

## ARTICLE

# INVESTIGATING THE FREQUENCY OF PENETRATING AND BLUNT CHEST TRAUMAS AND THEIR EFFECTS ON THE MORTALITY OF PATIENTS VISITING PEIMANIEH HOSPITAL IN JAHROM FROM 2006 TO 2015

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## ABSTRACT

**Introduction:** Nowadays trauma has become one of the most important, dangerous and prevalent causes of damage to humans in all communities. A trauma can inflict serious injuries and harms on an individual. It may also cause death or disability. Regarding damaged organs, there are some categorizations among which traumas to head and chest require more attention by medical staff. Chest trauma is associated with a high mortality rate, and the majority of traumatic cases affect young men who are the main labor force in a community. Therefore, the aim of this study was to determine the mortality rate of penetrating and blunt chest traumas in patients visiting Peimanieh Hospital in Jahrom in the past ten years. **Materials And Methods:** This is a retrospective cohort study in which various cases were investigated. For this purpose, 301 chest trauma cases were collected in compliance with the inclusion and exclusion criteria. A checklist was codified in accordance with the research objectives to collect the data recorded in cases. The research variables included the date of an accident, traumatic organs, X-rays, pathology test results, therapeutic interventions, hospitalization period, and the cause of death. After completing the information, the data were analyzed in SPSS 17. **Findings:** In this study, there were 244 male and 57 female patients, out of whom 19 individuals passed away, and the rest got cured. Moreover, there were 274 blunt trauma cases (12 deaths) and 27 penetrating trauma cases (7 deaths). These two types of trauma had significant effects on the deaths of patients ( $P=0.010$ ). There was a significant association between chest trauma and abdominal trauma in 178 cases ( $P=0.001$ ). **Conclusions:** The majority of chest trauma cases were blunt. However, the penetrating trauma was much more associated with mortality. In addition, abdominal trauma was associated with trauma to the chest in the most cases.

## INTRODUCTION

In today's world, trauma is the main cause of death, hospitalization, and disability in all age groups. Perhaps it has the greatest social and economic effect on all the stages of a disease. Therefore, victims of traumas receive more attention and care than other patients these days. Moreover, trauma is a cause of death in the first four decades of life. Death by trauma is not limited to a particular region or country. Given the increasing use of motor vehicles, the statistics for trauma, especially the ones caused by accidents, are on the rise. In addition, 25% of traumatic cases caused by motor vehicle accidents are chest traumas. This type of trauma is the cause of 45% of deaths by trauma per se [1]. According to a report presented by the UN on traumas caused by accidents in some European and Asian countries, Iran is ranked the first in terms of the rate of accidents resulting in traumas. Another study points out that the most prevalent cause of trauma in Iran is vehicular accidents [2]. A trauma damages different organs including the thorax. According to the statistics in the USA, 20-25% of traumatic deaths were chest traumas [1]. Due to the vital importance of the thorax, it can generally be stated that chest trauma is the cause of 20-50% of traumatic deaths [3]. Studying trauma and investigating the type of an accident can be important in preventing, controlling and reducing damages and complications. Trauma has been regarded as an important mental-health issue in the majority of developing communities. It causes more deaths in people who are younger than 30 years old in comparison with other diseases. Chest traumas are divided into two penetrating and blunt groups. Such traumas can cause damages to the chest wall including ribs and the spine or the organs inside the thorax such as the heart, lungs, diaphragm, and large vessels. These damages can cause hemothorax, pneumothorax, rib fractures, heart damages, scapular and sternal fractures, rupture of major vessels such as the aorta and pulmonary artery, and diaphragm rupture. Each of these damages can seriously threaten an injured individual's life and may even cause death [4]. The blunt trauma can be caused by motor vehicle accidents, fall from a height, or non-penetrating injuries. Motor vehicle accidents account for 70% of such traumas. Penetrating chest traumas can be usually caused by a knife strike, a bullet, and similar objects. Chest traumas cause high costs resulting from damages to young people and the loss of productive years of life due to resultant disabilities. The considerable point is that 40% of all traumatic deaths can be prevented; however, the survival of the injured people may be accompanied by disabilities [1]. Nowadays nearly 6000 cases of disability (out of 10000 cases) are caused by chest traumas [1]. The key to the diagnosis of mediastinal damages is to have a solid mentality about the likelihood of chest traumas in the injured. This mentality is obtained from a patient's precise history of the intensity and mechanism of a trauma. A high percentage of damages can be diagnosed using simple paraclinical methods such as a simple radiography of the chest. Since the epidemiology and prevalence of chest trauma can vary in different areas. The statistics for the damages caused by penetrating and blunt chest traumas can be considerable for many reasons including the high use of motor vehicles and the large number of accidents. The necessity of taking

### KEY WORDS

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care of patients suffering from chest traumas can save their lives. Therefore, investigating and determining the mortality rates of penetrating and blunt chest traumas can evaluate the success rate and the quality of health services and treatments very well. There is little comprehensive and accurate statistics and information pertaining to the relationships between chest traumas and the mortality rates of patients in Jahrom Country. Thus, this study was conducted to investigate the frequency of penetrating and blunt chest traumas and their effects on the mortality of patients visiting Peimanieh Hospital in Jahrom in the past ten years.

## METHOD

This is a retrospective cohort study in which different cases were investigated. The statistical population included the patients visiting Peimanieh Hospital in Jahrom to cure penetrating and blunt chest traumas from 2006 to 2015. To select the cases having necessary information in the study period, the archives of the hospital and contents of patients' cases were searched for chest traumas or other relevant injuries. Therefore, 301 cases were collected in compliance with the inclusion and exclusion criteria. Based on the research objectives and the data recorded in cases, a checklist was codified. The variables of this checklist include the date of an accident, the cause of an accident, traumatic organs, X-rays, pathology test results, therapeutic interventions, hospitalization period, and the cause of death. On this checklist, there are some items provided for each variable to be selected in accordance with each case. The items pertaining to traumatic organs are as follows: head trauma, penetrating chest trauma, blunt chest trauma, abdominal trauma, and pelvic trauma. The X-rays included MRI, CTA, CT scan, CXR and MRA. The pathology test results included rib fractures, sternal fractures, scapular fracture, hemothorax, pneumothorax, aortic rupture, cardio damages, pericarditis, lung injury, esophagus injury, and damages to the chest wall. The therapeutic interventions include supportive, restorative and surgical measures. Regarding the hospitalization period, there were two items: longer than a week and shorter than a week. Finally, the causes of death were divided into chest trauma, other traumas and non-traumatic causes. In addition to research variables, this checklist was used to collect the demographic information of patients (age, gender, and trauma type) as well as the death causes of the deceased patients. The inclusion criteria were the thoroughness of information in a patient's case and the validity of the period in which chest trauma occurred. The exclusion criteria included incompleteness of information in a patient's case and the lack of a chest trauma. The cases were investigated with full confidentiality, and the names and medical records of patients were not used in any results. After collecting data, the descriptive statistics and logistic regression were used to analyze data in SPSS 17.

## FINDINGS

This study was conducted on the cases of patients with chest traumas and patients with various traumas accompanied by chest traumas visiting Peimanieh Hospital in Jahrom in the past ten years. After applying the inclusion and exclusion criteria, 301 cases were collected. There were 244 men (81%) and 57 women (19%). Moreover, 17 male and 2 female patients passed away; however, the rest got cured. The average weight and age of patients were  $73.28 \pm 14.40$  and  $36.71 \pm 11.02$ , respectively. [Table 1-4] indicates the number of investigated patients in separate genders. The results of chi-squared test indicated that there was not a significant relationship between gender and death by trauma.

Trauma is more prevalent in men than in women; therefore, the rates of treatment and death are higher in men, too. However, there is not a significant difference between men and women in the relationship between gender and death by chest trauma (p-value:0.334).

Out of 301 chest trauma cases, there were 274 blunt cases (91%) and 27 penetrating cases (9%). Furthermore, 12 blunt cases (63%) and 7 penetrating cases (37%) passed away. [Table 1] shows a comparison.

**Table 1:** The Treated and deceased cases in two Trauma types

	Treated	Deceased	p-value
Blunt Trauma	262 (92.9%)	12 (63.2%)	0.000
Penetrating Trauma	20 (7.1%)	7 (36.8%)	

According to this [Table 1], 282 patients were cured. There were 262 (92.9%) blunt trauma cases and 20 (7.1%) penetrating trauma cases. In total, there were 19 deaths, 12 of which were caused by blunt traumas (63.2%), and the other 7 deaths were caused by penetrating traumas (36.8%). According to the chi-squared test, penetrating traumas caused significantly more deaths than blunt traumas did (p-value<0.05).

In addition, 121 chest trauma cases were accompanied by pelvic traumas. There were 111 treated and 10 deceased cases. There were 3 head trauma cases, none of which caused deaths. Moreover, 178 cases were accompanied by abdominal traumas, 12 of which were deceased. Two patients suffered only from the chest traumas, and two others were diagnosed with abdominal and pelvic traumas. Table 2 indicates the prevalence of chest traumas and other types of trauma.

**Table 2:** Chest trauma and other types of trauma

Trauma	Pelvis		Head		Abdomens	
	Yes	No	Yes	No	Yes	No
Quantity	121(40.2%)	180(59.8%)	3(1%)	298(99%)	178(59.1%)	123(40.9%)
Treated	111(39.4%)	171(60.6%)	3(1.1%)	279(98.9%)	166(58.9%)	116(41.1%)
Deceased	10(52.6%)	9(47.4%)	0(0%)	19(100%)	12(63.2%)	7(36.8%)
Total p-value	0.043		0.651		0.039	

The chi-squared test indicated that abdominal and pelvic traumas were accompanied by chest trauma the most (p-value<0.05). Moreover, there was not a significant relationship between chest trauma and head trauma.

Regarding diagnostic measures, 295 patients with chest traumas took chest X-rays (CXR), and 254 patients took CT scans. None of the patients took a CTA, MRI, or MRA. [Table 3] shows the X-rays requested for 301 patients with chest traumas.

**Table 3:** The X-Rays taken for patients with chest traumas

X-Rays	CXR	CT-scan	CTA	MRI	MRA
Quantity	259(98%)	254(84.4%)	0(0%)	0(0%)	0(0%)

According to [Table 3], CXR and CT-scan were the most common diagnostic methods in patients with chest traumas.

In total, there were 38 patients with hemothorax (12.6%), and 32 patients were cured (84%). There were 22 scapular fracture cases (7%), 12 sternal fracture cases (4%), and 79 rib fractures (26%). None of the patients had pericarditis (0%). Two of them suffered (0.6%) and died (100%) from heart damages. Moreover, there were 7 aortic rupture cases (2.5%), three of whom were cured (43%). There were also 78 pneumothorax cases (26%), 120 chest wall injuries (40%), 4 esophagus injuries (1.3%), and 19 lung injuries (6.3%). Table 4 shows the prevalence of each side effect pertaining to chest traumas and mortality rates.

**Table 4:** The mortality rates and side effects of chest traumas

Side Effect	Hemothorax		Heart Injury		Aortic Rupture		Pneumothorax		Chest Wall Injury	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Quantity	38 (12.6%)	263 (87.4%)	2 (0.7%)	299 (99.3%)	7 (2.3%)	294 (97.7%)	78 (25.9%)	223 (74.1%)	120 (39.9%)	181 (60.1%)
Treated	32 (11.3%)	250 (88.7%)	0 (0%)	282 (100%)	3 (1.1%)	279 (98.9%)	68 (24.1%)	214 (75.9%)	108 (28.3%)	174 (61.7%)
Deceased	6 (31.6%)	13 (68.4%)	2 (10.5%)	17 (89.5%)	4 (21.1%)	15 (78.9%)	10 (52.6%)	9 (47.4%)	12 (63.2%)	7 (36.8%)
p-value	0.01		0.00		0.02		0.06		0.032	

According to [Table 4], the most prevalent side effect of chest trauma was the chest wall injury (39.9%). The most dangerous side effect of chest trauma was heart injury which increased the mortality rate significantly (p-value<0.05).

Essential health interventions were provided for 140 patients (46%), 135 of whom (96%) were cured. Moreover, 161 patients (53%) received restorative-surgical interventions, and 147 of them (91%) were cured.[ Table 5-4] investigates therapeutic methods.

**Table 5:** Different therapeutic methods and outcomes

Interventions	Supportive	Surgical	P-value
Treated	134 (47.7%)	147 (52.3%)	0.071
Deceased	5 (26.3%)	14 (73.7%)	
Total	139 (46.3%)	161 (53.7%)	

According to [Table 5], the use of supportive measures was nearly equal to the use of restorative-surgical interventions. There was not a significant difference between the success rates of these two methods (p-value>0.05). Moreover, 251 patients (83%) were hospitalized for shorter than a week, and 234 patients (93%) were cured. Only 50 patients (17%) were hospitalized for longer than a week, and 2 of them (4%) passed away.

## DISCUSSION

Traumas are very prevalent in everyday life, insofar as many patients visiting the emergency or surgery wards of hospitals are traumatic patients. In more acute traumas, injuries and fractures are more common. Therefore, such traumas cause fewer problems threatening life. Head and chest traumas are regarded as the most dangerous types of trauma because of vital organs in these spots. If rapid and appropriate medical services are not provided for such patients, they will soon face serious hazards. This study indicated that

traumas were more prevalent in men than in women, something which can easily be justified because men are more prone to traumas than women due to their occupational conditions. Apart from few dangers which may happen to women at home or work such as cuts and burns, other types of trauma usually happen to men.

This study also indicated that the majority of chest trauma cases are blunt; however, penetrating traumas were significantly associated with more deaths. As mentioned, many of traumas are not so severe that patients face the risk of an early death. In addition, many traumas do not result from a hit by sharp objects. Therefore, a blunt trauma should be so severe that it can result in serious side effects such as hemothorax, apnea, or coronary artery ruptures. However, a sharp object such as a knife or bullet can easily cause these types of complications. Thus, such penetrating traumas are much more dangerous so that they cause more deaths. The most important conclusion of this study can be stated as follows: blunt traumas are more prevalent; however, they cause fewer deaths. On the other hand, although penetrating traumas are less frequent, they are much deadlier than blunt traumas. The mortality difference between these two types of trauma is clearly obvious. In this study, only 12 patients passed away out of 274 patients with blunt traumas; however, there were 7 deaths among only 27 patients with penetrating traumas. This study also pointed out that chest traumas were associated with abdominal and pelvic injuries in a way that very few chest traumas were not accompanied by any other types of trauma. In this regard, abdominal and pelvic traumas were the most prevalent. Due to the proximity of abdominal organs, especially the upper organs such as the liver and stomach, abdominal traumas are more frequent in chest traumas. Moreover, the mechanism of majority of traumas are in a way that blows are generally struck to the anterior body; therefore, mediastinal, abdominal and pelvic traumas cannot be distinguished. Traffic accidents, being thrown off motorcycles, and falling off heights are different types of such traumas. Results indicated that chest X-rays and CT-scan were the mostly-used X-rays requested by doctors. Their availability and high diagnostic values in the investigation of main mediastinal complications have made these X-rays the most important radiographies. The most dangerous side effects of chest traumas were heart injuries, aortic ruptures and hemothorax which caused the largest number of deaths. In other words, 100% of patients with heart failures passed away. According to the results, every injury to vital mechanisms caused more deaths. Heart injuries caused by traumas result in serious problems in blood circulation and flow through vital organs. They can critically endanger patients very shortly. Moreover, if traumas cause ruptures of heart tissues, the volume of circulated blood decreases greatly, and hemorrhage makes patients prone to hypovolemic and tamponade shocks. Aortic ruptures increase the mortality rates in these patients with a similar mechanism. Another lethal side effect of chest trauma is hemothorax jeopardizing patients by inducing pressure in the pleural layers and preventing the proper expansion of lungs through decreasing arterial oxygen saturation. Previous studies had similar results to this study. In a study conducted by Zargar et al., the majority of traumatic injuries were among men. Moreover, blunt traumas were much more prevalent than penetrating traumas. Both of these results are consistent with the present study. Zargar et al. mentioned that traumas were mainly caused by traffic accidents. They also investigated the participants in terms of literacy. According to their results, the patients were mainly illiterate or lowly literate. Unlike the current study, Zargar did not work on the side effects of trauma, common injured organs and mortality rates [5].

Haratian et al. obtained similar findings. The majority of trauma cases were blunt, and most of the patients were young men. Furthermore, the most prevalent involved part of the mediastinum was the chest wall. The mortality rate of chest trauma was reported 3.8%, something which is slightly different from the results of current study (6.3%). Unlike the current study, Haratian concluded that more than a half of chest traumas were not accompanied by any other types of injuries. However, few patients suffered only from chest trauma in the current study. Perhaps it is because of the higher mortality rate. Like Zargar, Haratian pointed out that the main cause of trauma was traffic accidents [6]. Pool et al. conducted a study on the fracture of the first rib and concluded that there was not a significant difference between the fracture of this rib and other upper ribs in the mediastinum. According to them, precautionary measures should be taken into account for other types of traumas in all cases of chest trauma. The current study did not distinguish ribs. However, it was concluded that if the fracture of each caused hemothorax, mortality would be more possible [7]. Ekpi et al. conducted a five-year study on patients with chest traumas. Their findings are consistent with the findings of this study. According to their study, the majority of patients were young men with blunt traumas. However, there was not a significant difference between blunt and penetrating traumas in terms of mortality rates. Another inconsistency was the use of MEWS (Modified Early Warning Score) system. Since this is a retrospective cohort study, it was not possible to use this system. Ekpi also stated that bilateral injuries to the chest and delay in transferring patients to the hospital could increase the mortality rates. Such factors were paid more attention in the current study. In other words, each factor increasing mortality was investigated separately [8]. Zareh et al. obtained similar results. They found out that the majority of traumatic patients were young men with blunt traumas. Unlike the current study, they focused on pre-hospital factors such as piping and investigating the compliance with the process of maintaining vital signs. However, the current study investigated patients in hospital processes. Like Ekpi, Zareh et al. used the score systems TRISS-B, TRISS-P, RTS and ISS. As mentioned, such systems could not be used in the current study because it is a retrospective cohort study [2]. Farzandipour et al. conducted a study in 2004 to show that the majority of traumatic patients were young men. However, they did not investigate the frequency of blunt and penetrating traumas. It is interesting to know that the statistical sample in their study included 6415 individuals who were selected through interviews with patients and companions or questionnaires. They also mentioned that traffic accidents were the main causes of traumas. According to them, arms were the most injured organs. Another innovation of their study was to calculate the average expenditures of treatment. Their study generally investigated the individuals and social injuries caused by trauma and the causes.

However, the current study investigated and analyzed the quality of traumas, their side effects and the survival of patients [9]. Another study was conducted in Vali-e Asr Hospital in Fasa in 2010. There were similar results in that study. Young men were the majority of patients visiting the hospital to complain about chest traumas which were mostly caused by traffic accidents. In this study, Bijani et al. mentioned that the least prevalent cause of trauma was a blow by cold weapons. Unlike the current study, they did not deal with blunt or penetrating traumas in particular. In their study, head traumas were mainly accompanied by chest traumas. However, the current study pointed out that abdominal traumas were mainly accompanied by chest trauma. Another difference in Bijani's study was the investigation of clinical symptoms in patients with chest trauma as soon as they were admitted into the hospital. In this case, chest pain and tenderness were reported [10].

## CONCLUSION

According to the research results and like other similar studies, the majority of patients visiting the surgery wards of hospitals and complaining about chest traumas were young and middle-aged men. Moreover, the majority of cases suffered from blunt traumas. However, patients with penetrating traumas were more prone to death compared with those with blunt traumas. Therefore, it can be concluded that chest trauma is one of the most dangerous types of trauma, especially when it is penetrating. It requires serious care and follow-up in all and even in minor cases because of severe and irreversible injuries. The current study is based on the importance of chest trauma and the necessity of investigating risk factors, jeopardizing conditions and correcting the attitude towards patients with chest traumas. The mortality rate of chest traumas is higher than other types of trauma, and penetrating traumas are more associated with death among other types.

### CONFLICT OF INTEREST

There is no conflict of interest.

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None

### FINANCIAL DISCLOSURE

None

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