

CASE REPORT

HAND GRENADE BLAST INJURIES: AN EXPERIENCE IN HOSPITAL UNIVERSITI SAINS MALAYSIA

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Hand grenade explosion is a rare occasion in our local community. Most of us have seen or heard about the injuries only from the TV news or newspaper. We report two cases of bomb blast injury that occurred in an army camp in September 2000. These case studies illustrate the clinical presentations of hand grenade blast injuries that present with multiple organ involvement. We would like to share our experience in managing such cases in a busy emergency department and highlight the outcome of those two cases. Certain issues pertaining to the complexity of the injuries and mass casualty management are also highlighted.

Key words : Hand Grenade Blast Injuries, Clinical Presentation, Outcome

Submitted-20-02-2005, Accepted-03-12-06

Introduction

Explosions have the capability to cause life-threatening injuries in single or multiple victims simultaneously. It also has a capability to cause singular or multiple injuries. A hand grenade

explosion is a rare occasion in our local community. In fact, grenades are only available in the Malaysian Armed Forces.

Management of blast injury victims is very

Figure 1 : CT thorax showing bilateral hemothorax. Arrow indicates shrapnel in-situ between the pericardium and aortic arch

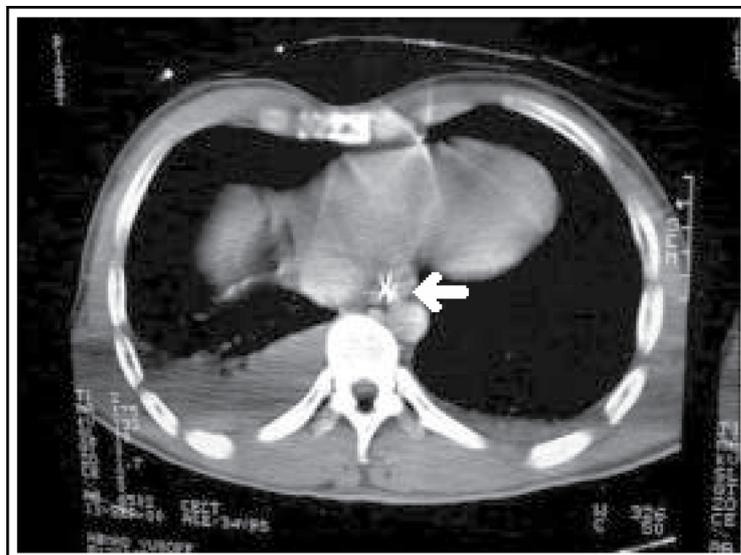


Figure 2 : Severe right hand injury with multiple shrapnel in-situ



complex and time consuming during the initial management at emergency department since it involves various surgical disciplines and extensive radiographic imaging. We describe 2 cases of bomb blast injury that occurred at an army camp in September 2000. The purpose of these reported cases is to illustrate the clinical presentations of hand grenade blast injury and the possible outcomes.

Four army personnel were alleged to sustain grenade explosion injuries during grenade throwing exercise on the field. Two of them died instantly. Another two injured soldiers were referred immediately to Hospital Universiti Sains Malaysia, Kota Bharu, Kelantan.

Case 1

34-year-old army personnel. Initial primary survey revealed normal conscious level, normal orientation to time, place and person. He was also noted to be pale. His respiratory rate was 20/min, pulse rate 82/min and blood pressure 128/69 mmHg. Chest examinations revealed reduce air entry and stony dullness over the right thorax. A diagnosis of right hemothorax was made. Chest tube was inserted immediately and 200 mls of blood was drained. There was no other significant finding during the primary survey. During the secondary survey, it was noted that he had generalized abdominal tenderness

and it was more pronounced on the right hypochondrium. No abdominal discoloration and signs of peritonitis was found. Other injuries included a lacerated wound over his left arm, multiple pellet punctured wounds over the whole body and a right upper brachial plexus injury.

Focused abdominal ultrasonography in trauma (FAST) revealed a minimal peritoneal fluid collection. Immediate CT thorax showed bilateral hemothorax and shrapnel in-situ between the pericardium and aortic arch (figure 1). CT abdomen also revealed multiple shrapnel in situ.

He underwent emergency exploratory laparotomy. He had a perforated stomach, gall bladder and punctured liver. Temporary liver packing, gastric and gall bladder wall repair were commenced. The operation was successful and he was admitted and managed in the intensive care unit (ICU). His condition progressed very well in ICU and then later in the surgical ward. The surgical team discharged him on day 25.

Case 2

30-year-old army personnel. He had severe injuries to the right hand and both eyes. Initial primary survey, GCS was 12/15, pulse rate 90/min and blood pressure 130/86 mmHg. He sustained multiple laceration wounds over the brows, lids and

Figure 3 : CT brain showing right subdural hematoma, subarachnoid hemorrhage, brain contusion and bilateral eye injuries



cornea with the uveal and vitreous tissue exposed. He also had very severe injuries of the right hand with amputated fingers at the proximal interphalangeal joints (figure 2). He was pushed immediately to the CT room. His CT brain revealed contusion, subdural hematoma over right temporoparietal region, subarachnoid hemorrhage, generalized cerebral edema and bilateral globe rupture (figure 3). He underwent urgent craniectomy, Rickhem's insertion and extraventricular drainage procedure followed by eye surgery. During eye surgery, he developed severe cerebral edema. Thiocoma cerebral resuscitation was immediately instituted. Postoperatively, he was admitted into the ICU. His condition in ICU was stormy whereby he developed lung contusion, lung collapse, sepsis, and diabetes insipidus. He died a week later due to multiple organ failure.

Discussion

Explosions can produce classic injury patterns from blunt and penetrating mechanisms to several organ systems (1, 2). Hand grenade explosion causes blast injuries. Hand grenades will be fragmented upon detonation, therefore, it maximizes the damage from flying debris (shrapnel). Blast injury refers to the biophysical and patho-physiological events and the clinical syndrome and patho-anatomical changes

caused by exposure of a living body to the shock wave (blast) generated by a detonated explosive (3). There are four mechanisms of blast injury (4,5). A primary blast injury is caused by the shock wave or "blast wave". It is also known as blast over pressure (BOP). Organisms exposed to BOP mostly experience internal injury to the hollow organs, in particular the lungs, gastrointestinal tract, and the ears. Lung injury and the development of air emboli in the pulmonary and systemic circulations are the main mechanisms leading to death from the blast itself. The first victim suffered from pulmonary and intestinal barotraumas secondary to the BOP. A secondary blast injury is due to the "blast wind" and result from the victim being struck by the flying debris or shrapnel. It caused penetrating foreign body into the globe, chest and abdomen as what our patient suffered from. A tertiary blast injury is a feature of high-energy explosions. This type of injury occurs when people fly through the air and strike other objects. A right hand injury (fractures and amputated fingers) in the second victim is an example. Quaternary or miscellaneous injuries include exposure to dust, which may be radioactive and thermal burns from the explosion and fires. A fifth blast injury mechanism has recently been proposed as the patients' hyperinflammatory response is unrelated to injury severity and complexity (6).

In our case scenario, the hand grenade was

detonated at an open space during the training session. There was only one survivor out of four army personnel who were involved in the accidental explosion. Mortality rates due to explosion varies between incidents. A recent study on terrorist bombing events demonstrated that immediate death/injury rates were higher for bombings involving structural collapse (25%) than for confined space (8%) and open-air detonations (4%) (7). A force of the blast is directly related to the size and type of explosion compound and is inversely related to the square of distance from detonation (8).

Grenade explosion may involve many victims. Therefore, initial medical management and primary triage begin at the site of the blast by emergency medical personnel. Some authors have recommended treating injuries of moderate severity first rather than the greatest injuries and “expectant” casualties as they will be more likely to survive in an overwhelmed and strained health care system (8). The idea was excellent and definitely it has been practiced by countries who adopt the Anglo-American or Franco-German Emergency Medical System. Emergency Medical Service or Prehospital Care in Kelantan is still at an early phase of development. Locally, there are multiple ways for the public to get assistance during an emergency. For example, he can drive himself to the hospital. He can also obtain help from family and friends or even bystanders at the scene. Sometimes, the police will be called for assistance or most adequately, the hospital will be called to send an ambulance (9).

As a conclusion, bomb blast injuries management is very challenging since blast victims often show a combination of the 4 main groups of trauma (blast, blunt, penetrating, and thermal). It is important for healthcare providers to understand the mechanism of bomb blast injuries and the injury pattern among explosion victims. Emergency physicians, surgeons, anesthesiologists and others should work closely as a team in order to treat blast casualties effectively and efficiently (10, 11). Although trauma team activation does not guarantee better survival, better compliance with trauma team activation protocols optimizes processes of care and may translate into improved survival (12). We also need to emphasize that all hospitals and other medical centers need to plan and prepare in advance for mass casualty catastrophes.

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References

1. David L. Ciraulo, Eric R, David V, et al. A survey Assessment of the Level of Preparation for Domestic Terrorism & Mass Casualty Incidents among Eastern Association for the Surgery of Trauma members. *J Trauma, Injury, Infection, Critical Care* 2004; **56**: 1033-41
2. Center for Disease Control and Prevention (CDC). Explosions and Blast Injuries: A Primer for Clinicians. Available from: URL:<http://www.bt.cdc.gov/masscasualties/explosions.asp>. Access 11 May 2007
3. Diving Medicine Online: Underwater blast injuries. Available from: URL: www.scuba-doc.com/uwblast.html. Access 11 May 2007
4. Judith E. Tintinalli, Ernest R, Ronald L. Krome. 1996. Emergency Medicine: A Comprehensive Study Guide. 4th Edition. McGraw Hill Companies: 888-890.
5. Kay B. Leissner, Rafael Ortega and W. Scott Beattie. Anesthesia Implications of Blast Injury. *Journal of Cardiothoracic and Vascular Anesthesia* 2006; **vol 20**: 872-880
6. P. Sorkin, A. Nimrod and P. Biderman *et al.*, The quinary (Vth) injury pattern of blast, *J Trauma* 2004; **56**: 232
7. Arnold JL, Halpern P, Tsai MC, Smithline H. Mass casualty terrorist bombings: a comparison of outcomes by bombing type. *Ann Emerg Med.* 2004; **43(2)**: 263-73
8. K. Peleg, L. Aharonson-Daniel and M. Stein *et al.* Gunshot and explosion injuries: Characteristics, outcomes, and implications for care of terror-related injuries in Israel, *Ann Surg.* 2004; **239**: 311-318.
9. NHNA Rahman and CJ Holliman. Emergency Medicine in Malaysia. *Hong Kong Journal of Emergency Medicine* 2005; **12**: 246-251
10. M.Y. Shamir, Y.G. Weiss and D. Willner *et al.*, Multiple casualty terror events: The anesthesiologist's perspective, *Anesth Analg* 2004; **98**: 1746-1752.
11. G. Almogy, H. Belzberg and Y. Mintz *et al.*, Suicide bombing attacks: Update and modifications to the protocol, *Ann Surg* 2004; **239**: 295-303.
12. Timothy H. Rainer, N.K. Cheung, Janice H.H. Yeung and Colin A. Graham. Do trauma teams make a difference? A single centre registry study. *Resuscitation* 2007; **73**: 374-381