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ORIGINAL ARTICLE

A Bomb Explosion In Diyarbakir: Clinical Findings And Management of Emergency Department

Diyarbakır'da Bir Bomba Patlaması: Klinik Bulgular ve Acil Servis Yönetimi

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Abstract

Objectives: In this study, we present management of emergency department, patients' clinical findings and mortality analysis after a bomb explosion.

Methods: Patients brought to Diyarbakır Dicle University Hospital emergency department after the explosion at 5 June 2015 were retrospectively examined. Patients' age, gender, triage, system injuries, hypotension, blood transfusion, admission to the ICU, Intensive care unit surgical treatment, amputation and trauma scores (Glasgow Coma Score (GCS), Revised Trauma Score (RTS), Injury Severity Score (ISS), Trauma Score-Injury Severity Score (TRISS), Shock index) were studied. Factors affecting emergency department management and mortality were analyzed.

Results: The mean age was found as 29.64±12.88 years in survivors and 36±19.98 years in deaths. GCS, ISS and shock index were found as the factors affecting mortality ($p \leq 0.05$). Wounded taken to the resuscitation room, hypotension, blood transfusion, intubation, treatment in ICU and amputation were correlated with mortality ($p < 0.05$).

Conclusion: A fast and effective triage system must be applied in EDs following a bomb explosion. The explosion of a bomb on the open areas are the most common injury to the lower extremity injury. Mortality is most often associated with lower limb amputations.

Key words: Bomb explosions, emergency department managenet, mortality.

Özet

Amaç: Bu çalışmada bir bombalı saldırı sonrasında acil servis yönetimi, hastaların klinik bulguları ve mortalite analizi sunulmuştur

Yöntemler: Diyarbakır Dicle Üniversitesi Hastanesi Acil servisi'ne 5 Haziran 2015 tarihindeki patlama sonrası gelen hastalar retrospektif incelendi. Yaş, cinsiyet, triaj, sistem yaralanmaları, hipotansiyon, kan transfüzyonu, entübasyon, yoğun bakıma yatış, cerrahi tedavi, ampütasyon, travma skorları[Glasgow Coma Skalası (GCS) Skoru, Revize Trauma Skoru (RTS), Yaralanma Şiddet Skoru (Injury Severity Skoru -ISS), Travma Skoru-Yaralanma Şiddet Skoru (TRISS), Şok İndeksi] incelendi. Acil servis yönetimi ve mortalite üzerine etkili faktörler analiz edildi.

Bulgular: Yaşayanların yaş ortalaması 29,64±12,88 yıl ve ölenlerin yaş ortalaması 36±19,98 yıl idi. GCS, ISS, shock index mortaliteyi etkileyen faktörlerdi ($p \leq 0,05$). Resüsitasyon odasına alınan yaralılar, hipotansiyon, kan transfüzyonu, entübasyon, yoğun bakımda tedavi, cerrahi tedavi ve ampütasyon yapılması mortalite ile ilişkiliydi ($p < 0,05$).

Sonuç: Bir bombalama eyleminin ardından acil servislerde hızlı ve etkili bir triaj sistemi uygulanmalıdır. Açık alanda gerçekleşen bombalı patlamalarda en yaygın yaralanma alt ekstremite yaralanmaları olup mortalite en sık alt uzuv ampütasyonları ile ilişkilidir.

Anahtar kelimeler: Bombalı patlamalar, acil servis yönetimi, mortalite.

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INTRODUCTION

Bombing attacks are not limited to war. In addition, these are frequently used by terrorists to establish a ground for their political demands and to come into question in the world. These actions that have become more frequent nowadays causes serious injuries and mortality. Comparing with the other types of injuries, explosion injuries may cause combined injuries including blast, blunt, penetrating and burns [1,2]. In general, blast injuries are explained by four mechanisms: 1) Primary blast injuries include rupture of the tympanic membrane and blast pulmonary injury due to the blast wave. 2) Secondary blast or explosive injuries are caused directly by particles and flying objects that strike people, usually penetrating 3). Tertiary blast or explosive injuries are resulted from displacement of air by the explosion, creating a blast wind that can throw victims and surrounding structures 4). Quaternary blast injuries occurs through toxins, inhalation and radiation contamination [3]. Terrorist bombing actions affect hospital and EDs in many ways, requiring to take effective and appropriate approaches [4].

In this study, we present management of emergency department, patients' clinical findings and mortality analysis after a bomb explosion.

METHODS

Hospital and emergency department

Dicle University Hospital provides advanced healt care both to Diyarbakır province and Southeastern Anatolia Region with 1300 inpatient bed availability. Approximately thirty thousand to fifty-four thousand patients present to the emergency department of the hospital annually with 20% of being trauma patients. The emergency department consists of medical primary examination, trauma primary examination, resuscitation room, observation room and an operating room. While patients with stable vital signs are assessed in medical and trauma primary examination, those with unstable vital signs are evaluated in the resuscitation room. Resuscitation room is equipped with monitors, mechanical ventilators, ultrasound device and sets for emergency interventions. Resuscitation room is adjacent to tomography device and operating room, and there is a direct access here to these facilities

Scene information

Two successive explosions occurred in the election meeting which took place in Diyarbakır Istasyon Square at 5 June 2015 with local time 17:55. The first blast occurred in a trash barrel about 60 meters ahead of the rally platform. The second and big blast occurred after 5 minutes in front of the electrical transformer which was located right across the platform (Figure 1). Fragmentation bombs were used and the explosions were not suicidal attacks.

Figure 1: Diyarbakır Istasyon Square in the election meeting and locations of bomb explosions (A:First blast, B: Second blast, C: Election meeting platform)

Assessment and management

Upon receiving the news, Hospital Emergency Incident Command System (HEICS) was activated. Emergency department and all departments of the hospital were mobilized according to the plan. The number of emergency specialists, trauma surgeons,

anesthesiologists, radiologists, experienced health care personnel and allied health staff was increased. The operating rooms were activated. Patients requiring surgical intervention and intensive care were identified. Accordingly, number of beds in ICU was determined. Vehicle and human traffic inside and outside the hospital was organized by security teams. Special sections were prepared for media and relatives of the patients. A continuous coordination was provided with 112 emergency call center, other institutions and organizations.

All patients presented in the ED at that time were quickly assessed again and hospitalized in the nearest relevant department for diagnosis and treatment, and ED was made empty and suitable for the wounded who will be brought. Patients were brought from the scene by paramedics with ambulances or private vehicles. Sixty patients were brought by ambulances and 45 by private vehicles. The first casualties arrived to the ED 15 minutes after the explosion. Patient transfer from the scene and surrounding hospitals took over two hours. A triage team consisting of emergency specialists and experienced health care staff was set up in entrance of the ED. The wounded with respiratory distress, a systolic blood pressure less than 90mmHg, tachypnea, tachycardia, bradycardia, decreased level of consciousness, low Glascow coma score, active bleeding, multiple trauma, penetrating injuries of the thorax and abdomen, amputated or crushed extremity injuries were taken to the emergency resuscitation room while the other slightly wounded and patients with stable vital signs were taken to the primary examination rooms. All the patients were assessed by emergency specialists and in resuscitated line with ATLS (Advanced Trauma Life Support) program. Patients' diagnosis and treatment procedures were performed according to the current protocols and consulted to the relevant departments. All wounded coming from the bomb explosion were immediately evaluated and after vital stabilization was obtained, they were assessed in three categories: the slightly wounded were treated and discharged if there was no symptom after evaluating again for primary blast injuries. Patients requiring emergency surgery were sent to the operation room without waiting. Of the wounded requiring radio-diagnosis, patients who required surgery were referred to the operating room and those did not require surgery were followed-up in the relevant clinics and ICU. Therefore, empty and sutiable places were obtained in the ED for new wounded arrivals.

Patient data

Patients brought to Diyarbakir Dicle University Hospital emergency department after the explosion at 5 June 2015 were retrospectively examined. Patients age, gender, triage, system injuries, hypotension, blood transfusion, admission to the ICU, surgical treatment, amputation and trauma scores (Glasgow Coma Score (GCS), Revised Trauma Score (RTS), Injury Severity Score (ISS), Trauma Score-Injury Severity Score (TRISS), shock index) were studied. Factors affecting emergency department management and mortality were analyzed.

Statistical Analysis

Statistical analysis was performed utilizing SPSS 18.0 for windows statistical package software. Quantitative variables are expressed as mean ± standard deviation (SD) and categorical variables are given as number and percentage (%). Normality of the data was studied. Comparison of two groups showing normal distribution was made using independent t test. Whereas, comparison of two group with non-normal distribution was made with Mann Whitney U test. Inter groups comparison of qualitative variables was carried out using Chi-kare ($\chi 2$) test. Two-way

hypotheses were used and p≤0.05 values were considered as statistically significant.

RESULTS

A total of 5 victims died at the bomb explosion with one being at the scene and 4 in the hospital and, 402 persons were injured. One hundred and five wounded from this explosion were brought to the emergency department of Dicle University Hospital. The mean age of wounded was 29.89±13.13 years. Hemodynamically stable wounded were assessed in the emergency primary examination rooms and unstable patients in the resuscitation room. Of wounded presented, 84 were examinated in the emergency first examination rooms and 21 in the emergency resucitation room. Out of 105 wounded, 101 survived and 4 died. One of the wounded died in the hospital death within the first 4 hours, one after 3 days, one after 5 days and one after 6 days of admission. There was no patient with primary blast injury from the explosion which occurred in an open area. Majority of the other injuries were secondary blast injuries. When organ injuries were examined; there were 23 head, 7 thorax, 2 abdomen, 10 upper extremity, 53 lower extremity, 1 pelvis and 2 vertebra injuries. Of the wounded, 15 received treatment in the ICU, 15 blood transfusion, 7 intubation, 24 surgical treatment and 8 amputation. Four of the patients undergone amputation died. Two of these underwent bilateral lower extremity amputation and the other two patients underwent unilateral lower extremity amputation (Table1).

Wounded taken to the resuscitation room, hypotension, blood transfusion, intubation, treatment in ICU and amputation were correlated with mortality (p<0.05).

The mean age was found as 29.64±12.88 years in survivors and 36±19.98 years in deaths. GCS, ISS and shock index were found as the factors affecting mortality (p≤0.05). Trauma scores of the wounded in the bomb explosion were given in Table2.

Table1: Clinic characteristics of the wounded in explosion and the factors affecting mortality

Characteristic	Total (n=105)	Survived (n=101)	Died (n=4)	P
Gender				
Female	19	18	1	0.556
Male	86	83	3	
Age				
< 18	13	12	1	0.415
19-45	82	80	2	0.208
46-65	8	7	1	0.275
> 65	2	2	0	1
Triage				
Resuscitation room	84	84	0	0.001
First examination room	21	17	4	
Amputation	8	4	4	0.001
Upper extremity	1	1	0	1
Abone elbow	0	0	0	0
Below ekbow	1	1	0	
Lower extremity	7	3	4	<0.001
Above knee	0	0	0	<0.001
Below knee	7	3	4	
Hypotension	15	11	4	<0.001
Organ injury				
Head & neck	23	22	1	1
Thorax	7	6	1	0.244
Abdomen	2	2	0	1
Upper extremity	10	10	0	1
Lower extremity	53	49	4	0.118
Pelvis	1	1	0	1
Vertebrae	2	2	0	1
Surgical treatment	24	20	4	0.002
Blood transfusion	15	11	4	<0.001
ICU admission	15	11	4	<0.001
Intubation	7	3	4	<0.001

Table 2: The relationship of age and trauma scorings with mortality

Characteristics	Survived (n=101)	Died (n=4)	P
Age	29.64±12.88	36±19.98	0.572
GCS	14.69±1.12	10.25±1.25	0.005
RTS	7.79±0.30	6.58±1.02	0.101
ISS	5.77±7,73	30.25±5.50	0.002
TRISS blunt	98.81±3,73	85.65±14.42	0.165
TRISS penetrating	98.46±4	83.42±14.49	0.129
Shock index	0.73±0.37	1.3±0.37	0.05

GCS:Glasgow Coma Score , RTS:Revised Trauma Score, ISS:Injury Severity Score, TRISS:Trauma Score-Injury Severity Score.

DISCUSSION

Emergency departments are the areas in hospitals where health care professionals take the stage in massive diseasters such as multiple vehicle collision, industrial accidents, fires, gunshot injuries, bombing attacks, biological and chemical attacks and earhquakes. Emergency departmets (EDs) and health care personnel working there should be used to, ready and have necessary management plans for disaster conditions.

To draw attention, terrosist attack are committed in places that have a symbolic importance for society, important government agencies, public institutions and the locations crowded intensively with people. Knowing location of bombing provides information about the target group that would be affected by disaster [4]. When we learned that the bomb explosion occurred in an election meeting, this was quite warning for us in estimation of the size of target group and promptes us to immediately activate HEICS.

Hospital Emergency Incident Command System is an organization providing fast and effective response of EDs and, management and coordination in hospitals [5]. Within the scope of emergency department management; mobilization of resources, additional personnel and personal protective equipment, triage, management of specific injuries and patients' flow to computed tomography, operating rooms and ICUs should be provided in a planned and effective way [4]. In the present study, an effective ED management was performed after bomb explosion with HEICS.

Simple Triage and Rapid Assessment (START) system quickly defines patients according to major pulmonary, hemodynamic and central nervous system findings [6]. However, some criticized this triage system, because primary blast injuries of pulmonary, intestinal and solid organs may be diagnosed in the late period [4]. In the bombing attack which has taken place in Madrid at 11 March 2004, when performing triage at the ED entrance Gutierrez de Ceballos et al. [7] took critical patients and hemodynamically unstable patients to the shock room and assessed the other minor wounded in other sections of the ED. In addition, they examined all patients for primary blast injury. We used the triage system that was a simple and fast as the START system. Since the injuries in our case occurred in an open area, there were no primary blast injuries. Furthermore, since we evaluated patients again for primary blast injury, we believe that the triage system which we used is both practical and effective. Therefore, simple and fast systems like START may be more effective and convenient with re-triage and assessment.

Collapse of structures and whether the explosion occurred in open or closed areas affects the mechanism of injury and mortality. Furthermore, penetrating soft tissue injuries are more common in open area blasts [8]. Severity of injury, rate of mortality and primary blast injuries are quite rare in open area blasts compared to closed area blasts [9]. Hart et al. [10] compared Brixton open area and Soho closed area explosions in London. While no death and primary blast injuries occurred in Brixton open area blast, 2 death and 5 primary blast injuries occurred in Soho blast. Because in

our study the explosion took place in an open area, there were no primary blast injuries, majority of the wounded had penetrating soft tissue injury and rate of mortality was low.

When bombing blasts are examined according to affected parts of the body, the most common injuries are seen in the lower extremities followed by the upper extremities [11,12]. Traumatic extremity amputations are a frequently encountered phenomen in bomb explosions [13,14]. In the present study, distribution of the injuries according to the body regions were consistent with the literature.

Yavuz et al. [15] retrospectively analyzed 120 mortality cases resulted from the terrorist bombings in Istanbul between 1976 and 2000, and found that head traumas were the most common cause of death. On the other hand, Mirza et al. [16] reported that 1142 persons were injured and 249 persons died in 46 terrorsit bombing attacks in Karachi between 2007 and 2011. The most common death of mortality was found as shock due to multiple injuries (62.65%) followed by head trauma without hemorrhage at 14.86%. Patel et al. [14] reported that 222 persons were injured in the terrorist bombing attach committed in a coach and train in London at 7 June 2005 and 48 (70%) of 69 traumatic amputation cases with majority of them being lower extremity amputations occurred among death people, and only 24.5% of these persons survived. In our study, all of death cases from the open area explosion occurred in patients with hemorrhagic shock due to lower extremity amputations. Except one patient, three wounded were brought to the hospital between 40 and 60 minutes after the explosion by private vehicles without any pre-hospital medical intervention. When the died persons arrived to the ED, GCSs were between 9 and 12, all of them had lower extremity amputation and were at stage 4 hypovolemic shock. Despite the wounded were resuscitated according to ATLS program without losing time, taken to the operating room and no primary blast injury was identified at the subsequent examination and follow-up, on of the wounded death within the first 4 hours, while in the next few days two wounded death due to sepsis and one because of disseminated intravascular coagulation and multiorgan failure. Although mortality from lower extremity amputations is high in the literature, we think that health care teams with ambulance getting difficulty to access wounded people after bomb explosion in places with large crowds such as election meeting and transfer of the wounded people to EDs with private vehicles without any medical intervention may lead to death.

When bombing attacks are examined according to trauma scores, Kosashvili et al. [9] reported that ISS score is most commonly 8 or less in explosions committed in coach, open and closed areas, while a ISS score above15 is the most common in closed area blasts. In a study ISS score was found as 8 or lower in about half and higher than 25 in about 15% of the cases [17]. In another study, mean ISS score was 12 among the survivors [18]. In the present study; GCS, ISS and shock index were significantly correlated with mortality.

CONCLUSION

A fast and effective management should be executed, that will use all the units of hospital at high level. A fast and effective triage system should be performed in EDs after bomb explosion. Wounded victims should be resuscitated according to ATLS program and, diagnostic and therapeutic procedures should be accordingly carried out. The most common causes of death in traumas were head followed by thorax and abdomen injuries, while lower extremity injuries may be the most common injuries and lower extremity amputations may be the most common cause of mortality after bomb explosions.

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