–33)	< 0.001
GCS	10 (8) (3–15)	10 (8) (3–15)	10 (7) (3–15)	0.087	8 (6) (3–15)	13 (6) (3–15)	< 0.001
CCI score	4 (4) (0–12)	4 (4) (0–11)	4 (3) (0–12)	0.123	5 (4) (0–12)	4 (4) (0–11)	< 0.001

ICU, intensive care unit; *LOS*, length of stay; *GCS*, Glasgow coma score; *APACHE II*, acute physiology and chronic health evaluation; *SOFA*, sequential organ failure assessment; *CCI*, Charlson co-morbidity index

[a] The Mann-Whitney *U* test was used for two unpaired group comparisons because of non-parametric distribution of continuous variables

more females in the surviving group ($p = 0.006$). The non-surviving group had more respiratory insufficiency, pneumonia, skin infection, sepsis/septic shock, acute renal failure, and acute hepatic failure/coma ($p < 0.001$, $p < 0.001$, $p = 0.004$, $p < 0.001$, $p = 0.007$, $p = 0.002$, respectively). Cardiac and respiratory arrests just before admission were significantly higher in the non-surviving group ($p < 0.001$, for both). There were no differences between groups for co-morbid diseases other than malignancy. Both hematological (26.6%) and solid (38.9%) malignancies were more common in the non-surviving group ($p = 0.005$, $p < 0.001$, respectively). The rates of invasive mechanical ventilation (85.5%), central venous catheter (81%), acute hemodialysis (51%), and vasopressor treatment (87.2%) were very high in non-surviving patients ($p < 0.001$, for all).

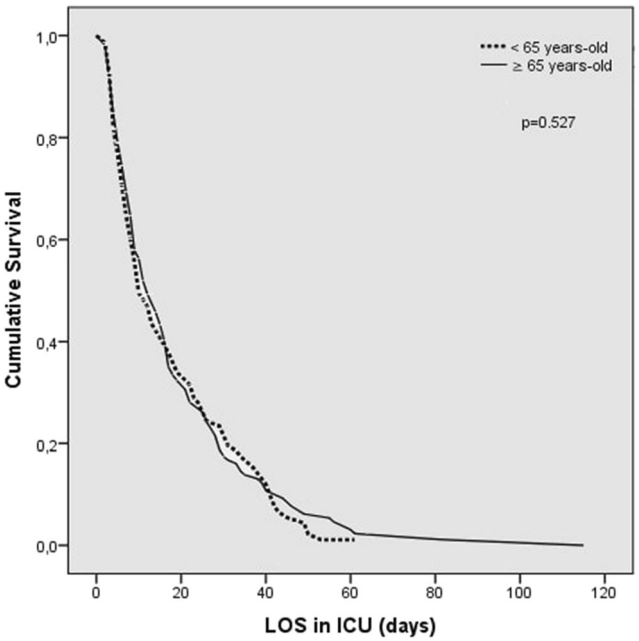

Fig. 1 Kaplan-Meier survival curves for patients stratified by age. Patients < 65 years old (straight line) had the same intensive care outcomes with patients ≥ 65 years old (dotted line) ($p = 0.527$). ICU, intensive care unit; LOS, length of stay

As presented in Table 2, there was no difference between surviving and non-surviving patients in terms of age (69 vs. 68) ($p = 0.589$). However, there were significant differences in terms of ICU LOS (6 vs. 8 days), hospital LOS before ICU (1 vs. 6 days), SOFA score (7 vs. 10), APACHE II score (19 vs. 26), APACHE II score (age excluded) (15 vs. 22), GCS (13 vs. 8), and CCI score (4 vs. 5) ($p < 0.001$, for all).

In the logistic regression analysis, long ICU LOS; long hospital LOS before ICU; high APACHE II score; high CCI score; presence of pneumonia, acute hepatic failure/coma, and malignancy; use of invasive mechanical ventilation; acute hemodialysis; and need for vasopressors were found to be independent predictors of ICU mortality (Table 4). Age and gender were not found to be predictors of mortality.

Discussion

Chronic diseases are common in the elderly, and their physiological condition is not good because of age [15]. According to previous studies, the benefit of the ICU for the elderly is controversial [16–18]. Approximately 60% of our medical ICU patients were aged 65 and over. This rate is quite high. When we examined patients aged 65 and over, 40.8% were between 65 and 74 years, 42.3% between 75 and 84 years, and 16.9% were over the age of 85.

Table 3 Clinical characteristics of the patients according to intensive care unit mortality

	Non-surviving patients (*n*: 406)		Surviving patients (*n*: 287)		*p* value[a]
	n	%	*n*	%	
Gender (female)	160	39.4	143	49.8	0.006
Admission diagnosis					
Acute congestive heart failure	29	7.1	23	8.0	0.668
Respiratory insufficiency	272	67.0	115	40.1	< 0.001
Pulmonary embolism	12	3.0	8	2.8	0.896
Pulmonary edema	73	18.0	51	17.8	0.943
Pneumonia	245	60.3	124	43.2	< 0.001
Skin infection/abscess	55	13.5	19	6.6	0.004
Urinary tract infection	75	18.5	46	16.0	0.404
Sepsis/septic shock	267	65.8	92	32.1	< 0.001
Acute renal failure	255	62.8	151	52.6	0.007
Acute hepatic failure/coma	59	14.5	20	7.0	0.002
GIS hemorrhage	35	8.6	43	15.0	0.009
Acute cerebrovascular event	39	9.6	24	8.4	0.575
Respiratory arrest	117	28.8	16	5.6	< 0.001
Cardiac arrest	77	19.0	9	3.1	< 0.001
Postoperative period	7	1.7	18	6.3	0.002
Co-morbid diseases					
Hypertension	192	47.3	157	54.7	0.055
Diabetes mellitus	106	26.1	99	34.5	0.017
Cardiovascular disease	139	34.2	107	37.3	0.409
Chronic pulmonary disease	70	17.2	65	22.6	0.077
Chronic liver failure	38	9.4	28	9.8	0.861
Chronic renal failure	96	23.6	87	30.3	0.05
Chronic cerebrovascular event	59	14.5	45	15.7	0.677
Malignancy	255	62.8	101	35.2	< 0.001
Solid malignancy	158	38.9	54	18.8	< 0.001
Solid malignancy with metastasis	111	27.3	287	9.8	< 0.001
Hematological malignancy	108	26.6	50	17.4	0.005
Invasive procedures					
Invasive mechanical ventilation	347	85.5	79	27.5	< 0.001
Central venous catheter	329	81.0	117	40.8	< 0.001
Hemodialysis (acute)	207	51.0	59	20.6	< 0.001
Hemodialysis (chronic)	25	6.2	23	8.0	0.343
Need for vasopressors	354	87.2	103	35.9	< 0.001

[a] Chi-square test was used for comparison of categorical variables

The overall ICU mortality rate was 58.6% in our study, and rates of mortality were similar in young and old age groups (58.8% vs. 58.5%, respectively). According to our study, age is not a risk factor for ICU mortality. However, varying results have been obtained regarding the effect of age on mortality in previous studies. In some studies, age was an indicator of prognosis and mortality [19–24], while in others, it was not [7–9, 25, 26]. The fact that the studies had different results was mostly due to the differences in their methodologies. Studies were carried out on different patient profiles and in various hospital conditions. In addition, the age groups used to compare patients differed in each study. While some studies compared patients less than 65 years old and over, others only divided patients over 65 years old into different age groups and compared them.

The reported mortality rates in elderly patients were mostly between 25 and 65% [22, 23, 27, 28]. However, in studies conducted in Turkey and some other developing countries, overall mortality rates were high in medical ICUs, and mortality rates of up to 83% have been reported [7, 25]. The

Table 4 Independent predictors of intensive care unit mortality

Variables	Odds ratio	95% CI	*p* value[a]
ICU LOS (day), per point	1.03	(1.01–1.05)	0.012
Hospital LOS before ICU (day), per point	1.04	(1.02–1.06)	< 0.001
APACHE II, per point	1.06	(1.03–1.1)	0.001
CCI, per point	1.14	(1.03–1.3)	0.013
Pneumonia	1.7	(1.08–2.68)	0.022
Acute hepatic failure/coma	3.67	(1.71–7.89)	0.001
Malignancy	2.55	(1.58–4.13)	< 0.001
Invasive mechanical ventilation	6.73	(4.2–10.8)	< 0.001
Hemodialysis (acute)	2.01	(1.23–3.29)	0.005
Need for vasopressors	4.31	(2.64–7.03)	< 0.001
Age (years), per point	1.0	(0.98–1.01)	0.669
Gender (male)	1.43	(0.91–2.24)	0.118

OR, odds ratio; *CI*, confidence interval; *ICU*, intensive care unit; *LOS*, length of stay; *APACHE II*, acute physiology and chronic health evaluation; *CCI*, Charlson co-morbidity index

[a] The logistic regression analysis backward elimination method was used, and age, gender, ICU LOS, hospital LOS before ICU, respiratory insufficiency, pneumonia, sepsis/septic shock pneumonia, skin infection/abscess, GIS hemorrhage, acute renal failure, acute hepatic failure/coma, cardiac arrest, malignancy, invasive mechanical ventilation, need for vasopressors, acute hemodialysis, Glasgow coma score, APACHE II score, SOFA score, and CCI score were included on the first step. References were the absence of the disease in categorized variables and being female in gender (Nagelkerke R^2: 0.62)

diversity of factors in patient selection during admission to the ICU and the lack of technical support during follow-up could be the primary reasons for variability in mortality rates. There is no concept of "do not resuscitate" in Turkey for terminally ill patients. Due to reasons such as socio-cultural structure and inadequate legal arrangements, the need for life support, rather than potential benefit and life expectancy, is decisive for ICU admission in our country. Therefore, all patients who need support are followed up and treated in existing ICU beds.

In previous studies, high mortality in ICU patients has also been shown to be associated with the need for positive inotropic agents, the presence of sepsis, and renal injury, regardless of age [23–25, 29, 30]. In our study, the non-surviving group had more respiratory insufficiency, pneumonia, skin infection, sepsis/septic shock, acute renal failure, and acute hepatic failure/coma. Cardiac arrest and respiratory arrest just before admission were significantly more frequent in the non-surviving group. The rates of invasive mechanical ventilation (85.5%), central venous catheter (81%), acute hemodialysis (51%), and vasopressor treatment (87.2%) were very high in the non-surviving patients.

Although the APACHE II score is accepted as the gold standard in predicting mortality, it evaluates the severity of the acute clinical state of the patient rather than chronic diseases. Even though there are studies reporting that APACHE II and SOFA scores can predict hospital and/or long-term mortality in the elderly [21, 25–27, 31, 32], there are also studies [33, 34] reporting the opposite. One systematic review states that there is no clinical evaluation model that can predict mortality in the elderly [35]. Classic ICU scoring systems include the age factor and are not designed for the specific characteristics of the elderly. In addition to the severity of the patient's primary disease, co-morbid diseases are an important factor affecting mortality. The scoring systems calculated by values in the first 24 h, such as APACHE II, could not be adequate for predicting mortality since they do not include co-morbid diseases and conditions that develop after the first 24 h in the ICU. Baseline functional and nutritional status, quality of life, presence of active malignancy, and cardiopulmonary resuscitation should also be considered in order to predict prognosis in the elderly [15, 17, 36, 37]. In our study, the rate of patients diagnosed with malignancy and sepsis was much higher than that in developed countries. In addition, our patients' APACHE II and SOFA scores were quite high, but when we compared the APACHE II score (age excluded), there was no difference between age groups and mortality rates.

The effects of acute and chronic diseases on short- and long-term survival in ICU patients are uncertain. Studies investigating the role of co-morbid diseases in ICU mortality have used different scales, such as the CCI, the Elixhauser scale, the McCabe scale, or the number of affected organ systems. Sacanella et al. [26] and Vosylius et al. [27] found that mortality was high in the elderly, whereas co-morbid diseases were not associated with mortality. In contrast, there are studies reporting that co-morbid diseases, especially fatal co-morbid diseases, increase short- and/or long-term mortality [21, 26, 28, 29, 31].

We evaluated the baseline health status of patients using the CCI and found that the co-morbid diseases, apart from

malignancy, had no effect on mortality. The rate of malignancy was very high (51.4%) in our patients and mostly included terminally ill patients. Unlike in most studies, solid malignancies were more common in young patients (35.1%) in our study. There are few studies about the prognoses of elderly patients with malignancy in the ICU, and two of them reported poor results in lung cancer patients [38, 39]. Auclin et al. [40] reported that patients 65 years or older with solid malignancy accounted for 14.3% of ICU admissions and had the same ICU mortality rate as patients without malignancy. Active malignancy was found to be independently associated with a 6-month mortality (odds ratio, 2.59 [95% CI, 1.74–3.90]) [40].

There was no survival advantage between the young and elderly groups. We can explain this situation with the other findings of our study. There were no differences between the young and elderly groups in terms of ICU LOS, hospital LOS before ICU, SOFA score, APACHE II score (age excluded), GCS, and CCI score. There were no differences between groups in rates of invasive procedures or need for vasopressors. The only difference between age groups was the APACHE II score. When we compared patients according to their discharge status, there was no difference between surviving and non-surviving patients in terms of age (69 vs. 68). However, there were significant differences in terms of ICU LOS, hospital LOS before ICU, SOFA score, APACHE II score, APACHE II score (age excluded), GCS, and CCI score. There were no differences between the survival groups for co-morbid diseases except malignancy. Both hematological and solid malignancies were more common in the non-surviving group. Mortality was found to be higher in cases of acute organ failure, such as respiratory failure, detected within the first 24 h than in cases of co-morbid diseases except malignancy. As our findings show, when patients were grouped by age, there was no difference between many acute and chronic conditions, and ICU follow-up time and interventions, whereas when they were grouped by mortality, there were significant differences in all parameters except age and chronic non-fatal diseases.

Age and gender were not found to be predictors of mortality. But, ICU LOS; long hospital LOS before ICU; high APACHE II score; high CCI score; presence of pneumonia, acute hepatic failure/coma, and malignancy; acute hemodialysis; need for vasopressors; and invasive mechanical ventilation were found to be independent predictors of ICU mortality.

In our study, the presence of high rates of malignancy in patients less than 65 years of age made the scorings of co-morbid diseases and APACHE II (age excluded) scores of the patients similar. As a result, APACHE II scores can be misleading in patient groups with high malignancy rates. The age factor, which has been shown to be associated with mortality in some studies, has lost its importance in patients with similar chronic disease backgrounds and high rates of malignancies. Age may be associated with decreased survival in study groups that include a small number of terminally ill patients and have low mortality rates. In addition, it is seen in the data of our study that, in the case of indication, all the medical treatments and invasive interventions were performed without discriminating whether the patient was young or old. There was no difference between young and old patients in terms of acute diseases or invasive procedures, such as renal replacement therapy or invasive mechanical ventilation, and therefore mortality.

The fact that our study cohort included a high number of patients who are mostly elderly and had high rates of co-morbidities and malignancy enabled us to better demonstrate the effect of all these conditions on mortality. Since it was a single-center study, there were no differences among patients in terms of patient acceptance criteria and treatment approaches. By this, potential physician bias was prevented.

The main limitation of our study is that it was a retrospective study. Patients were followed until being discharged from the ICU, so we did not evaluate the long-term outcomes. The nutritional and functional statuses of patients and the presence of delirium were not evaluated.

In conclusion, there was no difference between the young and elderly groups in mortality rates. The co-morbid diseases, apart from malignancy, had no effect on mortality. The APACHE II score including age can be misleading in patient groups with high malignancy rates. Especially in ICUs of developing countries with a high number of co-morbid diseases and terminally ill patients, age should not be a determining factor in patient selection for ICU and the treatment decisions to be applied to the patients.

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Compliance with ethical standards

This study was performed in line with the principles of the Declaration of Helsinki and approved by the Ethics Committee of Ondokuz Mayıs University (2019/330).

Conflict of interest The authors declare that they have no conflict of interest.

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