

## Yoğun Bakım Ünitesinde Takip Edilen Kafa ve Göğüs Travması Hastalarında Mortalite Oranı Tahmin Edilebilir mi?

### Can Mortality Rate in Head and Chest Trauma Patients in the Intensive Care Unit be Predicted?

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**Amaç:** Bu çalışmanın amacı, kafa ve göğüs travması tanısıyla yoğun bakım ünitesinde takip edilen hastaların; revize travma skoru, basitleştirilmiş akut fizyoloji skoru ve çeşitli biyokimya parametrelerini araştırmak ve bu değerlerin mortalite oranı üzerindeki tahmin ettirme gücünü araştırmaktır.

**Yöntem:** Çalışmamız, üniversite hastanesi yoğun bakım ünitesinde (YBÜ) takip edilen kafa ve göğüs travma hastalarını, hastane veri tabanına dayanarak retrospektif olarak inceleyen gözlemsel kohort çalışmadır. Haziran 2016 ile Haziran 2017 yılları arasında üçüncü basamak bir hastanenin YBÜ'nde ardışık olarak tedavi edilen kafa ve göğüs travması hastalarının verileri kaydedildi. Hastalar mortalite ve yaşayan olarak iki gruba ayrıldı. Hastaların demografik verileri, basitleştirilmiş akut fizyoloji skoru (SAPS II) ve revize travma skoru (RTS), mekanik ventilasyonda ve yoğun bakım ünitesinde kalış süreleri, mortalite oranları, giriş Glasgow koma skoru (GKS), izlem süresince hemodiyaliz gereksinimleri, yoğun bakıma kabulden sonraki ilk 48 saat içinde beslenme durumu ve yoğun bakıma ilk kabul edildiklerindeki çeşitli biyokimya parametreleri değerlendirildi.

**Bulgular:** Çalışmamızda kafa ve göğüs travması hastalarında, hemodiyaliz tedavisi yapılan ( $p=0,0016$ ), entübe edilen, mekanik ventilatörde takip edilen ( $p<0,001$ ) ve parenteral olarak beslenen hastalarda, 28 günlük mortalite oranları daha yüksek bulundu. Hastaların yirmi sekiz günlük mortalite oranları, basitleştirilmiş akut fizyoloji skoru (SAPS II) ( $p<0,001$ ), YBÜ'de kalma süresi ( $p=0,009$ ), mekanik ventilasyon süresi ( $p<0,001$ ) yüksek olanlarda ve serum kreatinin ve glikoz değerleri artmış olanlarda yüksek bulundu. 28 günlük mortalite oranı yüksek olan hastalarda, GKS, RTS ve serum albumin seviyesi anlamlı olarak düşük bulundu.

**Sonuç:** Kafa ve göğüs travma hastalarının mortalite oranlarını tahmin etmek için, RTS, GKS ve serum albumin seviyelerinin iyi bir belirteç olabileceğini düşünüyoruz.

**Anahtar Kelimeler:** Travma, yoğun bakım ünitesi, mortalite.

#### ABSTRACT

**Objective:** The aim of this study is to evaluate the patients who are followed up with a diagnosis of head and chest trauma; to investigate the revised trauma score, the simplified acute physiology score, and various biochemistry parameters and to reveal the role of these values on mortality rates.

**Methods:** Our study is an observational cohort study that retrospectively examines head, and thoracic trauma patients followed in the university hospital ICU, based on the hospital database. Data of trauma patients who were treated consecutively in the ICU of a tertiary hospital between June 2016 and June 2017 were recorded. Patients were divided into two groups as mortality and living. Demographic data of the patients simplified acute physiology score (SAPS II) and revised trauma score (RTS),

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length of stay in mechanical ventilation and intensive care unit, mortality rates, admission Glasgow coma score (GCS), hemodialysis requirements during follow-up, first post-ICU admission Nutritional status and various biochemistry parameters admitted to intensive care unit were evaluated within 48 hours.

**Results:** In our study, 28-day mortality rates were found to be higher in patients with head and chest trauma, those who underwent hemodialysis treatment ( $p = 0.0016$ ), were intubated, followed by mechanical ventilation ( $p < 0.001$ ), and fed parenterally. Patients with 28-day mortality rates, simplified acute physiology score (SAPS) 2 ( $p < 0.001$ ), length of stay in the ICU ( $p = 0.009$ ), high mechanical ventilation duration ( $p < 0.001$ ), and those with increased serum creatinine and glucose levels found high. In patients with a high 28-day mortality rate, GCS, RTS, and serum albumin levels were found to be significantly lower.

**Conclusion:** We think that RTS, GCS, and serum albumin levels may be useful markers to estimate the mortality rates of head and chest trauma patients.

**Key words:** Trauma, intensive care unit, mortality.

## 1. INTRODUCTION

In a publication published by the World Health Organization in 2014, it was stated that worldwide trauma-related deaths exceeded 5000000 cases per year and constituted 9% of all death rates (1). In our country, deaths due to traumas rank fifth among the causes of death (2). Approximately 400000 patients are victims of traumatic injury, including accidents, assault, vehicle collisions, and penetrating trauma in Turkey (3). Therefore, it is a major cause of death and a public health problem in Turkey.

Approximately half of the deaths due to trauma are due to head trauma (4). The mortality rate due to severe head traumas is 35% (5). Additionally, twenty to twenty-five percent of trauma-associated deaths are due to thoracic trauma (6). Management of trauma patients is a highly complex process, usually involving considerable resuscitation efforts, comprehensive imaging, multiple operations, prolonged intensive care unit (ICU), and complex rehabilitation programs. In severe trauma cases, reducing mortality and morbidity by increasing the quality of care has become a target for healthcare professionals. Although keeping vital parameters within reasonable limits is valuable in demonstrating its effectiveness in resuscitation, it is a fact that the evaluation of these values alone is not sufficient for the management of critical patients. For this reason, trauma centers use trauma scores, intensive care scores, and various biochemistry parameters that can help guide diagnosis and treatment. Today, factors affecting mortality are investigated in trauma patients followed in ICUs.

In our study, we aimed to investigate their serum glucose, creatinine, albumin levels, and patients' GCS, RTS, and SAPS II values and the predictive power of these values on mortality.

## 2. MATERIALS AND METHODS

The study started after obtaining approval from Dumlupınar University, Faculty of Medicine Ethics Committee. (Approval No: 2018-2/9) In this study, the data of 1052 patients who were followed up in the anesthesia intensive care unit between July 2016 and July 2017 were retrospectively reviewed. The data of pregnant patients were excluded from the study. 124 consecutive patients with a diagnosis of head and thoracic trauma were included in the study. Demographic data of the patients, SAPS II, RTS, GKS, length of stay in mechanical ventilation and ICU, hemodialysis requirements, nutritional status within the first 48 hours after admission to ICU, and various biochemistry values during access to intensive care were

evaluated. The 28-day mortality rates of the patients were recorded. Patients were divided into two groups as survivors and patients who died within the first 28 days. The predictive power of biochemistry parameters on mortality was investigated with the calculated ICU and trauma scores.

### Statistical Analysis

The data of the study were transferred to the SPSS v20 program. Categorical data are expressed by frequency and percentage, while continuous data are represented by mean, standard deviation, median, minimum, and maximum. The chi-square test compared categorical data. The consistency of consistent data to normal distribution was tested with the Shapiro Wilk test. While comparing the means, the t-test was used for data with normal distribution, whereas the Mann Whitney U test was used for data not suitable for normal distribution. Survival analyzes were done with the Kaplan Meier Log-Rank test. The variables that were found significant in survival analyzes were taken into the Cox regression analysis model.  $p < 0.05$  was accepted as the level of significance.

### 3. RESULTS

Within the specified period for the study, 124 (11.78%) patients were followed up in the intensive care unit with the diagnosis of trauma. 94 (70.1%) of the patients constituting the study group were male, 30 (22.4%) were female, and the mean age was  $44.79 \pm 20.7$  years. It was determined that there was at least one comorbid disease in 32.8% of the patients, 41.0% were intubated, 46.3% had enteral feeding, 4.5% needed hemodialysis, and 14.2% were ex. Median (min-max) values of some clinical and laboratory features of the patients were 14 (3-15) for GKS, 26 (8-96) for SAPS II, 6 (1-72) days for a stay in the intensive care unit, 1 (0-72) days for mechanical ventilation, 1 (0.00-7.90) mg / dL for creatinine, 3.4 (1.10-5.00) g / dL for albumin, 152 (65-380) mmol / L for Glucose (Table 1).

**Table 1.** Distribution Of Demographic, Clinical And Laboratory Features Of The Patients (N=124)

	n (%)
<b>Gender</b>	
Male	94 (75.8)
Female	30 (24.2)
<b>Comorbidities</b>	
Present	44 (35.5)
Absent	80 (64.5)
<b>Intubation</b>	
Present	55 (44.4)
Absent	69 (55.6)
<b>Nutrition</b>	
None	11 (8.9)
Enteral	62 (50)
Parenteral	49 (39.5)
Both	2 (1.6)
<b>Need of hemodialysis</b>	
Present	6 (4.8)
Absent	118 (95.2)
<b>Survival</b>	
Dead	19 (15.3)
Survived	105 (84.7)
<b>Age, medyan (Min-Max)</b>	44 (14-90)

**Table 1.** Distribution Of Demographic, Clinical And Laboratory Features Of The Patients (N=124) (continuation of the table)

	n (%)
<b>GCS</b> , medyan (Min-Max)	14 (3-15)
<b>SAPS II</b> , medyan (Min-Max)	26 (8-96)
<b>ICU stay</b> (days), medyan (Min-Max)	6 (1-72)
<b>Mechanical ventilation</b> (days), medyan (Min-Max)	1 (0-72)
<b>Creatinine</b> , mg/dL, medyan (Min-Max)	1 (0.00-7.90)
<b>Albumin</b> , g/dL, medyan (Min-Max)	3.4 (1.10-5.00)
<b>Glucose</b> , mmol/L, medyan (Min-Max)	152 (65-380)

GCS: Glasgow Coma Scale, SAPS 2: Simplified Acute Physiology Score 2, ICU: Intensive Care Unit

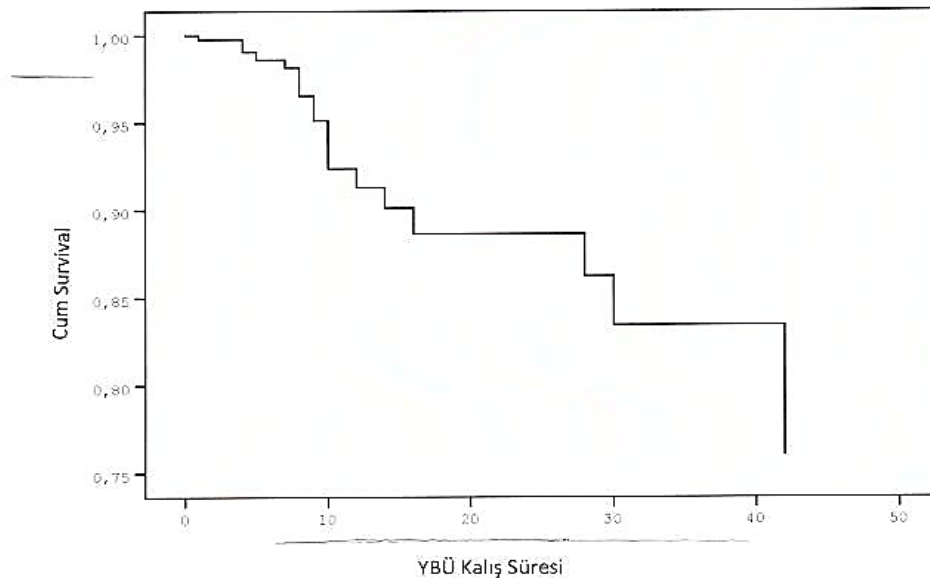
It was found that mortality in trauma patients did not differ according to gender and age. It was found that the 28-days-mortality was higher in patients who needed hemodialysis ( $p = 0.046$ ), who were intubated ( $p < 0.001$ ), and who fed parenterally ( $0.017$ ). The median values of patients who died in 28-days had higher SAPS II ( $p < 0.001$ ), ICU residence time ( $p = 0.009$ ), mechanical ventilation time ( $p < 0.001$ ), creatinine ( $p < 0.001$ ), glucose ( $p < 0.001$ ), revised trauma scores ( $p < 0.001$ ), and albumin ( $p < 0.001$ ) was found to be significantly lower in patients who died in 28 days (Table 2).

**Table 2.** Distribution Of The Characteristics And Clinical Features Of The Patients At The Time Of Admission According To 28-Days-Mortality

	28-days-mortality		p
	Survived n (%)	Death n (%)	
<b>Gender**</b>			
Male	79 (84.0)	15 (16.0)	1.000
Female	26 (86.7)	4 (13.3)	
<b>Need of hemodialysis**</b>			
Present	102 (86.4)	16 (13.6)	0.046
Absent	3 (50.0)	3 (50.0)	
<b>Intubation**</b>			
Present	67 (97.1)	2 (2.9)	<0.001
Absent	38 (69.1)	17 (30.9)	
<b>Nutrition**</b>			
Enteral	57 (91.9)	5 (8.1)	0.017
Parenteral	37 (75.5)	12 (24.5)	
	<b>Medyan (min-max)</b>	<b>Medyan (min-max)</b>	<b>P</b>
<b>Age*</b>	43 (14-90)	51 (17-83)	0.700
<b>SAPS II*</b>	22.50 (8-96)	68 (30-86)	<0.001
<b>GCS*</b>	14.5 (3-15)	6 (3-13)	<0.001
<b>Trauma score*</b>	6 (5-8)	2 (1-4)	<0.001
<b>ICU stay* (days)</b>	5 (1-72)	9 (1-42)	0.009
<b>Mechanical ventilation* (days)</b>	0 (0-72)	8 (0-42)	<0.001
<b>Creatinine*, mg/dL</b>	0.98 (0.00-2.50)	1.77 (0.80-7.9)	<0.001
<b>Albumin*, g/dL</b>	3.50 (1.9-5.0)	2.80 (1.1-4.1)	<0.001
<b>Glucose*, mmol/L</b>	144.50 (65-380)	189 (121-320)	<0.001

\*Mann Whitney U and chi-square, GCS: Glasgow Coma Scale, SAPS 2: Simplified Acute Physiology Score 2, ICU: Intensive Care Unit, CRP: C-Reactive Protein

The median survival time of the patients in the study group was 42.00 (33.64-54.32) days. (Figure 1).



**Figure 1.** Overall Survival of Patients

It was found that the overall survival time in patients hospitalized in the intensive care unit due to trauma did not differ significantly according to gender ( $p = 0.869$ ), hemodialysis requirement ( $p = 0.189$ ), and nutritional status ( $p = 0.232$ ) (Table 3).

**Table 3.** Overall Survival Results (Kaplan-Meier Method, Log-Rank Test)

	n	Exitus	Mean	Standard error	%95 Interval Lower	Confidence Upper	p
<b>Overall survival</b>	124	19	42.00	5.28	33.64	54.32	N/A
<b>Gender</b>							
Female	30	4	39.68	8.16	23.68	55.67	0.869
Male	94	15	44.71	5.98	32.99	56.42	
<b>Need of hemodialysis</b>							
Present	118	16	40.45	4.59	31.45	49.46	0.189
Absent	6	3	34.63	14.17	6.85	62.40	
<b>Nutrition</b>							
Enteral	62	5	52.55	7.51	37.82	67.27	0.237
Parenteral	49	17	31.38	4.04	23.47	39.28	

As a result of Cox Regression Analysis, CRP ( $p = 0.023$ ), Albumin ( $p = 0.002$ ) and GKS ( $p = 0.013$ ) were found to be associated with 28-day mortality ( $p = 1.000$ ) (Table 4).

**Table 4.** Cox Regression Model For Overall Survival

	$\beta$ Coefficient	Standard error	Wald	p	Exp ( $\beta$ )	Confidence Interval	
						Lower	Upper
<b>Albumin</b>	-1.170	0.385	9.254	0.002	0.310	0.146	0.660
<b>GCS</b>	-0.177	0.071	6.125	0.013	0.838	0.728	0.964

GCS: Glasgow Coma Scale, SAPS 2: Simplified Acute Physiology Score 2, ICU: Intensive Care Unit, CRP: C-Reactive Protein

#### 4. DISCUSSION

In intensive care patients, mortality may vary according to age, gender, pre-trauma health status, the severity of the injury, and response to treatment. The mortality rate of patients with trauma varies between 15-40% according to the studies until this time (7). In this study, the mortality rate was determined as 15.3% in parallel with the literature.

When the demographic data of trauma patients are examined, it is seen that the male gender is in the majority (8). In our study, 75.8% of patients are male. Similarly, (9) defined 71% of patients as male and 28% as females in their study on 80544 trauma cases.

In many studies, although the age factor was found to be among the significant factors affecting mortality, it was not found statistically significant in our study. It was thought that the age factor was not statistically significant since the mean age of both groups was very close. Of the patients included in our study, the average age of 44.7 was documented.

Evaluation of trauma patients is made using several trauma scores. Scoring systems are classified into physiologic, anatomic, and combined anatomic with physiologic (10). The revised trauma score (RTS) is a physiologic-based triage score. The RTS has three variables, respiratory rate, systolic blood pressure, and GCS. In this study, it was found that there was a statistically significant difference between low RTS and increased mortality. (11), also reported RTS statistically significant difference between low RTS and increased mortality. Similarly, (12) analyzed 1276 death trauma patients between 1995 and 2000 and showed that RTS could be used to predict mortality in trauma patients. RTS includes the GCS. Therefore, if there is any head injury, this scoring system can be used for better assessment. However, if there is no significant head trauma, RTS prediction can be decreased for the prediction of survival. In our study, in parallel with the literature, RTS were found to be significantly lower. However, the presence of head trauma in most of the patients followed up contributed to this result. The increase in respiratory rate due to pain and respiratory distress in thoracic traumas confirms the power of rts to predict mortality.

SAPS II systems are based on multiple logistic regression equations that describe abnormalities in multiple physiologic variables during the first 24 hrs in the ICU because many deaths occur soon after admission (13), (14) showed SAPS II predictive implications for ICU death. When the present study SAPS II scoring of those who died within 28 days was calculated, the median values were found to be significantly higher (13) defined SAPS II had an excellent ability to discriminate between survivors and non-survivors. The GCS used both in calculating RTS and in SAPS II are essential in patient follow-up, especially in the presence of head trauma. GCS, developed by Jennett and Bond, is used to evaluate the neurological status of the patient and cerebral dysfunction in multiple traumas associated with head trauma (15). Low GCS values are associated with increased mortality. In our study, it was found that there was a statistically significant difference between low GCS and increased mortality. (16) also found that GCS is clinical variability of which statistically significant relationship to acquaint abnormal CT findings.

In the study, the mean duration of stay in ICU was  $9.98 \pm 12.55$  days. (17) The average length of stay ICU in 143 patients were reported to be 8.6 days. As patients' intensive care unit stay increases, the risk of infection increases, and at the same time, the duration of stay and mortality increases in patients who develop infections (18). However, in this study, we found

that the period of intensive care stay of trauma patients did not affect 28 days of mortality of the patients. We believe that the complications caused by prolonged hospitalization time in multiple trauma do not affect on 28 days of the death, even if the duration of hospitalization is prolonged thanks to the prevention of early complications such as early enteral feeding, the implementation of ventilator-related pneumonia preventive protocols, early appropriate antibiotherapy and appropriate follow-up.

We followed to evaluate the nutritional status of the trauma patients, parenteral nutrition was chosen which does not tolerate the enteral feeding route or has contraindications, and we found that feeding patients parenterally was found to be high with a 28-day mortality rate. When we look at the literature, in support of this, in the latest European Clinical Nutrition and Metabolism Guidelines, the recommendation level is to apply nutrition to all patients who are not expected to start full-dose nutrition within three days, and all critical patients who are hemodynamically stable and have gastrointestinal system functions as possible by the expert committee (19). Sufficient early (<24 hours) feeding was recommended.

Serum glucose regulation is as important as nutritional status of patients. (20). Recent randomized prospective data suggests that early hyperglycemia is associated with excess mortality in critically ill patients, and tight glucose control leads to improved outcomes in a prospective randomized and controlled study of including 1548 patients. It was concluded that intensive insulin therapy reduces mortality and morbidity in patients admitted to the surgical intensive care unit. (21) investigated the different relationship levels of early blood glucose elevation to outcome in a trauma ICU population they concluded early hyperglycemia as defined by glucose  $>$  or  $=$  200mg/dl are associated with significantly higher infection and mortality rates in trauma patient independent of injury characteristics. In our study, it was shown that the mortality rate of the group with high blood glucose levels (200 mg/dl over) is higher in inpatient admission in ICU.

Hypoalbuminaemia is a predictor of increased mortality and morbidity in ICU patients (22). By looking at all the studies about albumin in literature in 16 years, Goldwasser and Feldman evaluated ten studies that have the maximum number of participants (minimum 609, maximum 17,440 patients). They found that the rate of mortality's highness and level serum albumin's lowness is the same. A reduction in serum albumin concentration of 2.5 g / dL has been reported to increase the probability of death by 24-56% (23). A significant association between low albumin levels and mortality was also shown in our study. Besides, this study, mortality rates were significantly higher in patients with high serum creatinine levels. We evaluated the increase in serum creatinine as trauma-induced acute kidney injury (AKI). AKI is a clinical diagnosis guided by standard criteria based on changes in serum creatinine, urine output, or both. The severity of AKI is determined by the magnitude of the increase in serum creatinine or a decrease in urine output (24). The presence of AKI is associated with increased morbidity and mortality (25). Our study was compatible with literature knowledge. Six patients who were in this study (4.8%) needed hemodialysis. Post-traumatic AKI might be prevented by resuscitating patients aggressively in an early phase and avoiding prolonged untreated shock. Nevertheless, more evidence is required to support this observation.

## 5. CONCLUSION

In our study, we aimed to evaluate as many parameters as possible. We examined the predictive power of the most frequently used biochemical parameters and various scores on mortality while evaluating the trauma patients who were followed up.

Summary, it was shown that serum glucose, albumin, creatinine and GCS, RTS, and SAPS II scores could be correlated with mortality rates. Especially, we thought that RTS could be effective in predicting mortality in patients with both head and chest trauma since it includes both GCS and respiratory rate. However, we think that further studies are needed on the factors predicting mortality in trauma patients.

### Ethical Consideration of the Study

The study started after obtaining approval from Dumlupınar University, Faculty of Medicine Ethics Committee. (Approval No: 2018-2/9)

### Conflict of Interest

None declared.

### Financial Disclosure

The authors declared that this study has received no financial support.

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