

An Emergency Medical System Approach to Disaster Planning

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The increasing prevalence of terrorist attacks and natural disasters has mandated that more emphasis be placed on emergency disaster planning. This report focuses on the 1976 Courthouse bombing in Boston, which generated 20 casualties. Ambulance response by Boston's Emergency Medical Service system was made in 2.5 minutes and all victims were transported from the scene within 20 minutes. Successful management of this incident employed several important principles of disaster planning. These include the initial medical response, staging at the scene, and hospital notification. Additionally, the concept of triage as an integral part of disaster planning is explained with examples of the on-site medical stabilization and treatment of casualties. The importance of these concepts in practice and the necessity of close coordination of ambulance response and the responses of other emergency agencies, i.e., Police and Fire, were clearly demonstrated in the disaster which resulted from the Courthouse bombing.

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One of the more disturbing facts of the 1970's is the increasing occurrence of terrorist attacks. Such attacks have had global significance. The terrorist killing of Israeli olympic athletes, the massacre at Lod Airport, and the frequent kidnapping and murders in many parts of the world are all examples of terrorism. Until recently the United States in general and the Northeast in particular has had the luxury of dispassionately viewing such occurrences with an aloof concern. Events of 1976, however, mandate that systems be developed to deal with terrorism within our own communities.

In December of 1975, LaGuardia Airport in New York was bombed, 11 people were killed and 55 people were injured, according to the New York Police Department. In April 1976, a bomb exploded in Boston's Suffolk County Courthouse which resulted in 20 persons being taken to hospitals. A number of subsequent bomb attacks on other public buildings in Massachusetts occurred, requiring medical standby for assistance and treatment of victims.

This report discusses the disaster situation which resulted from the April 1976 bombing of the Suffolk County Courthouse. The discussion outlines the actual events and implementation of the existing disaster plan as well as summarizing the major areas of importance in managing this type of disaster.* Accordingly, the specifics of

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* Disasters in the same category as the Courthouse bombing generate numerous casualties within a limited time frame. It is important to distinguish this from the type of disaster situation where the flow of

the initial medical response and on-site activity which included a systematic approach to triage, staging, medical stabilization and treatment of victims, as well as hospital notification and patient transport, are presented.

The data were compiled from the records of the Boston Department of Health and Hospitals (DHH), Division of Emergency Medical Services (EMS), and include selected elements from tape recordings of telephone calls and radio transmissions from the EMS Communications Center. The medical data were primarily obtained from the ambulance trip reports which are filled out by the Emergency Medical Technicians for every ambulance response made by the Department of Health and Hospitals in the City of Boston. Further clarification and information regarding the medical stabilization and intervention carried out by the Emergency Medical Technicians at the scene were obtained in an interview procedure of the Emergency Medical Technicians who responded to the incident.

BOSTON'S EMERGENCY MEDICAL SERVICE SYSTEM

The Emergency Medical Service system which serves Boston is comprised of an Emergency Communication Center, a primary Emergency Ambulance Service, a number of private ambulance companies which serve as back-up for the emergency service, and 14 major hospitals with fully equipped emergency rooms, and an am-

victims in a steady stream spans several days, and there are the additional complications of prolonged functioning at peak performance within a restricted environment. It was this latter type of disaster situation which resulted in Boston during the Blizzard of February 1978.

balance-to-hospital early alert radio link. The Boston Department of Health and Hospitals operates both the centralized Communications Center for Ambulance Operations and the Emergency Ambulance Service. A key component in the efficient functioning of emergency communications is the fact that the Ambulance Operations Center operated by the Department of Health and Hospitals is physically located at the Boston Police Communications Center where all 911 emergency calls are received. This single point of entry by telephone for all emergency communications allows direct and easy public access to the system and facilitates close coordination of police, fire, and ambulance response.

The Communications Center for Ambulance Operations is staffed by fully trained Emergency Medical Technicians (EMT's) who answer calls for medical assistance and dispatch ambulances using an on-line computer system which records all medical calls and ambulance responses. Specifically, a call to 911 for medical assistance activates the Ambulance Operations Center. The EMT who screens the call obtains the medical information regarding the problem as well as the geographic location of the incident and types this information into a computer terminal. Once the necessary information is completed the incident is displayed on a computer screen to the EMT dispatcher, who verifies the status of all available ambulances and then dispatches the one closest to the scene of the incident. The dispatcher also transmits all pertinent medical information regarding the patient to the responding ambulance while it is enroute to the scene.

The Department of Health and Hospitals ambulances are fully equipped modular-type vehicles which are staffed by two Emergency Medical Technicians. These EMT's have a minimum of 81 hours of training and are skilled in cardiopulmonary resuscitation, extrication, and patient stabilization. They also rotate to the Emergency Floor of the Boston City Hospital for specialized ongoing training on a regular basis. The personnel of the private ambulance companies which back up DHH ambulances are also trained in the 81-hour Basic Emergency Medical Technician program and possess skills in cardiopulmonary resuscitation, extrication, and patient stabilization.

The major hospitals in Boston are connected by radio and telephone links to the Emergency Medical Service system. The Emergency Medical Technician in the ambulance can alert the Emergency Room staff to the nature and status of the patient's condition while still enroute to the hospital by relating this information to the dispatcher, who can then speak to the Emergency Room by direct-line telephone.

Patients transported by DHH ambulances are allowed to choose their hospital destination unless their condition is critical. In the case of a critically ill patient, the ambulance is directed to the closest emergency room that is adequately equipped to treat the patient problem. To guide the ambulance personnel in selecting the ap-

propriate hospital the Boston hospitals have cooperatively developed a Point-of-Entry Plan, which rates each hospital's capacity to provide both emergency and in-hospital care to patients in each of the following categories: trauma, cardiac, pediatrics, obstetrics and gynecology, burns, psychiatry, and drug- or alcohol-related problems (3).

BOSTON COURTHOUSE TERRORIST EXPLOSION

Emergency Medical Service—Notification. At 9:12:20 on the morning of 22 April 1976, a telephone call was received at 911 from Room 206 at the Suffolk Superior Courthouse in downtown Boston. The call was taken by one of the 16 civilian clerks who answer telephones in the Boston Police Communication Center. The call was immediately identified as one requiring medical assistance and accordingly was directed to the Ambulance Operations Center. The caller started by saying, "... at the courthouse there has been a bomb explosion." The EMT screening calls elicited that the location was the Suffolk Superior Courthouse on the second floor in Room 206. The caller hung up before any additional information could be obtained.

This call immediately set into motion a systems response which included the notification of the Police and Fire Departments and a series of calls to private ambulance companies to provide back-up services and the redeployment of DHH ambulances in such a way to manage the potential disaster from the explosion, as well as be responsible for any concurrent medical emergencies expected to occur in a city whose population swells to approximately 1,150,000 persons during the day (7).

At 9:14 AM, 2.5 minutes after the explosion, the first DHH ambulance and Emergency Medical Technicians arrived on the scene. Within 6½ minutes of the call, three ambulance services and 10 ambulances responded to the disaster. Police vehicles and fire apparatus were also responding to the scene. The coordination of ambulance response with the response of the Fire and Police Departments was facilitated by the interaction between the Department of Health and Hospitals' ambulance dispatchers and Police Department dispatchers as well as the direct-line communications to Fire Alarm Headquarters.

The Superintendent of the DHH Ambulance Service and a Supervisory Assistant (Senior Emergency Medical Technician) on duty in the ambulance station at Boston City Hospital were alerted by the dispatcher. They immediately proceeded to the disaster scene to evaluate the situation, coordinate the medical evacuation, and to establish a Triage System and Staging Center.

The dispatcher also alerted the major Boston hospitals to the situation at the Courthouse. This precipitated individual hospital disaster responses and put each hospital in a state of readiness to receive an unknown number of patients.

An additional component of the medical response in a disaster situation was the dispatch of a physician to provide on-scene assistance. At 9:23 AM the call went out for this assistance and within minutes the police had dispatched a cruiser to pick up an emergency room physician and take him/her to the scene of the incident.

Another important aspect of the dispatcher's responsibility in this type of disaster situation was to rearrange the deployment of ambulances in order to be able to respond to any other incident in a reasonable period of time. At 9:19 AM, the most peripheral ambulance covering the southwestern part of the City was relocated to a more centralized area. (See Table I for listing of ambulance status at the time of bombing.)

Perspective at the Scene. The scene at the Courthouse was initially confusing, although it was immediately apparent that a major explosion had occurred. However, there were also the possibilities that this was the first of several bombs or that the explosion could have broken a gas main. In either of these cases there was the impending risk of a secondary explosion and fire.

The scene in Room 206 on the second floor of the Suffolk Superior Courthouse was chaotic. The blast had damaged the walls and roof and there were plaster, chairs, and debris scattered throughout the room and along the corridor. The victims were in varying states of distress which ranged from hysterical screaming to semiconsciousness.

TABLE I
Status of ambulances at the time of the disaster

Time	20A1-Charles St., clear	20A11-Edward Everett Sq., clear	20A6-Motorola for radio adjustment	20A4-on another call	20A3-Franklin Park, clear	24C3-Ambulance Station
9:10 AM						
9:12:20	Telephone message received					
9:13	20A1 dispatched	20 A11 responds				
9:14	↓			20A4 to BCH with patient		
9:15	20A1 arrives					Sr. EMT-Supervisor responding
9:16			20A6-receives telephone message	20A4 clears BCH		
9:17			↓	20A4 dispatched to Courthouse		
9:18				↓		
9:19		20A11 arrives EMT crew helps set up triage area				Supervisors arrive, Turret sends 10 ambulances
9:20					20A3 relocates to Edw. Everett	
9:21						
9:22			20A6 arrives			
9:23	20A1 to MGH		20A6 to NEMC			
9:24			↓	20A4 arrives		
9:25	at MGH			20A4 through Police lines		
9:26				20A4 to NEMC		
9:27				↓		
9:28	20A1 returns to Courthouse		20A6 at NEMC			
9:29			↓			
9:30			20A6 clear NEMC returning			Injured removed
9:31		20A11 to BUMC	↓	20A4 at NEMC		
9:32			20A6 arrives			
9:33						
9:34						Supervisor and Sr. EMT clear all units, keep one ambulance standing by

The Police were the first responders at the scene. They entered the Courthouse and attended to those victims who were screaming in pain or fear. The first Emergency Medical Technicians to arrive quickly scanned the scene to gain a general impression of the extent of the disaster and the approximate number of casualties.

The DHH Ambulance Superintendent and Senior EMT arrived on the scene 7 minutes after being notified by the dispatcher and entered the Courthouse to survey the bombed area and to evaluate the extent and number of injuries.

The Superintendent remained inside the disaster area and established voice contact with the ambulance dispatcher by portable radio, while at the same time consulting with Fire and Police officials to select an area away from the explosion for triage. After assisting in the removal of one seriously injured patient the Senior EMT also established his position at the staging center. An integral component of the triage area was the coordination of and direction for movement of injured patients out of the building and into ambulances for transported to selected hospitals.

The rationale of transporting patients to specifically designated hospitals allowed the less critical victims to go to hospitals farther from the incident than the more severely injured patients. Accordingly, the third ambulance on the scene transported patients to the second closest hospital in order not to overwhelm the closest hospital.

PATIENT MANAGEMENT

A total of 20 casualties resulted from the bombing of the Courthouse. One of the first patients encountered was a young man lying motionless on the floor near a bank of elevators with a severe blast injury to his right lower leg and foot. An Emergency Medical Technician cleared his airway and established the presence of adequate spontaneous respiration as well as a palpable pulse. A cervical collar was placed around the patient's neck and a Robinson frame (a 2-part stretcher designed to cause minimal movement of the vertebral column) was placed under the patient. Air splints were then placed on both arms and the left leg, since they were possibly fractured. In the patient's lower right leg the proximal tibia was completely exposed and partially transected midway down the shaft. The distal tibia and foot were carefully placed in icepacks and the patient was transported by stretcher to the ambulance. One Emergency Medical Technician stayed with the patient throughout the trip to the hospital and gave the receiving team in the emergency room a definitive patient report. Before the patient's arrival the pertinent medical information had been transmitted via radio to the team in the emergency room.

At 9:19 AM, an ambulance crew picked up a 46-year-old woman who had been thrown down eight stairs from the explosion. She was semiconscious and had a question of internal injuries and a fracture of the left lower extremity. Her respirations were labored and the pulse was 104/min and regular. There were also multiple abrasions over her entire body. The EMT assessed and reassured the patient, stabilized her left leg with an air splint, and started oxygen. While the ambulance was enroute to the hospital, the hospital was alerted that they would be receiving "... a female, about 45, semiconscious, at

this time having possible fractures of a lower extremity, possible internal injuries from the explosion, with difficulty breathing. Estimated time of arrival about five or six minutes." This statement gave the hospital an idea of the type of emergency to expect and the approximate amount of time before the ambulance arrived.

The patient was immediately examined upon her arrival at the hospital by a physician, who then supported the impressions of the EMT with a tentative diagnosis of head injury with a possible fractured left ankle.

DISCUSSION

The preceding description of events has outlined the systematic approach to major medical emergencies and disaster situations which was being implemented in Boston at the time of the 1976 Courthouse bombing. As this systematic approach becomes better understood and more closely followed by emergency medical service agencies and public safety agencies, more effective patient management and medical care should result.

The fact that dialing 911 serves as a single telephone entry point to an emergency aid system is a vital feature of an effective emergency response system. The caller can be immediately connected with the Police, Fire and/or the Emergency Medical Service system, and does not need to have several different numbers at hand. The message "Dial 911" is also written on all DHH ambulances and Police vehicles in the City of Boston to further facilitate public awareness to emergency responders.

The rapid and easy communication among Police, Fire, and Emergency Medical responders is aided by the location of the Ambulance Operations Center within the Police Communications Center and the direct line telephone connection to Fire Alarm Headquarters. Equally important to effective and efficient response by Emergency Medical personnel is the ability to communicate quickly and easily with private ambulance companies for additional back-up service.

The Courthouse situation illustrated the need for an easily identifiable person to take charge of patient management at the scene of a disaster. It is this person's responsibility to triage the victims as well as to coordinate the responding medical resources (2). A staging area should be established for the victims in an easily accessible location a short distance away from the disaster scene itself. Patients can then be brought to this area to be more easily transported in ambulances and to limit the congestion at the immediate scene.

It is also the responsibility of the person in charge at the scene to ensure that the hospitals closest to the disaster are not overwhelmed by the first few patients, who may in fact not be the most severely injured. Additionally, any specific medical information which can be transmitted to the receiving hospital concerning the patient and mechanism of injury will enable a greater level of medical response to be generated at these hospitals.

The actual functioning of the triage system in the Courthouse incident was incomplete, since some victims

had been removed by police vehicle before the arrival of the EMS Superintendent, and some private ambulance companies did not respond to instructions to transport their patients to the more distant hospitals. This presented the opportunity for expansion of the then existing disaster plan agreements with these agencies. Subsequently, these agreements were outlined in specific terms concerning patient transport and hospital destination under the direction of DHH's Emergency Medical Service representative. Accordingly, it is reasonable to assume that as the public safety and medical agencies gain further experience in working together and as the communications center becomes more complex, the principles of triage will be more closely adhered to by the responding departments.*

The importance of establishing the triage center away from the incident is particularly relevant in the instance reported, since terrorist attacks often have two bombs, the second of which is timed to go off a short while after the first. In fact, the second bomb is usually located at the elevation of the head or higher to effect greater loss of life and injuries. Accordingly, it is important to remove all injured from the scene as soon as possible.

The fundamental concept of triage is to provide the greatest good to the greatest number of people. This involves a decision regarding the priority of care given to groups of patients. Several medical experts, among them Miller and Cantrell (8), Nissan and Elder (9), and Ballinger (1), have suggested practical triage schemes for application in disaster situations. While these authors disagree on their numbering system and nomenclature, all systems have in common the identification of four groups of patients. Class I includes the severely injured victims who can be saved if they receive appropriate stabilization, transportation, and treatment immediately, e.g., those with cardiac arrest, respiratory problems, severe hemorrhage or shock. Class II are persons with urgent, but less serious injuries, who can be transported and treated after the most serious have been attended to, e.g., fractures, eye injuries, etc. Class III are the "walking wounded" who can often be attended to in small groups and, if ambulances are in short supply, can be transported by other means such as police or fire vehicles. Last, Class IV includes those people who are dead or so severely injured that even immediate total care would be inadequate to prevent death.

It is essential that all personnel who respond to a disaster are familiar with this triage concept as a fundamental guideline in the treatment of patients and utilization of medical resources.

The medical triage officer should immediately identify

him/herself to the Fire Chief and the senior Police Officer, since their cooperation will be required to establish the triage area away from fire, riots, and second bombs, and still close enough to the scene to be readily accessible. Once this triage and staging center has been set up all victims should be brought to it. The triage area will then accommodate both the full ambulance transportation component as well as the disaster triage team working together in a known geographic location (4).

The establishment of a triage and staging center is particularly relevant in the situation of a potential disaster where there is time to set up a working plan (9). An example of this was the opening of the Boston Public Schools in 1975, where student unrest was expected in a number of schools. Accordingly, triage and staging centers were set up in advance to be close to the schools and all officials alerted to the exact location of medical assistance. These triage areas also had the effect of protecting the medical workers from flying missiles, tear gas, etc. In fact, it is a useful working principle to clearly identify health workers, since rioters usually respect rather than injure people who are directly rendering medical assistance.

Response for the 1975 school opening was planned to be a graduated one, ranging from the Basic Life Support ambulances and their Emergency Medical Technicians, to the establishment of a staffed triage center with a disaster triage team of a physician and nurse. Fortunately, there were no major disasters or riots and these disaster plans were never activated.

The triage officer is also in direct contact with all the responding hospitals in the area. Responsibility in this triage position includes sending Class I patients to the nearest hospitals, while at the same time preventing an excessive number of Class II or Class III patients from being sent to any one hospital. The triage officer must also verify that the hospitals have been informed about the extent and type of injuries of patients being transported to their institutions. The reporting system used at the time of this incident is based upon the direct history of the patient rather than the Trauma Index, which has been useful in other systems (6, 10). This principle where hospitals farther away from the incident are utilized for the less severely injured patients while the more critically injured victims are taken to the closest hospitals is known as "leapfrogging."

Yet another central issue in disaster management is the training of disaster personnel. In Emergency Medical Services this means that system functioning is dependent upon EMT expertise. In the Boston EMS system, ongoing training is an important component. There are regular EMT rounds during which ambulance personnel discuss their cases with Emergency Service physicians. The EMT's select and formally present interesting, unusual, or challenging cases which they have seen and stabilized on the street. The treatment initiated by the EMT is then correlated with the emergency room therapy and

* The disaster situation caused by the Blizzard of February 1978 served to test the present capability for a disaster response in Boston. Appropriately, the effective management of the situation which occurred was a result of the coordination of emergency response vehicles and personnel via the communications network and adherence to the disaster response guidelines in effect in our city.

in-house treatment the patient received. The participation of both the EMT's and the Emergency Room physicians forms a useful framework for understanding patient management as a continuous process. This training also serves to upgrade the skills of the EMT's, who are the first link with the patient in the prehospital component of Emergency Medical Services. The rounds have also proved useful in alerting hospital-based personnel to the character and quality of the work done by Emergency Medical Technicians on the streets.

CONCLUSIONS

The emergency response to disaster in Boston generated by the bombing of the Suffolk Superior Courthouse in April 1976 depicted specific areas for system enhancement. To date several system improvements have occurred. These advances have included refinements to the ambulance-to-hospital communication system which has now become functionally more complex with the implementation of the Central Medical Emergency Direction (C-MED) system in facilitating direct communication between the ambulance in the field and the Emergency Room in the hospital. Second, the number of ambulances throughout the City has been increased with accompanying deployment changes in an effort to respond to a large percentage of calls within a 5-minute response time. System enhancement has also included the expansion from a Basic Life Support level of prehospital care to a capability for Advanced Life Support. This Advanced Life Support level of prehospital care is supported through the operation of a trauma team which includes surgeons, physicians, nurses, and paramedics. The presence of a physician and paramedics at the scene of a medical emergency allows definitive resuscitative measures at the scene.

These changes have been precipitated to a certain degree by the Massachusetts Ambulance Law passed in 1973 under the sponsorship of the Massachusetts De-

partment of Public Health, which provides for standards resulting in the upgrading of both public and private ambulance services. Cooperative planning has also occurred with medical personnel from all Boston hospitals carried out in association with the Massachusetts Office of Emergency Medical Services and the Council of Boston Teaching Hospitals. The increased interest, consolidation of EMS and general recognition of its potential has also facilitated a greater level of cooperation and interface between EMS and other primary responders, such as the Police and Fire Departments, in circumstances where the agencies must work together. The importance of a coordinated and consolidated effort was one of the major lessons of the Boston Courthouse bombing incident. It is in fact entirely appropriate that having had this Courthouse disaster experience, the system is now prepared to meet disaster situations as a working unit. This, in addition to resulting in effective disaster management, has also resulted in better care and understanding for the normal daily medical emergencies occurring in a major American city.

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