Original Article

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Mortality Rate In Intensive Care Units of Tertiary Health Institutions and Identifying Risk Factors: Analysis of 3945 Patients

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ABSTRACT

Objective: To evaluate demographic data of patients hospitalized in the intensive care unit (ICU) of a tertiary health institution and to reveal demographic and laboratory parameters associated with mortality.

Methods: Between January 2008 and 2013, patients who were hospitalized in our clinic were retrospectively analyzed. During the evaluation, the demographic characteristics of patients; creatinine, urea, uric acid, albumin, LDH, ALT, AST, sodium, and hemoglobin levels; hematocrit; and white blood cell and platelet counts were assessed. The patients were then divided into two groups according to those who died and those transferred to a service.

Results: Between January 2008 and 2013, a total of 3945 patients were enrolled. In patients who died in the ICU, the average age, presence of an operation history, and hospitalization time in the ICU were statistically significant. After the evaluation, laboratory parameters including urea, creatinine, uric acid, and LDH levels and white blood cell count were significantly higher in patients who died in the ICU than in those who were transferred to a relevant service as healthy patients. Further, serum albumin, and hemoglobin levels; hematocrit; and platelet count were significantly lower in patients who died.

Conclusion: In elderly patients, the presence of am operation history and elevated urea, creatinine, uric acid, and LDH levels and white blood cell counts and decreased albumin and hemoglobin levels; platelet counts; and hematocrit were significantly associated with higher mortality rates in the ICU.

Keywords: Creatinine, Intensive Care Unit, thrombocytopenia, mortality, demographics

Introduction

Intensive care units (ICU) are special units in which patients with life-threatening health problems are followed and treated, and support units are used when necessary for the maintenance of life functions (1). The need for an ICU increases as the population rises worldwide and the number of elderly people having comorbidities increases. Since the treatment is expensive and the number of beds is limited, the patients who may benefit from the intensive care hospitalization should be chosen cautiously. Moreover, determining the factors that increase the rate of mortality in patients hospitalized in the ICU will decrease mortality.

When the studies in literature are considered, mortality rates of patients in the ICU vary between 20.5% and 43%, and the most common causes of death are sepsis, cardiopulmonary arrest, pneumonia, and arrhythmias (2). Moreover, as ICU patients are generally old and have weakened immune system, their mortality rates increase. Additionally, performing invasive procedures frequently for patients in ICU, close contact of patients with the health staff, unnatural nutrition of patients, and abnormalities of their blood parameters attract attention as the most important factors that increase mortality (3).

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In this study, we aimed to investigate the clinical characteristics of the patients treated in intensive care unit in our hospital, the mortality effects of the patients' intensive care unit parameters and the mortality rates in patients.

Methods

After obtaining local ethical committee approval, the files of patients who were hospitalized in the ICU of our hospital between January 2008 and January 2013 were searched retrospectively. Only the patients who were treated in the ICU of our hospital and discharged or were exitus were included in the study. Patients who were sent to other centers during their treatment and those who were sent to our hospital to continue their treatment were excluded from the study. Also, the patients whose files could not be accessed were excluded from the study.

While the files of the patients were examined, the clinical parameters of patient demographic characteristics, primary intensive care hospitalization diagnosis group, indication for intensive care hospitalization, comorbid diseases, need for mechanical ventilation and duration, re-intubation, ICU hospitalization duration, and ICU mortality were evaluated over the data processing system of the hospital. Moreover, patients' laboratory values of creatinine, urea, uric acid, albumin, lactate dehydrogenase (LDH), aspartate transaminase (AST), alanine transaminase (ALT), sodium, hematocrit, hemoglobin, white blood cell count, and thrombocyte count at the time of their hospitalization were examined. The patients were divided into two groups as those who were referred to the related service in a healthy state from ICU and those who were exitus. These two groups were compared in terms of demographic data and laboratory parameters.

Statistical Analysis

Descriptive statistics were expressed according to the data type as mean, standard deviation (SD), median (interquartile range), and percentage. The factors affecting ICU hospitalization duration and mortality were tested using regression analysis. Mann–Whitney U, Chi square, t- tests were used according to the data type for comparison between the groups. The Statistical Package for Social Sciences 18.0 version (SPSS Inc; Chicago, IL, US) program was used for statistical analysis and a p value of <0.05 was accepted as statistically significant.

Results

After excluding the patients not conforming with the study criteria, a total of 3945 patients, 2194 males and 1751 females, receiving treatment in our hospital ICU between January 2008 and January 2013 were included. The mean age of the patients was 61.6 years. Of these patients, 1905 (48.4%) were transferred to the ICU after surgery. Hemodynamic stability, respiratory failure, and change in mental state were detected as the most common hospitalization indications. Of the patients hospitalized in the ICU, 19.5% had a disease relating to more than one system, followed by nervous system diseases, cerebrovascular accidents, gastrointestinal disorders, and respiratory system diseases. The mean hospitalization durations in the ICU were 10.2±25.2 days (range, 0-418 days). The mortality rate was 32.5% (Table 1).

The mean age of patients who were exitus in the follow-up showed a high statistical significance compared to those who had recovered and were discharged (p<0,001). Moreover, both the groups displayed no difference in terms of gender. Also, the rate of undergoing an operation and duration of hospitalization in the ICU were significantly higher in the exitus patients. Similarly, the incidence of a disease related to more than one system was higher in the exitus patients (p<0.001; Table 2).

When laboratory parameters were evaluated, the mean urea, creatinine, uric acid, LDH, and white blood cell values of the

Table 1. Demographic characteristics of the patients hospitalized in the ICU

Demographic data		Number (n, %)
Age, years		61.6±18.9 (1-10)
Gender	Male	2194 (55.6)
	Female	1751 (44.4)
Unit	Emergency intensive care and reanimation	1494 (39.7)
	H. Intensive Care and Reanimation	2451 (62.1)
Operation	None	2029 (51.6)
	Yes	1905 (48.4)
Duration of hospitalization		10.2±25.2 (0-418)
Result	Recovery	2662 (67.5)
	Exitus	1283 (32.5)
Comorbid diseases (such as DM+HT, etc. and vasculitis included)		768 (%19.5)
Nervous system and cerebrovascular diseases		663 (%16.9)
Gastrointestinal system		512 (%13)
Respiratory system		373 (%9.5)
Cardiovascular system		356 (%9.1)
Urogenital system		340 (%8.6)
Musculoskeletal disorders (orthopedical post-ops, etc.)		268 (%6.8)
Hepatobiliary system		145 (%3.7)
Endocrine and metabolic system		145 (%3.7)
hematopoietic system		89 (%2.3)
Infection diseases		82 (%2.1)
Others (traumas, traffic accidents, intoxication, firearm, drowning in water, and genetic diseases)		192 (%4.9)

ICU: intensive care unit, n: number, H: Haseki Training and Research Hospital, DM: diabetes mellitus, HT: hypertension

Table 2. Comparison of demographic characteristics of the patients who were exitus and discharged patients to their services

		Exitus (n, %)	Recovered (n, %)	p
Age. years		63.8±18.4 (1-101)	60.5±19.0 (1-99)	<0.001
Gender	Male	735 (57.3)	1459 (54.8)	0.142
	Female	548 (42.7)	1203 (45.2)	
Unit	Emergency intensive care and reanimation	566 (44.1)	928 (34.9)	<0.001
	H. Intensive Care and Reanimation	717 (55.9)	1734 (65.1)	
Operation	None	992 (77.4)	1037 (39.1)	<0.001
	Yes	289 (22.6)	1616 (60.9)	
Duration of hospitalization		17.7±33.4	6.6±19.1	<0.001
Comorbid diseases		372 (%29.1)	396 (%14.9)	<0.001
Nervous system and cerebrovascular diseases		230 (%18.0)	433 (%16.3)	
Gastrointestinal system		116 (%9.1)	396 (%14.9)	
Respiratory system		95 (%7.4)	278 (%10.5)	
Cardiovascular system		174 (%13.6)	182 (%6.9)	
Urogenital system		54 (%4.2)	286 (%10.8)	
Musculoskeletal disorders		25 (%2.0)	243 (%9.2)	
Hepatobiliary system		34 (%2.7)	111 (%4.2)	
Endocrine-metabolic system		31 (%2.4)	114 (%4.3)	
Hematopoietic system		45 (%3.5)	44 (%1.7)	
Infection diseases		43 (%3.4)	39 (%1.5)	
Others		60 (%4.7)	132 (5)	

N: number. H: Haseki Training and Research Hospital

Table 3. Comparison of demographic characteristics of the patients who were exitus and discharged patients to their services

Serum parameters	Exitus	Recovered	p
Urea	82.5±66.8	55.1±48.0	<0.001
Creatinine	2.2±2.4	1.4±1.6	<0.001
Uric acid	6.0±3.1	4.2±2.5	0.018
Albumin	2.6±0.7	2.8±0.7	<0.001
LDH	574.3±1297.8	467±811.3	0.011
AST	167.8±593.9	149.0±586.0	0.195
ALT	125.7±342.6	108.4±333.7	0.111
Sodium	138.5±7.9	137.9±5.2	0.253
Hematocrit	32.9±7.6	33.7±6.8	<0.001
Hemoglobin	10.8±2.5	11.1±2.3	<0.001
Thrombocyte	228.9±131.5	244.4±130.0	<0.001
White blood cell	14.3±10.8	13.1±7.2	0.021

LDH; lactate dehydrogenase, AST; aspartate transaminase, ALT; alanine transaminase

exitus patients were statistically higher than those of patients who had recovered and were discharged (p<0,001). Moreover, the mean serum albumin, hematocrit, hemoglobin, and thrombocyte values in the exitus patients' group were significantly low (p<0.001). Both groups displayed no significant difference in terms of sodium, AST, and ALT (Table 3).

Discussion

It is known that ICUs are departments in which mortality rates are the highest (2-4). Knowing the factors that affect mortality is quite important for the physicians working at the ICU in comprehending the severity of the disease and taking necessary precautions. Recently, for the evaluation of patients hospitalized in the ICU, scoring systems, such as Acute Physiology and Chronic Health Evaluation (APACHE), Mortality Prediction Model (MPM), Multiple Organ Dysfunction Score (MODS), and Sequential Organ Failure Assessment Score (SOFA) are used. The scores using physiologic measurements display parallelism with prognosis and the mortality risk of the disease (5). We also examined the demographic data and laboratory parameters of the patients, which may affect the mortality in ICU.

The total mortality rate of the patients followed up in the ICU was 32.5% and this rate was similar with other studies in literature (2, 3). When the units where the patients were

hospitalized were evaluated, it was detected that the mortality rate in the emergency ICU was significantly higher than that in the general ICU (p<0,001). The frequency of an operation was higher in the medical histories of exitus patients compared to those discharged with complete recovery (p<0.001). We attribute this result to the fact that the ICU need of patients hospitalized in general clinics can be predicted and these patients can be transferred to the ICU after a faster intervention.

The age of the patient is considered a factor affecting mortality rates in ICU, similar to other studies. In the study conducted by Furchs et al., it was suggested that the mortality increased over the age of 75 years and that age was an independent risk factor in determining mortality (7, 8). In our study, the mean age of patients who were exitus was statistically higher than that of patients who were discharged from the hospital with complete recovery (p<0.001).

The hospitalization duration in ICUs is relatively important since the bed availability of ICUs is limited. In the study conducted by Sticker et al. (9), it was reported that only 11% of the patients stayed more than 1 week in the ICU. Furthermore, Fakhry suggested that functional recoveries of the patients staying more than 2 weeks in the ICU were less than 50% and less than one-half of these patients could return to their normal lives (10). Additionally, some studies have shown that the patient mortality can reach up to 50% in hospitalizations longer than 2 weeks in the ICU (11). In this study, while the duration of hospitalization of the patients who were exitus was 17.7±33.4, it was detected as 6.6±19.1 in those who were discharged with complete recovery, with a statistically significant difference (p<0,001).

In our study, low levels of albumin, hematocrit, hemoglobin, and thrombocytes were more common in the exitus group. A higher frequency of comorbid diseases in this patient group may be one of the reasons explaining this situation. Liver diseases and kidney diseases leading to protein leakage may cause hypoalbuminemia. Moreover, systemic diseases impair blood cell formation by suppressing bone marrow with the stress they create (12). Additionally, multiple drug use by patients having many comorbid diseases can suppress bone marrow (13).

Previous or newly occurring renal damage in the patients admitted to the ICU affect the mortality rates of patients. Fluid loss appearing in these patients, hypotension, sepsis, and rhabdomyolysis cause renal damage. Moreover, acute renal damage or deterioration of renal functions of the patients also increases mortality (14). In our study, the laboratory parameters, such as urea, creatinine, and uric acid, were significantly high in the ICU exitus patients (p<0,001).

There are important deficiencies of our study although it was conducted in a tertiary health care center with a high patient load. Retrospective design of the patient is one of them. Lack of scoring system usage during the evaluation of patients is one of the limitations of the study. At the same time, grouping the comorbid diseases only under the name of systemic diseases and not using scoring systems for indicating their severity can be accepted as weaknesses of the study.

Our study has shown that age, surgical history, and multiple-system comorbid disease increase the mortality rate. Moreover, urea, creatinine, uric acid, and elevated white blood cell count as laboratory parameters along with albumin, hematocrit, and low level of thrombocyte are linked with mortality significantly.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Haseki Training and Research Hospital.

Informed Consent: Written informed consent was not obtained from patients due to the retrospective design of study.

Peer-review: Externally peer-reviewed.

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