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ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA

Factors affecting mortality in patients with multitrauma which were treated in intensive care unit

Yoğun bakım biriminde izlenen çoklu travma hastalarında mortaliteye etki eden faktörler

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ABSTRACT

Objective: The aim of this study was to evaluate multiple trauma patients hospitalized in intensive care unit (ICU) of an emergency department at a university hospital.

Methods: The study was performed between January 2006 and January 2009 with 138 patients in the emergency intensive care unit. Those patients who die within 6 hours after trauma and the patients with chronic renal failure, chronic liver failure, chronic heart failure and metastatic cancers were excluded to this study. Trauma etiology, duration of intensive care and mechanical ventilation, support therapies, trauma scores and mortality rates were determined. Data were evaluated by statistical methods.

Results: The mean age of the patients was 31±21.8 (range 1-80) years. Of these patients, 112 (81.2%) were male and 26 (18.8%) were female. The most common etiologies of multitrauma were car occupant's accidents (40.6%) and pedestrian's accidents (37%). Mean length of stay at mechanical ventilation and length of stay in ICU were 2.2 days (0-30 days) and 5.3 days (1-30 days), respectively. Totally 56 (43.5%) patients were ventilated mechanically, 34 (26.4%) patients received nutritional support and 22 (14.5%) were given inotropic agents. Mortality rate of these papatients were 50%, 44.1% and 77.7% respectively. The multitrauma patients, who mechanically ventilated, supported by inotropic and nutritional therapy had higher mortality rate than other patients.

Conclusion: The most common cause of multitrauma injuries were motor vehicle accidents, especially for young males. Trauma scores at admission, complications related to mechanical ventilation, inotropic and nutritional support therapies affected to morbidity and mortality in ICU trauma centers.

Key words: Emergency departments, multitrauma, intensive care unit

ÖZET

Amaç: Bu çalışmanın amacı, bir üniversite hastanesinin acil yoğun bakım biriminde takip edilen çoklu travma hastalarının değerlendirilmesidir.

Yöntemler: Çalışmaya Ocak 2006- Ocak 2009 tarihleri arasında fakültemizin acil yoğun bakım biriminde takip edilen çoklu travma hastaları alındı. Travma sonrası ilk altı saat içinde hayatını kaybedenler, kronik böbrek yetmezliği, kronik karaciğer hastalığı, konjestif kalp yetersizliği ve metastatik kanser hastaları çalışma dışı bırakıldı. Travmanın nedeni, yoğun bakım ve mekanik ventilatörlerde kalış süreleri, aldığı destek tedaviler, travma skorları ve mortalite oranları belirlendi. Elde edilen bulgular istatistiksel olarak değerlendirildi.

Bulgular: Çalışmaya alınan hastaların yaş ortalaması 31±21.82 (aralık 1-80) yıl idi. Hastaların 112'si (%81.2) erkek 26'sı (%18.8) kadın idi. Çoklu travmanın en sık nedenleri araç içi trafik kazaları (%40.6) ve araç dışı trafik kazaları (%37) idi. Ortalama yoğun bakımda ve mekanik ventilatörde kalış süreleri sırasıyla 5.3 gün (1-30 gün) ve 2.2 gün (0- 30 gün) idi. Hastalardan 56'sı (%43.5) mekanik ventilatör desteği alırken, 34 (%26.4) hastanın beslenme desteği aldığı ve 22 (%14.5) hastanın inotrop desteği aldığı belirlenmiştir. Bu hastaların mortalite oranları sırasıyla %50, %44.1 and %77.7 idi. Mekanik ventilasyondaki, inotrop ve beslenme desteği alan çoklu travma hastalarındaki mortalite oranları tüm hastalardaki mortalite oranlarından yüksek bulunmuştur.

Sonuç: Çoklu travma yaralanmalarının en sık nedeni motorlu araç kazaları olup, özellikle genç erkekleri etkilemektedir. Hastaların mekanik ventilasyon, inotrop ve beslenme desteği ile ilgili komplikasyonlar travma yoğun bakım merkezlerindeki ölüm ve sakatlıklar üzerinde etkili olmaktadır.

Anahtar kelimeler: Acil servis, çoklu travma, yoğun bakım ünitesi

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INTRODUCTION

Traumatic injuries are the most frequent causes of referral to emergency departments and they often cause various disabilities or death, particularly in young individuals. Approximately 10% of all deaths are estimated as being due to injuries and in 1990, approximately 5 million deaths were thought to be associated with traumatic injuries, with a corresponding figure of 8,4 million individuals estimated for 2020 [1]. According to the statistics of the year 2000 in the United States, a total of 14,113 deaths due to accidents were determined among individuals between 15 and 25 years of age related to various causes: 73% of these fatal cases were due to motor vehicle accidents, while 6% of deaths due to all causes and 8% of all patients discharged from hospitals constitute similar cases involved in motor vehicle accidents [2]. Fatal injuries are regarded as a major public health issue, both in terms of economic and social aspects, while traumatic injuries cause substantial problems due to disabilities [3].

Multitrauma is a structural tissue damage caused by the impact of kinetic, thermal or chemical energy on tissues, leading to injuries in more than one body region or system. The human body is divided into four major regions, namely, the head-face-neck, the thorax, the abdomen and the extremities. Presence of trauma in at least two of these regions is described as multitrauma [4]. Injuries limited to these body regions are classified as local injuries as long as they are confined to specific regions. In this article, various clinical and demographic data thought to be relevant in terms of disabilities and deaths among multitrauma patients, have been evaluated.

METHOD

In the context of this article, multitrauma patients in all age groups who were followed up in the intensive care unit of the emergency department at a university hospital between January 2006 and January 2009 were evaluated retrospectively. The study was conducted upon approval of the Local Ethical Committee. The data of the enrolled patients were obtained by evaluating the hospital computer records, observation of the records of nurses and the discharge forms completed by physicians.

Patients who died within the first six hours of trauma, patients with chronic renal failure, chronic liver disease, chronic heart failure and metastatic cancers, and trauma patients with inaccessible records were excluded from the study. The Glasgow Coma Scales (GCS) of patients were calculated according to the values prior to intervention in resuscitated patients, and in cases where surgical intervention was performed, GCS was calculated according to pre-intervention values, whereas in the remaining patients, the values on admission to the intensive care unit was accepted as the basis for GCS. Age, gender, type of trauma, GCS, Revised Trauma Score (RTS), Abbreviated Injury Scale (AIS) and Injury Severity Score (ISS) values on admission, requirement for mechanical ventilation, duration of mechanical ventilation, nutritional support, treatment with inotropic support, Systemic Inflammatory Response Syndrome (SIRS), sepsis, development of clinical Multiple Organ Failure (MOF), length of stay at the intensive care unit and clinical outcome in all patients were investigated retrospectively. Invasive procedures such as tracheostomy, intubation, tube thoracostomy and central venous catheterization and use of erythrocyte suspension, which are thought to be associated with death and disabilities, were recorded in all multitrauma patients.

The SPSS 13.0® Microsoft for Windows program was used for the descriptive statistical analysis of all evaluated parameters, and the statistical data were obtained by the Pearson correlation analysis. P values below 0.05 were accepted as significant.

RESULTS

In the context of this study, a total of 146 patients with multitrauma were retrospectively evaluated. Three patients were excluded due to incomplete data in files while four patients were excluded due to death within the first six hours of admission to the intensive care, in addition to one chronic renal failure patient. The mean age of 138 patients who were enrolled in the work was determined as 31±21 (1-80); 18.8% of the patients (n:26) were women, while 81.2% (n:112) were men. The mean length of stay in the hospital was 5.3±11 (1-30 days) with a median of 3 days and no statistically significant correlation was found between the length of stay and the mortality rates (p=0.053). While 26.8% of the

patients (n:37) died, 58% (n:80) were transferred to other departments, and 15.2% (n:21) were discharged from emergency intensive care unit. The distribution of the patients in terms of etiology of trauma and mortality rates has been presented in Table 1.

Table 1. The distribution of trauma and mortality rates

Etiology of trauma	Enrolled patients n (%)	Mortality rates n (%)
Fall from a height	13 (9.4)	6 (46.1)
Pedestrians accidents	56 (40.6)	17 (30.3)
Car occupants accidents	51 (37)	9 (17.6)
Motorcycle accident	8 (5.8)	4 (50)
Penetrating-cutting injuries	2 (1.4)	1 (50)
Gunshot injuries	5 (3.6)	0 (0)
Electrical injuries	3 (2.2)	0 (0)
Total	138 (100%)	37 (26.8%)

Red blood cell suspension was administered in 50% of the patients. The mortality rate for the red blood cell suspension group was observed to be 43.7%. The invasive interventions performed in patients admitted to the emergency intensive care and the mortality rates in this patient group have been displayed in Table 2.

Table 2. The invasive interventions performed in patients and the mortality rates

Performed interventions	Enrolled patients n (%)	Mortality rates n (%)
Intubation	69 (50)	36 (52.1)
Tracheostomy	8 (6.1)	5 (62.5)
Central venous catheterization	63 (45.7)	32(50.7)
Tube thoracostomy	41 (29.7)	26(63.4)

Evaluation of the affected body region in multitrauma patients revealed a rate of 83.3% for the head-neck region, 76% for the extremities, 50% for the thorax, and 17.4% for the abdominal region. The mean GCS value in all patients was 9.8, while the mean RTS value was 5.8; on the other hand, the mean GCS in patients in whom mortality was seen was determined as 5.1 and the mean RTS value was determined as 3.9 among fatal cases. Among patients with ISS scores between 0 and 14, the mortality rate was found to be 5.2%, while the mortality was 30.8% in patients with scores between 15 and 66, and as 100% among patients with scores between 66 and 75.

The rate of development of MOF among patients was 21.1% (n=27) with a fatal outcome in 55.5% of these patients. The rate of sepsis in the patients was 20.3% (n=26) with a fatal outcome in 46.1%. The rate of SIRS among the enrolled patients was 71.9% (n=98), while the mortality rate in this group was determined as 34.7%. The mean length of remaining on mechanical ventilation among patients admitted to the emergency intensive care was determined as 2.2±4.7 (1- 30 days) days; the rate of supportive treatment and the mortality rates in this group have been presented in Table 3.

Table 3. The rate of supportive treatment and the mortality rates in patients

Supportive treatments	Enrolled patients n (%)	Mortality rates n (%)
Mechanical ventilation <3 days	23 (18.2)	11 (47.8)
Mechanical ventilation >3 days	33 (25.3)	17 (51.5)
Nutritional support	34 (26.4)	15 (44.1)
Inotropic support	27 (19.5)	16 (59.2)

The requirements for mechanical ventilation, inotropic support and nutritional support in cases discharged or transferred to other departments and in patients with a fatal outcome have been presented in Table 4.

Table 4. The requirement of supportive treatments in patients with regard to their clinical outcomes (n:138)

Clinical outcomes	Mechanical ventilation n (%)	Inotropic support n (%)	Nutritional support n (%)
Discharged patients (n:21)	6 (28.6)	3 (14.3)	5 (33.6)
Transferred to other departments (n:80)	17 (21.2)	8 (10)	19 (23.7)
Fatal outcomes (n:37)	33 (89.9)	16 (43.2)	15 (42.2)

In the discharged patients, the mean GCS value was 11.8, the mean RTS value was 6.3±1.2, the mean length of stay at the hospital was 6.2±5 days and the mean length of stay on mechanical ventilation was 2.8±6.8 days. Among patients transferred to other departments, the mean GCS value was determined as 9.2, mean; the RTS value was 6.6±1.1, the mean length of stay at the hospital was 4±4.9 days and the mean length of stay on mechanical ventilation was 1.2±3.4 days. In patients with a fatal outcome, the mean GCS value was determined as 5.1, the mean RTS value was 3.7±2, the mean length of hospitalization was 4.62±5.2 days, and the mean length of mechanical ventilation was 3.9±5.3 days.

DISCUSSION

Individuals with multitrauma constitute a patient group with variable clinical courses and a high complication rate, who should be treated and followed-up in intensive care units. Therefore, both the medical and the social aspects of trauma should be carefully handled [5]. The mean age of patients was determined as 31±21 years and the rate of cases in men were found to be higher than that in women. Considering all the patients, the mean length of hospital stay was found to be 5.3 days and the patients with the shortest duration of hospitalization was the group transferred to the other departments in four days. Since a number of departments are involved in the management of multitrauma patients, they had to be followed up for a longer duration at the intensive care unit.

Among patients with invasive interventions or blood transfusions, the rates of mortality, coagulopathy and sepsis were found to be significantly increased [6]. Invasive interventions and blood transfusions are generally performed in patients with poor general health and trauma scores. Furthermore, it is known that blood transfusions and coagulopathy have a negative impact on cellular immunity [6,7]. Hence, it can be stated that the increase in the rates of mortality and sepsis among patients with invasive interventions and blood transfusions may be due to these factors.

In addition to the intensive care scoring systems, various trauma scoring systems have been utilized in the evaluation of multitrauma patients. The general health status of the patient determined by these scoring systems forms the basis of treatment protocols and mortality predictions. The GCS was used in the neurological evaluation of the patient and in the evaluation of cerebral functions in patients with multitrauma including head injuries [8]. GCS is a rapid, detailed and simple scoring system, which requires no additional examinations; hence, it is frequently used in trauma patients as a scoring system. As indicated in a number of trials, it has been known for long that low GCS values are associated with increased mortality [9]. The results of the current article showed a statistically significant and inverse correlation between GCS scores and mortality. Zhao XJ et al. [10] enrolled 3361 patients with multitrauma and coma in their retrospective article conducted in 2007. The investigators concluded that, just as GCS values, RTS values were also very closely related to mortality and that these scoring systems played a key role in efficient and rapid management of trauma [10]. In a study conducted by Algimantas Pamerneckas et al. in 2006 on 109 patients, they demonstrated that ISS was a significant factor in mortality [11] and the presented study was consistent with the literature.

As the requirement for intensive care increases in multitrauma patients, pathologies and clinical states such as SIRS, sepsis and MOF develop more frequently. Furthermore, mechanical ventilation is one of the factors which predispose multitrauma patients to SIRS, sepsis and MOF and hence, have a direct effect on mortality. On the other hand, mechanical ventilation is frequently required in the management of these clinical manifestations. All of these clinical states are major factors with a direct effect on mortality and success of treatment among the patients [12,13].

In a number of trials conducted on multitrauma patients, the rates of SIRS, sepsis, MOF and mortality were reported to have increased, parallel to the length of stay in intensive care [14]. According to the results of the current study, the impact of the length of stay in intensive care on SIRS, sepsis, MOF and mortality is consistent with the data provided in the literature [15]. Prolongation of the length of stay in intensive care may lead to prolonged mechanical ventilation or frequent development of Ventilator-associated pneumonia or nosocomial infections. Therefore, the length of stay in intensive care is considered to be a facilitating factor for SIRS, sepsis and MOF. Review of the literature has revealed that during the evaluation of multitrauma patients, sepsis and related clinical states and cases with single, double or multiple organ failures should be determined separately from the initial clinical state of the patients on admission [16]. No significant correlation was found between the nutritional support provided and mortality. These data are in compliance with the results of a review conducted by Marik PE et al. on 24 trails and 3013 patients in 2008 [17]. The high rate of mortality among patients who received inotropic support is related to the fatal injuries frequently seen in these patients and to the disturbed haemodynamics.

The limiting factor of our study is the non-experimental design, i.e. absence of a control group. Moreover, a complete comparison was not possible since no similar study was previously conducted in a center like an intensive care unit with a high rate of patient circulation and variability. On the other hand, the overall study results were regarded as being consistent with the literature.

The survival of trauma patients is related to the approach of the physician and to the immediate and optimal management provided for the patient. The major prognostic factors among multitrauma patients followed-up in intensive care are specified as GCS and trauma scores, mechanical ventilation, SIRS, sepsis and MOF. In this work, GCS, ISS, RTS, mechanical ventilation, sepsis, SIRS and MOF were determined as factors with a direct effect on mortality; however, no similar correlation was found between the provision of nutritional support and mortality. Furthermore, all of these parameters were seen to affect each other, as in the case of sepsis leading to MOF.

In conclusion, we suggest that management of multitrauma patients in intensive care units may lead to decreased morbidity and mortality rates, and more favorable results may be achieved in specialized trauma centers. Therefore, centers admitting multitrauma patients should be well equipped in terms of technical support, specially trained physicians, nurses and medical personnel. In addition, as indicated in this article, keeping daily and thorough records for patients in emergency units provides valuable information regarding the course of the disease and monitorization of the clinical consequences.

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