

Pattern of Injury and Outcome of Victims in Ahvaz Terrorist Attack

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Abstract

Background: Responses for medical emergencies can be different during most terrorist attacks in which civilians and military personnel might be killed or wounded.

Objectives: The present study aimed to reflect on injury patterns and the outcome of victims in terrorist attacks.

Methods: A retrospective research design study was conducted on the data obtained from terrorist attacks in the city of Ahvaz, Iran, on September 22, 2018. In this deadly incident, 92 military and civilian victims had been transferred to hospitals within the first 24 hours. To this end, the data including age, gender, causes, site of injuries, outcomes, and the Injury Severity Score (ISS) values were analyzed. Data were acquired from the Iranian Legal Medicine Organization, the Iranian Emergency Department, as well as health care facilities.

Results: The findings revealed that, out of 92 victims of Ahvaz terrorist attack, 85 cases (92.4%) were men. The mean age of these individuals was about 28.68±11.22 years and 41.3% of them were in need of urgent surgical interventions. There was no information regarding casualties in 22.3% of the cases. Moreover, 25% of the casualties had led to death. The mean of ISS was 8.19±13. Besides, there was a significant relationship between ISS values and patient outcomes ($p<0.0001$). A relationship was also observed between multiple injuries and mortality rates although it did not include main body parts.

Conclusion: The results showed that the mortality rate of casualties in the Ahvaz terrorist attack was high. With respect to the findings, extensive actions are needed to maintain the readiness of the emergency medical care services and to manage such events.

Keywords: Attack, Medical Emergency Team, Task Performance, Rapid Response Teams, Medical Countermeasures.

Introduction

Over the years, Iran has been among countries frequently attacked by terrorist groups. Therefore, mass casualty events have thus far occurred. The terror here means an act committed with violence against a person or a group to murder them, whose expansion and possibility can be influenced by numerous variables.¹

Moreover, the severity and extent of casualties in terrorist attacks can be dependent on the method of assassination. As a result, low or high-velocity energy delivered by gunshots can cause a multimodal injury sustained to organs considered vital for survival. The impact of bullets on tissues can be accordingly characterized by a cavitation process or direct delivery of energy.² In these events, blood vessels, muscles, and bones are affected. Accordingly, immobilization of the bones, care for soft-tissue injuries, suitable wound dressings, and maintenance of organ function are among the most important strategies and challenges. The outcomes of such terrorist attacks can be also

influenced by management by a medical staff and knowledge of health care workers at the scene, during victim transfer to hospitals and even their hospital stays. A good organizational structure along with guidelines and training are thus taken into account as the most important factors improving outcomes.³

Besides, proper medical activity is a significant factor in responding to terrorist attacks. It will not only save lives but can also increase tolerance in society and give a message of hope and power. The ability of medical teams in monitoring terrorist attacks is similarly considered as a factor against such incidents to deal with the scare and fear induced by these events.⁴

For example, in one study, initial responses to the Boston Marathon bombings had been investigated. In this regard, in a joint effort, information available at health care centers in Boston, the United States, and the results of initial responses (adult level, adult/child level, child-level) had been examined. Each center had also imported its relevant data into a central

database (called REDCap), and the data had been analyzed to determine various clinical and logistics parameters before hospitalization and early hospitalization in a collective response to the terrorist attack. A total number of 281 people had been accordingly injured and 127 patients had been transferred to trauma centers on this day. As well, three cases (1%) of immediate casualties had been reported at the scene and no casualties had been seen in hospitals. Most of the hospitalized patients (66.6%) had suffered from soft-tissue injuries and bone damage in the lower extremities, and there was evidence of extensive bleeding at the scene in 31 cases. Moreover, 26 patients had tourniquets. Out of the 75 hospitalized victims, 54 individuals had received urgent surgical interventions and 12 cases (22%) had undergone amputations. The results of this study indicated adequate preparation, rapid logistics response, short transport time, quick access to operating rooms, and provision of multidisciplinary care approach to achieve excellent results.⁵

Based on the mechanism of trauma, the resources required for confronting terrorist attacks are also different. With respect to the medical data collected from terrorist attacks targeting the city of Paris, France, in November 2015, the wounded with the chance to be alive within the first 24 hours after the incident had been divided into two groups of explosive blast injuries and gunshot wounds. A total number of 337 injured people had been also hospitalized, 286 cases (85%) had been injured by gunshot wounds, and 51 individuals (15%) had become affected in the explosive blast. The results revealed that the casualties from shelling were more severe and required hospital resources more than explosive blast ones. In 181 cases (54%) of the casualties, emergency surgeries had been entailed, which were more common in gunshot wounds than in explosions.⁶

The evidence has demonstrated that three factors i.e. tourniquet use, blood transfusion, and rapid transfer had an obvious effect on these casualties and led to a decline in mortality rates.⁷

Civilian emergency units are not normally prepared to respond to such attacks. Therefore, medical teams should be provided with necessary equipment and facilities as well as training in terms of dispatch, transportation, and delivery of services in a wide range of health care fields in such situations. Moreover, clinical experiences should be recorded to mitigate the risk of a lack of documents in such terrorist attacks. However, clinical experiences regarding these

incidents are not available in many countries although their publication can be extremely effective in providing evidence-based programs, greater control, accident management, location communications, initial assessments, bleeding control kits, multi-tasking exercises, and particularly service delivery readiness.^{4,8-10}

Objectives

For this reason, the present study aimed to report on outcomes and reflect on injury patterns and the outcome of victims in terrorist attacks during a terrorist attack targeting the city of Ahvaz, Iran.

Materials and Methods

This retrospective study was conducted on data of the terrorist attack on the city of Ahvaz, Iran, on September 22, 2018. In this deadly event, 92 military and civilian victims were transferred to hospitals within the first 24 hours. For this reason, their information, including age, gender, causes of injuries, outcomes, and injury severity score (ISS) values were obtained from the Iranian Legal Medicine Organization, Iranian Emergency Department, and healthcare facilities. The variables were then described using mean \pm standard deviation (SD) or percentage values. A between-group comparison was further performed via Fisher's exact method and Student's t-test. The data were ultimately analyzed using the IBM SPSS Statistics software (version 23). It is noteworthy that all the comparisons were two-tailed and a p-value < 0.05 was considered significant.

In order to examine the severity of injuries, the Injury Severity Score (ISS) was utilized. This scale was based on the segmentation of the body into the face, chest, abdomen, pelvic contents, limbs, and pelvis. The method of calculation was that each injured part could be identified and the type of injury could be determined based on the highest score in the Abbreviated Injury Scale (AIS).

For this purpose, high scores could be specified from each of them and their squares could be added, indicating scores lower than 8=mild, scores of 8-15=medium, and scores higher than 15=severe.¹¹

Ethical considerations

This study has been approved by the Ethics Committee of Baqiyatallah University of Medical Sciences with code IR.BMSU.REC.1399.356.

Results

Out of the 92 victims, 85 cases (92.4%) were male. The number of non-gunshot injuries admitted to hospitals was six individuals (6.5%). The mean age of casualties was about 28.68 years with a standard deviation of 11.22, ranging from

5 to 55 years. Of these, 23 cases (25%) had lost their lives because of gunshot wounds. Moreover, 41.3% of the injured had undergone emergency surgeries. Other wounded cases needed medical treatments.

Table-1. Mean ISS (live and dead)

Variable/ Outcome	Number	ISS Mean±SD	Sig.
Live	47	4.30±3.29	p <0.0001
Dead	23	16.13±20.17	
Total	70	8.19±13	

Table-2. Relationship between the outcome of the injured and the location of the injury

Number	Location of injury	Total (N/%)	Dead (N/%)	Live (N/%)
1	Head	2(2.2)	0	2(2.9)
2	Face	1 (1.1)	0	1(1.4)
3	Neck	2(2.2)	0	2(2.9)
4	Chest	6(6.5)	3(13)	3(4.3)
5	Abdomen	2(2.2)	0	2(2.9)
6	Upper limb	8(8.7)	0	8(11.6)
7	Lower limb	15(16.3)	1(4.3)	14(20.3)
8	No Information	22(23.9)	0	22(31.9)
9	Non-shot	6(6.5)	0	6(8.7)
10	Head and Chest	1(1.1)	1(1)	0
11	Face and Upper limb	1(1.1)	1(1)	0
12	Neck and Abdomen	1(1.1)	1(1)	0
13	Neck and Upper limb	1(1.1)	1(1)	0
14	Neck and Lower limb	1(1.1)	1(4.3)	0
15	Chest and Abdomen	1(1.1)	1(4.3)	0
16	Chest and Upper limb	3 (3.3)	3(13)	0
17	Chest and Lower limb	4(3.4)	1(4.3)	3(4.3)
18	Upper limb and Lower limb	5(4.5)	2(8.7)	3(4.3)
19	Abdomen and Upper limb	3(3.3)	1(4.3)	2(2.9)
20	Head, Chest and Upper limb	1(1.1)	1(4.3)	0
21	Head , Chest and Lower limb	1(1.1)	1(4.3)	0
22	Face ,Chest and Upper limb	1(1.1)	1(4.3)	0
23	Chest , Upper limb and Lower limb	1(1.1)	1(4.3)	0
24	Head , Face ,Upper limb and Lower limb	1(1.1)	1(4.3)	0
25	Head , Chest, Upper and lower limbs	1(1.1)	1(4.3)	0
26	Neck , Chest , Abdomen and Upper limb	1(1.1)	1(4.3)	0
Total		92(100)	23(100)	69(100)
P-value		<0.001		

There was no information about 22.3% of the injuries in need of emergency surgeries. The mean ISS was significantly correlated with the fate of the injured ($p < 0.0001$). The injury severity was thus estimated by the ISS. Hence, the number of casualties increased despite the increase in the involvement of vital organs. The mean±SD of the ISS was 8.19±13 and the average was significantly correlated with the mortality rate ($p < 0.0001$) (Table-1).

Based on the results, 41.3% of the casualties needed urgent surgical interventions, 2.7% of the cases were in need of treatments in hospital, 8.7% of these individuals had received outpatient services, and finally, 25% of the victims had died.

The highest rates of injuries in casualties, based on the results, were related to the upper extremity cases with a value of 8.7%, lower extremity injuries with 16.3%, and then chest and non-shot cases with a value of 6.5%; respectively.

The results of the gunshots in the region with the final fate of the injured are presented in (Table-2). The location of the gunshots, number of bullet hits, or multiple injuries had accordingly caused a higher mortality rate (Table-2).

The injured had been transported by ambulances to three hospitals with a distance between 1500 and 3300 meters. All the hospitals had been also equipped with operating rooms and surgical wards. However, there was no information about the readiness of the hospitals during this attack. Evidence obtained in this regard indicated that the injured had been transferred to various medical centers throughout the city of Ahvaz.

Discussion

The present study aimed to reflect on injury patterns and the outcome of victims in terrorist attacks. The results showed that the mortality rate of the casualties Ahvaz terrorist attack was high and the outcome of casualties is poor. The causes for death, management, and medical care services provided in these events are thus associated with several challenges. A review of the related literature demonstrates that little attention has been paid to such an issue. Until now, few studies have been conducted about terrorist attacks. In this study, medical team performance was evaluated using the number of casualties (i.e. injuries and mortality rates) and its relationship with the calculated ISS was also examined. The results showed that the number of injured organs or limbs regardless of their roles and importance in survival could affect the fate of the injured. However, the injury severity could determine the fate of the injured person. For example, two injured cases had lost their lives due to five injuries in the lower and upper extremities. However, it is more likely that a person will fail after being shot in the vital organs. These results could highlight the significance of taking prompt treatment measures to save the lives of the injured. It was expected to observe a higher number of deaths after being shot in vital organs. Also, the results confirmed the importance of rapid transport and treatments in protecting the lives of victims. The findings revealed that gunshot wounds, especially in the abdominal area had been more severe than other forms of terrorist attacks, such as bombings, and required more treatments. In addition, these results had been reported in injuries following terrorist attacks in France.⁶ The median ISS was 13, 8.19%. Although the highest ISS was 16.13, the mortality rate was 20.17%. A further increase from 2.2% to 39.9% was observed in the survival rate with ISS in the range 25-75 via correct action plan (using a tourniquet, blood transfusion, and rapid transfer).⁷ The mortality rate in the present study was more than those reported in terrorist attacks targeting France and

Syria^{4,7} although the study reported the ISS of 5.91 for the injured transferred to trauma centers.¹²

It should be noted that triage is one of the most important activities performed by medical teams during terrorist attacks since they play a significant role in defining the prognosis of the injuries. So, one of the preferences in maneuvers, parades, and other military conferences is preparing and equipping the best triage. It seems that practicing the correct triage process, use of tourniquets, blood transfusion, and rapid transfer to surgical centers can reduce mortality rates. Data analysis by the United States Army also showed a 44% survival rate increase following these key activities in Iraq and Afghanistan.¹³ In this event, the mortality rate indicated a lack of bleeding control or appropriate triage.

Considering the type of encounter and management, mortality control in military attacks has been historically related to medical staff. Moreover, terrorist attacks in civil regions can lead to high mortality rates. However, in these events, more resources, medical staff, and hospital equipment need to be provided. Depending on the coordination and prior testing of the existing local medical system, it can be an advantage or a threat. Hospitals in the area of mass casualties in civilian regions can be overwhelmed by the wounded as well as families and friends in search of loved ones. Therefore, "population control" is assumed as a challenge in civilian areas.¹⁴ Proper therapeutic reactions to terrorist attacks are thus essential and they can be in conflict with the principle of terrorism, namely, aggression and fear. Medical teams responding to terrorist attacks can also improve the organization performance and quality care of victims, especially those affected by terrorist attacks.⁴ The results of this study and other investigations in the related literature established the necessity for a change in military medicine strategy. Therefore, there is a need for training in terms of improving capacity-building and managing health care services all through terrorist attacks in civilian areas among all medical groups. Additionally, it is of utmost importance to train military medical staff by other medical specialties.⁴ Besides, trauma centers should be equipped and use available resources to treat patients and to minimize tolls, injuries, and adverse complications. To save the injured, three base factors in such systems are transferring the right patient to the right hospital at the right time. In this regard, the results implied that the victims were transferred to three hospitals equipped with surgical and emergency departments during Ahvaz terrorist attack. According to scientific sources, victims with ISS higher than 16 need to be transferred to level-1trauma centers.¹⁵ However, medical teams must boost their ability to identify emergencies in difficult conditions. Equipping trauma centers with national and local simulation training and

laying focus on triage can thus contribute to decreasing the number of victims in these events.¹⁶

Furthermore, actions taken had not been recorded in pre-hospital emergency in this terrorist attack, and no information was available in terms of the control and the transport of the wounded. This weakness could be due to the inability of the medical teams during these incidents, which was consistent with the findings reported in the terrorist attacks in France.¹⁷ These management and planning challenges must be accordingly respected in terms of recording, admission, and discharge of the wounded. It should be noted that such challenges had led to the destruction of information about 22 wounded cases in the terrorist attack that had occurred in the city of Ahvaz.

Management and knowledge of the health care workers at the scene, during transfer to hospitals and in hospitals, are also among the effective factors. Appropriate organizational structure and guidelines along with training are thus considered as the most important factors improving outcomes of terrorist attacks.¹⁷ Therefore, the preparedness and skills of medical teams to control and manage terrorist attacks and to provide medical services necessitate developing pre-written scenarios and holding training courses for medical teams. In addition, the readiness of military and civilian medical teams is necessary for trauma systems, relief and rescue, transfer, and triage in the face of terrorist attacks. Consequently, statistics have shown the necessity of more activities to preserve emergency staff readiness. Similarly, civilian medical teams recruited in terrorist attacks must be careful in terms of recording and preserving information about injuries, actions taken, and follow-ups.

The present study had some limitations. Firstly, this study was retrospective with limited pieces of information. Secondly, the data were incompletely collected at pre-hospital and in-hospital stages. In general, it is recommended to establish a national trauma registration center, using standardized questionnaires, and to educate the staff for better management of these events.

Conclusions

The results showed that the mortality rate of the casualties in Ahvaz terrorist attack was high and the outcome of casualties is infelicitous. The main factors in coping with terrorist attacks are planning for the future, being aware of existing resources, and educating teamwork. In addition, the readiness of military and civilian medical teams is an important factor for the trauma system, relief, and rescue, transfer, as well as triage in the face of terrorist attacks. The number of victims can be also reduced by giving information

and providing the required equipment to medical teams in civilian regions. Besides, clinical experiences gained during terrorist attacks can play a key role in quick and effective decision-making, rescue the wounded, and consequently save time and cost. The responsibility of civilian medical teams is accordingly to take action and to deliver the right medical care services at all phases of transfer and treatment. In this regard, further studies are required to review incidents and actions fulfilled in different terrorist attacks. Moreover, writing scenarios and educating medical teams are essential for sufficient readiness and experience of medical teams to correctly control the situation, and then to manage and provide medical services. In addition, civilian medical teams recruited after terrorist attacks must be careful enough in terms of recording and preserving information about injuries, actions taken, and follow-ups.

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Authors' Contribution

All authors pass the four criteria for authorship contribution based on the International Committee of Medical Journal Editors (ICMJE) recommendations.

Conflict of Interests

The author(s) declare no conflicts of interest with respect to the authorship and/or publication of this article.

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