

## Original Article

# Characteristics of Trauma in North East Iran and the Prevention Strategies

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## Abstract

**Background:** The increase in mortality and morbidity of traumatized patients in developing countries might be due to disorganized medical services and credit tightness. This study was designed to describe the characteristics of injury, the strategies for the trauma prevention, and to improve the healthcare system.

**Methods:** This was part of a national research project about trauma, conducted in the main trauma center of Mashhad, in North East Iran; it was a prospective cross-sectional study which comprised of all consecutively admitted patients to the emergency department from December 2003 through July 2004.

**Results:** Most of the traumatized patients were male, uneducated, housewives, or workers. Motor vehicle accidents (during the time when fastening seat belts and wearing helmets were not compulsory) and falling (height less than four meters and falling on the ground) were considered as the most common mechanisms. Almost 68.5% of the patients transferred to the hospitals did not have prehospital care. With an average injury severity score (ISS) value of 10.3, lower extremities and head and neck were the most common traumatized anatomic areas leading to their related morbidity and mortality.

**Conclusion:** A large number of traumatized cases among uneducated and nonoccupational population makes the role of mass media more prominent. Public education about traffic law, streets, and vehicle security check seems to be crucial to decrease the mortality and morbidity.

**Keywords:** North East Iran, prevention, trauma

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## Introduction

One out of each ten deaths in the world is due to trauma, one of the most common mortality causes.<sup>1</sup> Thereby, trauma could be denominated as an epidemiologic concern. One Disability Adjusted Life Year (DALY) can be thought of as one lost a year of “healthy” life.<sup>2</sup> Nowadays, 14% of all DALY owe to trauma worldwide which would turn to 20% by 2020, WHO declares, where motor vehicle accidents would be the third main source of DALY.<sup>3</sup>

Fifty percent of all trauma-related mortalities occur in those who are in the age group of 15 to 44 years,<sup>4</sup> which would end up in a country’s high economic burden. A decrease in mortality and morbidity has been noticed in well-developed countries with a high economic income due to a prompt systematic trauma organization and their special services. Coincidentally, there has been an increase in mortality and morbidity of traumatized patients in developing countries which might be due to disorganized medical services and credit tightness. Iran’s second cause of death is trauma,<sup>4</sup> which makes it very essential to set up an efficient and practical healthcare system. This study was planned to gather adequate data for measuring epidemiologic and demographic characteristics of

trauma in Mashhad, North East Iran. Considering Mashhad as a holy place and the second largest city in Iran and a vast local traffic especially in the summer time, the epidemiologic evaluation of trauma and its monitoring would be of immense importance. Therefore, this study was designed to describe the characteristics of injury, the strategies for trauma prevention, and improvement of healthcare system in Mashhad.

## Materials and Methods

This was part of a national research project about trauma, authorized by the Ministry of Health and Medical Education, Mashhad University of Medical Sciences (MUMS), and Mashhad Vascular and Endovascular Research Center (MVASRC), conducted in Kamyab Hospital, the main trauma center in Mashhad, as a prospective, cross-sectional study comprising of all consecutively admitted patients in the emergency department from December 2003 through July 2004.

Explaining to the physicians the aim and methods of the study, and instructing them regarding how to determine the injury severity score (ISS), they fulfilled the questionnaire forms by interviewing those traumatic patients who were admitted to the hospital for more than 24 hours. The questionnaire form consisted of three parts: demographic characteristics, prehospital care, and hospital care; those were all re-evaluated and supervised by the quality control unit. All the cases were followed up till the discharge date.

Trauma severity was estimated by means of ISS which is an internationally accepted criteria based on head and neck, face, chest,

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abdomen, and extremities trauma, and is measured with a numerical score ranging from 0 to 75. The ISS is an anatomic scoring system that provides an overall score for patients with multiple injuries.<sup>5</sup>

Trauma and ISS (TRISS) combines both anatomic and physiologic measures of injury severity (ISS, RTS, patient's age) and so predicts probability of survival, in this study was used for qualitatively measuring the severity and, hence, the survival probabilities.<sup>5</sup>

To express how standard the traumatized patient's care has been, a scoring system, which has been named as Major Trauma Outcome Study (MTOS), is being used. MTOS includes three indexes of W, Z, and S. M index shows how similar the two population of the study and the standard population of the MTOS are. W and Z show how effective the care has been to prevent mortality.<sup>6</sup>

The collected data were analyzed using SPSS (version 11.5).

## Results

### Demographic characteristics

The total number of patients included in this study was 1544, of whom 54% were men and 46% were women. With an average age of 30.18 years, the youngest patient was one month old and the oldest one 95 years old. Considering the educational level, most traumatized patients were between uneducated population, those without even basic elementary education (508 patients, 32.9%), and primary education (428 patients, 27.7%). Among the patients, homemakers were the most vulnerable group, while workers took the second position (Table 1).

### Trauma characteristics

During the study period, most injuries took place in December (19.1%) and January (19.5%). Streets were the most traumatizing area (47.7%).

### Trauma mechanism

Motor vehicle accidents (67.2%) and falling (20.2%) were considered as the most common mechanisms (Table 2). The most falling incidents were related to the height less than four meters (35.3%) and falling on the ground (37.9%). In motor vehicles, fastening seat belts and wearing helmets were not compulsory during the study period (now compulsory owing to the vast similar reports).

Pedestrians (40.1%), motorcyclists (33.2%), and driver and passengers (25.6%) [the back seat passengers (10.6%) with highest rank] were the most traumatized victims in motor vehicle accidents (Figure 3). Only 7.4% of the motorcyclists had worn helmets. Ten percent of passengers had fastened their seat belts.

In total, 95.3% were blunt trauma and 4.7% penetrating injuries; the latter was lower in a similar study performed in Tehran.<sup>3</sup> Only 6.8% of the cases were occupation-related accidents. Stab wounds constituted 75% and gun-shots (70% of which were high-velocity gun-shots; bullet speed more than 2000 feet per second) 8.7% of all penetrating traumas.

### Prehospital care

Private ambulances (22.6%), public ambulances (16.9%), and private vehicles (60.5%) were used for transporting the patients. The mean required time for the ambulances to reach the trauma site since the accident occurrence time was 29 minutes (standard

deviation [SD] = 28 minutes), ranging from five minutes to four hours; it took two hours and 25 minutes (SD = six hours and six minutes) for the patients to reach the hospital since the trauma, which could be reduced to one hour and 27 minutes if the public ambulances were used. It should be noted that this relatively long period of time measures the urban area transportation time as well. This means that the actual transportation time is less than this.

The ambulance non usage motives were either unspecific (30.9%) or unrepresented urban servitudes (24%). While 1391 cases (90%) were transferred to hospitals without any prior information, only 488 of them (31.6%) could benefit from prehospital care.

### Hospital care

The patients' average remaining time in the emergency department was one hour and five minutes, ranging from five minutes to 10 hours. Evaluation of the patients' vital signs demonstrated a systolic blood pressure of less than 90 mmHg and a heart rate of more than 100 bpm in 17.5% and 6.7% of the cases, respectively.

Glasgow coma score (GCS) of more than 12 was recorded in 1367 (88.5%) cases, while only 110 cases (7.2%) were detected to have a GCS of 9 and less.

### Trauma characteristics

The most common traumatized anatomic areas were head and neck (42.5%) and lower extremities (45.5%) which mostly lead to admissions to the hospital (36.5% and 34.3%, respectively); annotating more than one anatomic traumatized site in some patients.

### Involved traumatized areas

The involved traumatized areas were divided into eight parts including head and neck, face, thorax, abdomen and pelvic, extremities, spine, skin, and burning; 46.6% of the cases had more than one traumatized area.

### Injury severity score (ISS)

The ISS of the patients had a distribution pattern as follows: less than 7 (mild severity) in 731 (47.3%), between 7 to 12 (moderate) in 490 (31.8%), and more than 12 (severe) in 323 (20.9%) patients. The average value of ISS in the traumatized patients was 10.3 (SD = 12.83), ranging from 1 to 75 (Figure 4).

### Care management

Comparing the therapeutic results to those of MTOS, three indexes of M, Z, and W were measured as 0.902, -6.1, and -1.9, respectively.

### Course of events

The average duration of hospitalization was 6.8 days (SD = 7.3), ranging from one to 90 days. The average hospital cost accounted was 1,974,427.9 Rials (SD = 2,747,270.6) in addition to extra cost of externally-provided medication and equipment which counted to be 878,635.80 Rials (SD = 123,130.02) for each of the patients (these costs were related to the teaching government hospitals). Thirty-three percent of the patients (508) did not have any health insurance protection (the new policy states that all patients should now be protected by health insurances).

Temporary disability and, hence, ineffectiveness to work was noticed in majority (1315) of the cases (85.2%) which lasted for about 25 days (SD = 19.20). Morbidity, due to limb amputation (17/22 upper limb and 5/22 lower limb), was recorded in 20

**Table 1.** Occupation.

	Frequency	Percentage
Hunter	1	.1
Cattleman	9	.6
Retired	17	1.1
Armed forces	27	1.7
Driver	46	3.0
Farmer	58	3.8
Office employee	67	4.3
Construction worker	69	4.5
Industrial worker	73	4.7
Jobless	74	4.8
Child	177	11.5
Workpeople	202	13.1
Student	210	13.6
Homemaker	449	29
Unknown	12	.8
Others	53	3.4
<b>Total</b>	<b>1544</b>	<b>100.0</b>

**Table 2.** Mechanism of trauma.

	Frequency	Percentage
Foreign body	1	.1
Burning	1	.1
Shotgun	1	.1
Blow gun	1	.1
Bite	6	.4
Gunshot	9	.6
Stab wounds	75	4.9
Blunt objects	84	5.4
Fall	312	20.1
MVA	1037	67.1
Unknown	2	.1
Others	15	1.0
<b>Total</b>	<b>1544</b>	<b>100.0</b>

(20/1544) cases (1.3%); 25% of whom were females and 5% of all were expired (1/20).

The most common cause of trauma-related mortality (6.1%, 94 cases) was head and neck injuries (87.7%), very often due to motor vehicle accidents followed by falling. Forty-six percent of all deaths occurred in the intensive care unit (ICU) and 40.2% in the emergency department.

The mean required time for the patients to stay in the ICU was 4.8 days (SD = 6.3), which constituted most of mortalities (46%).

## Discussion

The majority of traumatized cases were among young population, the most active and alive group of the society.

Unlike other similar studies, female to male ratio was almost equal (46%: 54%).<sup>3,4,7,8</sup>

The results of this study revealed more traumatized patients in uneducated (the group that includes 15% of general population) and primary-educated population. This could be due to more in-structibility of well- educated population; thereby teaching, especially by mass media, should come into the account more and more.<sup>5</sup>

Jobless people constituted the major part of trauma patients in other similar studies performed abroad,<sup>5-6</sup> which is same as our study; i.e., 93.2% of the traumatized cases were nonoccupational (housewives are on the top of the list followed by students in the second place).

As mentioned above, motor vehicle accidents and streets were the most common mechanism and location of trauma, respective-ly which is supported by other studies such as WHO's,<sup>7</sup> thereby

public education about traffic law, streets, and vehicle security checking seems to be crucial. During the last 20 years, combina-tion of a rapid economic growth and a mechanical lifestyle have led to an increased motor vehicle accidents and accordingly high mortality rates.<sup>8</sup>

Similar to other studies, pedestrians and motorcyclists consti-tuted a prominent percentage of trauma victims.<sup>9</sup> Fastening seat belts and wearing helmets would be one of the trauma prevention methods in motor vehicle accidents, considering infrequent usage of these safety equipments among our cases, and also decrease in mortality and morbidity by frequent usage of these measures, based on studies performed in other countries.<sup>9-11</sup>

Considering the large number of lower extremity injuries in mo-tor vehicle accidents, mandatory placing of a limb safety guard on motorcycles would lower the incidents of this traumatized loca-tion as well.

Falling has the second place of frequency among trauma mech-anisms which, in some articles, has pulled up itself to top of the list.<sup>12</sup> Stab wound was the most common type of penetrating trauma (76.7%) which could be due to its reachability by youths.

Suicide, as one the trauma mechanisms, had a prevalence of 0.6% which is lower than other studies (e.g., prevalence of 2%).<sup>13</sup> Self-immolation, as one of the suicide patterns, was not included in this study (as patients are routinely transferred to another specif-ic hospital). Among these patients, females are reported to have a significantly higher mortality rate.<sup>14</sup>

The average time between trauma occurrence to the time that the patients reached a hospital was two hours and 25 minutes; this interval was about 68 minutes in a similar study performed in the United States in 1995.<sup>15</sup>

The patients were transported to hospitals by using an ambu-

**Table 3.** Frequency of traumatized area.

Number of traumatized anatomical area in one patient	Frequency	Percentage
Only one	825	53.4
2	514	33.3
3	174	11.3
4	28	1.8
5	3	.2
<b>Total</b>	<b>1544</b>	<b>100.0</b>

lance in only 39% of the cases, while the rest (61%) preferred to use their own vehicles which reveals a poorer result compared to other countries.<sup>16</sup> Evaluating the possible causes of not using ambulances, unrepresented urban servitudes were the most common one. Thereby, opportune supervision and planning in order to prepare all facilities in the right time would be one of the practical goals. By considering these facts that 90% of the patients were transferred to hospitals without prior information and that only 31.6% of the patients had prehospital care, one could find out the need for an efficient urban servitude. Also, transporting the patients without prior informing of the clinical centers causes many difficulties for patients, which ends up in late attention to injured patients.<sup>17</sup>

An average injury score of 10.3 was noticed, of which 79% were included in ISS level of mild (less than 12). Thereby, one can conclude the moderation of injury in the population. By having a proper and efficient triage system, majority of patients could be treated in level 2 and 3 trauma centers, thereby reducing the number of patients referred to higher level centers; therefore, increasing the efficacy of the healthcare system.

Evaluating the anatomic sites of injury in motor vehicle accidents, head and neck were the most common sites, which is similar to studies performed in other countries.<sup>16,18</sup> Extremities and abdomen were ranked in the second and third places. It becomes necessary to consider better traffic regulations and safely design of cars, as well as best engineering and geometry design of roads.

The majority of cases had transient morbidity (84.5%). It would be better to follow up the discharged patients precisely up to their return to normal life and job, but because of the difficulty in data collection for such a vast investigation, instead the follow-up process performed only by considering clinically-based estimations.

The mortality was higher in this study compared to similar studies performed in other countries; 6.1 % vs. 2%. The morbidity as well was lower in other countries (67%).<sup>16,19-21</sup>

Many of the trauma-related mortalities could be prevented; e.g., the mechanism of 69% of all mortalities was due to accidents, which puts more pressure on the need for improving the public education about traffic law, streets, and vehicle security check. Almost 68.5% of the patients transferred to the hospitals did not have prehospital care; 85% of all mortalities occurred among those who had not received any pre-hospital care. Thirty-five percent of all mortalities were among people who were admitted to the ICU.<sup>22</sup>

As M index (0.902) was higher than 0.88, therefore our cases would be comparable to the control group in MTOS. Traumatic patients' management and care are significantly lower than the defined standards in MOTS, noticing negative results of W (-1.9) and Z (-6.1) indexes.<sup>4</sup> Putting all these together, confirms the inefficiency of medical services.

There was no insurance coverage for 33% of the cases. The average total cost for each person, while using government facilities,

was approximately 2,850,000 Rials, which shows a potentially preventable financial burden to the country's economy. Therefore, a comprehensive planning for trauma system all over the country could save time, cost, and energy.

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