Original article

Mechanisms of Traumatic Injuries in Multiple Trauma Patients

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Abstract:

Introduction: Trauma is a major cause of mortality and disability all over the world and causes more than 50 million deaths each year. Traumatic damages are increasing rapidly in a way that the world health organization states that traffic road injuries are going to be the third global cause of death and disability until 2020. The aim of this study is to investigate the relationship between the number and anatomical region of injury with the mechanism of trauma in multiple trauma patients.

Method: This cross-sectional study was performed on multiple trauma patients referred to Emergency Center of Imam Hospital in a sari. Demographic information and variables such as the mechanism of trauma, the number and anatomical region of injury were collected and recorded. Data were analyzed statistically using SPSS version 20.

Findings: 220 patients with average age 38.59±21.03 were included in this study. 158 individuals were male (71.8%) and 62 individuals were female (28.2%). The average age of males and females was 37.92±18.99 and 40.29±25.94 respectively. The most frequently observed trauma cases were in the age group of 21 to 30. The most frequent causes of trauma were the car to a car accident (44.5%), falling down from height (20%) and motor to a car accident (14.5%) that consist of 79% total traumatic injuries. Motor to car accident and conflicts were significantly higher in men than women ($P<0.004$ and $P<0.021$ respectively). The most frequent injury to one anatomical region was head and neck (23.6%) and thoracic (16.4%) respectively. Head, neck and thoracic injuries were occurred in 46.76% and 39% patients respectively alone or with another anatomical region of injuries.

Conclusion: Findings of this study indicate that car to a car accident is the most common mechanism of trauma and on the other hand the most common anatomical region of injury is head and neck. Individuals in the age group 21-30 are more at the risk of traumatic injuries. By considering the high frequency of traffic accidents as the leading cause of traumatic injuries, major reforms in traffic and transportation should be done to improve the structures related to traffic administrations and promoting the transplantation status.

Keywords: Multiple trauma, Mechanism of trauma, injury

Introduction:

Trauma is a major cause of mortality and disability all over the world with more than five million deaths each year (1). Disabilities caused by trauma has become one of the most serious public health problems in developed countries as well as countries with low total annual income (2). Traumatic damages are increasing rapidly in a way that the world health organization states that until 2020, traffic damages are going to be the third global cause of death and disability (3). In the United States, the overall fatality rate of multiple injuries was approximately 12%. Multiple trauma accounted for 16% of the world's medical expenses (4). Road traffic injuries are the major cause of mortality and morbidity in American countries with low to middle annual income (5). Road traffic injuries are considered the third greatest cause of mortality after myocardial infarction and cerebrovascular diseases. Iran has one of the highest road traffic mortality rates in the world that accounts for over 27000 deaths and almost 0.8 million injured people which is equal to 1.1 percent of the population (6). The death rate due to road traffic injuries (RTIs) in Iran was about 31 per 100000 populations in 2011 (7).

A high percentage of trauma patients (50-60%) die due to injuries before reaching the hospital (8). In individuals who suffer from severe multiple trauma injuries, the level of mental and physical health and their quality of life decrease after injuries (9, 10). Head injury, aging, and injury severity score (ISS) are kwon as unchangeable and independent indicators in increasing the mortality rate among multiple trauma patients (11, 12). Traumatic injuries are more common in young adults, particularly men (75%), which causes high costs to society because of life years lost due to death and disability (3). The mean age of the people who lose their lives because of car accidents is 28 years old (13). Transportation-related crashes (involving motor vehicles, bicycles, pedestrians and recreational vehicles) accounted for 49% of all TBIs (14). Firearm use, sports, and other recreational activities are other causes of traumatic injuries (15). Chest injury is one of the most common causes of multiple injuries. Approximately one-third of multiple trauma patients experience the complication of chest contusion (16). In 20% of patients with trauma, chest injury occurs alone or with other injuries and about 25% of all mortality caused by trauma is due to chest injury (17). falls, drowning, and burns account for second, third and fourth major causes of mortality among children respectively (18). Reduction in the mortality rate depends on the bilateral performance of both the public and the medical team staff (19, 20).

Considering the rate of injuries that multiple trauma patients suffer following types of traumatic injuries allocated more burden than other diseases, we decided to investigate types of trauma mechanisms, number and anatomical region of injury. With the knowledge of factors involved in each of patients presented to Emergency Center of Imam Hospital in a sari, it can be helpful to use the appropriate strategies in order to perform the most appropriate intervention and treatment procedures.

Methods:

This cross-sectional study was performed on multiple trauma patients referred to Emergency Center of Imam Hospital in a sari from September 2015 to March 2016. individuals with disability, primary symptoms such as dizziness, retrograde or anterograde amnesia, loss of consciousness and sharp, blunt or mix traumatic injuries, traffic road injuries, falling down from height, falling down from yokeflow or other related injuries who were admitted to the Emergency Center of Imam Hospital in Sari included to this study. Information such as trauma mechanism (car to car accidents, motor to car accidents, falling down from height or yokeflow, transportation-related accidents to passengers, incision or sharp trauma, conflict, etc.), types of trauma, anatomical region of injury (head and neck, thorax, abdomen and pelvic, vertebral column and spinal cord and limbs), number of anatomical region of injury, age and sex collected and recorded according to patient's medical profiles. Patients with historical diseases such as cerebral tumors, ischemic or hemorrhagic lesions, outpatient-treated individuals and also Checklists with incomplete recorded information excluded from the study. Data were analyzed statistically by using SPSS version 20.

Findings:

220 patients with average age 38.59 ± 21.08 were included in this study. 158 individuals were male (71.8%) and 62 individuals were female (28.2%). The minimum and maximum age were 1 and 96 respectively. The average age of males and females was 37.92±18.99 and 40.29±25.94 respectively. The most frequently observed trauma cases were in the age group of 21 to 30 years old. Approximately 60% of all trauma patients were in the age group 21-50 years. Table-1 demonstrate the patients' demographic characteristics (anatomical region of injury with three or more than three did not show). Overall car to car accident (44.5%), falling down from height (20%), motor to car accidents (14.5%), conflicts (9%), passenger related accidents (5.5%), other trauma mechanisms (4.5%) and falling down from yeoflow (~2%) were the frequency of the types of trauma mechanisms among total trauma patients respectively. The most frequent causes of trauma were the car to a car accident, falling down from height and motor to car accident respectively which consist of 79% of total traumatic injuries. Falling down from yokeflow was the least frequent mechanism of trauma in both males and females. Overall, the frequency of trauma mechanism among males and females were about 72% and 28% respectively. The burden of disease due to types of trauma mechanisms was 2.5-fold in men than in women. There were no significant differences between age and sex with mechanisms of trauma ($P<0.057$ and $P=0.5$ respectively). 57.3%, 32.7% and 10% of patients were injured in one, two and three or more anatomical regions of injuries respectively. The most frequent injury to one anatomical region was head and neck (23.6%) and thoracic (16.4%). Head and neck and thoracic injuries were occurred in 46.76% and 39% patients respectively alone or with other anatomical region injuries. There were no significant differences between the anatomical region of injury with

mechanisms of trauma (P=0.1). Table-2 and figure-1 demonstrate types of trauma mechanism frequencies in both male and female genders. Figure-2 demonstrate trauma mechanism and the number of an anatomical region of injury.

Discussion:

Injuries are one of the most important public health issues worldwide and have a considerable contribution to the disease burden, especially in young adults (21). Trauma is still a leading cause of death and has an enormous impact on patient's life and health systems (22). The findings of this study indicate that the number of patients referred to the hospital were 2.5 times more in men than in women due to traumatic injuries. 71.8% and 28.2% of patients were male and female respectively; these findings were similar to most of the studies in this regard (23-25).

In our study, the average age of males and females were approximately 38 and 40 years old respectively. individuals in the age group of 21-30 years old were greater in risk of injury and individuals in the age group of 21 to 50 were more than half (59.1%) of all trauma patients. These age groups are counted as the young and active group of the society and due to their involvement in social activities, being bold and busy; they are at the risk of accident more than others. The highest risk age group were 16-30 and 20-29 years old in the studies conducted in Kashan and Gulian respectively. Other studies indicate that most patients were educated (75.3%) and 25% of all trauma patients were industrial workers. 37% of all trauma had occurred on holidays and 65.2% all cases had occurred in urban roads, 67.6% of trauma were blunt trauma and 89.9% of traffic road injuries had occurred outside the city (23, 24).

In the year 2014, Brattstrom and et al investigate the impact of gender and underlying medical condition on the short-term and long-term mortality after trauma on 4051 patients. Their results indicate that Male gender is an independent risk factor for mortality after trauma and it seems that the effect of gender is limited to elderly patients. Underlying disease associated with trauma is as a significant risk factor for injury after trauma and stated that the effects of trauma are not limited to a short period after trauma but it will have long-term consequences (26).

According to our study, the most common mechanism of trauma was the car to car accidents and the most common anatomical region of injury was head and neck. Car to car accidents and falling down from height were the most frequent mechanism of trauma in both men and women (respectively 28.12% and 13.64% in men, 16.36% and 6.36% in women). Passenger related accidents (~5.5%) and another mechanism of trauma (~4.5%) were the least frequent mechanisms of trauma. Improvement in trauma pre-hospital care can be effective in minimizing death and disability due to traumatic damages in all the world specially in low-income and middle-income countries such as Iran that is encountered with traffic road damages (27).

In the year 2013, Dhamangaonkar and et al investigated traumatic spinal cord injuries and neurological problems in 52 adult

patients. They concluded that most injuries result from falling down from height and traffic road injuries (28). In the year 2013, Walder and et al carried out a study in order to survey the severe traumatic brain injuries in the countries with high annual income in 921 patients with the average age 55 years old. They found out that 484 patients had suffered brain trauma following falling down from height (52.5%), 291 patients due to traffic road injuries (31.5%) and 146 patients due to other reasons (~16%) (29). In the year 2012, Chabok and et al investigated traumatic brain injuries in the children. Their results indicate that traffic road injuries are the most common cause of traumatic brain injuries in the children and there was a significant difference between the age of children with etiology of brain injuries and the location of the incidence (30).

In our study, the most frequent injury to one anatomical region was head and neck and thorax respectively. The most frequent injury to two anatomical regions was thorax, abdomen and pelvic (7.3%). In a study conducted in the year 2013 on 300 patients with chest trauma, 80% of patients were male and 20% of patients were women. The study group had an age range of 15-25 years. The average age was 35 years. The most cause of chest trauma was traffic road injuries (58.4%) and the least frequent cause of chest trauma was due to the use of cold weapons (2.7%). The most trauma associated with chest trauma was head trauma (58.3%) (25). In another study, the most common mechanism of trauma was car to car accidents (64.2%) and motor to car accidents (16.4%) respectively and All the individuals who were injured due to motor to car accidents had age under 40-year-old, 95.7% and 4.3% of patients had suffered from blunt and penetrative trauma respectively (8).

Conclusion:

Findings of this study indicate that the most common mechanism of trauma was the car to a car accident and the most common anatomical region of injury was head and neck. Individuals in the age group of 21-30 were more in the risk of traumatic injuries. By considering the high frequency of traffic accidents as the leading cause of traumatic injuries, major reforms in traffic and transportation should be done to improve the structures related to traffic administrations and promoting the transplantation status. Encouraging the use of safety belts in the car, wearing a helmet by motorcyclists, observing traffic rules, increasing the monitoring on roads inside and outside the city and also by making standard and safer roads can reduce the severity of injuries and mortality rates. On the other hand, given that conflict rates are also accounted for a significant percentage of traumatic injuries, rules preventing the use of cold weapons such as knives and machetes should be considered and precise enforcement of laws is required in this field.

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Table and Charts:

Table 1. Patients' demographic characteristics

demographic characteristics		number	Percent (%)
gender	Male	158	71.8
	female	62	28.2
age	≤10	10	4.5
	11-20	22	10
	21-30	62	28.2
	31-40	40	18.2
	41-50	28	12.7
	51-60	20	9.1
	61-70	12	5.5
	71-80	20	9.1
	81-90	4	1.8
	≥91	2	0.9
Anatomical region of injury (one region)	Head and neck (1) *	52	23.6
	Thorax (2)	36	16.4
	Abdomen and pelvic (3)	16	7.3
	Lower limb (4)	2	7.3
	Vertebral column and spinal cord (5)	2	0.9
	Upper limb (6)	16	0.9
Anatomical region of injury (two region)	2+3	16	7.3
	2+6	10	4.5
	1+2	8	3.6
	1+6	8	3.6
	1+3	6	2.7
	3+6	6	2.7
	1+4	4	1.8
	2+5	4	1.8
	1+5	2	0.9
	3+4	2	0.9
	3+5	2	0.9
	4+6	2	0.9
	5+6	2	0.9

* Numbers 1 to 6 in the parenthesis demonstrate one anatomical region of injury. "+" sign demonstrate two anatomical regions of injury

Table 2. Types of trauma mechanisms in both male and female genders

Mechanism of trauma	Gender	Percent (%) of trauma mechanism in each gender	Total percent (%) of each trauma mechanism
Car to cat accident	male	28.18 %	44.54 %
	female	16.36 %	
Motor to car	male	12.73 %	14.54 %

accident	female	1.818 %	
Falling down from height	male	13.64 %	20.00 %
	female	6.364 %	
Falling down from yokeflow	male	0.909 %	1.81 %
	female	0.909 %	
Conflict	male	8.182 %	9.09 %
	female	0.909 %	
Passengers related accident	male	4.545 %	5.45 %
	female	0.909 %	
Others	male	3.636 %	4.54 %
	female	0.909 %	

Chart 1. Types of trauma mechanism in males and females