

A Cohort Study : Prognostic Value of the Primary GCS, Mechanism and Severity of Trauma and In the Outcome of Multiple-Trauma Patients

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Abstract

Trauma is one of the major causes of death and disability worldwide, and a high percentage of trauma patients die of their injuries before reaching the hospital. Various factors in the scene and in emergency room can affect the outcome. The aim of this study was to determine the relationship between the mechanism of trauma and primary GCS with the mortality rate of trauma patients referred to a trauma center in west of Iran from 2019 to 2021. In this retrospective study all multiple trauma patients who referred to our emergency department from 2019 to 2014 were included. Demographic and clinical information was extracted from patient data file. The data were analyzed using SPSS v25. Of 2876 patients included, 73.7% were men. The most common cause of trauma was road traffic collisions (1121 cases). The second most mechanism was falling (1104 cases), 307 cases were injured by stab wounds, 197 cases had blunt injuries and 65 cases were traumatized by firearms. The rest of cases had unknown mechanisms. There was a significant difference between the mechanism of trauma in the two groups of deceased and non-deceased cases. In this study, out of 2876 trauma patients, 21 patients had a GCS less than 8, and 8 of them died. In patients with GCS of less than 8 and equal or more than 8, 38.1% and 1.4% of patients died respectively. There was a significant difference between the GCS of two groups of deceased and non-deceased patients. Based on our study, there was a significant relationship between the mechanism of trauma and initial GCS with the rate of mortality in critical trauma patients. More advanced therapeutic interventions by EMS personnel in patients with reduced consciousness and preventive measures to reduce collisions could reduce the resulting burden on the health system.

Keywords: Trauma, GCS, Mortality, road collisions

Introduction

Trauma is the most common cause of death in people under 44 years of age [2]. Since trauma mostly affects the young population, it causes more lost working years than other causes. About 40% of deaths caused by trauma

are reduced by preventive measures and the establishment of regional trauma systems [3]. According to the reports of the Iranian Society of Surgeons, trauma is the third leading cause of death, after cardiovascular diseases and cancer in Iran [4]. The increasing use of motor vehicles expose people to injuries caused by road collisions [5,6]. In fact, injuries are the most common cause of death among people aged 1 to 34, which leads to disability and loss of useful years of life [1]. According to the World Health Organization Road Safety Report, more than 1.2 million people die on the roads every year and 50 million others are injured so vehicle collisions remain a serious health problem especially in low-income countries [7]. A high rate (50-60%) of the victims of fatal accidents do not reach the hospital and die before reaching the medical centers [8].

Investigating the mechanism of injury is important, as it is very helpful in determining the next course of action. Concerning mechanisms include: being thrown out of the car, falling, overturning the car, high-speed accidents, motorcycle accident, car accident with pedestrians, and penetrating injuries such as stab and bullets [9,10]. Prompt and accurate identification of the mechanism and severity of the injury with proper prioritization of medical interventions may affect morbidity and mortality.

Considering the high prevalence of trauma victims in developing countries and as a result the high rate of death and morbidities, it seems necessary to evaluate related factors in this regard. The present study aims to determine the relationship between the mechanism of trauma and initial GCS with the mortality rate of trauma patients referred to our trauma center from 2019 to 2021.

Methods

This descriptive-analytical retrospective study was conducted at our trauma center to identify relation between initial GCS and mechanism of injury and final outcome in multiple trauma patients during January 2019-December 2021. All trauma patients who died in the emergency department, required at least 24 hours of hospitalization or were referred to our center from other hospitals were included.

Demographic information including age, sex, and information related to the disease, including the type and mechanism of the trauma were documented in the hospital registry checklist by trained research assistant. This checklist was approved by the first executor of the project as an expert. In case of incomplete file, the patient was removed from the study.

The information obtained from this checklist was coded and then analyzed by spss software version 25. In the descriptive analysis, Central criteria (mean-median) and dispersion (standard deviation) were reported along with tables and graphs. For analytical analysis, Chi-square test was used for qualitative data and independent t-test was used to compare quantitative data. If the initial assumptions were not met as normal, Mann-Whitney parametric test was used. Logistic regression was used to investigate factors affecting mortality. P value < 0.05 was considered to be statistically significant.

The design was approved by the Ethics Committee of Kermanshah University of Medical Sciences.

Results

The mean and standard deviation of the initial GCS of patients in the emergency department was 14.28 ± 1.53 . The mean and standard deviation of GCS of deceased and survived patients was 10.96 ± 3.91 and 14.33 ± 1.40 respectively. The mean and standard deviation of the initial GCS of the deceased and survived male was 11.14 ± 3.88 and 14.30 ± 1.46 and of the deceased and survived female was 10.36 ± 4.15 and 14.42 ± 1.21 respectively. The rate of mortality in GCS of less than 8 and equal or more than 8 was 38.1% and 1.4% respectively, Fig 1. Of 47 patients died, 17% had GCS less than 8 and 83% had GCS equal and above 8. Based on the results of the chi-square test, there was a statistically significant difference between the two distributions of GCS in deceased and non-deceased patients with a 95% confidence coefficient (Chi = 173.975; $p < 0.001$), (Table 1).

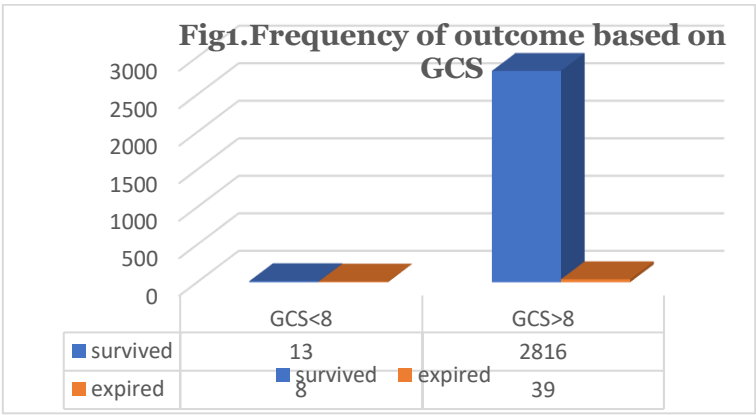


Table1. Frequency of outcome based on GCS and ISS

variable		outcome				P value
		discharge		death		
		number	percent	number	percent	
GCS	<8	13	0.5	8	17	0.001
	≥8	2816	99.5	39	83	
	total	2829	100	47	100	
ISS	<16	2777	98.1	40	87	0.001
	≥16	52	1.9	7	13	
	total	2829	100	47	100	

In this study, out of 2876 patients, the most common mechanism of trauma was road traffic collisions (1121 cases). falls were the second most common cause of trauma (1104 cases).The frequency of other mechanisms was as follow: 307 cases of penetrating trauma,197 cases of blunt trauma, 65 cases of firearms. 13 cases due to other accidents, 14 cases of animal bites, 3 people were burned, 4 people were suffocated, 3 people were electrocuted, 9 cases due to the blast wave. Also, 27 people were traumatized by unknown factors. The highest mortality rate was due to road traffic collisions (20 cases), Fig 2. Of 47 patients died, 42.6% due to road traffic collisions, 4.3% due to non-traumatic injuries, 38.3% due to falls, 8.5% due to the use of firearms and 6.4% of the rest had died due to other factors. Based on the results of the chi-square test, the two frequency distributions of the mechanism of trauma in deceased and non-deceased patients with a confidence coefficient of 95% were statistically significantly different (Chi = 18.120; p<0.003), (Table 2).

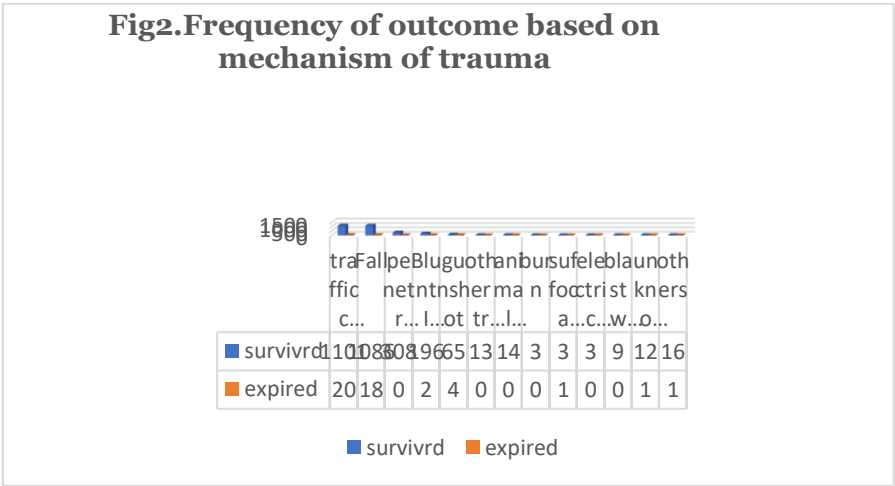
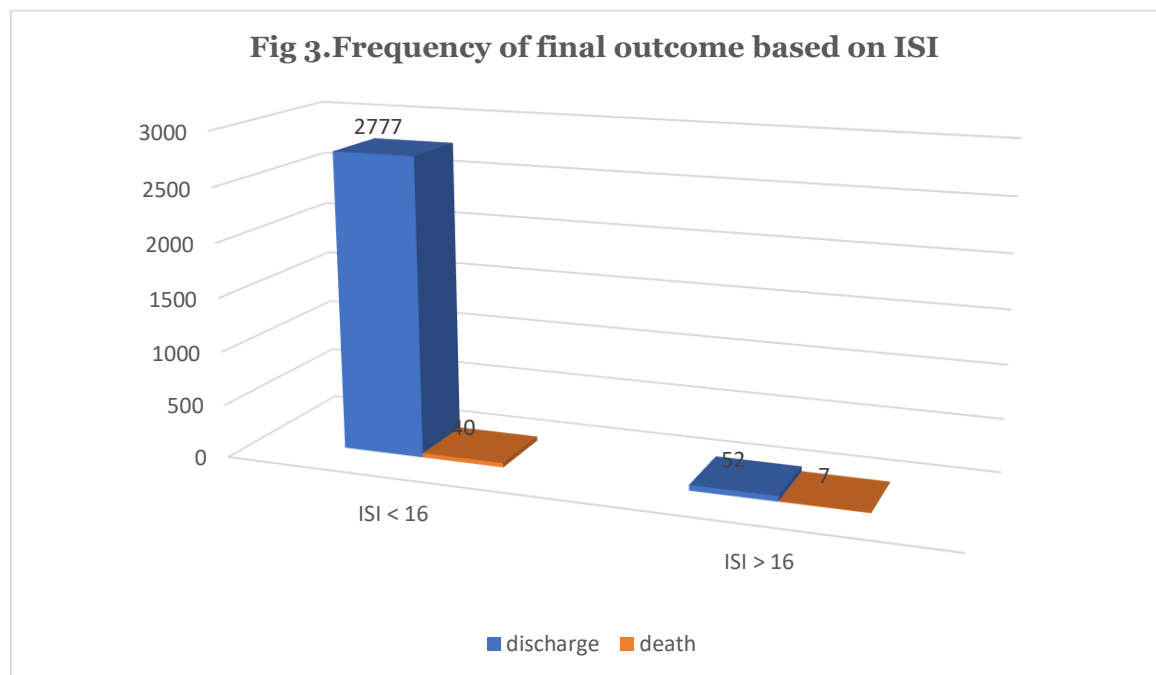


Table 2. Frequency of outcome based on mechanism of trauma

mechanism	expired		discharge		P value
	number	percent	number	percent	
Road collisions	20	42.6	1114	39.5	0.003
Blunt Injury	2	4.3	196	6.9	
Fall	18	38.3	1086	38.5	
Penetrating Injury	0	0	308	10.9	
gunshot	4	8.5	65	2.2	
Others	3	6.4	60	2	
Total	47	100	2829	100	

In this study, out of 2876 trauma patients, 58 had an ISS (Injury Severity Score) greater than 16, and 6 of these patients died. The rate of mortality in ISS less and equal or more than 16 was 1.4% and 10.3% respectively, Fig 3. Of 47 patients died, 0.87% had an ISS of less than 16 and 0.13% had an ISS of 16 and above. Based on the results of the chi-square test, the frequency distribution of ISS in deceased and non-deceased patients had a statistically significant difference with a confidence coefficient of 95% (Chi = 28.366; $p < 0.001$). (Table 1).



Discussion

In this study, the most common cause of trauma was road traffic collisions (1121 cases) followed by falls (1104 cases). Consistent with the results of the present study, Tabatabai et al. [16] showed that out of 5555 trauma patients included, road collisions followed by falls were the most common cause of trauma including 2138 (38.5%) and 1298 (23.4%) cases respectively. Also, the results of Khormali et al.'s study [14] reported that the most common cause of injury is road collisions (73.5%), followed by falls (20.2%). In the study of Yadalhi et al. [17], motorcycle accidents were the most common mechanism of injury (66.7%). The results of this study, consistent with the results of the present study, showed that the most common cause of trauma and the most common cause of death due to trauma was motor vehicle collisions. In a study conducted by Saeednejad et al. [15] with the aim of establishing a relationship between the mechanism of injury, co-morbidities of the patient and the severity of the injury, consistent with the results of the present study, the most common mechanism of injury was road traffic injuries (49%) followed by fall (25.5%). Also, in the study conducted by Chatimah et al. [19], they showed that almost half of the trauma injuries were caused by road collisions (89 cases, 49.2%).

Out of 2876 trauma patients in our study, 47 patients died, 42.6% due to road traffic collisions, 4.3% due to non-penetrating injuries, 38.3% due to falls, 8.5% due to gunshot and 6.4% of the rest had died due to other mechanisms. Based on the results of the chi-square test, with a confidence coefficient of 95%, the two distributions of the trauma mechanisms in expired and survived patients were statistically significantly different, ($\chi^2 = 18.120$; $p < 0.003$). Isfahani et al.'s study [12] showed that out of 1266 patients who died due to trauma, 604 people (47.7%) had early death, 427 people (33.7%) died after care and 235 people (18.6 %) died late in the course of hospitalization. The mechanism and type of trauma and pre-trauma conditions were significantly different between the three categories of death. In the study conducted by Oliveris et al. [56] in Greece, among 326 patients, mechanisms included road collisions (5.5%), falls (21.1 %) and violence (7.4%).

In this study, out of 2876 trauma patients, 21 had a GCS less than 8, and 8 of these patients died. The mortality rate in the GCS category less than 8 and in the GCS category 8 and more was 38.1% and 1.4% respectively. The results of the present study showed that the overall mortality rate of trauma patients was about 1.6%, while in the study of Yadalhi et al. [17], the mortality rate was 10.4%. In our study, of 47 deceased patients 17% had GCS less than 8 and 83% had GCS of 8 and above. Based on the result of the chi-square test, there was a statistically significant difference between the two distributions of GCS in deceased and non-deceased patients with a confidence coefficient of 95% ($\chi^2 = 173.975$; $p < 0.001$). Adam et al [11] investigated the prognostic value of GCS in predicting mortality in 537 multi-trauma patients. The overall mortality of trauma patients was about 13%. In line with the results of the present study, the average GCS score in deceased patients was significantly lower than non-deceased patients ($p=0.0001$). Suilik et al. [13] conducted a study with the aim of evaluating the prognostic value of GCS in trauma patients in the emergency department. A total of 2548 patients were studied, of which 11 (0.4%) died. Consistent with the results of the present study GCS predicted the mortality of trauma patients aged 16 to 80 years. Yadollahi et al. [17] showed that for each unit increase in the GCS, the risk of death decreases by about 40%, so in line with the results of the present study, an increase in GCS reduces the risk of death in trauma patients. Yueh-TzuChiang et al. [20], predictive factors of mortality in 1561 trauma patients were investigated. Consistent with the results of the present study, the results showed that GCS less than 8 was one of the factors associated with increased mortality.

In our study, of 47 patients died, 87% had an ISS of less than 16 and 13% had an ISS of 16 and above. Based on the results of the chi-square test, the frequency distribution of ISS in deceased and non-deceased patients with a confidence coefficient of 95% had a statistically significant difference ($\chi^2 = 28.366$; $p < 0.001$). According to Isfahani et al.'s study [12] the ISS index was a predictor of delayed mortality. In the study of Suilik et al. [13], a total of 2548 patients were studied, of which 11 (0.4%) died. Consistent with the results of the present study, ISS ($p=0.047$) predicted the mortality of trauma patients aged 16 to 80 years. Yadollahi et al. [17] showed that for each unit increase in the ISS score, the risk of death will increase by 10%. Therefore, in line with the results of the present study, increasing the ISS index increases the risk of death in trauma patients. In the study conducted by Yueh-TzuChiang et al.[20], predictive factors of mortality in 1561 trauma patients were evaluated. Consistent with the results of the present study, the results showed that ISS above 24 was one of the factors associated with increased risk of mortality.

Conclusion

Our study showed that there was a significant difference in the mechanism of trauma in the deceased and surviving groups. Also, there was a significant difference in the frequency distribution of GCS between deceased and non-deceased patients. According to the findings of the present study, the average GCS score of deceased and surviving patients was 10.96 and 14.33 respectively.

According to our study, the most common mechanisms of significant trauma were accidents and falls. It seems that it would be possible to reduce the mortality of trauma patients and the resulting burden on the health system by consider the necessary preventive interventions for various causes of trauma, especially the improvement of the transportation system and serious laws aimed at reducing collisions and occupational safety measures to reduce falls, and by improving the quality of providing hospital and pre-hospital services.

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Ethical approval: All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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Declaration of competing interest: The authors deny any conflict of interest in any terms or by any means during the study.

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