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# Emergency Department Management In Bombing And Blast Incidents

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## Citation

M Kalemoglu. *Emergency Department Management In Bombing And Blast Incidents*. The Internet Journal of Rescue and Disaster Medicine. 2004 Volume 5 Number 1.

## Abstract

Bombings and other blast-related events place severe demands on pre-hospital and in-hospital care systems. The resulting surge of victims can overwhelm the resources of any facility not prepared for such an event, recent terrorist attacks underscore the urgency and need for preparedness. These challenges can become more daunting with potential hazardous material exposure; this means that adequate and rapid disposition of victims is even more critical in order to avoid contamination of hospitals or entire communities.

## INTRODUCTION

Disasters and mass casualty incidents where hundreds, thousands, or tens of thousands of victims potentially need to be cared for are generally not adequately addressed in hospital emergency plans. Nevertheless, these incidents may occur, and recent terrorist actions around the globe suggest that it would be prudent for hospitals to improve on their preparedness for a mass casualty incident. The quantity, severity, and diversity of injuries can easily overwhelm the ability of local medical resources to deliver comprehensive and definitive medical care to all victims characterize disasters of natural and terrorist nature. Injuries can result from accidental explosions in factories or fuel depots, or intentional bombings such as those related to terrorism. Large blasts often produce such a massive number of victims that medical systems can be overloaded and incapacitated unless these are adequately prepared to handle the medical consequences of such events.

Bombs are attractive to terrorists because when compared to other weapons of mass destruction these are relatively easy to design, assemble, deliver and because bombing incidents are sudden and violent in nature. Large explosions attract media coverage and produce a large number of casualties, which ultimately furthers the terrorist goal of disrupting society.

The introduction of victims contaminated with hazardous materials into systems unprepared for such conditions inevitably leads to cross-contamination of pre-hospital and

in-hospital care providers, other patients, visitors, and families. The potential morbidity and mortality that follows such contamination is at least theoretically avoidable by having in place special preparations, protocols, and paradigms to deal with possible blast events producing mass casualties, exposure to hazardous materials, or both.

## EMERGENCY DEPARTMENT (ED) DISASTER PLAN

The medical and surgical treatment of traumatic injuries suffered by victims of blasts is well described in the literature. When victims are relatively few in number, management follows established pre-hospital and in-hospital plans for multi-casualty events, but when the number exceeds the response capacity a contingency plan needs to be activated and implemented.

Explosions from intentional bombings and other blasts are among the few instantaneous traumatic events that can produce massive casualties requiring immediate medical attention. The possible presence of hazardous materials (hazmat) in terrorist-related blast events and certain industrial accidents make the problem of severe multiple injuries even more dangerous. Biohazards may not be detected or recognized at first, so all blast-related events suspected or known to be intentional should be handled as if they involved biohazardous agents.

Decontamination of victims can be accomplished at the triage site, thus reducing the in-hospital spread of

biohazards. Triage, decontamination, and management capabilities at an out-of-hospital site allow for appropriate triage and timely delivery of decontaminated patients to in-hospital systems in a sequence based on severity of injuries. Critically injured (“red-tag”) patients can be sent first, followed by patients with intermediate needs (“yellow-tag”), and then by those with minor injuries (“green-tag”). Depending on the resources of the community, it is possible to send patients with green-tag injuries to pre-designated alternative destinations such as area hospitals or clinics that can manage decontaminated green-tag patients but not patients who are critically injured.(1)

After initial on-scene interventions, some green-tag victims might require no further immediate medical attention. Hospitals must determine the maximum number of care providers, trained and outfitted for hazmat work, who could rapidly be available if need be, and then develop plans for managing the large number of patients expected.

Education and training are important in:

1. Disaster planning and drills.
2. Communications and security
3. Integration of local, regional, and national resources into a disaster system.
4. Critical incident stress management.
5. Current publications and experience in disaster management.
6. Media relations.
7. Protection of health care delivery personnel and facilities.
8. Detection and decontamination of biological, chemical, and radiation exposure.
9. Triage principles and implementation.
10. Logistics of medical evaluation, stabilization, disposition, and reporting.

Studies have demonstrated that in the first 12 hours post incident, half of the victims seek Emergency Department (ED) treatment, thus directly affecting utilization rates and demand for ED capacity during these mass-casualty incidents (MCIs) and disasters. This is specially noted in walking wounded (or green tag patients) that come directly

to the ED for treatment. In a publication by Halpern P et al. it was described how only 10-15% of patients present to ED by ambulance services (2). This presents a paradigm of care as potential green tag patients can consume medical materials and shift direct patient care to them, leading to other more critical patients not receiving rapid and effective care and treatment. Emergency Department utilization rates in mass-casualty terrorist bombings are likely to be influenced by the number of immediately surviving injured and the availability of ED and general care areas. Hospital utilization rates are complementary to immediate mortality rates. Bombings with the highest ED utilization rates usually have the lowest rates of immediate mortality, because bombings that kill fewer victims on-scene generate more immediately surviving injured (and vice versa). The relationship between ED utilization rates and the number of injured survivors may be more complex. Meanwhile all patients should be carried through the bomb detect apparatus in the triage field, because some terrorist patients could still be carrying bomb on their bodies.

The maximum number of injured survivors seeking emergency care at the ED's helps define the upper limits of the demand for ED capacity during MCIs and disasters. Several factors are likely to influence the maximum number of injured survivors utilizing a single ED in a mass casualty terrorist bombing, including: the number of immediately surviving injured, hospital proximity to the bombing site, primary distribution of casualties by prehospital EMS to hospitals, and the number of available ED's.

Hospital admission rates influence the demand and hospital response capacity in MCIs and disasters. A number of factors likely to influence hospital admission rates due to terrorist bombings include the pattern and injury severity, the practice of over-triage, and the demand for specific hospital services, such as operative therapy, critical care and observation. (3,4,5,6,7)

Hospital admission rates are the greatest from the confined space and terrorist-suicide subgroups, presumably because the overall injury severity tends to be greater with events of this nature. Greater hospitalization rates may also reflect the over-triage of ED patients to beds inside the hospital, which, in turn, may be influenced by institutional policy or the inexperience of responding physicians (8).

The time interval from the onset of an event to the arrival of the first injured survivor helps define the immediacy with which such events impact the EDs. Factors likely to affect

this time interval include the ability of injured victims to transport themselves (or be transported) to hospitals by modes of transportation other than using prehospital EMS vehicles, hospital proximity, and ambient traffic conditions. (8,9,10,11,12,13,14) In general, victims with relatively minor injuries, who are not entrapped or incapacitated, tend to bypass the prehospital EMS system and go rapidly by other means to the nearest hospital. (12,13) For example, in the 2003 Istanbul Bombing, a first wave of injured survivors with relatively minor injuries began arriving to the Emergency Departments as early as five minutes after the blast, while victims with injuries requiring hospitalization tended to arrive later in a second wave via prehospital EMS. (15,16)

The first priority of any ED faced with the aftermath of an explosion is to activate the hospital emergency or disaster plan in order to mobilize the capacity, (facilities, pharmaceuticals, and personnel) equipment, supplies, and personnel required by large numbers of victims. Concomitantly, a clear chain of command within the ED and hospital staff should be initiated by well-trained personnel in advance to work together under mass-casualty incident (MCI) conditions. The Hospital Emergency Incident Command System (HEICS) provides a useful organizational tool for the command and coordination of hospital and ED emergency response.(17) The HEICS provides a predictable chain of command, clear lines of communication, prioritized actions, accountability of performance, and harmonized nomenclature.

Most Emergency Departments will have at least a few minutes from the time they are first notified of the event until the time the first victims arrive. During this brief period, the ED should be immediately cleared of as many patients as possible through discharge home or admission to the hospital. A pre-determined ED evacuation plan is critical, since the arrival of casualties into an ED still full with regular patients can lead to significant confusion this should be done concomitantly with a clearing and expansion of the hospital's general in-patient and care capacity one useful method with hospitalized patients is to have all in-patients evaluated by pre-designated teams for possible disposition home. Elective surgery cases should be canceled and the recovery room should be cleared and patients in intensive care units (ICUs) should be evaluated by pre-designated teams for possible transfer out. Besides their obvious uses, these critical care areas also may be needed to resuscitate victims in the rare instance when the number of critically injured exceeds the number of ED beds. While ED

patients are being evacuated, the ED resuscitation area should be prepared to receive the most critically injured victims.

Since most patients will have soft tissue, orthopedic, ocular, and minor burn injuries, sufficient equipment, supplies, and medication (including analgesics, antibiotics, and tetanus immunizations) for the management of these clinical entities should be deployed preferably from a dedicated "disaster" stockpile. (18)

At the same time material resources are mobilized, essential personnel also must be assembled and assigned to designated areas. Injury patterns in those seeking emergency care in terrorist bombings suggest that emergency physicians and trauma surgeons are the medical personnel most likely to be needed by large numbers of injured survivors, since they are trained in rapid assessment and general trauma care. Since virtually all mass casualties, terrorist bombings produce a variety of serious injuries requiring specialty care, neurosurgeons, vascular surgeons, orthopedists, maxillofacial surgeons, and ophthalmologists also should be included in the initial response (19,20,21). In addition, obstetricians should stand by for the assessment of pregnant casualties. Anesthesiologists also will be needed for the many expected emergency operations and possibly to bolster ED resuscitation efforts, while radiologists and radiology technicians will be needed to expedite diagnostic imaging (22). There is also a need to prepare for an increase in the number of nurses and ancillary staff working in the Emergency Department.

All medical personnel involved in the direct care of victims require water-impermeable gowns, surgical masks, goggles, and gloves ("universal precautions") to protect against the transmission of blood-borne viral disease. At the same time that other supplies are being mobilized to anticipated patient care areas, personal protective equipment should be distributed unless already pre-deployed.

Another immediate priority is to setup a triage area at the entrance into the ED treatment area, which allows for unimpeded ambulance flow outside the ED and helps to avoid the immediate need to re-triage casualties once inside the ED. Triage can be performed suitably by experienced emergency physicians, mid-level surgeons and nursing staff, saving senior trauma surgeons for more effective roles in the ED or operating room.

## CONCLUSION

The integration and implementation of the above guidelines and principles throughout the medical system should enable them to handle MCI resulting from terrorist bombings better. The management of MCI is not a hospital-based mission, and should be handled as a cooperative task of the entire medical system.

A rational approach to the emergency management of acts of terrorism requires that the lessons learned from previous mass casualty, terrorist bombings be incorporated into current planning and preparedness.

Hospitals, urgent care clinics, and other facilities should work proactively with area prehospital event command systems to develop plans for ultimate patient care and disposition. Local communities must take the lead in developing incident command systems for initial management of such events. Ultimate management and disposition of large numbers of casualties, especially if contaminated, cannot follow standard patient management protocols; new protocols are needed. To avoid a total, overwhelming break down of in-hospital resources, hospitals need to assume a lead role in addressing such issues in their local communities.

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