Overall Asessment of the Response to Terrorist Bombings in Trains, Madrid, 11 March 2004

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Abstract

Objectives: To provide an overall assessment of the response to the terrorist bombings in Madrid, 11 March 2004, which were considered the deadliest terrorist attack on European soil in modern times.

Materials and Methods: Overall data on the number of victims treated at the scenes and at primary care facilities and hospitals, as well as the logistics involved, were reported by the EMS and the Health Authority of the Comunidad de Madrid local government. Data were mainly obtained by retrospective chart review, and did not include casualties who had only emotional shock, superficial bruises or transient hearing loss from barotraumas without eardrum perforation. We defined as critical any casualty with an Injury Severity Score (ISS) >15.

Results: Over 70,000 personnel were mobilized in the care of the victims. EMS response and total evacuation times at the four blast scenes averaged 7 and 99 min, respectively. There were around 2,000 casualties, and a typical bimodal distribution of deaths, with 177 immediate fatalities and 14 subsequent in-hospital deaths. Almost 60% of casualties were taken to the two closest hospitals. Problems related to security, identification of casualties and record-keeping were encountered at the closest hospital. Closed doors increased the immediate fatality rate in the trains. Most survivors had noncritical injuries, but 14% of the 512 casualties assessed had an ISS >15. The critical mortality rate was 19.5%. The most frequently injured body regions were the head/neck and face. In all, 124 major surgical interventions were performed on 82 victims in the first 24 h, and orthopedic trauma procedures accounted for 50% of the case load. Most patients with lung injuries from the blasts required intubation and mechanical ventilation, and their survival rate was 88.3%. Also, 35% of laparotomies were either negative or nontherapeutic.

Conclusion: There was a rapid EMS response and evacuation, but also overtriage, uneven distribution of casualties and difficulties in communication. The sizes and resources of the closest hospitals, as well as the early hour, were probably decisive in the adequacy of the overall response.

Key Words
Blast injury · Mass casualty incident · Injury Severity Score · Terrorist attack · Injury pattern · Preparedness · Surge capacity

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Introduction

Many voices are now saying that terrorism is currently the main form of war being fought by mankind. We know that, with the exception of some chemical incidents in Japan, most terrorist attacks in recent years have been perpetrated with conventional weapons (guns and explosive devices). Our main sources of information on the injury patterns, treatment and logistics involved are military confrontations and the few published reports of large terrorist attacks directed against civilians.

There is currently growing concern in the global medical community about the threat posed by terrorism, and also the surge capacities and preparedness of hospitals to deal with the injuries sustained by victims of major accidents and/or disasters. The differences between those two levels of casualty loads are defined today as follows [1]: (a) *major accidents* (or major incidents; mass casualty incidents, MCIs), where available resources are initially insufficient but the level of medical care is maintained through the appropriate mobilization and redistribution of those

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resources; and (b) *disasters*, where the level of medical care cannot be maintained despite these measures.

The next urban MCI resulting from terrorist bombings after the events of 11 September 2001 in New York took place in Madrid on 11 March 2004; this was rightly considered the deadliest terrorist attack on European soil in modern times. Between 07:39 and 07:42, ten explosions took place in four commuter trains along the train line that runs from the periphery of Madrid into Atocha railway station, located close to the centre of the city: 177 people were killed instantly and around 1,800 were injured. The bombs were detonated by mobile phones. The first three bombs went off while the train was stopped and the doors were open, producing 29 immediate deaths. The second train was approaching the station, with the doors closed, when another four bombs went off, causing 64 immediate fatalities. The third was absolutely devastating and, although only two bombs exploded, the train had stopped and its doors were still closed, causing 67 instant deaths. The fourth train had stopped at the station and opened its doors, and this last explosion killed 17 passengers instantly. All this happened within 5 min and, shortly before 08:00, the first patient, walking but wounded, arrived at Gregorio Marañón University General Hospital (GMUGH), which was closest to the blasts and is the largest hospital in Madrid in terms of number of beds and manpower.

What follows is a summary of the prehospital care, the logistics involved at the closest hospital, the early mortality and the management of casualties at the hospitals that received most of the victims, together with a reflection on the overall outcome.

Materials and Methods

Overall data on the number of victims treated at the scenes, at primary care facilities and hospitals, as well as the logistics involved, were reported by the Health Authority of the Comunidad de Madrid local government. We present data on prehospital triage provided by Madrid's EMS, a summary of the organization of the clinical management at the closest hospital, and the early management of casualties treated at the hospitals that received most victims. We were unable to retrieve data from some hospitals, but these received only a few critical patients.

Madrid is a Spanish Autonomous Community which implemented two different EMS or institutions, SUMMA 112 and SAMUR, at that time. The SUMMA 112 service takes care of home emergencies and also accidents and emergencies in peripheral towns, roads and highways. The SAMUR service, which was created in 1991, deals with urban emergencies occurring on the city streets, and was the main EMS involved in the prehospital care of the 11-M victims. None of these are hospital-based, and all EMS can be called using the universal emergency phone number 112. The SAMUR resources on that day included 60 basic life support (BLS) mobile units, 37 advanced life support (ALS) mobile units and 16 rapid intervention vehicles (RIV).

Data were mainly obtained by retrospective chart review, and did not include casualties who had only emotional shock, superficial bruises or transient hearing loss from barotraumas without eardrum perforation. Blast lung injury (BLI) was diagnosed on the basis of hypoxemia and typical lung opacities, with or without pneumothorax, and the absence of rib fractures or other chest wall injury. We defined as critical any casualty with an Injury Severity Score (ISS) > 15, and the critical mortality rate was defined as the percentage of patients dying with an ISS > 15. Neurological status was assessed when appropriate by means of the Glasgow Coma Scale (GCS).

Results

Prehospital Triage, Distribution of Casualties and Resources Mobilized

According to official information, the resources mobilized to care for the casualties and their families were unprecedented in our country, with > 70,000 personnel involved, including health workers, ambulance personnel, psychologists, forensic staff, fire fighters, local police, national police, Civil Guard, Civil Protection, no. 112 operators and voluntary personnel. Notification about the blasts at the second focus was delayed for 10 min, as it was initially wrongly believed that they were associated with the first explosions because of their proximity – they were separated from each other by only a few hundred meters. Initial emergency treatment and triage were performed by EMS near the scenes of the blasts.

SAMUR set up a field hospital in an adjacent vacated municipal building, where over 250 patients were assisted. Table 1 shows in detail the response and total evacuation times from the different scenes as reported by SAMUR, as well as the resources mobilized, the number of casualties attended to by them at each focus, and the number transferred to hospitals. Figure 1 shows the flow of casualties according to the level of treatment, and the number transferred to hospitals.

Table 1. SAMUR prehospital data. (SAMUR: Servicio de Asistencia Municipal de Urgencia y Rescate; ALS: advanced life support; BLS: basic life support; RIV: rapid intervention vehicle).

Parameter	1st focus	2nd focus	3rd focus	4th focus
SAMUR response time (min)	7	8	5	9
Human resources	156	127	77	30
Physician	23	12	8	4
Nursing	65	34	42	18
Vehicles	36	26	22	10
ALS	15	8	5	3
BLS	13	15	14	5
RIV	8	3	3	2
Casualties found dead	29	64	67	17
Assisted	115	165	56	52
Critical	15	25	6	4
Severe	30	30	20	16
Minor	70	110	30	32
Transferred to hospitals	115	165	56	52
SAMUR	35	55	26	20
Police, private	80	110	30	32
Total evacuation time (min)	105	145	70	75

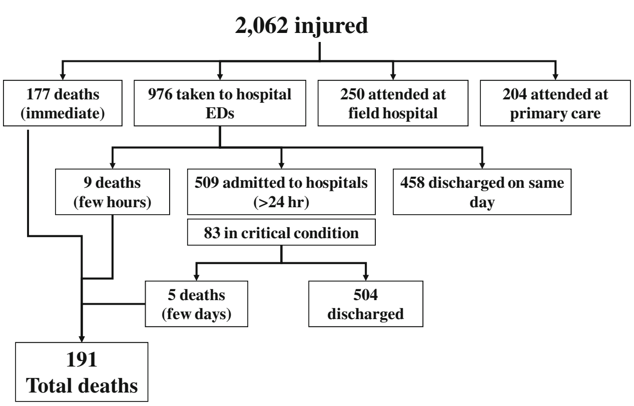


Figure 1. Flow of casualties according to level of treatment.

Figure 2 depicts the sites of the blasts relative to the locations of the main hospitals, and the distribution of casualties among them. Note that the two largest public hospitals in Madrid (GMUGH and "12 de Octubre" University General Hospital, which were also closest to the blasts) received 58% of casualties. There were a few large public hospitals that received almost no patients at all, or only those with minor injuries.

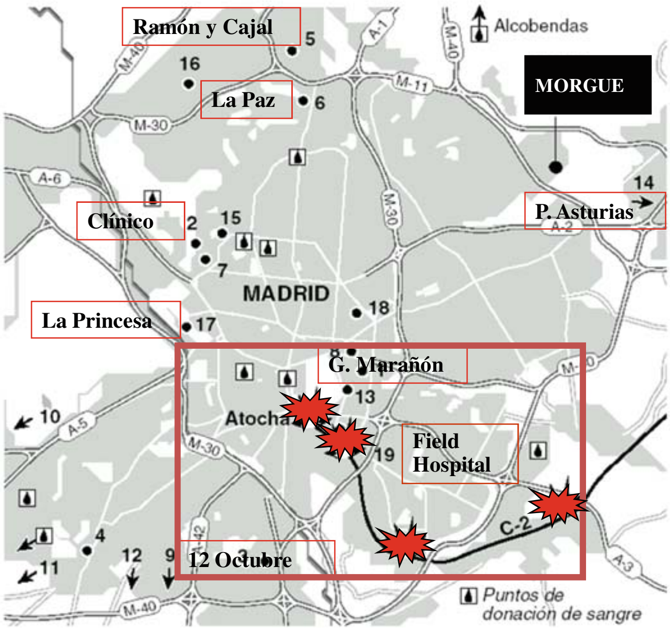
Organization and Logistics at the Closest Hospital (GMUGH)

This has already been described in detail [2]. GMUGH is an 1,800-bed teaching public hospital serving a population of around 700,000 people. Its personnel at the time included 1,166 doctors, 2,127 nurses, 1,707 technicians, 2,287 administrative staff, and others. It is one of the busiest hospitals in Madrid, with more than 54,000 patients admitted in the year before the bombings (60% of them through the Emergency Department), and over 34,000 surgical interventions performed in that year. The number of medical, surgical ICUs and recovery rooms varies between 54 and 60, depending on the needs and the time of the year. At that early hour, around 30 operating rooms (ORs) were being readied for scheduled surgery.

At 07:45 the first radio and TV broadcasts were announcing the explosions, and at 08:00 the ED was informed of the imminent arrival of victims, but with very little, if any, information on the expected number of casualties or the magnitude of the problem. Many personnel were already on duty or on their way to work, and night shifts remained on duty. When the seriously injured started arriving, the number of physicians, nurses and students was in fact much higher than needed, and many had to be asked to move out of the ED on several occasions.

The Disaster Plan was activated by the General Manager of the hospital, and the Director met with the chiefs of the main departments and services. The first aim was to estimate the capacity of the ED and the hospital to admit victims, and an order was issued to discharge as many patients as possible; this allowed for 347 ward beds to be available in the first 2 h. At the beginning of that day there were 123 patients in the ED, 30 waiting for a bed and 93 under work-up and observation. By 09:30, only ten of those patients remained in the ED because they needed monitoring; 30 were admitted to the wards, and 83 were discharged home. At the same time, all 66 elective surgeries were canceled, and this allowed for 22 ORs to be made ready for emergency surgery on the victims. Early in the morning, many ICU patients were transferred to a more intermediate level of care to make room for the incoming critical patients.

Disaster Command decided to centralize all of the information for the families and the media in a building separated from the medical building (the Teaching Pavilion). Over there, the work was really difficult, especially when dealing with the families. A specific database system for the casualties who were admitted to the hospital was created. These data were available online to other hospitals and health authorities. We believe that this early decision to share information with other hospitals was a great help to the families in locating their loved ones.



HOSPITAL	Nº PATIENTS
G. Marañón	312
12 Octubre	255
H. Clínico	68
Ramón y Cajal	15
La Paz	38
Princesa	47
Getafe	40
P. de Asturias	63
Others	142
Field hospital	250
Primary care	204
Total	1430

Figure 2. Blasts, location of hospitals and distribution of patients (as reported by the Madrid Health Authority on the evening of the blasts).

Figure 3 shows the flow of arrivals of 312 casualties to GMUGH. Before 08:00, the first two walking wounded were received. Between 08:00 and 09:00, more than 90 survivors were attended to, and by noon more than 80% of all of the survivors had been received. At some point during the first hour, with so many victims arriving at the same time, the first triage area was moved to the outside of the ED, and an experienced general surgeon and and anesthetist mainly triaged the patients that appeared critical; these were taken either to one resuscitation bay in the ED, directly to the OR, or to a second triage in the ICUs. Patients who appeared to be stable were triaged inside the ED and distributed to major or minor trauma areas. The medical and surgical observation units of the ED were transformed into the major trauma area, led by ED medical staff with medical and surgical residents and nursing personnel.

A total of 62 casualties were considered walking wounded or worried well and were soon discharged home. Another 91 patients (29%) were admitted for more than 24 h to the hospital, 29 of them in a critical condition. Four of these patients died in the first few hours, and one died on the seventh day. The blood bank delivered 145 units of type-specific blood during the day, 60 units of fresh frozen plasma and 75 units of platelets. Figure 4 shows the typical pattern of blood bank seen in these MCIs. Comparing that day with the same day of the previous week, there was a huge increase in the number of donations at GMUGH, but the number of units transfused was only about 2.5 times that of a normal day.

Early Mortality and Management of Casualties

According to official information on the days following the MCI, the explosions resulted in around 2,000 casualties, 177 (8.6%) of which were killed immediately (on-the-scene deaths). Nine of the 14 subsequent fatalities occurred within minutes or hours of admis-

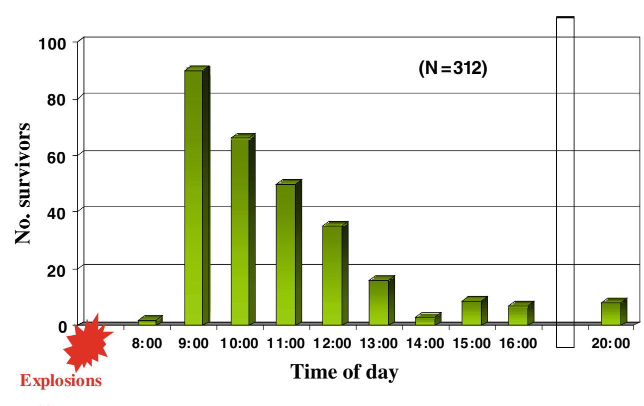


Figure 3. Number of casualties arriving at GMUGH according to time of day.

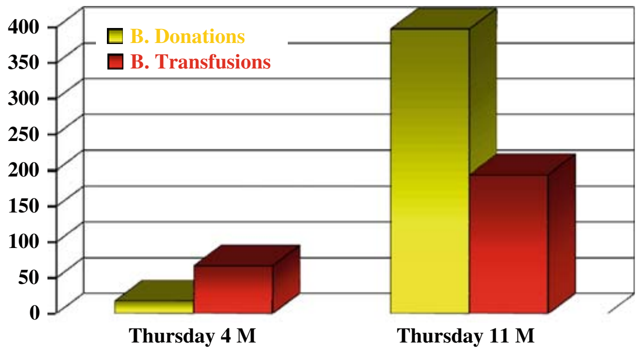


Figure 4. Blood bank level at GMUGH on the morning of the bombings, as compared with that on the same day of the previous week.

sion from multiple injuries that could not be fully assessed in some cases; severe head trauma, respiratory insufficiency and multiple fractures were common among them. Eight of those nine early deaths were deemed unpreventable on clinical grounds by peer review, with the exception of a missed thoracic aortic injury. The critical mortality rate was 19.5%.

A total of 775 victims were taken to the seven hospitals assessed, five of them large public university general hospitals with over 1,000 beds. Only data from 512 victims were analyzed, the other 263 only suffering from superficial bruises, mild contusions, transient hearing loss from barotrauma without eardrum perforation, and/or emotional shock. Table 2 shows, in order of decreasing frequency, the main types of injuries sustained. There is significant overlap among the groups, as most patients had more than one injury or fracture. Table 3 shows the major surgical interventions performed in the first 24 h; note that there is overlap between the data because many patients underwent combined procedures. Shrapnel wounds to the head, neck and extremities (and less commonly to the torso) of very different grades of severity predominated. Orthopedic, plastic and maxillofacial surgeons assumed the lead role in managing these shrapnel injuries. Many were of minor-to-moderate severity, but some wounds had extensive tissue loss and gross contamination, consuming a great deal of OR resources. All BLI patients were admitted to ICUs, and the majority underwent orotracheal intubation and mechanical ventilation. One of them underwent an emergency negative thoracotomy for impending cardiac arrest. The survival rate of BLI patients was of 88.3% (38/43). Most eye lesions were of a mild-to-moderate severity (closed-globe injuries). Extensive and severe burns were not a common problem.

Table 2. Main types of injuries sustained. (ORIF: orthopedic internal fixation; OREF: orthopedic external fixation).

Injuries	Casualties (n = 512) (%)
Tympanic perforation	240 (47)
Shrapnel wounds (soft tissues)	211 (41)
Head-neck	94
Torso	40
Limbs	77
Thoracic	185 (36)
Lung contusion	58 (11)
Blast lung injury (BLI)	43 (8.5)
Rib fractures	43 (8.5)
Pneumothorax	31 (6)
Hemothorax	13
Other	13
Eyes	95 (18.5)
Burns	89 (17.5)
First degree	46
Second degree	50
Third degree	7
Fractures (excluding head, chest wall and spine)	81 (16)
Maxillofacial	48 (9.4)
Long bones	40 (7.8)
Other	17
Head	52 (10)
Fractured base of skull	9
Brain contusion	9
Subdural hematoma	8
Subarachnoid hemorrhage	11
Other (fractured calvarium, brain infarct, etc.)	17
Spine and spinal cord	31 (6)
Vertebral fracture	23 (5 with neurological deficit)
D1-6 segment	15
Spinal cord trauma without spine fracture	8 (with transient neurological deficit)
Abdominal	25 (5)
Liver	9
Spleen	10
Kidney	3
Small bowel	3
Large bowel	2
Stomach	1
Traumatic amputations	19 (3.7)
Ear-lobe	13
Finger	2
Left leg	4
"Mangled" limbs	6
Peripheral nerves (excluding mangled limbs)	5
Peripheral vascular (excluding mangled limbs)	4

Maxillofacial and open long bone fractures were most prevalent. There was an immediate reconstruc-

Table 3. Major surgical interventions performed in the first 24 h. (ORIF: orthopedic internal fixation; OREF: orthopedic external fixation).

Specialties involved	n = 124 (in 82 patients)
Orthopedic	40
Revision of amputation stump	4
Amputation of mangled limb	
Leg	3
Arm	2
ORIF of fractures	7
OREF of fractures	
Leg	7
Arm	3
Fasciotomy (leg)	4
Wound debridement	30
Plastic/reconstructive	21
General/abdominal	17
Nontherapeutic laparotomy	2
Negative laparotomy	4
Splenectomy	4
Liver hemostasis	2
Gastric suture	1
Small bowel resection	1
Small bowel suture	1
Large bowel resection	2
Maxillofacial	17
Neurosurgery	11
Open skull fracture with depressed fragments	6
Drainage of intracranial hematoma	5
Ophthalmology	11
Globe enucleations	4
Suture of perforated globe	7
Peripheral vascular	4
Otolaryngology	2
Thoracic	1

tion of a severed facial nerve, and some bone fixation in severe open maxillofacial fractures; nevertheless, the majority of these reconstructive procedures were delayed. Spinal fractures predominated in the upper thoracic spine (D1–6), and all of those 15 patients with fractured upper thoracic vertebrae had severe associated blast injuries to the torso; in addition, all five patients with neurological deficit had fractures to the D1-6 segment.

There were few casualties with severe abdominal injuries, and solid organ contusions and lacerations predominated over gastrointestinal perforations. Shrapnel penetration caused gastrointestinal perforations in two patients, to the stomach and right colon, respectively. The other four patients with bowel injuries, three of whom underwent suture or resection, are believed to have suffered a primary blast mechanism. There was no evidence of penetrating injury in the other 19 patients with abdominal solid organ injuries. The percentage of laparotomies that were either negative or nontherapeutic was 35% (6/17).

Most of the reported cases of ear-lobe amputation were seen at the hospital that received the largest number of critical casualties. In the six patients with mangled limbs, it is unclear whether the damage was caused by the effect of the blast or by flying shrapnel, or both, but five of them had to be amputated. Seventy-eight patients were admitted to ICUs (15%). Their ISS varied from 11 to 75, with an average score of 29. There was some variability among the mean ISS at the different hospitals.

Radiologists were very actively involved from early on, and a focused abdominal sonography for trauma (FAST) was performed on 63 patients during the first few hours; 75 spiral CT scans had been done by the end of the day at the seven centers, together with an MRI scan. Three vascular interventional radiology procedures (embolizations) were performed, all at the same center (GMH), for intercostal artery, hepatic and hepatosplenic bleeding, respectively. All three procedures were successful in stopping the hemorrhage. The two patients with hepatic bleeding had undergone previous craniotomies for large subdural hematomas. With the virtual exception of the general surgeons and neurosurgeons, most of the other surgical specialists that were mainly involved had to perform several and repeated procedures in the days following the blasts.

Discussion

Table 4 summarizes the reflections on the overall outcome of the Madrid terrorist bombings, and some of those reflections deserve special comment. There were definitely areas of weakness in the response that just confirm the conclusions of other previous assessments of urban MCIs in other parts of the world [3, 4]. First of all, a hospital's proximity to a terrorist bombing, rather than its trauma designation, is the best predictor of the casualty load delivered to its doors. Most patients, particularly most urgent patients, are brought to the nearest hospital [4]. Different simultaneous bombing sites and the large casualty load certainly complicated the work of the EMS in Madrid, and almost 60% of casualties were taken to the two closest hospitals.

Regarding *prehospital management and triage*, it is difficult to distinguish between casualties requiring immediate and delayed treatment by a rapid examination in the field, because the blast mechanism makes

Table 4. Reflections on the overall response to the Madrid bombings.

What went wrong: areas of weakness
1. Initial chaos due to overtriage and uneven distribution of casualties to hospitals
2. Difficulties in communicating with the scenes of the blasts
3. Initial deficiencies in security (excess of voluntary personnel outside), identification of casualties and record-keeping
4. Initial problems with the information given to the families
5. Hospital staff not acquainted with patterns of blast injuries
6. In retrospect, care was provided to some "expectant injuries" at GMUGH
7. Excessive number of blood donations
What went right: areas of strength
1. Rapid EMS response (except for one site) and evacuation
2. Hospital triage by trained staff
3. The sizes and resources of the closest hospitals probably helped (no secondary transfers from GMUGH)
4. Appropriate measures were taken to maximize surge capacity
5. Early online database of patients admitted to GMUGH
6. Spontaneous, selfless and determined collaboration by all hospital personnel

it difficult to assess the extent of a patient's injuries accurately. On the other hand, there are few differences between the initial requirements for prehospital care of the victim of an explosion and a regular trauma patient [4]. In the opinion of experts, during MCIs the EMS should adopt a "scoop and run" approach, with minimal medical intervention at the site and rapid evacuation to the nearest medical facility. Stein & Hirshberg [5] recommend the following basic field medical care guidelines:

(1) Victims with amputated body parts and no signs of life are dead
(2) Victims without breathing or pulse and with dilated pupils are dead
(3) CPR is not indicated at the scene
(4) Airway management with cervical spine control is indicated
(5) Improve oxygenation with supplemental O_2 or needle decompression as needed
(6) Control hemorrhage by tourniquet or direct pressure
(7) Align fractures, splint limb-to-limb, and cover open wounds

It is reasonable to plan for a rough distribution of 80% nonurgent and 20% immediate/urgent patients [6]. Almogy and coworkers [7] recommend that burns over more than 10% of the BSA, skull fractures, or penetrating wounds to the head or torso should be considered markers of proximity to the center of the blast and should be used to identify patients at high risk for BLI, thus warranting early evacuation to a level I trauma center. The magnitude of the MCI in Madrid probably made it difficult to implement all of those guidelines in the field, butat GMUGH we received many patients with secured airways and cervical spine control. The general feeling is that our EMS did their best on that fateful morning and, considering the overall picture, did a good job.

Communication between the scenes of the blasts and the hospitals was poor or nonexistent, as has been the rule so far in these situations. This added to the initial hospital chaos experienced during the first hour. Historically this has been a problem at multiple levels in every significant terrorist bombing event. In this regard, the initiative of the District of Columbia Hospital Association to fund a private radiofrequency system, the hospital mutual aid radio system (known as H-MARS), has proven valuable in providing a direct ED–ED link among hospitals in the area. The system uses existing infrastructure to facilitate reliable communications during an emergency, enabling health care providers to coordinate easily without telephones or cell phones [8].

Regarding familiarity with the types of injuries and their management, civilian care providers are usually not acquainted with the *blast injuries* sustained by victims of these MCIs; this was also the case at GMUGH and probably most other hospitals as well. The hallmark of blast injury involves the respiratory system. BLI patients present with progressive hypoxemia and respiratory distress, hemoptysis in many, and pulmonary infiltrates on chest radiograph [9–12]. Although the majority require mechanical ventilation, short- and long-term prognosis is good, as attested by previous experience [12] and our 82.4% survival rate in these patients. The most frequently injured body regions were the head-neck and face. Ear-lobe amputations and upper thoracic spine fractures were markers of critical injuries. Maxillofacial and open long bone fractures were most prevalent, and severe burns and eye and abdominal injuries were an uncommon occurrence. Regarding abdominal injuries and their management, our 35% rate of either negative or nontherapeutic laparotomy might seem a bit high, even in the chaotic situation of an MCI. This rate was 100% in the assessment of the experiences of Aylwin and colleagues at the Royal London Hospital, following the London bombings [13, 14], but they report a lower number of major trauma cases than at GMUGH in

Madrid. It is difficult under extreme circumstances to find an appropriate balance between the natural instinct of caution and the best interests of the patients [13], but, until proven otherwise, it is probably safer to follow the advice of experts in the field, who advocate a liberal use of laparotomy based on clinical findings alone [15]. A multidisciplinary approach was necessary in most operated patients, and orthopedic trauma procedures represented 50% of the case load in the first 24 h.

Of the fatalities of the terrorist bombings of the Madrid trains, 93% were immediate, and most survivors had noncritical injuries [2]. A typical biphasic distribution of mortality rates was seen in Madrid; that is, a high immediate mortality rate followed by low early and late mortality rates. This pattern contrasts with the triphasic distribution of deaths typically associated with conventional blunt and penetrating trauma. Also, the greater number of immediate fatalities encountered in the trains that had the doors closed is in accordance with previous experience [16]. ''Expectant injuries'' in MCIs are defined as those that are so severe or require such time and resources that care cannot be provided without jeopardizing other more salvageable victims. However, the decision as to what constitutes an expectant injury must be individualized according to the number and type of casualties, and the available resources [3, 5]. Our first two in-hospital deaths at GMUGH occurred shortly after arrival and probably belonged to this category; nevertheless, this is difficult to affirm in view of the large amount of resources at our disposal.

As regards the areas of strength of the Madrid response at GMUGH and other hospitals, we believe that appropriate measures were taken to maximize *surge capacity*. Common sense dictates such behavior under those circumstances, but it is worth remembering that a damage-control philosophy is warranted not only in the surgical conduct of interventions, but also in the key areas of the hospital (radiology, laboratory, ICU and blood bank) [14]. Trauma centers define surge capacity as the number of critical casualties arriving per unit of time that can be managed without compromising care [17]. Peak arrival time at the ED is reported to occur 30–60 min after the event, but there has been great variability, as also shown at GMUGH. We fully agree with the concept that the realistic admitting capacity of a hospital is determined by the available surgical resources; that is, the number of trauma teams available [4]. As already mentioned in a previous publication [2], the Madrid bombings occurred shortly before the start of a midweek working day, when most clinicians and medical personnel were on their way to work or already in hospital, and night shifts were still on duty. This, together with empty operating rooms and personnel waiting for the first scheduled cases, proved decisive for the adequacy of the medical and surgical response at GMUGH and other hospitals. Hirshberg and colleagues' computer modeling of an urban terrorist bombing, based on Israeli data, predicted that the admitted capacity of a hospital depends primarily on the number of available surgeons, and that the major bottlenecks to patient flow are the limited number of ED resuscitation beds and the CT scanner, not the OR. The study also suggests that the effects of overtriage can be mitigated by adding improvised resuscitation bays in the ED [17]. We at GMUGH also had to improvise additional resuscitative bays in the ED; this proved a necessity and also a key factor in handling the sudden almost simultaneous arrival of many critical casualties.

In retrospect, there are certainly areas for improvement in the overall response to the Madrid terrorist bombings. At the hospital level, the secret of readiness is probably having a simple, straightforward plan that everyone knows and will automatically follow. It seems that the terrorist threat is here to stay for the foreseeable future, and hospital disaster management plans should be implemented and drills conducted at regular intervals, in collaboration with EMS, something that we have not done in the past. On the other hand, educational initiatives for the civilian care provider are needed to address the issues of preparation for an MCI. Surgeons, and especially those with expertise in trauma, certainly have an important responsibility and a major role to play with regard to scientific and educational development, planning and management [1]. We must shy away from the feeling of apathy and complacency that still seems to prevail in our medical community because of the rarity of these events, and motivate our colleagues if we want to achieve success [18].

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