ORIGINAL RESEARCH

Potential Risk Factors of Death in Multiple Trauma Patients

Sina Jelodar, Peyman Jafari, Mahnaz Yadollahi, Golnar Sabetian Jahromi, Hoseynali Khalili, Hamidreza Abbasi, Shahram Bolandparvaz, Shahram Paydar*

Trauma Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

Abstract

Introduction: Trauma has been recognized as one of the leading causes of death in many countries for decades. Reduction in mortality and morbidity rate of trauma cases is one of the most important attitudes in this field. Evaluation of different risk factors have been considered as the main goal of some studies. The purpose of this study was determining potential risk factors of death in trauma patients. **Method:** In a retrograde study, data of 740 patients admitted during three years (2009-2011) were studied. Demographic data (sex and age), clinical factors (blood pressure, pulse rate, respiratory rate, Glasgow coma scale (GCS)), trauma characteristics (location, type of injury, etc.), as well as outcome of patients were evaluated. Data analyses was done using SPSS 18.0. Stepwise multivariate regression analysis was used for recognition of independent predictive factors of death in multiple trauma patients. **Results:** Of those admitted, majority of patients were male (81.4%), 68% between 18 to 60 years, and 11.2% of them died during the course of treatment. Age; type of trauma; abnormal respiration rate, pulse rate, blood pressure; total GCS ≤8; abnormal pupil size; and head and neck; vertebral, and extremities fractures were obtained as significant predictive factor of death. GCS≤8, head and neck fracture, and abnormal pulse rate were independent death predictors. **Conclusion:** We identified GCS≤8, head and neck fracture, and abnormal pulse rate as predictive factors of mortality after trauma, which remained independent in the presence of all other factors and potentially treatable.

Key words: Risk factors; mortality; death; multiple trauma

Cite this article as: Jelodar S, Jafari P, Yadollahi M, et al. Potential risk factors of death in multiple trauma patients. Emergency. 2014;2(4):170-3.

Introduction:

Trauma has been recognized as one of the responsible causes of death and disability in the world for decades (1-4). In 1966, National Research Council published a book entitled ''Accidental Death and Disability the Neglected Disease of Modern Society'' which attracted a great deal of attention towards the high rate of mortality among trauma patients (5). Identification of variants that lead to death after trauma has been addressed by many researchers (6-9). MacLeod and colleagues concluded that low hemoglobin, elevated prothrombin time (PT), partial thromboplastin time (PTT), and elevated base deficit were prognostic indicators which remained independent and potentially treatable among all causes of mortality after trauma(6). On the other hand, head injury, increasing age, and injury severity score (ISS) were found as independent untreatable indicators of mortality (6, 10). It is clear that reduce in mortality and morbidity rate of trauma is a bilateral function from people and educated medical staff (11-16). It may be concluded that except immediate deaths, many death predictors are controllable or treatable at the scene by passing pedestrians or the paramedics to keep the patient alive until he or she arrives at the emergency department (17). The aim of this study was to identify independent risk factors of death in trauma patients.

Methods:

Study design and setting:

Current retrograde cross-sectional study was carried out on documents of patients admitted to the emergency department of Rajaee Hospital, Shiraz, Iran, through 2009-2011. Study protocol was approved by Ethics Committee of Shiraz University of Medical Sciences.

Subjects:

The patients older than 18 years old and younger than 80 were enrolled. Inclusion criteria consisted of injury severity score (ISS) > 9, change in hemodynamic of patients, and more than one simultaneous injury. Pregnant women, assaults, burn >20% body surface area, dead on arrival, diabetic patients, and transferred out to another institution were excluded. The minimum sample size for the study was equal to 342 cases, with an odds ratio (OR) of 4.0 for Glasgow comma scale (GCS) ≤9 and prevalence of 6.3% mortality in trauma patients (18), at the significance level of 5% (one-sided test) and power of 90%. Finally, 740 patients were enrolled to

***Corresponding Author**: Shahram Paydar; Trauma Research Center, Shahid Rajaei Trauma Hospital, Shahid Chamran blvd, Shiraz, Iran. Tel/Fax: +987116254206; Email: paydarsh@gmail.com

Received: July 2014; Accepted: August 2014

the study based on simple random sampling and using a random number table.

Variables

Demographic data (sex and age), clinical factors (blood pressure, pulse rate, respiratory rate, pupil size, GCS), trauma characteristics (location, type of injury, etc.), as well as outcomes of patients were evaluated. The outcome was defined as death or viability. An outcome variable, "death," was considered if the patient had either an emergency room result of "death" or a hospital result of "expired."

Statistical analysis

Statistical analysis was performed using SPSS version 13.0. Categorical data were compared using Chi-squared or Fisher's exact test. Variables that were established as mortality predictors in univariate analysis, were entered to a stepwise logistic regression to determine independent predictive variables of mortality. Data were presented as OR and 95% confidence interval (95% CI). P values <0.05 were statistically considered significant.

Results:

Seven hundred forty patients were enrolled (81.4% male). The mean age of patients was 34.62± 5.75 years (range: 18-80). Eighty-three (11.2%) patients were died during the course of treatment. After performing the

Table1: Relationship between demographic and clinical factors and death in studied patients

Variable	Alive (%)	Death (%)	p-value
Age			
<60	456 (95.4)	22 (4.6)	0.001
≥60	199 (88.4)	26 (11.6)	
Gender			
Male	467 (93.4)	33 (6.6)	0.38
Female	109 (95.6)	5 (4.4)	
Respiratory rate			
Normal	330 (85.4)	56 (14.5)	0.002
Abnormal	295 (92.8)	23 (7.2)	
Type of accident			
Motor vehicle accident	606 (89.6)	70 (10.4)	<0.001
Fall	50 (86.2)	8 (13.8)	
Other	1 (16.7)	5 (83.3)	
Pulse rate			
Normal	173 (80.5)	42 (19.5)	<0.001
Abnormal	451 (95.2)	38 (7.8)	
Blood pressure			
Normal	394 (92.3)	33 (7.7)	<0.001
Abnormal	257 (84.0)	49 (16.0)	
Glasgow comma scale			
>8	553 (95.2)	28 (4.8)	<0.001
≤8	54 (51.9)	50 (48.1)	
Pupil size			
Normal	126 (79.8)	32 (20.5)	<0.001
Abnormal	6 (31.6)	13 (68.4)	
Head and neck fracture			
No	624 (90.7)	64 (9.3)	<0.001
Yes	33 (63.5)	19 (36.5)	
Thoracic injury			
No	530 (88.5)	69 (11.5)	0.6
Yes	127 (90.1)	14 (9.9)	
Vertebral fracture			
No	602 (88.1)	81 (11.9)	0.05
Yes	55 (96.5)	2 (3.5)	
Abdominal injury			
No	569 (86.6)	74 (89.2)	0.74
Yes	88 (90.7)	9 (9.3)	
Pelvic fracture			
No	609 (88.9)	76 (11.1)	0.71
Yes	48 (87.3)	7 (12.7)	
Extremities fracture			
No	327 (85.6)	55 (14.4)	0.005
Yes	330 (92.2)	28 (7.8)	

univariate analysis, age> 60 years (p=0.001), type of trauma (p<0.001), abnormal respiration rate (p=0.001), abnormal pulse rate (p<0.001), abnormal blood pressure e (p<0.001), total GCS <8 (p<0.001), abnormal pupil size (p<0.001), head and neck fracture (p<0.001), vertebral fracture (p=0.05), and extremities fracture (p=0.005) were identified as the potential predictive factors of death (Table 1). The results of stepwise multivariate logistic regression analysis were summarized in Table 2. Based on the results, only three varia bles remained as independent predictors of death. These variants were total GCS belo w 8 (OR=16.5; 95% CI: 5.9-40.8; p<0.001), presence of head and neck fracture (OR=5.8; 95% CI: 3.1-9.5; p<0.001), and abnormal pulse rate (OR=5.7; 95% CI: 1.9-17.5; p<0.001).

Discussion:

This study was performed in order to find the independent predictors of death in trauma cases. In the current study GCS below 8 beside presence of head and neck fracture as well as abnormal pulse rate have been recognized as independent predictors of death in trauma patients. Evaluation of demographic and clinical factors are crucial in management of trauma victims because of its effect on mortality rate. Lichtveld et al. in 2007 showed age, presence of isolated neurological damage, base excess, and hemoglobin as death risk factors. They also reported that severe head injuries and hemorrhage as the most important risk factors of death in the first 24 hours after the accident (19, 20). Kuhls et al. showed age and GCS yields higher discriminatory power in mortality prediction in trauma (21). Probst C et al. categorized risk factors in treatable and untreatable indicators of mortality groups, and mentioned head injury, increasing age, and injury severity score (ISS) in the second group (10). The incidence of coagulation abnormalities, early after trauma, was considered also as independent predictors of mortality even in the presence of other risk factors (22). Since death has a significant correlation with ages younger than 60, the victim's age should always be considered as a death predictor. However, normal vital sign in a primary evaluation should not persuade the examiner and more rapid evaluations should be performed. A study found the mortality rate for all grades of injury was about 10% higher in the 70 years and older ages when compared to the 20 to 70 years (23). Our analysis showed a significant correlation between age, respiratory rate, blood pressure, pulse rate, head and neck fractures, vertebral fracture, extremity fracture, and GCS with death after trauma. A high ISS (≥ 30), post-injury GCS status, and hemodynamic function can affect elderly trauma mortality (24). Multivariate analysis using mixed effect logistic regression was applied and adjusted for age, gender, ISS and GCS to overcome their confounding effect on mortality rates (25). Since the majority of deaths occur due to brain damage (i.e. decrease in GCS score) or neck rather than multi organ failures, the trauma team must be cautious and well trained to reduce the unwanted iatrogenic damages in these vital organs (26). This study confirmed the association of head and neck fracture with death (P<0.001). It is clear that an eligible and reliable treatment protocol such as ATLS is an important factor to reduce the mortality and morbidity of the patient with multiple traumas (16, 21). Findings revealed that mortality rate of trauma victims can be reduced only with a focused primary survey and an efficient treatment plan, as well as proper use of resources.

Table 2: Independent predictors of death in studied patients

Predictive factor	OR	95% CI	P
GCS ≤8	16.5	5.9-40.8	<0.001
Head and neck fracture	5.8	3.1-9.5	<0.001
Abnormal pulse rate	5.7	1.9-17.5	0.002

OR: Odds ratio
CI: confidence interval

Conclusion:

We identified GCS below 8, head and neck fracture, and abnormal pulse rate as predictive factors of mortality after trauma, remained independent in the presence of all other factors and potentially treatable. Additionally, the results showed the association of age<60, type of trauma, abnormal respiration rate, abnormal pulse rate, abnormal blood pressure, total GCS <8, abnormal pupil size, head and neck fracture, vertebral fracture, and extremities fracture with death in trauma patients.

Acknowledgments:

We would like to say thank to all the emergency department staffs of Imam Khomeini Hospital, Sari, Iran.

Conflict of interest:

None

Funding support:

None

Authors' contributions:

All authors participated in the study concept and design, acquisition of data, data analysis, drafting of the manuscript, and critical revision of the manuscript for important intellectual content.

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