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Impact of the Terrorist Bombings of the Neve Shalom and Beth Israel Synagogues on a Hospital in Istanbul, Turkey

Ülkümen Rodoplu, MD, Jeffrey L. Arnold, MD, Rifat Tokyay, MD, Gurkan Ersoy, MD, Serkan Cetiner, Tayfun Yücel, MD

Abstract

Objectives: The authors sought to estimate the impact of the open-air mass-casualty terrorist bombings of the Neve Shalom and Beth Israel Synagogues in Istanbul, Turkey, on November 15, 2003, on the American Hospital (AH) in terms of resource utilization, epidemiologic outcomes, and time course of emergency needs. **Methods:** A retrospective descriptive study using data from hospital records of injured survivors who used the emergency department at AH on November 15, 2003, to determine the number and percentage of injured survivors who were hospitalized, received operative care, had specific injury types, had an Injury Severity Score ≥16, died, and arrived within certain time intervals. **Results:** AH received 69 (91%) injured survivors from the scene, of which nine (12%) were hospitalized and three (4%) received operative care. Starting four hours after the initial blast, seven (9%) injured survivors were transferred to AH from other hospitals, of which five (7%) were hospitalized and four (5%) received operative care. Of the 49 injured survivors from the scene with documented injuries, 43 (88%) had injuries to the head or face, 42 (86%) had lacerations, five (10%) had fractures, one (2%) had a penetrating eye injury, one (2%) had a serious intracranial injury, and none had primary blast injuries. Four (5%) injured survivors at AH had an Injury Severity Score ≥16, and none died. **Conclusions:** Seventy-six injured survivors used the emergency department at AH, including a delayed wave of injured survivors transferred from other hospitals. The majority of injured survivors with documented injuries had non–life-threatening lacerations of the head or face, and relatively few injured survivors were hospitalized or received operative care. ACADEMIC EMERGENCY MEDICINE 2005; 12:135–141.

On the morning of November 15, 2003, terrorists believed to be affiliated with the Islamic Great Eastern Raiders Front and Al Qaeda carried out two near-simultaneous suicide bombings against the Beth Israel Synagogue and the Neve Shalom Synagogue, two of the oldest synagogues in Istanbul, Turkey.[1–3] At the time, these two bombings comprised the single largest terrorist attack in modern Turkish history, killing 30 persons and injuring an estimated 298 others.[4–8]

The first suicide bombing occurred at 0929, when a pickup truck carrying an improvised explosive device consisting of an estimated 400 kg of ammonium sulfate, ammonium nitrate, and compressed fuel oil, exploded at the entrance of the Neve Shalom Synagogue in the historic Beyoglu district of Istanbul.[1–3] The blast tore open the front of the synagogue and vaporized a small police watch post outside. In neighboring streets, storefront windows were blown out hundreds of meters away.[3]

At 0930 and approximately 5 km away, a second pickup truck carrying a similar improvised explosive device exploded in front of the Beth Israel Synagogue in the Osmanbey section of the city.[2,3] The explosion shattered windows in surrounding buildings and left a wide crater in the street.[3] Following the blasts, injured survivors sought emergency care at 23 medical facilities, including the American Hospital (AH), which received the greatest number of victims that day.[2,9]

Both bombings on November 15, 2003, may be classified as open-air mass-casualty terrorist bombings because they 1) took place in open streets outside of structures but did not lead to structural collapse and 2) produced ≥30 casualties.[10,11] Although mass-casualty terrorist bombings have become an increasingly important challenge for hospital emergency preparedness in many countries in recent years, little has been reported in the medical literature about the impact of open-air bombings on emergency depart-

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Received June 30, 2004; revision received September 20, 2004; accepted September 28, 2004.

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doi:10.1197/j.aem.2004.09.019

ments (EDs) and hospitals, especially in developing countries.[12–14] Accordingly, we sought to estimate the impact of these open-air mass-casualty bombings on AH in terms of resource utilization, epidemiologic outcomes, and time course of emergency needs.

METHODS

Study Design. We performed a retrospective descriptive study using hospital logbooks, trauma registry, and individual patient records at AH. This study was approved by the institutional review board at AH in Istanbul on March 5, 2004.

Study Setting and Population. We studied injured survivors of the two terrorist bombings on November 15, 2003, who used the ED at AH on that date. AH is a private 300-bed hospital located 6 km from the Neve Shalom Synagogue bombing site and 6 km from the Beth Israel Synagogue bombing site in Istanbul, Turkey. The ED at AH has 12 beds, and its usual daily census ranges from 80 to 100 patients. AH is designated as a Level 1 trauma center by the Ministry of Health in Turkey, according to the American College of Surgeons trauma center criteria. Because AH is a private hospital, it rarely receives trauma patients in transfer from other hospitals; trauma transfers in Istanbul are almost always directed to government-sponsored Level 1 trauma centers.

The emergency medical services (EMS) system in Istanbul is comprised of the Ministry of Health–sponsored 112-Istanbul EMS and several private ambulance services and is coordinated by a Ministry of Health–sponsored central dispatch center. Minutes after the bombings, the Ministry of Health dispatched 26 112-Istanbul EMS ambulances to the scenes and placed the private ambulance services on standby.[2] One hour after the first blast, an estimated 50 112-Istanbul EMS ambulances and 170 personnel were on-scene at the two sites.[2]

Our study period extended from November 15, 2003, to December 2, 2003, the date that the last hospitalized injured survivor was discharged from AH.

Study Protocol. One author identified injured survivors who used the ED on November 15, 2003, from the handwritten logbook in the ED at AH. We defined ''used the ED'' as either presenting to the ED for emergency care or being transferred to the ED from another medical facility. Injured survivors from the bombings were distinguished from other patients using the ED on November 15, 2003, by a concurrent notation in the logbook based on the report of the victim or a person who accompanied them (e.g., relative). This author reviewed handwritten hospital records of injured survivors identified as having used the ED and abstracted data shown in Table 1 to standard study data forms. These data elements were selected from several previous reports of mass-casualty terrorist bombings.[10,11,15–26] He also examined the handwritten logbooks in the operating room and admitting office and the trauma registry to supplement information from individual records.

TABLE 1. Data Abstracted from Hospital Records in This Study

Category	Data Abstracted
Demographic characteristics	Age[15,17,18]
Resource utilization	Sought emergency care at ED from scene[10,11,15,18,20,23,24]
	Transferred to ED from other hospital[17,18,20]
	Transferred from ED to other hospital[17,18,20]
	Treated and released from ED[18,26]
	Hospitalized[18–27]
	Received operative care[18–20,23]
Epidemiologic outcomes	Injury types[10,11,16–18,21]
	Injury locations (anatomic sites)[16,18,21–23]
	Death[10,11,15,24,26,27]
Time course of emergency needs	Time of ED arrival[11,25]
	Time and date of death[10,17]

Measurements. We adopted measures of the impact of bombings on hospitals from several studies of mass-casualty terrorist bombings (Tables 2 and 3).[10,11,17–28] These measures include the number and percentage of injured survivors who 1) used the ED, were treated and released, were hospitalized, and received operative care (resource utilization); and 2) had specific injury types, had dichotomized Injury Severity Scores (ISS <16 and ≥ 16), died on arrival at the ED, and died in the ED or hospital (epidemiologic outcomes).

In addition, we adopted the number and percentage of injured survivors arriving in the ED within one hour of the initial blast as a measure of the time course of emergency needs from guidelines proffered by the U.S. Centers for Disease Control and Prevention.[29] We expanded this to include the number and percentage of injured survivors arriving in the ED 1) at least one hour but less than four hours after the initial blast and 2) at least four hours after the initial blast. We adopted the number and percentage of injured survivors who died in the ED or hospital less than four hours after the initial blast (early death) or at least four hours after the initial blast (late death) as measures of the time course of emergency needs from two previous studies of mass-casualty terrorist bombings.[10,11]

We defined ''primary injured survivors who used the ED'' as injured survivors who sought emergency care at the ED from the scene (regardless of their mode of transport) and ''secondary injured survivors

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TABLE 2. Resource Utilization at American Hospital

Category	Measure	No. (%) *N* = 76
ED use	Injured survivors used ED[10,11]	76 (100)
	Primary injured survivors used ED	69 (91)
	Secondary injured survivors used ED (transferred to ED from other hospital)[17,18,20]	7 (9)
ED disposition	Injured survivors treated and released[10,11,18,26]	62 (82)
	Primary injured survivors treated and released	60 (79)
	Secondary injured survivors treated and released	2 (3)
	Primary injured survivors transferred to another hospital[17,18,20]	0 (0)
Hospitalization	Injured survivors hospitalized[10,11,18–27]	14 (18)
	Primary injured survivors hospitalized	9 (12)
	Secondary injured survivors hospitalized	5 (7)
Operative care	Injured survivors received operative care[18–20,23]	7 (9)
	Primary injured survivors received operative care	3 (4)
	Secondary injured survivors received operative care	4 (5)

who used the ED'' as those who were transferred to the ED from another hospital.

We determined dichotomized ISS (ISS <16 or ISS ≥16) for injured survivors in the following manner. First, we assigned all injured survivors who were treated and released from the ED a categorical ISS <16 (and did not calculate each individual ISS). Next, we determined the ISS for hospitalized injured survivors from injury type and anatomic location data in their hospital records and operative reports, using standard methodology, and then corroborated this assignment with the ISS in the hospital trauma registry.[30]

Data Analysis. We summed the available individual data to produce totals, which we then used to calculate percentages based on the number of injured survivors who used the ED at AH (Tables 2 and 3) or were hospitalized at AH (Table 3). We did not calculate percentages for age groups or time of ED arrival for primary injured survivors, because relevant data were largely unavailable.

In determining the number of injured survivors with specific injury types, we used the following definitions: 1) pulmonary blast injury includes pulmonary contusion, pneumothorax, pneumomediasti-

TABLE 3. Epidemiologic Outcomes at American Hospital

Category	Measure	No. (%) of Injured Survivors Who Used the ED (*N* = 56)	No. (%) of Primary Injured Survivors Who Used the ED (*N* = 49)	No. (%) of Injured Survivors Hospitalized (*N* = 14)	No. (%) of Primary Injured Survivors Hospitalized (*N* = 9)
Injury type	Pulmonary blast injury[10,11]	0 (0)	0 (0)	0 (0)	0 (0)
	Ruptured tympanic membrane[10,11]	0 (0)	0 (0)	0 (0)	0 (0)
	Intestinal perforation[10,11]	0 (0)	0 (0)	0 (0)	0 (0)
	Laceration[10,11]	48 (86)	42 (86)	11 (79)	7 (78)
	Penetrating eye injury[10,11]	3 (5)	1 (2)	3 (21)	1 (11)
	Penetrating abdominal injury[10,11]	0 (0)	0 (0)	0 (0)	0 (0)
	Penetrating vascular injury[10,11]	0 (0)	0 (0)	0 (0)	0 (0)
	Tendon laceration[10,11]	1 (2)	1 (2)	0 (0)	0 (0)
	Fracture[10,11]	9 (16)	5 (10)	6 (43)	2 (22)
	Head or facial injury, all types[16,28]	49 (88)	43 (88)	12 (86)	7 (78)
	Head injury, all types[10,11]	37 (66)	33 (67)	8 (57)	5 (56)
	Intracranial injury[10,11]	4 (7)	1 (2)	4 (29)	1 (11)
	Liver or spleen injury[10,11]	0 (0)	0 (0)	0 (0)	0 (0)
	Burn[10,11]	1 (2)	0 (0)	1 (7)	0 (0)
Injury severity	ISS <16[11,12,16,21,22]	72 (95)*	68 (99)†	10 (71)	8 (89)
	ISS ≥16[11,12,16,21,22]	4 (5)*	1 (1)†	4 (29)	1 (11)
Mortality	Death[10,11,15,24,26,27]	0 (0)*	0 (0)†	0 (0)	0 (0)

Injury type data not available for 20 primary injured survivors.
ISS = Injury Severity Score.
*Based on 76 injured survivors.
†Based on 69 primary injured survivors.

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num, and blast lung injury; 2) penetrating eye injury includes ruptured globe and intraocular foreign body; 3) penetrating vascular injury includes arterial and venous injuries; 4) intracranial injury includes open or depressed skull fracture and intracranial hemorrhage; and 5) liver or spleen injury includes all mechanisms of injury.[10] We counted more than one injury type per injured survivor when present. We then calculated percentages of injured survivors with specific injury types based on the 49 primary injured survivors and seven secondary injured survivors for whom data were available (Table 3).

RESULTS

Seventy-six injured survivors used the ED at AH on November 15, 2003, of which 14 (18%) were hospitalized and seven (9%) received operative care (Table 2). Figure 1 shows the flow of injured survivors from the two synagogue bombing sites to and within AH. Sixty-nine (91%) primary injured survivors sought emergency care from the scene, of which at least 12 (16%) were elders (65 years old or older) and at least three (4%) were younger than 18 years of age. Fourteen (18%) other primary injured survivors had undocumented ages.

Nine (12%) primary injured survivors were hospitalized, of which three (4%) received operative care, including one with an epidural hematoma, one with a penetrating eye injury, and another with an open tibia and closed femur fractures. The six (8%) hospitalized primary injured survivors who did not receive operative care included two with unspecified head injuries (of whom one was the only hospitalized elder at AH), one with a penetrating eye injury, one with a scapula fracture, and two with multiple lacerations.

Seven (9%) secondary injured survivors were transferred to the ED from other hospitals, of whom one was an elder and one was younger than 18 years of age. Five (7%) of these secondary injured survivors were hospitalized, of whom four (5%) received operative care. Injured survivors receiving operative care included one with an epidural hematoma, one with an intracerebral hemorrhage, one with a penetrating eye injury, and one with a radius and ulna fracture. The fifth hospitalized secondary injured survivor had a subdural hematoma and skull fracture but did not receive operative care. Two other secondary injured survivors, including the elder, had multiple lacerations and were treated and released.

The numbers and percentages of all injured survivors and primary injured survivors who used the ED and were hospitalized with specific injury types are shown in Table 3. Forty-two (86%) of the 49 primary injured survivors with documented injuries who used the ED had lacerations, of which 27 (55%) were multiple. Forty-three (88%) primary injured survivors who used the ED had head or facial injuries. In addition, five (10%) had fractures, one (2%) had a penetrating eye injury, one (2%) had a serious intracranial injury, and none had primary blast injuries.

Table 3 shows the numbers and percentages of all injured survivors and primary injured survivors with dichotomized ISS at AH who used the ED or were hospitalized. No deaths on arrival, deaths within less than four hours (early deaths), or deaths after at least four hours (late deaths) occurred at AH.

Only two (3%) primary injured survivors were documented as arriving within one hour after the blast. Twenty-one (28%) primary injured survivors were documented as arriving after one hour, of which six were hospitalized. Another 46 (61%) injured survivors did not have documented ED arrival times, of which 35 (46%) had minor injuries and were discharged home, eight (11%) had undocumented injuries and were discharged home, and three (4%) were hospitalized. The seven (9%) secondary injured survivors transferred to AH from other hospitals all arrived after four hours.

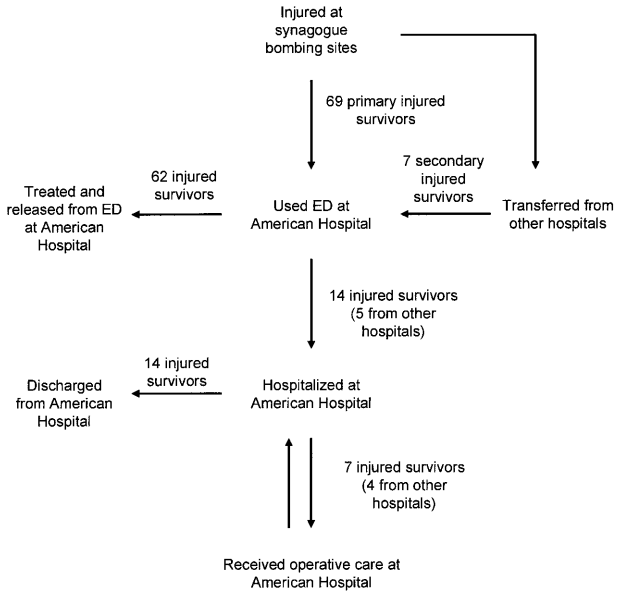


Figure 1. Flow of victims from bombing sites to and within American Hospital.

DISCUSSION

American Hospital received 76 of the estimated 328 total injured at the scene, the greatest number of all hospitals in Istanbul after the attack. In contrast, Taksim Education and Research State Hospital, a 300-bed government Level 1 trauma center with 15 ED beds located only 1 km from each synagogue site, received 46 injured survivors. Sisli Etfal Education and Research State Hospital, a 300-bed government Level 1 trauma center with 15 ED beds located 7 km from the Neve Shalom Synagogue and 8 km from the Beth Israel

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Synagogue, received 36 injured survivors. The St. George Austrian Hospital, an 80-bed private hospital with five ED beds located 7 km from the Neve Shalom Synagogue and 8 km from the Beth Israel Synagogue, received 20 injured survivors. In addition, the Osmanoglu Clinic, a private clinic with no ED or inpatient beds located 2 km from the Neve Shalom Synagogue and 1 km from the Beth Israel Synagogue, received 20 injured survivors. No other medical facility received more than ten injured survivors.

Several factors were likely to have contributed to the misdistribution of injured survivors to AH, including 1) the lack of central coordination of ambulance distribution according to changing hospital loads; 2) the lack of field triage, with ambulances simultaneously transporting seriously injured nonambulatory victims and ambulatory victims with minor injuries; 3) self-referral of victims, who had their private physicians on staff at AH; 4) ambulance transport to AH at the request of victims; and 5) the status of AH in the community as a large Level 1 trauma center, which may have motivated some injured survivors to self-refer and some ambulance crews to select AH as a destination. AH also received at least 12 elder victims from the scenes, reflecting the population at risk for injury in the vicinity of the two synagogues.

The percentage of primary injured survivors hospitalized at AH (12%) is consistent with previous reports of open-air mass-casualty bombings, in which the majority of injured survivors who used the ED did not require hospitalization and were treated and released.[10–14,18,20,23,26,27,31] For example, in a study of nine other open-air mass-casualty bombings, only 15% (95% confidence interval [CI] = 5% to 26%) of injured survivors who sought emergency care were hospitalized.[10]

The percentage of injured survivors with head or facial injuries was at least 78% across all groups of injured survivors (Table 3). Several reports have pointed out the tendency of explosions to injure the head or face, based on their relative exposure and lack of protective clothing.[16,22–24,28,32] For example, in the terrorist bombing of the U.S. Marine Battalion Landing Team Headquarters at the Beirut International Airport in 1983, in which the four-story structure collapsed (and relatively more head injuries may be expected), 37 (33%) of 112 immediate survivors had head injuries.[32] The higher-than-expected percentages here may be due to the lack of data from injured survivors with injuries to other anatomic sites, the misdistribution of victims with head or facial injuries to AH, or the mechanism of these open-air bombings on narrow window-lined streets, which may have produced relatively more injured survivors with head or facial injuries due to flying fragments.

The percentage of primary injured survivors with lacerations at AH (86%) is consistent with previous reports of open-air mass-casualty terrorist bombings, in which the majority of injuries were caused by flying fragments.[10–14,18,20,23,26,27,31] For example, the pooled percentage of ED patients with penetrating soft tissue injuries in nine other open-air mass-casualty bombings was reported to be 86% (95% CI = 58% to 100%).[10] A major share of the ED response at AH involved providing wound care to this large proportion of injured survivors with non–life-threatening injuries. In addition, the percentage of lacerations in hospitalized primary injured survivors at AH (78%) is consistent with the previously reported pooled percentage of penetrating soft tissue injuries in hospitalized patients in nine other open-air mass-casualty bombings (57%; 95% CI = 24% to 90%).[10] As in other open-air mass-casualty terrorist bombings, AH also received primary injured survivors with serious injuries requiring operative care, including penetrating eye injuries, fractures, and intracranial injuries, suggesting the need to mobilize ED and in-hospital resources aimed at managing these conditions in open-air bombings.[10,11]

Only 1% of primary injured survivors who used the ED and 11% of hospitalized primary injured survivors at AH had an ISS $\geq$16. In the only previously published report of injury severity scores in open-air mass-casualty terrorist bombings, Leibovici et al. reported that 27% of hospitalized injured survivors had an ISS $>$16 in two bombings in Israel, in which terrorists detonated improvised explosive devices amid dense crowds.[12] In contrast to these bombings in Israel, victims on the street in the Istanbul bombings on November 15, 2003, were relatively dispersed and those inside the synagogues were relatively protected by walls at the time of detonation, accounting for their lower overall injury severity.

The absence of early or late deaths at AH is consistent with the biphasic mortality pattern observed in other open-air mass-casualty terrorist bombings, in which the vast majority of deaths took place at the scene or en route to hospitals, followed by rare early and occasional late deaths.[10,11]

Finally, these results suggest that three waves of injured survivors occurred. The first wave was most likely comprised of primary injured survivors with mostly minor injuries who began using the ED shortly after the blast. According to eyewitnesses, during the first hour after the blast, the ED documentation of individual injured survivors was limited due to the evolving, chaotic situation. Of the 46 injured survivors in the ED without documented arrival times, 43 were discharged home with minor injuries and only three were hospitalized. This group of primary injured survivors with poor documentation most likely represented a first wave of patients with predominantly minor injuries. The second overlapping wave was comprised of primary injured survivors with more serious injuries that required hospitalization, with six

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of the nine primary injured survivors who were hospitalized arriving more than one hour after the blast. In addition, a third wave began four hours after the initial blast and was comprised of seven secondary injured survivors transferred to the ED from other hospitals. This third wave may be associated with health care systems in which medical facilities that initially receive victims lack the capacity to provide definitive medical care, leading to the secondary distribution of victims to tertiary-level hospitals. Because these victims tend to have serious injuries requiring hospitalization and operative care, this third-wave phenomenon may represent another important consideration for hospital emergency planning.

LIMITATIONS

A major limitation of this study is our use of data from hospital records that were generated during the challenging circumstances of the emergency response to these bombings, especially during the first hour after the initial blast. Because some records were incomplete, illegible, or not available, we were unable to collect various data on several primary injured survivors, including 1) age (not available for 14 injured survivors), 2) injuries (not available for 20, of whom none were hospitalized), and 3) ED arrival time (not available for 46, of whom three were hospitalized). The lack of injury data for 20 primary injured survivors who were treated and released was likely to have decreased our reported percentage of lacerations and increased our reported percentages of more serious injuries, because it is very likely that some of these 20 injured survivors had soft tissue lacerations that were not counted. In addition, a number of minor injuries that were likely to have been present in the injured survivors were not recorded, such as puncture wounds, retained foreign bodies, abrasions, contusions, sprains, or strains. The lack of ED arrival time data for 46 injured survivors made it impossible to distinguish the first two waves on the basis of a specific time cutoff. Instead, we could only correlate the first chaotic hour after the blasts with the poor documentation of the many primary injured survivors who were discharged home and the tendency for primary injured survivors who required hospitalization to arrive after one hour. In addition, we were unable to study the mode of arrival of injured survivors at AH, because the mode of arrival was only recorded for seven (9%) victims, of which none were reported to have arrived by EMS. According to eyewitnesses, ambulance crews did bring injured survivors to AH but did not use triage tags or provide written documentation of their out-of-hospital care.

This study also has at least two potential sources of bias: 1) our retrospective study design and 2) our data collection by an author who also participated in the hospital emergency response. In addition, we were unable to investigate other important aspects of resource utilization, including the types of operations received, hospital length of stay, or admission to critical care units. Finally, our results are limited to AH and may not represent other hospitals that received injured survivors on November 15, 2003.

CONCLUSIONS

Seventy-six injured survivors used the ED at AH, including a delayed wave of injured survivors transferred from other hospitals. The majority of injured survivors with documented injuries had non–life-threatening lacerations of the head or face, and relatively few injured survivors were hospitalized or received operative care. Understanding the impact of these open-air mass-casualty bombings on AH may help guide rational hospital emergency planning and preparedness in communities at risk for these events.

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