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## ORIGINAL ARTICLES

# Assessment of traumatic injuries in 1028 patients referred to the Ayatollah Taleghani Hospital from the Sarpul-Zahab earthquake

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**Abstract:** *Introduction: Investigating and recognizing the epidemiological structure of earthquake damages in earthquake-prone countries is of great importance. The aim of this study was to evaluation of traumatic injuries in 1028 patients referred to the Ayatollah Taleghani Hospital from the Sarpul-Zahab earthquake (November 12, 2017).*

*Method: This study is a cross-sectional study that includes 1028 traumatic patients from the Kermanshah earthquake. The patients, including outpatients in the emergency department, admitted in orthopedic, general surgery and neurosurgery, or even patients who needed to be transferred to other treatment centers.*

*Result: Of the 1,028 patients, 488 were men (47.5%). The number of men with high injury severity was 51 (10.4%) and the number of women with high severity of the injury was 58 (10.7%). The average age of the injured was 33.04±15.01 years. The mean ISS measure in this study was 8.9±1.6. A total of 109 (10.6%) had scores above 17. The number of cases with head and neck injury was 328 (24%), 233 cases (17%), chest 114 (8.3%), The abdomen or pelvis is 190 (13.9%), the spine is 200 patients (14.6%). After examining the type of trauma in 1791 injuries, 1074 injuries (59.9%) had penetrating trauma and 717 injuries (40.1%) of blunt trauma were calculated. Of patients with severe trauma, 83 patients suffered severe injuries (7.7%) and in patients with blunt trauma, 68 patients suffered severe injuries (9.4%). The mortality rate was 5 (0.5%).*

*Conclusion: This study established a fracture pattern in the referred patient of the Sarpul-Zahab earthquake to the Ayatollah Taleghani Hospital and is practical for clinicians to increase understanding of this natural disaster and permits superior selection of the triage management and therapeutic process.*

**Keywords:** *earthquake, disaster, trauma, Kermanshah*

## INTRODUCTION

Trauma is the most common cause of morbidity and mortality in the first third of life in human societies [1-3]. In recent years, trauma has always been one of the three main causes of injury and general mortality [4]. The distribution of incidence of natural disasters is different in the various regions of the world. There are more than a few potent geographical regions for trauma experiences, such as earthquakes, organized violence, terrorism, combats, and

other natural disasters [5-6]. In the past few decades, Iran has experienced more than a few earthquakes, which caused severe and massive damages. Therefore, investigating and recognizing the epidemiological structure of earthquake damages in earthquake-prone countries such as Iran is of great importance. On November 12, 2017, an earthquake

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take place in Sarpul-Zahab and Sallatha Babajani cities, Kermanshah Province, Iran, with a 6.9-magnitude on the Richter scale. The urban and population density areas were exposed due to this earthquake for significant severe and massive damages. The fracture pattern in injured patients due to earthquakes is different in the various regions of the world, for example, in the earthquake of Armenia, the head and neck injury rate was 22% [7]. In the Wenchuan earthquake, the highest number of injuries has been seen in those who suffered damage to the external surface of the body [8-9]. Generally, the fracture pattern of an earthquake can be including simple morbidity, to even mortality. Therefore, characterization of the mechanism and epidemiologic variables of these traumatic events is necessary for the management of proper initial triage [10].

The aim of this study was to evaluation of traumatic injuries in 1028 patients referred to the Ayatollah Taleghani Hospital from the Sarpul-Zahab earthquake (November 12, 2017) regarding different levels of demographic variables (age and gender), pathology of the disease (anatomical location of the injury, type of trauma, triage level, etc.) and the stages of treatment (how the patient transmits, operating care, etc).

## METHODS

This study is a cross-sectional study that includes traumatic patients from the earthquake in Kermanshah province on November 12, 2017, referred to the Ayatollah Taleghani Hospital of Kermanshah as the largest treatment center in the west of Iran. The study population included 1028 patients, including outpatients in the emergency department, admitted in orthopedic, general surgery, and neurosurgery, or even patients who needed to be transferred to other treatment centers.

Data analysis including frequency varying levels, the percentage of damage to the severity of the trauma for variables such as age, sex, type of trauma, and injury as well as the correlation between trauma severity and anatomical location of some of the variables. After the initial studies, the patients' medical records were filled in for two months.

The severity of trauma by ISS method according to the AIS criteria for traumatic patients with a proper pre-study was carried out. To calculate the patient ISS, the body is divided into six parts as follows:

Head and neck

Face

Chest

Abdomen or pelvis

Spinal cord

Limbs

To calculate the ISS, the highest severity of AIS is considered

in the three areas of the body that have seen the most damage, then we squeeze three AIS scores together to calculate the severity of the ISS damage. AIS scoring is based on the amount of injury and the anatomical location of the damage between 1 and 6, which is 1 indicates minor damage and 6 is the number of fatal injuries. Hence, the severity of the ISS damage is between 1 and 75, since by eliminating deadly injuries with a score of 6, the sum of the squares of other AIS levels is 75 ( $25 + 25 + 25 = 75$ ), 75 ( $25 + 25 + 25$ ), the injuries that the IIS is 6, 75 are considered [6, 13, 14]. Registered demographic data allow the proportion of male and female patients or the age range of patients to be identified in terms of the severity of the injury. The structure of the damage is also known by its characteristics, such as trauma, triage, and anatomical location. The protocol of the study was approved by the ethical committee of Baqiyatallah University of medical sciences.

Data analysis was performed using SPSS-20 software. Descriptive statistics such as frequency, percent, mean and standard deviation were presented.

## RESULTS

1028 patients transferred to Ayatollah Taleghani hospital were included in the study. Table 1 depicts patients' characteristics regarding transition status, sex, age levels, Anatomic location of the injury, Triage level, Type of trauma, Duration of admission, ISS, and outcomes (Table 1). Of the 1,028 patients, 488 were men (47.5%). The number of men with high injury severity was 51 (10.4%) and the number of women with high severity of the injury was 58 (10.7%). The ratio of women with high severity of the injury was 5.6% for all patients and 4.9% for men. The average age of the injured was  $33.04 \pm 15.01$ , range from 1 to 95 years.

**Table 1:** Patients' characteristics regarding transition status, sex, age levels, Anatomic location of the injury, Triage level, Type of trauma, Duration of admission, ISS, and outcomes

Variable	N	%
Transition status		
Emergency	354	34.4
Personal car	420	40.9
Other ways	254	24.7
Sex		
Male	488	47.5
female	540	52.5
Age		
0-4	56	5.4
5-14	59	5.7
15-24	136	13.2
25-44	410	39.9
45-64	242	23.5
>65	125	12.3

Variable	N	%
<b>Anatomic location of the injury</b>		
Head and neck	328	18.3
Face	233	13
Chest	114	6.3
Abdomen and pelvis	190	10.7
Spine and Spinal cord	200	11.2
Limb	726	40.5
<b>Triage level</b>		
1	2	0.2
2	470	45.7
3	534	52.0
4	22	2.1
5	0	0.0
<b>Type of trauma</b>		
Penetrating	1074	59.9
Blunt	717	40.1
<b>Duration of admission</b>		
1 day	676	65.8
1-7 day	328	31.9
7-30 day	22	2.1
>30 day	2	0.2
<b>Operational care</b>		
Emergency clearance	527	51.3
Orthopedic surgery	349	33.9
General surgery	109	10.6
Neurological surgery	43	4.2
<b>The outcomes</b>		
Partial recovery	733	71.3
Die	5	0.5
Transfer to another hospital	189	18.4
Other	101	9.8
<b>ISS</b>		
1-7	578	56.2
8-16	341	33.2
17-25	71	6.9
>25	38	3.7

The mean ISS measure in this study was  $8.9 \pm 1.6$ , ranging from 1 to 75. A total of 109 (10.6%) had scores above 17.

The total of injuries for 1028 patients was 1,791 injuries, according to the anatomical status of injury, the number of cases with head and neck injury was 328 (24%), 233 cases (17%), chest 114 (8.3%), The abdomen or pelvis is 190 (13.9%), the spine is 200 patients (14.6%). The organs are 726 cases (53.3%) (Table 2).

**Table 2:** Frequency of different anatomic location groups of damage in the ISS levels

		ISS				Total
		1-7	8-16	17-25	>25	
Anato	Head and neck	136	99	54	39	328
	Face	104	98	21	10	233
	Chest	43	50	14	7	114

Abdomen or pelvis	66	62	30	32	190
Spinal cord	83	62	25	30	200
Limbs	489	161	51	25	726
Total	921	532	195	143	1791

The division of patients in terms of the age group showed that the highest number of patients was in the age group of 25-44 years, and the lowest number of patients was in the age group of 0-4 years. This severity of injury shows that the severity of injury in the age group of 15 to 24 years has the highest proportion compared to other groups (Table 3).

**Table 3.** Frequency of different age groups and frequency of severe injuries in groups

		Frequency	Frequency percent	Percentage of damage
Age	0-4	56	5.4	3.5
	5-14	59	5.7	6.7
	15-24	136	13.2	12.5
	25-44	410	39.9	11.4
	45-64	242	23.5	8.6
	>65	125	12.3	14.4

After examining the type of trauma in 1791 injuries, 1074 injuries (59.9%) had penetrating trauma and 717 injuries (40.1%) of blunt trauma were calculated. Of patients with severe trauma, 83 patients suffered severe injuries (7.7%) and in patients with blunt trauma, 68 patients suffered severe injuries (9.4%). The mortality rate was 5 (0.5%).

## DISCUSSION

Earthquakes are administered in different methods, according to particular regions and countries [11]. In the past few decades, Natural disasters have affected 800 million people, and have caused over \$500 billion of economic costs [12-14].

In recent decades, various methods have been used to evaluate the severity of the trauma, including ISS, TRISS, etc. In this study, the ISS method was used and we examined the severity of trauma with other variables. Being the benchmark used in this article, ISS is a global traumatic survey criterion defined based on the sum of the three injuries with the highest AIS score. ISS is usually divided into 6 areas per person and is also used for patients with more than one injury. The numerical value of this numerical criterion is between 1 and 75, with scores less than 7.5 categorized in the group of weak injuries, scores between 7.5 to 17 categorized in the group of moderate injuries, and scores more than 17 categorized in the group of severe injuries. Traumatic studies and epidemiological structure of the trauma caused by the earthquake led to the classification

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of vulnerable groups and the identification of vulnerable anatomical parts of the body in injured people. This knowledge informs us about the necessary steps to prevent further problems and to deal with the damage that has been caused.

In this study, five mortality (2 female and 3 male patients) were seen that have multiple trauma and blunt abdominal trauma. 60 % of the dead were between the ages of 25-45. The severity of injury for all of them was higher than 25, with an average injury severity of 38.4. this mortality can reduce if the management of triage was done with the standard method, for example, Sonography in Trauma (FAST) can be regarded in the administration of disaster management, that it can reduce mortalities due to blunt abdominal and multiple traumas, as Kakaei et al. [15] reported on the value of FAST as a primary diagnostic method for revealing of blunt abdominal and multiple trauma. Therefore, conducting FAST is a primary screening with high speed that can use in situations of disaster. The impotence of the FAST as a primary diagnostic method has been confirmed in the previous studies for primary screening [16].

The administration of triage of patients is one of the most important episodes of disaster management, hence, it has been indicated that triage of injured patients in disastrous events, particularly earthquakes, can decrease considerably mortality and morbidity. The accessibility of hospitals is very significant in disaster administration after earthquakes, and this subject is related to the structure of the hospital and building standards [17]. In this study, we have few mortality (5 cases), because the administration of triage of patients was done correctly, and the hospital was accessible and all the patients were established on the same crisis day. Although, in the Bam earthquake, the patients were triaged during the night following the disaster, since the two main hospitals of Bam were destroyed [18].

In this study, the demographic results established that trauma was more common in females (52.5% for females and 47.5% for males), and 39.3% of the patients have 25-44 years. The several studies indicated comparable outcome with these in the different regions of the world however In

the Pakistan earthquake, 60.7% of the patient was male and 39.3% were female and 49% of patients have 25-44 years [19] because the most population of this region are in the third decade of life.

In this study, the age range of the patients was 1-95 years with a mean of 33.4 years. In the Marmara earthquake, Turkey, the age range of the patients was 11-74 years with an average of 34 years.

Limb injuries are the most common trauma in earthquake injuries, in this study, 42% of patients have presented limb injuries that the previous studies indicated similar outcomes, as 39% of the patients suffered head and neck injuries in the Armenia earthquake [8-11]. In our study, the most frequent area exposed for injury was limbs (42%) and followed by head and neck (18%), face (12.7%), abdomen and pelvis (10.5%), chest (5.9%). Also, the most common area exposed for injury was limbs (38.5 %) and followed by chest (21.4%), abdomen and pelvis (15.2%), spine (9.5%), head and neck (7.9%), face (1.3%) in the Wenchuan earthquake. In the Bam earthquake, 68% of the organs were damaged, compared to 42% in our study. Because the Bam earthquake occurred more time than this earthquake, also the strength of the Bam earthquake was higher due to the surface of the earthquake center [12, 20-24].

## CONCLUSION

This study allows us to assess and manage the crisis, trauma due to earthquake, epidemiology of earthquake trauma. The results of this study confirmed with studies of other earthquakes in the world, however, some results different since this study was conducted to determine the epidemiological structure of the trauma, the issues which haven't been discussed in the literature. Consequently, this study established a fracture pattern in the referred patient of the Sarpul-Zahab earthquake to the Ayatollah Taleghani Hospital and is practical for clinicians to increase understanding of this natural disaster and permits superior selection of the triage management and therapeutic process.

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