

Original article

Epidemiology of Injuries Caused By Motor Accidents in Patients Referred To Emergency Department of A Trauma Center Hospital in North of Iran

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Abstract

Introduction: Determining the frequency distribution of injuries caused by motor accidents in patients referred to emergency department of a trauma center Hospital in north of Iran

Methods: The statistical population of our study was all patients with injuries due to motor accidents to emergency department of Imam Khomeini Hospital from April 2015 to April 2018. In this longitudinal descriptive study, all stages of the collection of information through the student's application file have been completed. Information included in the checklist includes demographic information, type of lesion, location of the lesion, multiple scales, vehicle type and level of consciousness. For statistical analysis, variables were first described based on descriptive statistics method including mean \pm standard deviation for quantitative variables such as age and frequency tables for qualitative variables such as type of injury. In order to compare the type of injuries in both sexes and location and age comparison in a variety of injuries, Chi square or Fisher exact test, T test and variance analysis test were used.

Findings: Based on these results, head and neck, right lower organs, and right upper organs had 37.4%, 12.2% and 12% of total highest percentage of lesion site, respectively. People with at least one type of lesion had 67.8% of the injured in the head and neck, 22.1% of the patients suffered damage to the right lower organs and 21.8% of the patients had injury in right upper organs. The non-penetrating type of lesion (89.3%) is more abundant than penetrating lesion. To investigate the frequency of para-clinical type in individuals, FAST sonography has the highest frequency and total percentage in all kinds of para-clinics (31.7%)

Conclusion: According to the conducted studies and the results of this study, it can be concluded that the prevention of injuries caused by accidents can be used to correctly teach the use of helmets for motorcyclists and seat belts for car occupants, Also, due to the high prevalence of head lobe lesions, special attention should be given to the correct transmission of patients to the emergency department.

Keywords: Injury, Accidents, Helmet

Introduction:

In medical science, any injury, shock, or accident occurs on the human body is called trauma, with the condition that, the damage be entered from outside of the body and the internal agent or disease do not create it (1). Trauma today is one of the important issues that is considered seriously in most advanced countries, because it is the fourth cause of death in the whole world and the first cause of death in the first four decades of life. Trauma is responsible for 9% of the world's deaths, thousands of deaths annually and millions of injuries caused by various Traumas. These deaths are increasing year by year (2).

In Iran, although cardiovascular diseases are the first cause of death and accidents driving are the next, but the most deaths in our country is due to injuries from driving accidents (3), because cardiovascular diseases more occur in the elderly people, but the Trauma usually occurs in young people (4). So far, 50% of the trauma effects are related to traffic accidents, especially in Iran, in a country where, according to experts, one person gets injuries and permanent handicaps or dies every 20 minutes. What needs to be addressed about further damage is doubled attention to this matter that parliament, the government, the ministry of health and universities must mobilize their full potential in order to organize and sustain the trauma system in the country. For this reason, in developed countries a system of trauma has been created to solve this problem and also for managing and treating the injured person from the scene of the incident up to the end of its treatment and rehabilitation, and its effective return to society (5-7).

Trauma can be categorized based on the mechanism (driving accidents, falling accidents, etc.), the place of trauma (head, chest, abdomen, face, spinal cord, pelvis, soft tissues, etc.) or the characteristics of the causative agent (penetrating abdomen injuries with a sharp object) or non-penetrant damage (blunt), as well as thermal or pressure damage (Barotrauma), etc.

On the other hand, multiple trauma patients are referred to patients suffering from more than one area injuring (6, 1).

Trauma, injury and its consequences are major problems in today's societies and constitute a serious threat to the health of the community (8). Driving accidents is one of the most important causes of disability and death in countries around the world, according to World Health Organization reports, it will be the world's third highest death rating in 2020.

Apart from the disability and economic burden imposed on the health system, it is one of the major problems in the way of improving the quality of public health (9). About 1.2 million deaths from accidents occur in countries with a moderate income level (10). Nearly 60% of non-penetrant traumas are due to accidents caused by driving accidents and 20% of penetrating traumas occur in the abdominal region (11). Visceral and internal organs traumas can be caused by accidents, falls, or clashes in people. In abdominal injuries and internal bleeding, symptoms such as decreased consciousness, anesthesia, rapid and superficial breathing, thirst, facial and lip color loss, low blood pressure, shock, blood in urine and stiffness in the abdomen will appear in the injured person (12).

In a study by Haddadi et al. (2014) in patients referred to Imam Khomeini Hospital, Sari showed that car accidents had

a very important contribution (75.2%) to head injuries (13). Head injuries (such as head trauma) can be accompanied with symptoms such as headache for more than an hour, nausea, vomiting, imbalance, irrelevant and meaningless expression, asymmetry of the pupils, and failure to answer the question about the past. In spinal cord injuries or spinal cord traumas, sensory and motor disorders are one of the most important symptoms. Accidents are the most common cause of spinal cord injuries. This type of trauma is caused by injuries to the spinal column, spinal cord elongation, and fracture in the spinal column, spinal cord and damage to the intermediate seal disc (12).

Generally, the mortality rate due to non-penetrant trauma is far more than penetrating trauma, and despite new and applied diagnostic methods such as CT scan, damage to any medical device is still a complicated issue (14). Considering the high rates of injuries caused by driving accidents in Mazandaran province and imposing heavy costs on patients and the health system, and the need for accurate statistics and information for future planning and targeting, and the lack of specific epidemiological studies for injuries caused by driving accidents, studying to respond to this need was felt. In this study, we evaluated the frequency of injuries caused by driving accidents in patients referred to the emergency department of the Sari hospital from April 2014 to April 2016, over a period of 2 years, to improve preventive and remedial planning with the help of this information in the future. It should also be noted that due to the lack of such information in this center and the high distribution of clients with driving accidents, such a project has been of particular

importance because in the least efficiency, will be the basis of many future studies.

In a study by Masoumi et al. (2016) entitled "Factors Influencing Driving Accident Severity" in Golestan and Imam Khomeini Hospitals in Ahwaz, in a one-month cross-sectional survey, they studied all injured car accidents that were transferred to the emergency department of Golestan and Imam Khomeini Hospitals in March 2013 based on the Haddon matrix criteria in three groups of factors (host, agent, and environment).

All patients' demographic information was extracted based on Haddon matrix risk factors and analyzed by SPSS ver.20 software. In the results of 700 transmitted injuries (mean age 29.26 ± 12.66), about 92.4% were male and the rest were women, 610 (87.1%) that were injured in car accidents, 308 People (44%) with motorized car accident and 175 people (25%) with a motorcycle-car collision mechanism. 371 cases (53%) occurred between 2 pm and 8 pm. The most violations were recorded for 570 cases (81.4%), and 57 cases (8.1%) were reported in the take up from right direction.

59.9% of the injuries occurred in road accidents while 61.3% of injuries caused by driving accidents were low to moderate ($p < 0.001$), the most common mechanisms of injury in Life threatening injuries were respectively car reversal (72.5%), pedestrian motorcycle collision (23.8%) and motorcycle accident (13.14%).

According to the results, the most important and most effective risk factors on the severity of injury include age over 50 years, were the lack of use of safety devices and the underlying factors of the patient. The most influential environmental factors, including environmental and road safety accidents,

ranged from 2 pm to 8 pm, and eventually vehicle reversals, pedestrian traffic accidents and pedestrian motorcycle accidents had the most significant impact on injury factors (9). Haddadi and colleagues published a study in 2014 entitled "Epidemiological study of head injuries in patients referring to Imam Khomeini Hospital in Sari. This study was conducted with the aim of investigating the epidemiological effects of head injuries in patients referred to Imam Khomeini Hospital in Sari in 2013-2014. In this descriptive study, 1304 head trauma patients were studied at the time of entering the hospital. For each patient, a questionnaire including demographic information, time of injury, Glasgow's Criterion, CT scan findings and injuries were completed and data were analyzed by SPSS ver.17 software.

The findings of the study indicate that the age of most injured were 20 to 30 years old (29.6%) and most of them were males (67.9%), the most common cause of injury was accidents (2 / 75%) and the most used vehicle was motorcycle (40%). The winter season (36.9%) was the most spectacular season and the highest incident time was 18 to 24 pm. (48%). The greatest number of injuries was related to trauma (30.2%) and CT scan of the injuries was also normal in 33.1% of cases. The most common abnormal finding in CT scan was the fracture of the skull (18%). Also, 7.8% of the patients suffered from severe brain damage and 52 (0.4%) of the injured died and bleeding was the main cause of their death.

The severity of brain damage was high in 34 of these people (65%), in moderate (7.69%) and in mild (26.79%). This study showed that driving accidents play a very important

role in causing injuries. Driving accident prevention can lead to reducing head injury (13).

Sing et al. in 2014 published a book entitled Template, severity, and extent of injuries from driving accidents. This retrospective study aimed at determining the pattern, severity, and extent of injuries caused by driving accidents in The Hapur Hospital of India was completed within a year.

347 patients received questionnaires from patients' files and all of the patients' data were analyzed using SPSS ver.16 software. The results of the 347 cases of driving accidents referring to the emergency department showed that men with 258 cases (74.35%) were more likely to be victims than those with 141 cases of women (40.63%). Most of the people i.e.141 cases (40.63%) were in the age group of 20-30 years old.

Urbanization with 222 cases (64%) was more significant than those who lived in the countryside. The most part of the body that was damaged were organs with 499 (53.54%) and maxilla-facial damage with 80 cases (19.31%) of the total of 802 external injuries, respectively. The most common types of injury were rupture of 307 cases (38.28%), abrasion 306 cases (38.15%) and bruising with 154 cases (19.20%), respectively. The highest incidence of multiple injuries was seen in upper limbs, 216 (26.93%), lower organs 210 (26.18%) and face damages 170 cases (21.20%).

While injuries from accidents were dominant in both organs. The rupture was reported in 210 cases (38.83%), chest in 19 cases (36.2%), abdomen in 13 cases (61.1%), and spine cords in 11 cases (36.1%).

The fracture of the bone in the right half of the body was 55 cases (55.55%) with a

statistically significant difference. Most of the head injuries in the forehead were 77 cases (47.53%), sores were 33 cases (20.37%) and most of them were at the right side. At the end of the discussion, the author considers injuries from driving accidents to be important problems in the public health system of the community and considers urgent preventive decisions and policies on reducing disability and death resulting from driving accidents (8).

Methods:

The statistical population of this study is all referring patients with injuries caused by driving accidents to emergency department of Imam Khomeini Hospital from April 2015 to April 2018. All existing cases (whether they were in emergency or the cases were transmitted to the department) were all included in the study.

In this longitudinal descriptive study, all stages of the collection of information were conducted through the student's case study. Information in the checklist includes demographic information, type of injury, location of the injury, numbers of injuries, vehicle type and level of consciousness.

For statistical analysis, variables were first described based on descriptive statistics method including mean \pm standard deviation for quantitative variables such as age and frequency tables for qualitative variables such as type of injury.

Chi-square or Fisher exact test, t-test, and variance analysis were used to compare the type of injuries in both genders and location and age comparison in a variety of injuries. To do this, SPSS software was used. All statistical tests of this study were tested at a significance level of 0.05. The confidence level of this study was 95%. All descriptive

analyzes and inferences were performed using SPSS ver.16 software.

Findings:

Because of the possibility of a lesion occurring in several places for people who have been involved in the accident, we used a multi-response analysis to report the frequency and percentage of the injury. The results are presented in Table 1. Based on these results, head and neck, right lower organs, and right upper organs had 37.4%, 12.2% and 12% of total highest percentage of lesion site, respectively.

Also, in general, people with at least one type of lesion had 67.8% of the injured in the head and neck, 22.1% of the patients suffered damage to the right lower organs and 21.8% of the patients had injury in right upper organs.

To determine the frequency of the type of lesion (penetrating, non-penetrating) in individuals because of the possibility of an event of a lesion or both of the lesion in people who have suffered an accident, we studied the frequency of lesion type using the multi-response variables analysis method.

The results of Table 2 show that the non-penetrating type of lesion (7602) is more abundant than penetrating lesion (913). It can also be said that in the total number of people with at least one type of lesion, the type of non-penetrating lesion is 8/98 % in these individuals, while the type of lesion was observed only in 11.9% of these individuals.

To investigate the frequency of para-clinical type in individuals because of the possibility of more than one type of imaging in injured people, so by analyzing the multi-response variables, we tested the frequency of the type of lesion. The results in Table 3 show

that fast sonography has the highest frequency and total percentage in all kinds of para-clinics (31.7%) 7474.

In the row of percentage of location by separation, a case study of each type of Para clinic has been conducted and the percentage of any para-clinic is expressed in terms of the total number of people having para-clinic. According to the results recorded in this column, in all individuals with at least one type of para-clinic, 97.2% of them had a fast sonography.

Discussion:

According to the results of this study, the mean age of the patients was 23 years and men with 5078 (66%) had a larger share of patients and in all of the lesion sites they had a higher proportion than women. Regarding the location of the residence, according to the provincial capital and the hospital's location in the city of Sari, the highest number of patients 5248 (68.2%) had been transferred to the emergency department and after that, the city of Neka with 419 (4.5% %) cases. Khodadadi and colleagues, in a study entitled Epidemiology of Driving Accidents, at the Poursina Hospital in Rasht concluded that the majority of patients were under the age of 30 years (15).

Also, Singh et al. in a study on the pattern, severity, and manner of injuries from driving accidents have shown that the highest numbers of people was 141 (40.63%) in the age group of 20-30 years. In our study, the highest concentration of 6710 (87.2%) was in the age range of 15-64 years, which, according to the definition of the World Health Organization, is considered as the active and young people of the society. on the other hand, (71.5%) of the all patients were under the age of 40 years and the age

group 21-21 (31.1%) had the highest population with 2392 people, which is more consistent with the study of Salari and colleagues who received the highest population in group of 15-34 age of years (16) and it suggests that car accident damages is a major contributor to community labor problems, and providing more training in this age group can prevent further accidents.

In terms of education, the group with 3434 people (44.6%) with graduated person with diplomas and Associate Degree has the highest population and the subordinate and illiterate groups are including 2612 people (33.9%) and the Bachelor group has a population of 1398 people (18.2%) and only 248 people (3.3%) had MA and postgraduate degrees. In this respect Higher education had an important role in reducing the number of accidents caused by driving and vehicles. By providing higher education fields, we can prevent from accidents.

In our study, the most sites of lesions were head and neck injuries (37.4%), and lower and upper right organs were 12.2% and 12%, respectively, that its pattern was similar in all age groups.

Considering that the prevalence of accidents is high in vehicles (70.9%) and motorcycles (26.5%) and most of the injuries are in the neck areas, the importance of using helmets for motorcyclists and seat-belt for the passenger is clearly identifiable and necessary.

The high incidence of lesions in the right organs of the patient's body can be due to the right-handedness of most people in the community and the use of right organs to protect themselves at the time of the accidents. In terms of type of lesion, in total 89.3% of all patients with Non-penetrant trauma transferred to the emergency

department and 98.8% of these patients at least had one type of non-penetrating lesion, while the type of penetrant lesion was observed only in 11.9% of these people, which is justified by the mechanism of driving accidents.

Also, due to the high incidence of lesion, the number of lesion in most patients is 82.7% more than one case. In the study on patients who had been injured by driving accidents at the Emergency Hospital of Imam Khomeini Hospital in Sari, different methods of imaging have been used to check lesions.

Fast sonography has the highest frequency and the total percentage is 7474 (31.7%) and types of imaging methods are considered to be a useful method in view of the high prevalence of non-peritoneal lesions in these patients.

Concussion:

The results of this study show that in the majority of people suffering from injuries caused by accidents (95.1%), there was a slight decrease in consciousness. This is while in 1.3% of people, severe alertness has been observed of which 12% are related to head and neck lesions and chest. In terms of vital signs, 62.6% of patients had hypertension, 7.7% tachycardia, 1.2% bradycardia and 1.9% had increasing of body temperature and fever, which can be due to shock and other complications of the events caused by driving accidents.

Recommendations

Regarding the results and the prevention of injuries caused by driving accidents, it is possible to emphasize the correct training of helmets for motorcyclists and seat belts for car occupants. Also, due to the high prevalence of head muscle lesions, special attention should be given to the correct transfer of patients to the emergency

department. On the other hand, given the impact of education on people's education and the prevention of accidents, interventions may be useful in facilitating academic conditions in large-scale decision-making.

Limitations

One of the significant limitations in this research is its implementation at a university center with a limited statistical population. Therefore, it is suggested that this study be carried out in several university centers simultaneously with a higher statistical society.

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References:

1. David J. Epidemiology of trauma. *Surg Clin North Am.* 1996;76(4):168-70.
2. Wui LW, Shaun GE, Ramalingam G, Wai KM. Epidemiology of trauma in an acute care hospital in Singapore. *J Emerg Trauma Shock.* 2014;7(3):174-9.
3. Saadat S, Yousefifard M, Asady H, Moghadas Jafari A, Fayaz M, Hosseini M. The Most Important Causes of Death in Iranian Population; a Retrospective Cohort Study. *Emerg (Tehran).* 2015;3(1):16-21.
4. El-Hennawy H, El-Menyar A, Al-Thani H, Tuma M, Parchani A, Abdulrahman H, et al. Epidemiology, causes and prevention of car rollover crashes with ejection. *Ann Med Health Sci Res.* 2014;4(4):495-502.

5. Borchgrevink GE, Kaasa A, McDonagh D, Stiles TC, Haraldseth O, Lereim I. Acute treatment of whiplash neck sprain injuries: a randomized trial of treatment during the first 14 days after a car accident. *Spine*. 1998;23(1):25-31.
6. Benvenga S, Campenní A, Ruggeri RM, Trimarchi F. Hypopituitarism secondary to head trauma. *The Journal of Clinical Endocrinology & Metabolism*. 2000;85(4):1353-61.
7. Bozorgi F, Mirabi A, Chabra A, Mirabi R, Hosseinejad S-M, Zaheri H. Mechanisms of Traumatic Injuries in Multiple Trauma Patients. *International Journal of Medical Investigation*. 2018;7(2):7-15. eng.
8. Singh R, Singh HK, Gupta SC, Kumar Y. Pattern, severity and circumstances of injuries sustained in road traffic accidents: a tertiary care hospital-based study. *Indian J Community Med*. 2014;39(1):30-4.
9. Masoumi K, Forouzan A, Barzegari H, Asgari Darian A, Rahim F, Zohrevandi B, et al. Effective Factors in Severity of Traffic Accident-Related Traumas; an Epidemiologic Study Based on the Haddon Matrix. *Emerg (Tehran)*. 2016;4(2):78-82.
10. Karkee R, Lee AH. Epidemiology of road traffic injuries in Nepal, 2001-2013: systematic review and secondary data analysis. *BMJ Open*. 2016;6(4):e010757.
11. Ma OJ, Mateer JR, Ogata M, Kefer MP, Wittmann D, Aprahamian C. Prospective analysis of a rapid trauma ultrasound examination performed by emergency physicians. *The Journal of trauma*. 1995;38(6):879-85.
12. Hoffman JR, Mower WR, Wolfson AB, Todd KH, Zucker MI. Validity of a set of clinical criteria to rule out injury to the cervical spine in patients with blunt trauma. *New England Journal of Medicine*. 2000;343(2):94-9.
13. Asadian L, Hadadi K, Montaza SH, Khademloo M, Mirzaii N. An Epidemiological Study of Head Injuries in Patients Attending Sari Imam Khomeini Hospital, 2013- 2014. *Journal of Mazandaran University of Medical Sciences*. 2015;24(122):207-16.
14. Poitzman A, Makaroum T, Slasky S. Prospective study of CT in initial management of blunt abdominal trauma. *J Trauma*. 1996;26(3):585-89.
15. Khodadadi N, HOSEIN BZ, Charmi L, Alinia S, Asli A. Epidemiology of trauma due to driving accidents in Poursina trauma research center in Rasht. 2010.
16. Salari A, PirayehHaddad F, AGHILI AG. Demography of trauma patients due to driving accident in Yazd city. 2002.

Tables:**Table 1:** Frequency, total percentages and percentages by location of lesion in driving accidents.

location of lesion	Response		Percentage of locations by separation
	Total frequency	Total percentage	
head and neck	5216	37.4%	67.8%
Chest	1060	7.6%	13.8%
right upper organs	1676	12%	21.8%
left upper organs	1477	10.6%	19.2%
right lower organs	1700	12.2%	22.1%
left lower organs	1617	11.6%	21%
Abdomen and pelvis	1177	8.4%	15.3%
Internal gut	0	0%	0%
Genitals	42	0.3%	0.5%
Total	13965	100%	-

Table 2: Frequency, Total Percentage and Percent by Separation Based on the Type of Lesion in Driving Accidents

Type of lesion	Response		Percentage of locations by separation
	Total percentage	Total frequency	
penetrant	913	10.7%	11.9%
Non-penetrant	7602	89.3%	98.8%
Total	8515	100%	-

Table 3: Frequency, Total Percentage and Percent by separation in terms of Para clinical Type in Driving Accidents

Para clinical type	Response		Percentage of locations by separation
	Total percentage	Total frequency	
Fast sonography	7474	31.7%	97.2%
abdomen and pelvis Solography	27	0.1%	0.4%
CT scan	4612	19.5%	60%
MRI	42	0.2%	0.5%
CXR	7158	30.3%	93.1%
Organs' solography	4295	18.2%	55.8%
Total	23608	100%	-