

# Terrorism-Related Injuries

Charles DiMaggio, PhD<sup>1,2</sup>

March 6, 2011

<sup>1</sup> Department of Anesthesiology, Columbia University, College of Physicians and Surgeons, New York

<sup>2</sup> Department of Epidemiology, Columbia University, Mailman School of Public Health, New York

## 1 Introduction

Despite concern over chemical, radiological and biological attacks, the majority of direct terrorist-related physical injury to date has been the result of direct trauma. While many terror-related injuries tend to be of greater severity than non-terror related injuries and are characterized by penetrating wounds and the consequences of explosions, there are often a large proportion of persons with minor injuries.

## 2 The Israeli Experience

An Israeli review of a pediatric population found that 54% of 138 children injured due to terrorist activity had the highest injury severity score (25+) compared to 3% of 8,363 non-terror injured children. The terrorist-related injuries were significantly more likely to require a higher degree of critical care, more likely to involve penetrating injuries to the torso or open head wounds, and more likely to involve internal injuries. [2] In Bologna, Italy, in 1980 73 of 291 casualties died at the scene. Morbidity was characterized by primary blast injuries such as so-called blast lung and flash burns as well as secondary injuries such as concussions, lacerations and fractures. [4]

Terrorist-related injuries are more likely to involve gun-shot wounds and explosives than non-terrorist related injuries. In a one-year period between 1993 and 1994, one Israeli hospital reported treating 220 terrorist-related injuries. While, more than

half the patients (54%) were injured by thrown projectiles and stones, a quarter (25%) had been shot and 10 patients (4.5%) were injured by explosives. [7]

These kinds of injuries are labor and resource intensive and exact a great toll on healthcare systems. During a 15 month period between 2000 and 2001, 2.4% (561) of all trauma admissions to 9 acute-care Israeli hospitals were for terrorist-related injuries. Three quarters of patients were in their twenties and male. Forty eight percent of injuries were due to explosions, 47% due to gunshot wounds. The authors concluded that the severity of injuries required a greater level of critical care from that seen in non-terrorist-related injuries and imposed a significant burden on the Israeli healthcare system. [11]

Researchers have attempted to pool terrorist-related injuries to describe overall patterns. One such study combined 3,357 casualties from 220 world-wide terrorist incidents and found an immediate fatality rate of 13%. Thirty percent of survivors were hospitalized of whom 1.4% died. The authors concluded that discriminating triage could decrease overall survival. [8] A meta-analysis of 29 terrorist bombings concluded that most of the 903 deaths among the 8,634 casualties were immediate and untreatable. Penetrating soft-tissue injuries (41-86%) predominated followed by pulmonary injuries (1-21% of survivors) depending on the environment (closed or open space) in which the bombing occurred. [3]

While many injuries are immediately fatal, the majority of survivors will suffer less significant trauma. During a 4-1/2 year period from 1975 to 1979, one Jerusalem hospital reported 272 terrorist-related hospital admissions, the majority of which (87%) were graded as light according to a commonly used Injury Severity Score. Ten percent of injuries were considered severe. [1] A 1978 British study of 1532 consecutive terrorist bombing victims found only 9 deaths in hospital. [9]

### 3 The US Experience

More recent events have born out this experience. Seven hundred fifty nine persons sustained injuries after the 1995 Oklahoma City bombing: 167 persons died, 83 survivors were hospitalized. Survivors injuries were characterized by soft-tissue trauma such as lacerations and sprains. [?] Following the events of September 11th in New York City, two nearby hospitals treated approximately 900 patients, of whom 85% were walking wounded sustaining ocular injuries and lacerations. One hundred thirty five patients were admitted to hospital, of whom 18 required surgery. [6] Of 970 recorded injuries to rescue and non-rescue workers on that day in New York, 49% involved inhalation injuries followed by ocular injuries (26%) and minor soft-tissue trauma such as sprains and contusions (14%) and lacerations (14%). [?]

Injury research and control in general deserves greater attention and resources. Al-

though injury is the number one killer of 1 to 34 year-olds in the United States [12] and results in more potential years of life lost than cancer and cardiovascular disease combined, [10] for every dollar spent on cancer research, the federal government spends about 11 cents for injury research. [13]14 Despite its seemingly random nature, injuries, including those due to terrorism, are far from chance events and can be fitted to predictive models. Once adequately described, there is every reason to expect that terrorist-related injuries are at the very least amenable to secondary and tertiary public health interventions.

## 4 Research Questions

Many questions remain to be answered. [5] What are the types, prevalence and incidence of fatal and non-fatal injuries? What are the demographic characteristics, including race, ethnicity and socio-economic status, of affected individuals? What are the best means of transport and what are the most effective treatments? What resources will be needed and how will they effect surge response? This kind of information is crucial for medical and public health professionals and community planners and policy makers to prepare for the possibility of terrorist incidents.

The physical injuries associated with terrorism are characterized by immediately fatal and severe injuries in those most directly exposed to the event and a greater number of minor injuries for those more peripherally exposed. Many questions remain to be answered about how best to utilize health care resources in response to terrorism.

## References

- [1] Rapid assessment of injuries among survivors of the terrorist attack on the world trade center–new york city, september 2001. *MMWR Morb Mortal Wkly Rep*, 51(1):1–5, 2002.
- [2] J Adler, E Golan, J Golan, M Yitzhaki, and N Ben-Hur. Terrorist bombing experience during 1975-79. casualties admitted to the shaare zedek medical center. *Isr J Med Sci*, 19(2):189–193, 1983.
- [3] L Aharonson-Daniel, Y Waisman, YL Dannon, and K Peleg. Epidemiology of terror-related versus non-terror-related traumatic injury in children. *Pediatrics*, 112(4):e280, 2003.
- [4] JL Arnold, P Halpern, MC Tsai, and H Smithline. Mass casualty terrorist bombings: a comparison of outcomes by bombing type. *Ann Emerg Med*, 43(2):263–273, 2004.
- [5] B Brismar and L Bergenwald. The terrorist bomb explosion in bologna, italy, 1980: an analysis of the effects and injuries sustained. *J Trauma*, 22(3):216–220, 1982.
- [6] CDC. Mass trauma preparedness and response. [http://www.cdc.gov/masstrauma/research/possible\\_studies/medical\\_clinical/rapid\\_assessment.htm](http://www.cdc.gov/masstrauma/research/possible_studies/medical_clinical/rapid_assessment.htm), June 2005.
- [7] JG Cushman, HL Pachter, and HL Beaton. Two new york city hospitals' surgical response to the september 11, 2001, terrorist attack in new york city. *J Trauma*, 54(1):147–54; discussion 154–5, 2003.
- [8] H Emile and D Hashmonai. Victims of the palestinian uprising (intifada): a retrospective review of 220 cases. *J Emerg Med*, 16(3):389–394, 1998.
- [9] ER Frykberg and JJ 3rd Tepas. Terrorist bombings. lessons learned from belfast to beirut. *Ann Surg*, 208(5):569–576, 1988.
- [10] WA Hadden, WH Rutherford, and JD Merrett. The injuries of terrorist bombing: a study of 1532 consecutive patients. *Br J Surg*, 65(8):525–531, 1978.
- [11] S Mallonee, S Shariat, G Stennies, R Waxweiler, D Hogan, and F Jordan. Physical injuries and fatalities resulting from the oklahoma city bombing. *JAMA*, 276(5):382–387, 1996.
- [12] AA Meyer. Death and disability from injury: a global challenge. *J Trauma*, 44(1):1–12, 1998.
- [13] K Peleg, L Aharonson-Daniel, M Michael, and SC Shapira. Patterns of injury in hospitalized terrorist victims. *Am J Emerg Med*, 21(4):258–262, 2003.

- [14] FP Rivara, DC Grossman, and P Cummings. Injury prevention. first of two parts. *N Engl J Med*, 337(8):543–548, 1997.
- [15] Leon S. Robertson. *Injury epidemiology : research and control strategies*. Oxford University Press, New York, 1998.