Special Review

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Published online before print
10.1148/radiol.2371040585
Radiology 2005; 237:28–36

Abbreviation:
MCE = mass-casualty event

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Facing the New Threats of Terrorism: Radiologists' Perspectives Based on Experience in Israel[1]

On September 11, 2001, the world changed. The vicious giant of terrorism that was dormant until that date had arisen. After the horrific mass-casualty terror attack on the United States, any and all forms of assault seem possible. Owing to the complexity of injuries encountered in terror attack victims, fast and accurate imaging plays an essential role in triage and identification of abnormalities associated with injuries. The radiologist becomes a crucial part of the first-line team of doctors treating these patients. Knowledge that the best available treatment is given to terror attack victims can enhance the strength and endurance of society against terror. On the basis of the authors' experience with terror events in Israel, the steps involved in imaging of terror attack patients include conventional radiography, focused abdominal sonography in trauma, computed tomography, and angiography, with the judicious use of supplemental imaging.

On September 11, 2001, the world changed. The vicious giant of terrorism that was dormant until that date had arisen. After this horrific mass-casualty terror attack on the United States, any and all forms of assault seem possible. The terrorism of today, whether conventional or nonconventional, damages the body and mind. The purpose of this review is to describe the impact of conventional terror as it relates to the practice of radiology in an emergency hospital setting. The review is based on our experience with terrorist events in Israel. We will include an introduction on terror, management of a terror attack, and a focus on imaging.

TERROR

Can terrorism be clearly defined? The U.S. State Department defines terrorism as "premeditated, politically motivated violence perpetrated against noncombatant targets by subnational groups or clandestine agents, usually intended to influence an audience" (1). In another attempt to produce a useful definition, Paul R. Pillar, a former deputy chief of the counterterrorist center of the Central Intelligence Agency, argues that there are four key elements of terrorism: *(a)* It is premeditated—planned in advance—rather than an impulsive act of rage; *(b)* it is designed to change the existing political order; *(c)* it is not merely criminal, like the violence that certain groups may use to obtain money; and *(d)* it is aimed at civilians—not at military targets or combat-ready troops (2). Terror is carried out by subnational groups—not by the army of a country. A more practical definition, given by Jeane Kirkpatrick, former U.S. representative to the United Nations, is that "what the terrorist does is kill, maim, kidnap, and torture. His victims may be school children, industrialists returning home from work, political leaders or diplomats" (3).

The types of terrorism involve the use of conventional, biologic, chemical, and ionizing radiation weapons separately or in a combined fashion. The proper handling of each of these situations requires modification of the everyday approach taken by all health care providers, including the radiology team, in an attempt to decrease morbidity, mortality, and permanent disability.

ESSENTIALS

- *Owing to the complexity of injuries encountered in victims of terror attacks, fast and accurate imaging plays an essential role.*
- *The radiologist becomes a crucial part of the first-line team in the treatment of these patients.*
- *The steps involved in imaging victims of terror attacks include conventional radiography, focused abdominal sonography in trauma (FAST), CT, and angiography, with the judicious use of supplemental imaging.*

Conventional Terror

On March 9, 2002, Israeli radio broadcast that 11 people were killed and 54 injured, 10 of them severely, when a suicide bomber set off an explosion at 10:30 PM Saturday night in a crowded cafe at the center of Jerusalem (4). Hamas, a radical terrorist organization, claimed responsibility for the event. Photographs of this event show multiple victims lying in the cafe minutes after the explosion (Fig 1). Within 30 minutes the patients were all transported to hospitals, where complex but rapid care was judiciously administered to a considerable number of patients virtually simultaneously.

Mass-Casualty Events

The incident at the Jerusalem cafe can be defined as a mass-casualty event (MCE), in which the medical system was overwhelmed and the balance between resources and demands was temporarily uneven (5,6). On such occasions, the principal aim is to decrease mortality and morbidity for the entire affected population, even at the cost of providing potentially less than routine treatment for any given individual patient (7). This contradicts the classic paradigm of medical management, in which optimal treatment should be given to every single patient we treat.

The size of an MCE is defined as small if eight to 24 are injured, medium if 25–59 are injured, and large if 60 or more are injured (8). These events have unfortunately become commonplace in many countries, including Turkey, Indonesia, Iraq, Israel, and, recently, Spain (9–11) (Fig 2).

MEDICAL TREATMENT AND ADMINISTRATIVE ISSUES

Issues in the Field

As a result of this upswing in terrorist attacks, urban doctors have had to adopt concepts previously used on distant battlefields to treat large numbers of patients with complex injuries in a short period of time. In remote regions where hospitals are more than an hour away, such as where troops are operating in the field in Iraq or Afghanistan, the attempt to stabilize the patient's condition is the most important consideration (12,13). This is based on the principle of the "golden hour" (14–16), in which patients must be given definitive treatment within, at most, an hour from the time of injury, to increase the chance of survival. However, in urban areas we use the "scoop and run" (17–19) approach, in which the patient is evacuated in an ambulance and rushed to the medical facilities with minimal crucial treatment on site. This method is preferred because better and definitive treatment can be provided at the hospital and no precious time is wasted on site.

It should be also remembered that many obstacles and dangers exist at the scene of an MCE (20). First, there is inherent confusion, where many parties are interested in the details of the event rather than in the immediate needs of an injured patient. Second, there is a lack of a sufficient quantity of trained personnel available. Third, the area is defined as a mass disaster area, and there are dangers to medical personnel (eg, secondary explosions, unstable debris) that are not present in the hospital setting (21).

Treatment and Evacuation from the Scene

The priorities for evacuation and stabilization of patients do not necessarily correlate with the priorities for definitive treatment (22). For example, the treatment priority is very high for tension pneumothorax. Once the chest is drained in the field by means of needle thoracentesis a tension pneumothorax is turned into a simple pneumothorax and the patient is not at high priority on the list for evacuation. The patient may be treated in the hospital at a later stage by means of insertion of a draining thoracostomy tube. The patients that need to be evacuated urgently are those with internal bleeding that cannot be controlled outside of the operating room. These patients are in critical condition and must be evacuated immediately to a proper tertiary care trauma hospital.

Treatment and evacuation priorities must be coordinated by the medical manager or commander of the event. This can be the first qualified person arriving on site or the senior person arriving later (22,23). Each ambulance must be directed to a specific hospital. The selection of a hospital is based on the complexity of the injuries, the medical capabilities of the hospital (eg, trauma center level), and the number of patients already evacuated to a given hospital (20). Otherwise, without proper coordination there is a risk of mismatching or of not optimally using hospital resources.

Medical Management of a Terror Attack

Given the large number of patients involved and a limited time frame, we have found that the best solution to the problem of optimizing patient care is planning and preparation in order to reduce uncertainty and decrease reaction time (22). The initial report of terrorist activity involving casualties should be confirmed, and an official MCE status should be declared (24). Data gathered should include the type of event, the location, the estimated number of casualties, the likely severity of injuries, and the estimated time of arrival of patients. It must be remembered that this information may be vague, inaccurate, and even absent (22,24). Additional medical or paramedical staff should be called to the hospital as needed. The operating rooms, the blood bank, and the radiology department should be notified. It is also important to open a public information center, which can assist in identification of unknown patients. The information center can also gather data from and provide data to other hospitals, primary physicians, and other authorities and should be staffed mainly by social workers or other relevant medical personnel. This last step enables the medical personnel to better perform their life-saving roles with reduced interference (22).

Preliminary Actions

The emergency department should be evacuated of all noncritical patients, and all elective activities such as nonurgent surgery should be immediately delayed (21,22,24). According to these guidelines, cancellation of all elective activity in the radiology department should also be performed. All medical and administrative

Figure 1. A cafe in central Jerusalem, Israel, minutes after a suicide bomber exploded at the entrance. Medics are seen giving first aid to the victims on site. Note the confusion and debris that can complicate the efficient administration of medical treatment.

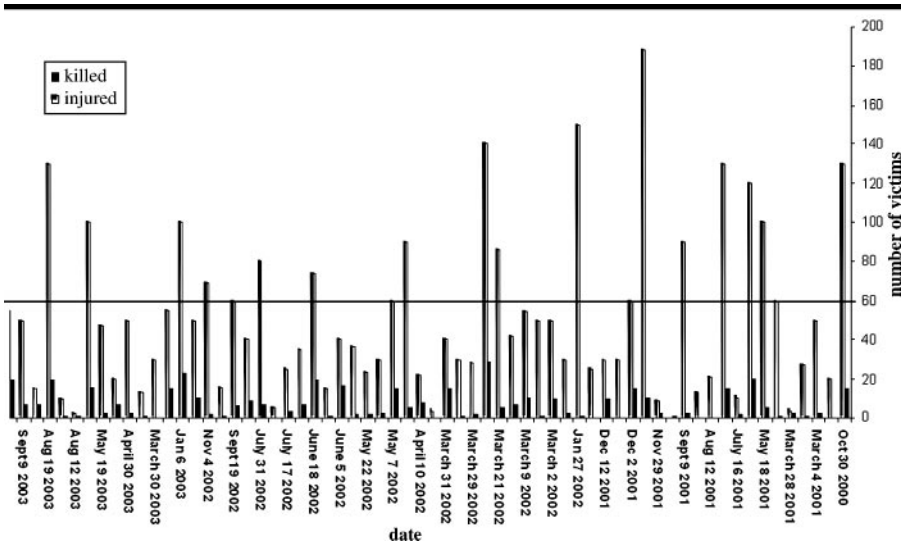


Figure 2. The number of people killed and injured in suicide bombing terror attacks in Israel between October 2000 (beginning of the second Palestinian intifada) and September 2003. Of 64 events, 20 were classified as large MCEs, with 60 or more injured per event.

staff should wear identification vests to decrease confusion.

Triage

Triage should be performed by the triage officer, and each patient's status should be categorized according to Advanced Trauma Life Support criteria into severe, moderate, or mild condition (21,24). Patients should be referred to treatment sites according to triage category. For major events, extra admission and treatment sites might be needed. Accordingly, "overtriage" or "undertriage" (eg, classifying a severe injury as mild) needs to be avoided.

Administrative Issues in the Hospital Setting

Some administrative points are particular to terror MCE management, including the fact that many patients arrive, with complicated medical conditions, within a short time from the terror attack. There often is a problem of identification because many patients are unconscious and arrive without identification papers or personal belongings. This is compounded by the problem of communication with families that call or gather at hospitals to determine what has happened to their loved ones. Panic reactions can occur in the families of patients and sometimes even in the medical personnel. Last, it must be remembered that other acute medical conditions, such as heart attacks in patients who may arrive to the emergency department at the same time, also need to be treated.

Control and Command Station

The command station should be equipped with all necessary communication aids, and it should register all casualties and their conditions (25,26). A census of the hospital resources that will be needed, such as operating rooms, ventilators and blood products, must be conducted rapidly and repeatedly to ensure that adequate resources are available. This information also needs to be communicated to the regional authorities, other hospitals, and military and/or emergency services, as appropriate.

Patient Identification

Given the nature of the injuries (eg, explosion, burns), visual recognition of an individual patient is not always possible and may be inaccurate and misleading. Early digital photographs should be obtained from different angles in living unknown patients. Although identification can be performed by examining personal effects (clothing, jewelry, pocket contents), it must be remembered that loose objects can be scattered by a bomb blast as projectiles over a wide area and may, therefore, be mistakenly attributed to the wrong person.

Physical evidence may also be used for identification. This evidence includes sex, estimated age, height, build, and skin color, as well as specific features such as scars, moles, and fingerprints (27). Another possibility (albeit less useful during acute critical care) is an autopsy, which may make genetic identification possible (28–30). Dental evidence of the teeth and jaws can also be used and is often accurate and reliable (31). Imaging may also play a role in the identification of a patient's age, previous surgeries,

and known congenital anomalies (Fig 3) (32,33). Specific examples include comparison with prior radiographs for the shape and size of facial sinuses, for curvature of the spine, and for arthritic changes (32,33).

Patterns of Injury

Although non–terror-related trauma patients are often encountered at medical centers, the injuries of terror-related trauma patients are often more complex (11). According to the Israeli trauma registry, one-third of terror victims had severe trauma, 26% needed to be admitted to the intensive care unit, and one-half underwent a procedure in the operating room. Also, the duration of hospitalization was longer than 2 weeks for approximately 20% of this population, and inpatient mortality was 6% (34). Furthermore, many of the injured are children, which can add to the complexity of diagnosis and treatment and can entail emotional issues (35). Critical injuries are seen in 25% of terror-related injuries, compared with 3% in non–terror-related injuries; internal injuries are present in 11% of the former, compared with 4% in the latter (35).

The mix and number of patients can differ depending on the consequences of the terror act. Owing to the high mortality rate on September 11, 2001—only 911 survivors were admitted to two hospitals in lower Manhattan, and 85% of these were ambulatory with mostly minor injuries (36). Of the remainder, only 13% underwent a surgical procedure (36).

Conclusion of the Event

Pronouncement of the end of an MCE is important, because the intensity of work required in this situation cannot continue for an extended period (22). Tomorrow is another working day, with its prescheduled elective activities. As soon as possible, participants from inside and outside the hospital need to meet for a debriefing session to draw candid conclusions and lessons regarding the event. This often results in updates to protocols and determination of where gaps exist in workforce, knowledge, and equipment that can potentially be remedied in advance of future events (21).

Planning

Standard operating procedures for various scenarios, including short-term scenarios such as terror acts or ongoing emergency settings, should be available and should be widely distributed to various members of the hospital's medical and administrative departments (37,38). Every hospital employee needs to know his or her role and responsibilities in the case of an MCE. These need to be updated regularly and practiced frequently. Drills are essential because most hospitals overestimate their capacity for treating a large number of seriously injured patients (39).

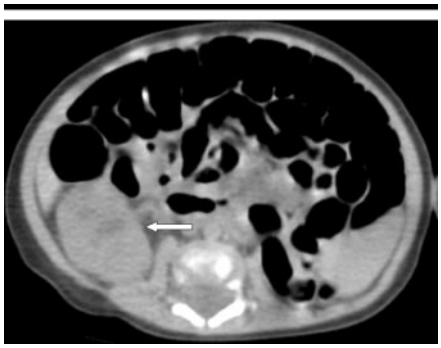


Figure 3. Transverse nonenhanced computed tomographic (CT) scan of the midabdomen of a 1-month-old baby who was born with a single kidney (arrow). His mother, victim of a terror explosion in a bus, was hospitalized elsewhere but was able to identify the baby by remembering from a prenatal sonogram that the baby had a single kidney.

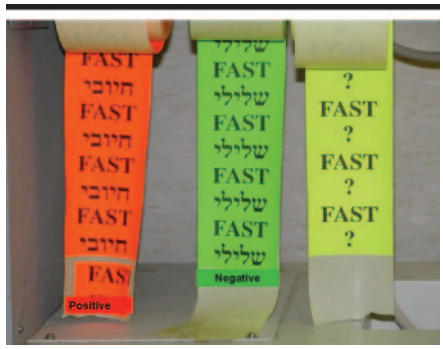


Figure 4. Color-coded stickers (see text for explanation) are used for immediate report of findings of focused abdominal sonography for trauma, or FAST, examinations performed in the emergency department on arrival of terror victims. This system is visually effective for expeditious reporting of results to all personnel involved in treating the patient in a clear and unequivocal manner.

THE ROLE OF RADIOLOGY IN TERROR ATTACKS

In recent years, the radiology department has gained an important role in the work-up of trauma patients in general and of victims of terror attacks in particular (40,41). Radiologic examinations, including radiography, CT, sonography, and angiography, are used to assess the site and extent of injuries. Radiologic images can help determine which patients will be triaged to immediate surgery and which will be followed up conservatively, often with use of repeated radiologic examination. In this section, we will describe how we have adjusted our conventional radiologic response and protocols for trauma to the nonconventional strategies required in response to a terror attack. These experiences have often been gleaned in retrospect from many unhappily learned lessons in trauma and, if applied appropriately, can, we hope, save the lives of many future terror victims (40,41).

Management of the Radiology Department

The problems of the hospital and emergency department also affect the radiology department. Large numbers of casualties whose complicated injuries are due to blast and shrapnel require the most sophisticated imaging but are often admitted with no or minimal early warning to the radiology department during a brief period (42). Personnel who must be notified are the department chair (or acting chief, when the chair is absent), chief administrator, chief technician, and radiologist(s) and radiologic technicians on call (41). Additional personnel, including potentially any and all radiologists, radiographers, and administrative staff, should be recruited on the basis of the size of the MCE. In our experience, many health care professionals arrive of their own accord after an MCE is announced in the media. During a prolonged event (or a heightened period of repeated MCEs occurring in the same geographic area), a rational allocation of the workforce must be performed by the chair, administrator, and chief technician. After declaration of an MCE, all outpatient and nonemergent inpatient studies need to be stopped in every section, including general radiology, CT, sonography, angiography, and magnetic resonance imaging.

Radiology in the Emergency Department

Bedside radiography and sonography units must be rapidly mobilized to the emergency department. On the basis of our experience, a primary function of the

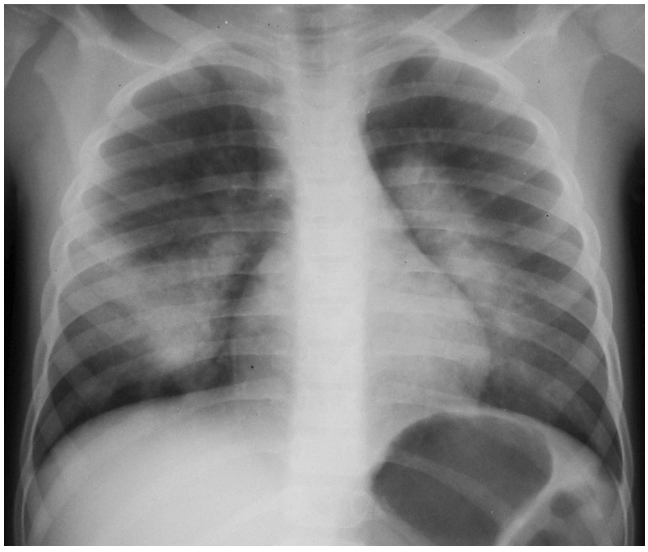


Figure 5. Frontal chest radiograph obtained in a 24-year-old woman several hours after blast injury shows bilateral opacities in a butterfly distribution, representing pulmonary contusion.

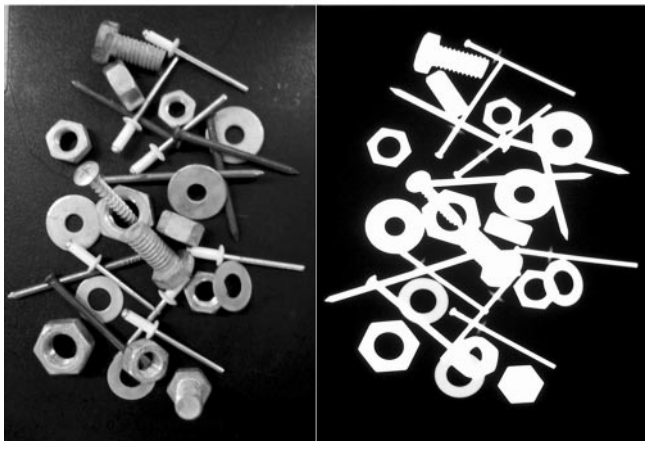
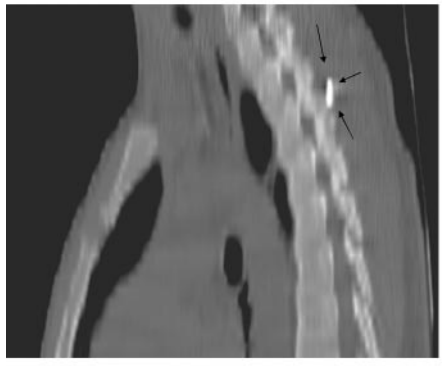


Figure 6. Typical metal objects incorporated in a terror bomb in order to maximize the impact and damage to the victim, as seen in a photograph (left) and on a radiograph (right).

a.



b.

Figure 7. **(a)** CT scout view shows metallic object (arrow) projected over the mediastinum in a 35-year-old terror attack victim. **(b)** Sagittal multiplanar CT reconstruction demonstrates that this object (arrows) is located in the deep soft tissues.

radiologist is to perform focused abdominal sonography in trauma, or FAST, in order to evaluate for free peritoneal fluid and to exclude hemodynamically significant abdominal injuries (43–46). This quick study takes 1–2 minutes per patient. To provide rapid reports that could be used instantly, we have developed colored stickers that are attached the patient's chart: red when positive for free peritoneal fluid, green when negative, and yellow when indeterminate (Fig 4). These are attached to the patient's chart in a clearly visible way to alert the staff as to whether the patient needs prompt further evaluation.

After initial evaluation in the emergency room and during the course of the MCE, radiologists and radiographers perform multiple standard imaging examinations. The radiology administrative staff register the examinations (sometimes, out of necessity, after the examinations have been performed), while the radiologists attempt to perform real-time on-site interpretation and, most important, communicate verbally as soon as possible with the physicians and staff who are part of an interdisciplinary team. Direct verbal communication is essential to decrease confusion and increase efficiency. Because most patients are in critical condition, it is essential to have designated qualified physicians (eg, surgeons or anesthesiologists) in the CT or angiography suite. They are needed to monitor and treat any change in the patient's condition during the course of imaging studies or procedures.

The stability of picture archiving and communication systems (PACS) may be hampered in an MCE. Preparation for PACS failure includes the ability to perform rapid interpretation of hard copies (47). This means adequate facilities must be available to both print and read these examinations. Hard copies should be transferred with the patient, with the understanding that many of these copies might be lost.

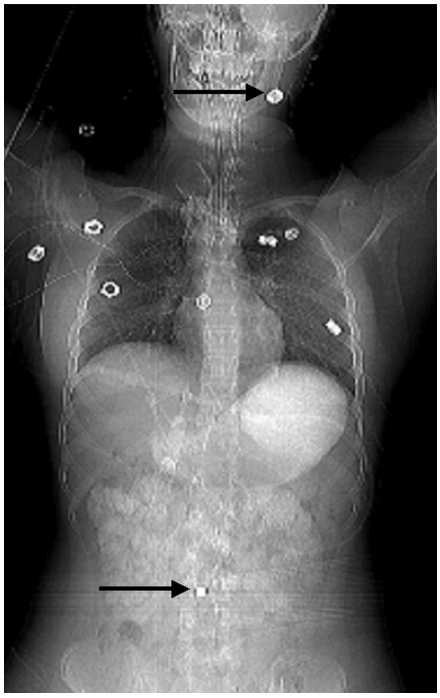
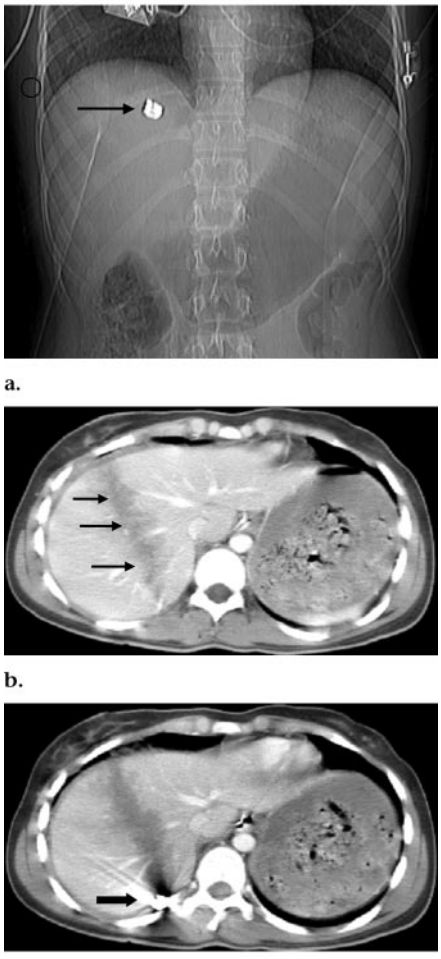


Figure 8. Coronal whole-body CT scout image demonstrates multiple metal objects projected over the chest. Two additional metal objects (arrows) that had not previously been noted on conventional chest radiographs are seen projected over the neck and midabdomen.

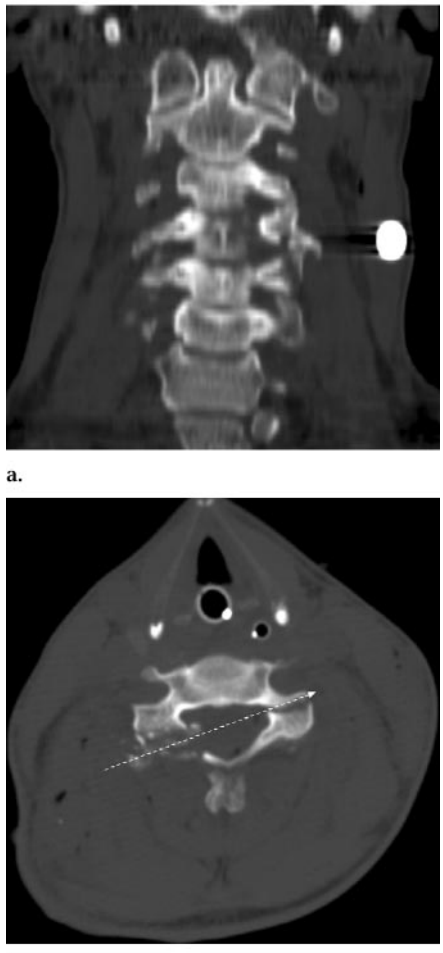


a.

b.

c.

Figure 9. **(a)** Coronal CT scout image of upper abdomen demonstrates a single metal object (arrow) projected over the liver. **(b, c)** Anterior-to-posterior trajectory of this shrapnel can be easily noted on transverse CT scans of the abdomen. The object (arrow in **c**) is located in posterior paraspinal region after causing liver laceration (arrows in **b**).



a.

b.

Figure 10. **(a)** Coronal multiplanar CT reconstruction shows metal object in left side of the neck. **(b)** Transverse CT scan at level of the object demonstrates soft-tissue damage and fractures of the laminae. Arrow = suspected trajectory of the shrapnel.

CONCEPTS IN IMAGING OF CONVENTIONAL TERROR-RELATED INJURIES

Conventional Terror Attacks

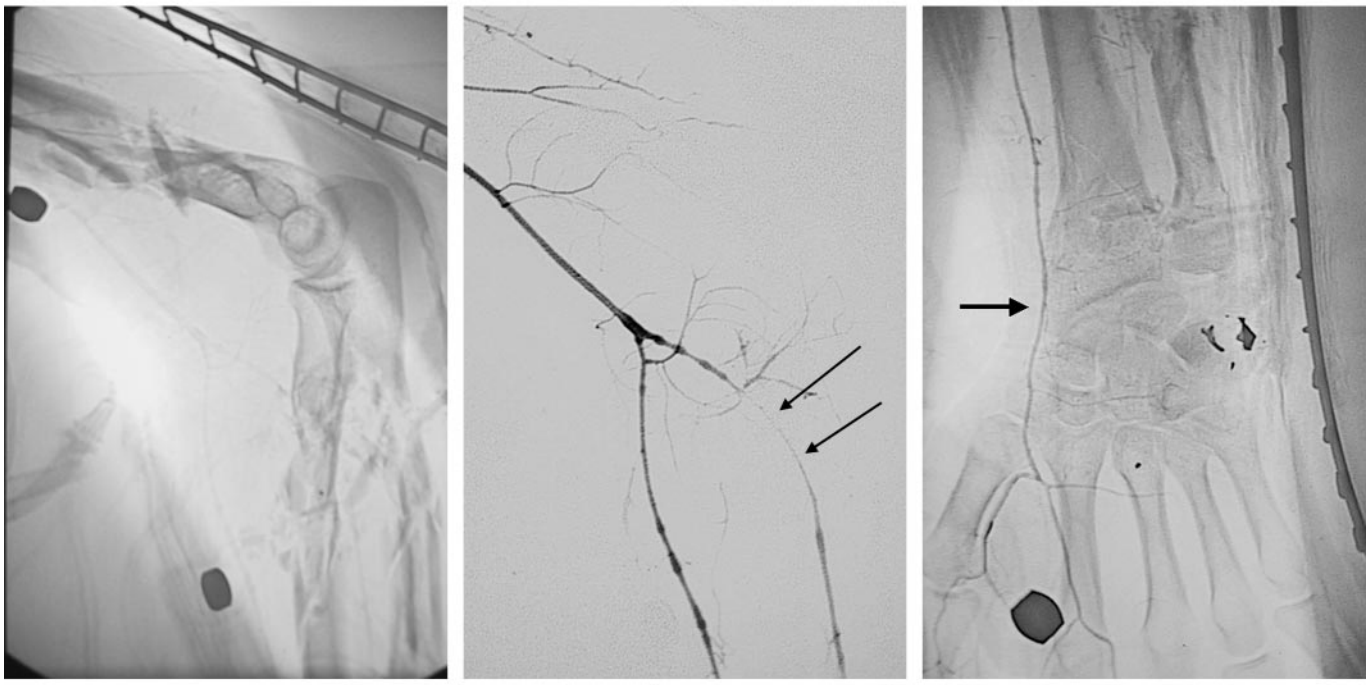
Conventional terror attacks inflict both blast injuries and penetrating wounds. These may occur separately; however, during a terror attack, the blast and penetrating wounds are often combined in a single patient.

Blast Injuries

During a detonation, the explosive substance transforms from a solid state to a gaseous one, creating the blast wave (48,49). A blast wave is rapidly progressive. In air, the blast wave front exponentially decreases in pressure and velocity as it advances from the center of the explosion until it reaches the velocity of sound (the point at which the explosion is heard). When the explosion occurs in a closed space, the blast damage is amplified owing to reflection of the blast wave (50). Because of the low density of air, high-velocity winds can be produced even by small changes in pressure. An overpressure of 0.25 psi (1.75 kPa; much lower than the overpressure caused during a terror bombing) corresponds to a wind velocity of 125 mph (201 km/h), the velocity of a hurricane (51). The wind may result in shear forces that may tear limbs of victims.

Blast injuries are caused by a number of mechanisms, including primary injuries caused by the blast wave (48,49); fragments propelled by the explosion (41); and falls or impacts, caused by the transient wind, against stationary objects. Blast injuries are often accompanied by severe burns due to the intense heat of the explosion (52). Blasts mainly affect air-containing organs such as the ears, the lungs, and the gastrointestinal tract (53–55). Common radiologic find-

Figure 11. Transverse CT scan of pelvis of a 40-year-old woman after administration of rectal contrast material. Shrapnel is noted on the left (thick arrow); however, it has penetrated and caused a rectal tear, as shown by extraluminal contrast material (thin arrows).



a. b. c.

Figure 12. Multiple soft-tissue injuries to the left arm and hand of a 40-year-old terror attack victim. **(a)** Lateral radiograph of the arm shows shrapnel and comminuted fractures of the humerus, radius, and ulna. **(b)** Lateral digital subtraction angiogram of the arm demonstrates spasm (arrows) of the vessels, without bleeding. **(c)** Anteroposterior nonsubtracted angiogram of the hand shows multiple shrapnel and a thin radial artery (arrow).

ings in the chest are pulmonary contusions that appear as unilateral or bilateral opacities on radiographs or CT scans (Fig 5) (56). These tend to clear within 1 week. Additional radiologic findings related to the chest include pneumothorax, hemothorax, and hemopericardium (56).

Penetrating Injuries

Penetrating injuries include stab wounds, gunshot wounds, and bombing-related injuries (eg, from suicide bombings, car or bus bombings). In recent years, terrorists have begun incorporating metallic objects in their bombs for the purpose of inflicting maximum injury (41,42) (Fig 6). These are objects that can be found at a local hardware store and include such items as nails, screws, bolts, and ball bearings; the included metallic objects may add up to 10 kg to a single bomb. These metallic objects penetrate the body at high speed and can become lodged anywhere, lacerating almost any organ in their course. Thus, a new type of trauma patient has emerged: one with combined injuries caused by a blast and by multiple high-velocity penetrating objects (41,42). The large number of metallic objects, along with the complex internal injuries they may inflict, requires a multimodality imaging approach.

Conventional Radiography

Sometimes, a radiograph is all that is needed for the decision on the urgent need to rush a patient to the operating room. Radiographs are usually helpful in the triage of patients for further imaging with CT, particularly when metallic fragments are identified. As in any trauma case, chest, cervical spine, and pelvic radiographs are routinely obtained as part of the initial work-up. Additional radiographs are obtained on the basis of the sites of penetrating wounds. Since these are obtained by using bedside machines, radiographs were classically acquired in only one plane. This results in a limited study. For example, on a single view, a foreign body that is lodged superficially in the soft tissues will look similar to one seated deep in the body, adjacent to vital organs (41). These two situations have very different clinical implications. The addition of a second orthogonal view as part of the initial evaluation when foreign metallic objects are noted can aid in more accurate localization and treatment (Fig 7).

Multiple shrapnel injuries add a new level of complexity. The role of conventional radiography in localizing foreign objects is limited when shrapnel is multiple. The addition of a second view in this situation may not be as helpful, since correlating each object on the two views is difficult and sometimes even impossible. Therefore, the main role of conventional radiography in the evaluation of multiple shrapnel injuries is in helping detect which parts of the body need further imaging, usually with CT.

CT Scanning

CT is a very important modality for the imaging of a terror attack victim (41). With today's state-of-the-art multisection helical scanners, it is possible to rapidly obtain considerable information regarding the extent of a patient's injury. During a terrorist attack, a radiologist should be stationed at every CT console to aid in planning the best protocol and to give real-time interpretations of the scans. On arrival at the CT suite, a whole-body scout image should be obtained initially. This may depict additional unsuspected sites of shrapnel that were not detected on the emergency department radiographs, thus extending the regions to be evaluated with CT (Fig 8).

The body regions examined include areas with metal objects, as well as routine scans of the head, chest, abdomen, and pelvis. Our protocol for adults includes the administration of 1000 mL of a diluted (2%) iodinated contrast agent by mouth or through a nasogastric tube, which is administered while the patient is on the way from the trauma unit to the CT unit. Head CT is performed without contrast enhancement. After the head study, 30 mL of iodinated contrast material is injected 2–3 minutes before scanning starts to opacify the collecting systems and ureters. During the CT study, 120–150 mL of iodinated contrast material is administered at a rate of 2–4 mL/sec, with a delay of 45–90 seconds. Study parameters depend on the scanner type, but the section thickness is 2–5 mm with a 20%–50% overlap. The use of CT angiography is based on clinical suspicion of vascular injury but is used in every case of a penetrating object in the neck.

CT is a superior modality for demonstrating the course a penetrating object has traveled and the resulting injuries (Fig 9). At times, even a single piece of shrapnel that appears to be superficial may cause a devastating internal injury. Thus, it is important to perform CT in all patients with penetrating shrapnel injuries caused by an explosion and particularly so in patients with penetrating head and neck injuries (Fig 10) (41,42).

Shrapnel in the pelvis may warrant rectal administration of contrast material prior to CT to aid in evaluating injuries to the colon (57). This may be helpful even if the metallic object appears to be outside of the true pelvis at the initial assessment, because the line of trajectory may have crossed through the pelvis and colon (Fig 11).

Multiplanar and three-dimensional reconstructions are invaluable tools and are commonly used for problem solving (41). If time permits (ie, in a stable patient and when the number of casualties is limited), three-dimensional CT reconstruction can be performed to facilitate the evaluation of blood vessels. These images, however, are often limited owing to streak artifacts caused by the metallic fragments (58).

Angiography

Angiography is a minimally invasive examination that should be reserved for patients in whom there is a clinical suspicion of vascular injury. These may include patients with limb ischemia, more than one site of injury due to multiple shrapnel wounds, or proximity of shrapnel to major vessels (59). During a terror attack, a penetrating foreign object may cause direct injury to a vessel or a complex fracture that results in vascular compromise (Fig 12). Angiography has the added benefit of allowing for therapy in certain cases, such as the treatment of active bleeding by means of embolization (59). In trauma cases, angiography has traditionally been reserved for hemodynamically stable patients. Owing to the complexity of injuries due to terror bombing, in individual cases angiography may play a crucial role in the preoperative evaluation of patients who are hemodynamically unstable (60).

CONCLUSIONS

In summary, because of the complexity of injuries encountered in terror attack patients, fast and accurate imaging plays an essential role in triage and evaluation of the injured. The radiologist becomes a crucial part of the first-line team of doctors treating these patients. Knowing that the best available treatment is given to terror attack victims can enhance the strength and endurance of society against terror. On the basis of our experience, the steps involved in imaging terror victims include two-view conventional radiography, focused abdominal sonography for trauma, CT, and angiography, with the judicious use of supplemental imaging (Fig 13).

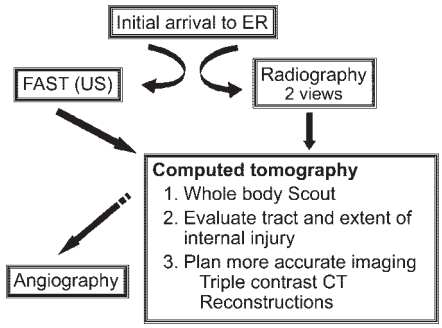


Figure 13. Work flowchart for imaging of terror attack victims includes radiography, focused abdominal sonography for trauma *(FAST),* CT, and angiography. The application of the different steps is based on the severity of injuries in the patient. *ER* = emergency room.

Acknowledgments: The authors thank the Hadassah–Beth Israel Deaconess Medical Center Radiology Research Initiative, and especially S. Nahum Goldberg, MD, PhD, for his invaluable assistance in reviewing this manuscript. This manuscript is dedicated to the memory of Drs M. Medan, S. Gillis, M. Goldin, and D. Applebaum, Israeli physicians and terror attack victims who dedicated themselves during their shortened lives to treating patients of all races, religions, and ethnicities.

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