Scandinavian Journal of Surgery 94: 259–266, 2005

THE ABC'S OF DISASTER RESPONSE

P. A. O'Neill

Department of Surgery, Division of Trauma Surgery and Surgical Critical Care, State University of New York, Downstate Medical Center, Kings County Hospital, Brooklyn, New York, USA

Key words: Disaster response; disaster preparedness; the Incident Command System (ICS); the Hospital Emergency Command System (HEICS)

INTRODUCTION

The ultimate goal of any mass casualty response, whether to a man-made or a natural event, is to obtain the best possible outcome for the greatest number of people. One of the most important prognostic factors that affect casualty outcome after mass casualty incidents (MCIs) is the time interval from exposure and injury to decontamination and definitive care (1). Not surprisingly, published reports from past MCIs have demonstrated a direct correlation between the time interval from rescue to definitive care and casualty mortality (2–12). To achieve the best outcomes there needs to be a rapid, seamless, and coordinated response between the rescue workers responding to the scene (first responders) and the individuals and healthcare facilities that will be providing definitive care (first receivers). Yet, the greatest challenge in any MCI continues to be in affecting this rapid and coordinated response by the many individuals and agencies involved. Several factors contribute to this difficulty.

For one, all MCIs regardless of cause or type, involve groups of individuals, healthcare facilities, and agencies responding from one or more geographic or governmental jurisdictions. The larger the incident the greater the number of agencies and jurisdictions involved. These entities normally do not work together and are not familiar with the routines or procedures of each other. This creates unique challenges in communication, coordination, and lines of authority for both first responders and first receivers when all these entities are suddenly and unpredictably required to coordinate activities and work together toward a common goal in a chaotic environment.

Second, medical personnel often have the misconception that all disasters are different and unpredictable and thus not amenable to preparation. Physicians often doubt the likelihood of being involved in a MCI or, worse yet, believe that the medical response during a disaster is merely an extension of their everyday practice (13, 14). These misconceptions have led to complacency among medical practioners towards disaster preparedness and a general lack of knowledge of the basic principles needed to mount an effective response. Yet if one looks at the published reports by surgeons who found themselves unexpectedly involved in a wide range of recent disasters, the authors acknowledge a misplaced sense of complacency before the event and admit to underestimating the difficulties encountered in achieving a smooth, coordinated response (13, 16, 26). On retrospective review of their experiences, these surgeons emphasize the need for a better understanding of basic disaster principles and management, and stress the need for well-developed hospital-wide response plans in advance of the incident. They collectively reiterate the need for surgeons to be actively involved in the development of these response plans.

No one can predict the time, location, or complexity of the next MCI. However, recent events have demonstrated an increasing threat for both natural and terrorist related disasters throughout the world suggesting that we are all vulnerable (2, 4, 6–9, 12, 13, 15, 16). Although disasters differ in type, size, and etiology, there are certain medical and organizational principles that are common to all. These similarities and common features have allowed for the development of a consistent medical approach to MCIs. This strategy, referred to as the "Mass Casualty Incident Response" has the primary objective of reducing mortality caused by disasters (17).

The intent of this paper is to familiarize the surgeon with some of the key principles of the MCI response. Significant emphasis will be placed on un-

Correspondence:
Patricia O'Neill, M.D.
Division of Trauma Surgery and Surgical Critical Care
Department of Surgery, Box 40
State University of New York-Downstate Medical Center
450 Clarkson Avenue
Brooklyn, New York 11203, USA
Email: paoneill@pol.net

derstanding the structure and principles of the Incident Command System (ICS) since the ICS is the fundamental structure on which all disaster responses are now based. The paper will present basic principles of hospital-wide preparedness and briefly review some of the lessons learned from past incidents so that the reader may be better prepared for the complexity and increasing threat by today's disasters.

THE INCIDENT COMMAND SYSTEM

HISTORY

The concept of the Incident Command System (ICS) was developed in the United States more than thirty years ago when a series of uncontrolled wildfires devastated the southern region of the State of California in 1970. At that time there was no mechanism to integrate the dozens of agencies involved in managing such a large-scale event and the response was chaotic, uncoordinated, and led to unprecedented operational problems. These fires resulted in 16 deaths, the destruction of 885 homes and an economic loss of approximately 233 million dollars (18). In its aftermath, a group of seven fire agencies came together and created a coalition taking the name Firefighting Resources of Southern California Organized for Potential Emergencies (FIRESCOPE). Their aim was to review and improve future coordination among regional fire agencies (18, 19). Two years later, in 1972, the FIRESCOPE coalition was charged by mandate from the United States Congress to develop a system that would coordinate and integrate other multiple disciplines for all large-scale complex fire emergencies. The FIRESCOPE coalition partnered with the Rand Corporation and the aerospace industry to develop the "Incident Command System" applying the then novel concepts of "systems theory" to the disaster setting (20).

By 1981, United States federal officials transitioned the ICS into a national program called the National Interagency ICS Management System (NIIMS) establishing it as the response system for all federal agencies within the United States (21, 22). In March of 2004, the United States Department of Homeland Security revamped the NIIMS into the National Incident Management System (NIMS) and declared the ICS as "best practice" and determined that it would be the standard organizational tool for all incidents within the American national emergency response system including state and local agencies (23, 24). Through the years, the ICS has been adopted internationally. The ICS structure, or some variation of it, is presently used worldwide.

IMPORTANT PRINCIPLES OF THE ICS

The incident command system is structured around five key principles:

1) Early implementation before an incident gets out of control. For every 5 minutes that an incident is allowed to evolve before the ICS is implemented, it takes 30 minutes longer to bring the incident under control once the command structure is in place.
2) Adherence to the structure of ICS by all responders including medical and hospital personnel.
3) The structure of the ICS is the same regardless of the nature of the disaster. The differences are in the specific expertise of the individuals assigned to key positions for a particular type of incident. For example, in a biologic incident one of the key positions would be staffed by an individual experienced in infection control whereas in a nuclear event the same role would be staffed by an expert in radiation safety and exposure.
4) The structure of the ICS is modular, allowing for incident command to expand or contract according to the changing needs of a particular situation. It also provides a "manageable span of control". Each person should supervise only 5 individuals (range 3 to 7) in order to have optimal control and effectiveness. No one person within the ICS structure should supervise more than 7 individuals.
5) The terminology, position titles, and communication procedures are standardized within the ICS in order to simplify the operational interface between different agencies, avoid confusion, and shorten response times.

THE ICS STRUCTURE

The most important thing to know about the ICS structure is that functional requirements, not titles, determine organizational hierarchy. The structure is built around 5 major management activities in the disaster area: command, operations, planning, logistics, and finance/administration.

The *Incident Commander (IC)* is responsible for all aspects of the response. He or she develops the incident objectives, manages all incident operations, and delegates specific tasks and responsibilities to subordinates (Fig. 1). Three officers report directly to the IC:

- The *safety officer* is responsible for assessing safety hazards at the scene and developing safeguards to protect the responders.
- The *public information officer* (PIO) serves as the point of contact for the media and the public, and is responsible for developing complete and accurate information regarding the incident.
- The *liaison officer* has the job of coordinating efforts with other agencies and services.

The remaining 4 activities are performed by members of the "General Staff" and include operations, planning, logistics, and finance/administrative responsibilities. Each function is managed by a "section chief" who reports to the IC. In small-scale incidents, these responsibilities may remain with the incident commander. In larger incidents they are generally assigned to specific individuals. This is a good example of the flexibility of this system in being amenable to ramping up or down according to the size and nature of the event. When necessary, one or all of these sections can be further supported by adding

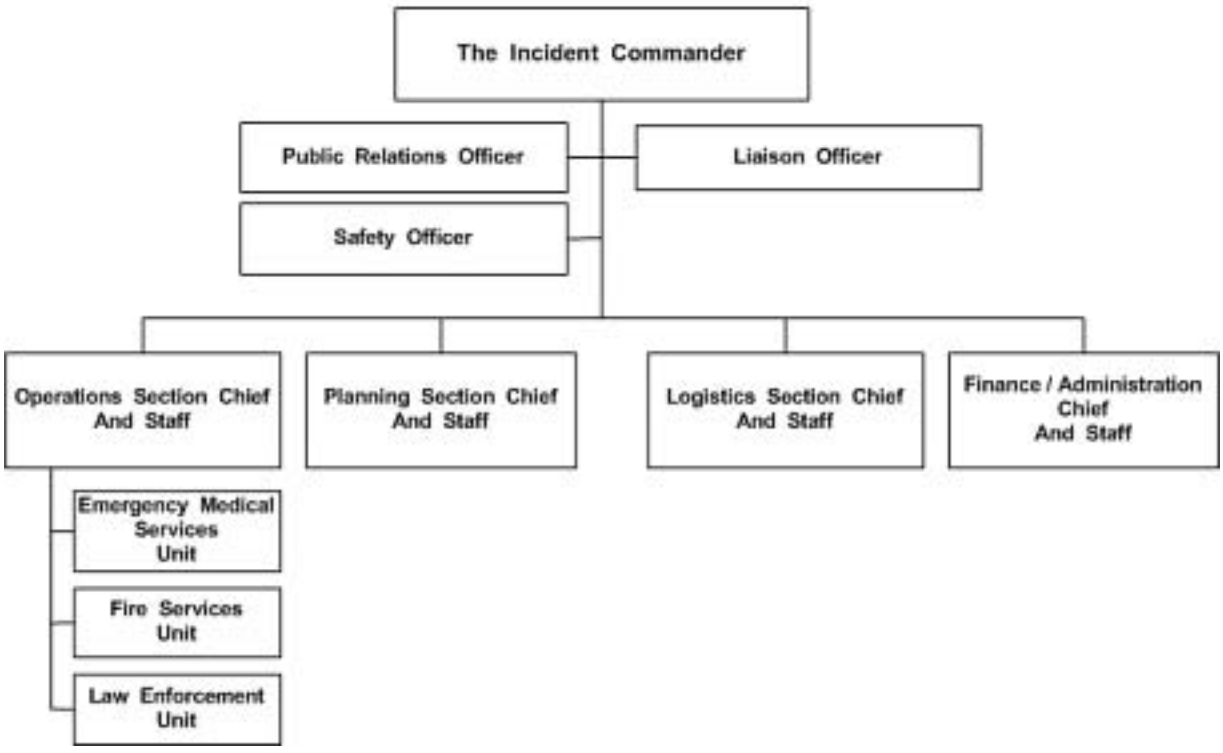

Fig. 1. The organizational structure of the Incident Command System (ICS) demonstrates the relationship between the command staff, the general staff, and the section chiefs. The modular structure allows for the incident command to be expanded or contracted according to the changing needs of a disaster situation. Additional units are added as needed under each of the section chiefs.

"units" that report back to that specific section chief thus creating a strict command hierarchy (Fig. 1).

The section of *operations* is responsible for all tactical operations including decontamination and waste control, air operations and ground rescue, implementing safety precautions and directing the allocation of resources. This is the only function of the ICS that interacts directly with the public, and includes all aspects of medical evaluation and care of casualties. This is actually the function of ICS that all other functions support and revolve around. Conversely, without all other functions, operations cannot succeed.

The *planning* section is responsible for developing the strategy and action plans that other section chiefs implement. They will maintain resource status, evaluate future resource needs and personnel, and maintain incident records. It is the responsibility of this function to "keep ahead of the disaster" as it evolves, and advise IC and other section chiefs of necessary actions and future needs. In some disasters of lesser magnitude, this function frequently becomes part of the Command section rather than stands apart as a separate unit.

The *logistics* section is responsible for obtaining the resources, equipment, and support to carry out the action plans and meet the specific needs of the incident, primarily in support of the operations section. This includes medical aid, food and supplies for incident personnel, as well as things such as fuel, space to carry out operations, and repair of necessary equipment.

The *finance/administrative* section chief and staff document all the financial costs of the incident including the cost of recovery for services and supplies. They analyze potential legal risks, staff compensation and possible claims for injury. This information can be valuable in the later analysis of the disaster for revision of the disaster plan and for the education of other responders.

THE HOSPITAL EMERGENCY INCIDENT COMMAND SYSTEM

The effective use of the ICS in integrating and coordinating first responders and multi-jurisdictional agencies at the scene of MCIs has led to the recognition that the same principles should prove equally effective when applied to an individual hospital. The Hospital Emergency Incident Command System (HEICS) was first developed in 1991 by the San Mateo County EMS Agency in California and was supported by the State of California Emergency Medical Services Authority (25). It follows the same general principles, structure, and terminology as the ICS itself. It is important to understand that HEICS is not the actual disaster plan for the individual hospital but rather the method by which the hospital operates when an emergency is declared.

By using the same terminology as the ICS, HEICS enables a more integrated and seamless response between first responders and healthcare institutions. It provides the hospital with a predefined organizatio-

nal system and an infrastructure that enables the institution and its personnel to respond in a more rapid and coordinated fashion. It has been shown to reduce some of the initial confusion and chaos experienced by the hospital at the onset of a medical disaster (25). Two important components of HEICS that help accomplish this are the use of predefined "call-down" mechanisms and preprinted "job action" sheets.

An effective hospital response requires an adequate number of appropriate staff. However, staffing levels within institutions vary significantly between shifts and on different days. Thus, it is important for all healthcare institutions to have a mechanism to rapidly obtain additional staff when needed. The HEICS recommends the use of predefined "call-down" mechanisms to address this problem. The details of the "call-down" mechanism can be individualized to the specific needs of the institution, but the basic concept requires each clinical and non-clinical department to have a preprinted list of contact information for all staff members. Once the disaster plan is activated, each department is responsible for using their call down mechanism to notify their staff. Separating the call-down process by department provides a system for notifying multiple individuals simultaneously, takes the burden off the page operating system, and also allows a more focused response if only certain individuals are needed.

Job-action sheets are preprinted one page job descriptions created for each functional position within the HEICS. The sheets are stored in an easily accessible location (i.e. in a disaster cabinet within the incident command center) to allow immediate distribution by the incident commander at the start of a disaster response. Each job action sheet lists, in order of priority, the specific tasks that the individual assigned to that position must perform throughout the different phases of the response. It also defines the person they are to report to and the specific mission associated with that function. In other words, the job action sheets inform the responding personnel what they need to do, when to do it, and who they report to. This is particularly helpful when staffing limitations might require some individuals to serve in more than one function or in functions that they would not normally be assigned. It also allows for continuity when staff may be rotated into or out of these positions as the disaster evolves. Thus, the job action sheets help to focus staff to perform those immediate actions that are known to be essential at the various stages of a disaster and preserve lines of reporting.

In addition to job action sheets there are other preprinted forms available for use in HEICS. The use of these preprinted forms provides a mechanism for accurate and timely documentation of expenses and resource utilization by the facility during all phases of the disaster response. They also increase the likelihood of financial reimbursement and may reduce potential liabilities during the institution's recovery phase. More information on these forms can be obtained through the California Emergency Medical Services Authority website at: www.emsa.cahwnet. gov.

THE HEICS STRUCTURE

Like the ICS, the HEICS has a modular structure (Fig 2). Each position on its organizational chart has a specific function to perform and has clear reporting channels defined. The 5 major functions outlined in the ICS are identical in HEICS and are critical functions in any disaster response. However, under each of the four section chiefs in HEICS there are units that were created to deal with the specific requirements of a hospital setting. For example, the functional "units" under the operations section in ICS usually include police, fire, and EMS. In the HEICS structure, these units are replaced by the surgical services, critical care, general nursing, and outpatient services among others (Fig. 2). It should be noted that the word "units" in this case refers to functional divisions within the chain of command and not to actual facilities as commonly referred to in daily clinical practice.

The modular structure of HEICS allows the hospital to activate only those elements needed to address a specific emergency. The plan allows for the addition of required elements or deactivation of other elements as the response evolves. The institution should not, however, change the terminology, names, or positions of the specific job functions within the organizational structure in order not to lose one of the main benefits of the ICS-based system, namely the use of identical nomenclature between first responders and other healthcare facilities. It also facilitates the mutual sharing of resources between agencies and institutions including managerial support.

ACHIEVING A SENSE OF READINESS

SIMULATION DRILLS

Knowing and understanding the organizational structure of the ICS and HEICS is only the first step to achieving a reasonable level of individual and institutional preparedness for a successful response. Knowing the language and structure has little benefit if the individual responders are not familiar with the specific regional or institutional disaster plan. Staff must be educated in the plan and rehearsed regularly through table-top and simulation drills. A critique of these drills should identify weaknesses and deficiencies in the institutional plan and lead to appropriate and timely revisions that should then be re-evaluated during subsequent drills.

In reviewing their response to the Centennial Olympic Bombing incident in Atlanta in 1996, Feliciano and co-workers attributed their excellent outcomes, at least in part, to the extensive preparations and drills performed prior to the event (12). Similarly, the burn surgeons at Rhode Island Hospital reported that experience gained from institutional disaster drills performed to prepare for terrorist-related events proved invaluable when a fire unexpectedly broke out in a nightclub resulting in 215 burn victims (15).

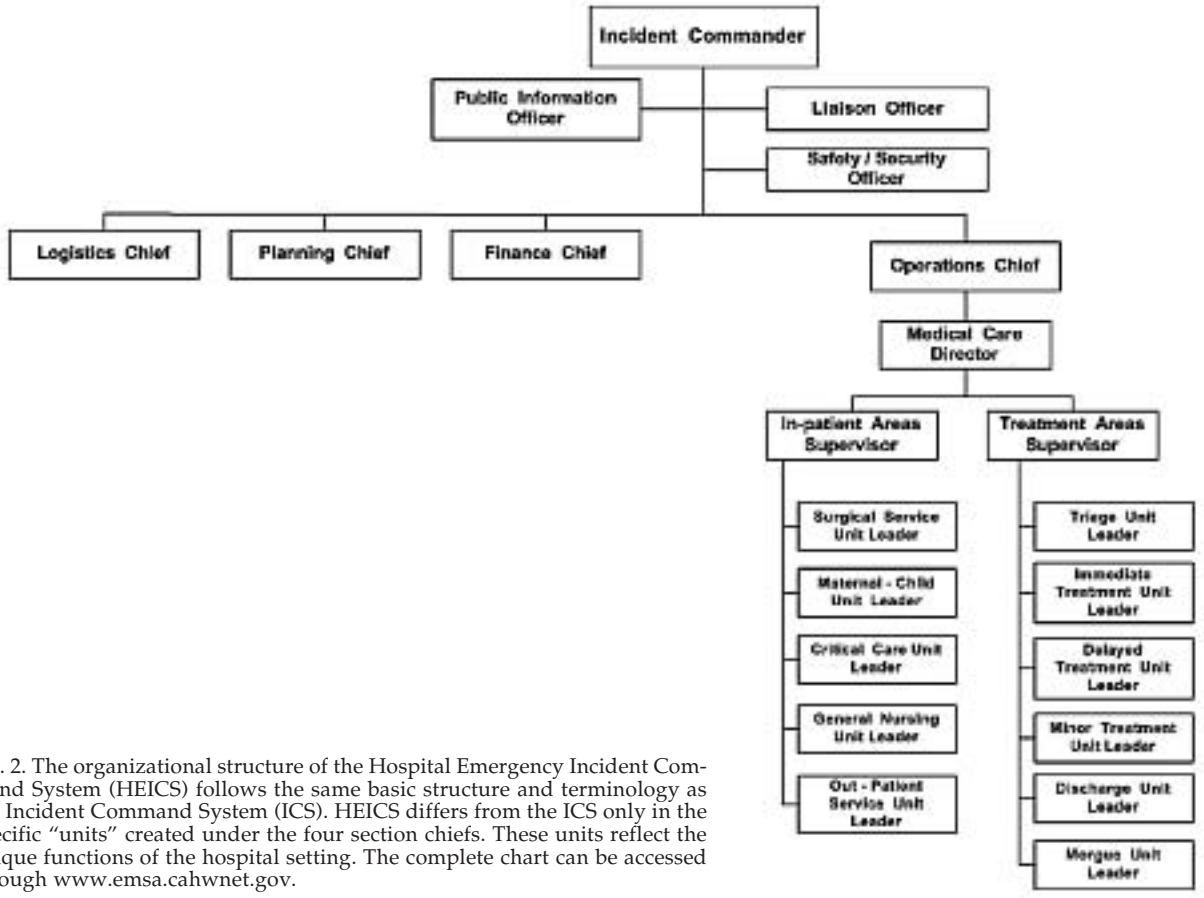

Fig. 2. The organizational structure of the Hospital Emergency Incident Command System (HEICS) follows the same basic structure and terminology as the Incident Command System (ICS). HEICS differs from the ICS only in the specific "units" created under the four section chiefs. These units reflect the unique functions of the hospital setting. The complete chart can be accessed through www.emsa.cahwnet.gov.

Being prepared for the range and scale of today's MCIs now requires planning beyond the scope of a single institution. In the ideal situation, the hospital's response plan should be integrated with that of local EMS, law enforcement, and other regional healthcare facilities and, simulation drills should be similarly integrated.

During an analysis of the terrorist bomb explosion in the central railway station in Bologna, Italy in 1980, Drs Brismar and Bergenwald speculated that the quick but unorganized work of rescuing the injured may have contributed to the fact that some of the patients with spinal injuries suffered from pareses (6). They also observed that the noise created by the large number of rescuers reduced the possibilities of hearing patients buried under the debris, thus reiterating the need for law enforcement to quickly control access to the site and admit only trained personnel. Good intentions alone do not guarantee good outcomes. It takes time and commitment. The planning and preparation for the integrated regional response for the 1996 Olympic Games actually took 5 years to complete (26), but resulted in an extremely rapid and coordinated response by all parties involved. Despite the early morning hour of the bombing (1:25 AM), the first casualties arrived in the hospital within minutes of the explosion and all 111 injured casualties were evacuated from the scene and brought to 11 area hospitals within 32 minutes of the event. Even with the rapid transport of victims from the site of the bombing, attending surgeons were already waiting in the emergency department (ED) when the first two patients requiring immediate operative intervention arrived (12).

BARRIERS TO AN EFFECTIVE RESPONSE AND LESSONS LEARNED

There is no doubt that experience is a key ingredient in a successful disaster response. Although disaster drills can serve as a partial substitute for first-hand experience, they cannot simulate all possible scenarios that may occur during a specific MCI. An important adjunct to disaster planning is, therefore, to learn from the experience of others. It is impossible to review all of the lessons learned throughout the years within the scope of this paper but, there are some lessons that bear mention as they either apply universally to all disasters or have some specific relevance to surgeons (13).

COMMUNICATION

Lack of effective and reliable communication is probably the most frequently encountered obstacle reported during a wide-variety of MCIs. Problems frequently occur in the flow of accurate information be-

tween the disaster scene and the hospital regarding the type and number of casualties anticipated; information which is critical for the appropriate and timely allocation of resources within the institution (12, 13, 15, 26). During the nightclub fire in 2003, the Rhode Island Hospital transferred 8 critically burned patients to a nearby trauma/burn center based on reports that they needed to prepare for more incoming victims. These reports subsequently proved false (15).

Analysis of several MCIs have demonstrated that existing phone lines rapidly become inundated by multiple calls (12, 13). It is recommended that dedicated extra phone lines be set up for exclusive use during an MCI. As a result of lessons learned in New York City during the World Trade Center attack in 2001 when all forms of telecommunication were lost after the collapse of the Twin Towers (27), it is also now recommended that alternative back-up methods of communication be part of the response plan, including cell phones, short wave radios, ham radios and satellite technology. Even with back-up technology, however, some institutions have had to resort to the use of foot messengers to carry information from one area of the hospital under exceptional circumstances (personal correspondence).

ESTABLISHING AUTHORITY AND COMMAND

The HEICS is based on a single command concept and generally allocates a single medical care director to the Emergency Department. It is noteworthy, that several surgeons have suggested a "dual command" strategy as a more effective mode of operation. In 1991, prior to the creation of HEICS, Weigelt and colleagues reported the creation of two separate command posts (medical and administrative) to enable the medical director to concentrate predominantly on medical care (13). Israeli surgeons also proposed creating a similar duality as a result of their experience with multiple urban suicide bombings (28). They proposed establishing two command physicians in the ED: one responsible for the overall medical and administrative needs of the ED (preferably an emergency physician) and the other directly supervising delivery of medical care (best performed by a trauma surgeon if available) (28). This strategy allows the second medical director to concentrate on the organization of medical teams, determine the need for medical resources, and oversee clinical management protocols without the distraction of administrative issues. The administrative director assumes the burden of all administrative issues within the ED such as logistics, planning, information management and communications.

On first consideration, one might think that this "dual command" may be in contradiction to the HEICS philosophy. However, this author does not believe this is so. Two critical principles of the HEICS are that functional requirements, not titles, determine hierarchy and that the modular structure provides a "manageable span of control". The concept of dual command is consistent with these principles. If an institution chooses to follow the recommendation of dual medical directors, care must be taken that these functions fall within the modular and hierarchal structure of the hospital emergency incident command system. Both systems recognize that multiple responsibilities are necessary for a successful response, and that no one function can accomplish all that is necessary for this to occur.

CREATION OF MEDICAL RESPONSE TEAMS

Small trauma teams composed of varying combinations of attending surgeons, residents, and nurses have been reported an effective component of the hospital response to several MCIs (12, 13, 15, 27). This multiple small teams approach was first advocated by Klein and Weigelt (13) after reviewing their surgical response to three successive MCI's in Dallas, Texas, between 1985 and 1988. They created trauma teams composed of a senior surgeon, two resident surgeons, two nurses, and a respiratory therapist and allowed only these teams' access to the ED. Each team was assigned specific patients to manage from initial evaluation throughout resuscitation and diagnostic studies until final disposition. Similar models were effectively used during the New York University/Bellevue Hospital response to the Twin Tower Collapse on September 11, 2001 (27) and by the Rhode Island Hospital response to a Nightclub fire in February 2003 (15).

The number of teams the hospital can assemble depends on staff availability, since the underlying premise is that the teams are composed of care providers with trauma experience. Thus, the availability of surgical staff will need immediate assessment during any mass casualty event and may alter triage decisions. The number of surgical teams immediately available can also be used by an institution to estimate the "surge capacity" for receiving critically injured casualties (28).

UNIDIRECTIONAL CASUALTY FLOW

Another critical barrier to a rapid and effective response is not providing specific instructions as to how to move patients and staff within the hospital to accommodate the incoming injured (15). During the first phase of the MCI response, the ED must be rapidly evacuated to make room for incoming wounded. There should be clear instructions outlined in advance as to where to relocate these evacuated patients. Similarly, plans need to include instructions for what to do with inpatients being discharged while awaiting family and /or transportation home. In addition, as victims of the MCI leave the emergency department for any reason, such as for head CT scan, they should not be permitted to return to the ED as their bed will likely be filled by the next incoming casualty. Thus, plans must be made to temporarily lodge patients who have moved from the ED for diagnostic studies and are pending study results to determine the patient's next or final destination (i.e. the operating room, ICU, or the ward). Maintaining this concept of unidirectional patient flow is critical to the orderly movement and tracking of patients.

SECURITY

Security is a critical component during all aspects of a disaster response. Without adequate security no phase of the disaster response can proceed safely or effectively. In general, security concerns are separated into scene and hospital concerns.

Security at the scene is usually provided by local police during the initial phase of an MCI. As the event evolves additional security may be required from military or state and federal law enforcement agencies. This is particularly true for terrorist related incidents in which the disaster scene will also be considered a crime scene and rescue workers will need to work carefully with law enforcement so as not to destroy important forensic evidence.

The first and foremost responsibility of any security force during an MCI is to ensure safety for the victims and other first responders at the scene. Rescue operations will be seriously compromised if rescue workers also become victims (27). Entry to the disaster site should be restricted to those with adequate training and authorization (6, 13, 14). There should be a system in place to identify authorized individuals in the field and to help identify those in positions of authority. This is frequently accomplished by the use of photo-identification badges in combination with color coded uniforms or vests. Security officers must also be prepared to manage the many volunteers who arrive at the scene of an MCI wanting to help. In order to facilitate rescue and evacuation efforts, security personnel will also need to establish control over traffic and roadways so that emergency personnel and rescue vehicles can gain easy access to the victims at the scene and an unobstructed exit for transport to the healthcare facilities.

Healthcare institutions have similar security concerns during a disaster response. In most present-day hospital disaster plans, security within the institution is expected to be provided by the institution's own security personnel. The role of hospital security officers during a disaster response must be clearly delineated in the disaster plan and, since this role is likely to be quite different from their usual day to day responsibilities, it is essential that these officers know the plan and participate actively in disaster drills (13, 14).

There are several institutional concerns that should be addressed in all hospital disaster plans. The plan should define who is responsible for clearing the ED and treatment areas within the institution and define what other areas of the hospital the security officers need to secure and where barriers need to be placed to help control crowds and walking wounded. Under certain circumstances such as in a chemical or biologic exposure, the entire hospital perimeter may need to be secured or even "locked-down" to prevent potential contaminated individuals from entering before decontamination or, potentially infectious individuals from leaving the institution to minimize spread of disease.

The plan should also define who will have access to the triage and treatment areas and how those individuals will be identified. This system should include a mechanism to identify voluntary or other temporary personnel from outside institutions that may be approved to participate as the disaster evolves. In addition, hospital security forces will need to direct the media to appropriate predesignated locations and control their activity to prevent interference with the delivery of care. Similarly, security personnel will also need to direct family members of victims to their appropriate gathering points and prevent their acess to patient care areas until determined by incident command.

Most local and regional disaster response plans rely on the hospitals' own security forces. However, during local and regional planning sessions in New York City, several hospitals have expressed concerns as to whether their hospital security personnel are adequately trained and prepared to secure the hospital perimeter or sustain a true hospital "lockdown" if the need arises (personal communications). The vast majority of hospital security personnel are unarmed, have had minimal, if any, training in crowd control, and do not deal with law enforcement issues on a daily basis. Most hospital perimeters are not designed to restrict entrance or egress to and from hospital grounds making the act of securing a hospital perimeter a difficult feat. This may be particularly difficult in a large urban environment where the influx of patients, families, and individuals just seeking shelter may be overwhelming. The recent events in New Orleans, Louisiana after hurricane Katrina have demonstrated the inability to predict public response during an MCI. The increase in violent activity, looting, and sniper attacks on police and rescue workers by civilians in New Orleans immediately following the hurricane was unprecedented (29, 30). These criminal activities hindered rescue efforts and overwhelmed local police forces which were already somewhat compromised by direct losses from the hurricane itself.

These events reiterate the importance of integrating multi-agency response plans and the need to constantly re-evaluate those plans. They raise new issues and concerns regarding civilian safety during an MCI and questions regarding hospital security and safety during conditions of civil unrest. There are no immediate answers to these newest questions. We can only begin by asking the questions, look at the new lessons learned, and try to come up with new solutions.

SUMMARY

The readiness of our healthcare facilities to respond to terrorist acts or naturally occurring epidemics and disasters has been at the center of public attention since September 11, 2001. The many other tragic events that have occurred throughout the world since then further reinforce the need for all healthcare facilities and medical personnel to increase their level of preparedness if they wish to optimize outcomes.

Maximizing survival rates and minimizing disability during any MCI hinges on rapid, seamless, and coordinated response between first responders and

first receivers. The Incident Command System and the HEICS are organizational tools that form the foundation for such a rapid and coordinated response. The ICS provides a simple and adaptable management structure that is capable of being expanded or contracted to meet the needs of a specific situation. The HEICS adapts the ICS into the hospital setting and, in addition to the benefits stated above; its use of the ICS nomenclature and terminology facilitates the communication and the sharing of resources between all agencies and health care institutions involved. A basic knowledge and understanding of the ICS principles and structure is essential for all individuals participating in a disaster response.

Previous efforts at disaster preparedness have focused predominantly on the pre-hospital and rescue phase of the disaster response, but a complete and coordinated community response requires creation of integrated disaster plans. True readiness can only be achieved by testing and modifying these plans through integrated simulation drills and table top exercises. Hospital-wide drills are essential to educate all staff members as to their institutional plan and serve as the only substitute at present to first hand experience. At present, there is no evidence-based literature to define what constitutes the best medical response by medical personnel within a disaster setting. This information will likely evolve over the next several decades as we now recognize Disaster Medicine as a separate scientific and medical entity. In the interim, we can develop and modify our response plans based on the "lessons learned" from past experience.

Prior events have demonstrated that general surgeons and surgical subspecialists are critical components to a successful hospital response for the vast majority of all mass casualty incidents. Thus, surgeons must take responsibility for increasing their knowledge and understanding of basic disaster management principles and must play an active role in developing their institutional disaster plans.

REFERENCES

1. Frykberg ER: Medical management of disasters and mass casualties from terrorist bombings: How can we cope? J Trauma 2004;53:201–212
2. Frykberg ER, Hutton PMJ, Blazer RH: Disaster in Beirut: an application of mass casualty principles. Mil Med 1987;11:563–566
3. Fryberg ER, Tepas JJ, Alexander RH: The 1983 Beirut airport terrorist bombing: injury patterns and implications for disaster management. Am Surg 1989;55:134–141
4. Henderson JV: Anatomy of a terrorist attack: the Cu Chi mess hall incident. J World Assoc Emerg Disaster Med 1986;2:69–73
5. Cooper GJ, Maynard RL, Cross WL, Hill JF: Casualties from Terrorist Bombings. J Trauma1983;23:955–967
6. Brismar B, Bergenwald L: The terrorist explosion in Bologna Italy 1980: an analysis of the efforts and injuries sustained. J Trauma 1982;22:216–220
7. Rignault DP, Deligny MC: The 1986 terrorist bombing experience in Paris. Ann Surg 1989;209:368–373
8. Biancolini CA, DelBosco CG, Jorge MA: Argentine Jewish Community Institution bomb explosion. J Trauma 1999;47: 728–732
9. Mallonee S, Shariat S, Stennies G, Waxweiler R, Hogan D, Jordan F: Physical injuries and fatalities resulting from the Oklahoma City bombing. JAMA 1996;276:382–387
10. Pyper PC, Graham WJH: Analysis of terrorist injuries treated at Craigavon Area Hospital, Northern Ireland, 1972–1980. Injury 1982;14:332–338
11. Waterworth TA, Carr MJJ: Report on injuries sustained by patients treated at the Birmingham General Hospital following the recent bomb explosions. BMJ 1975;2:25–27
12. Feliciano DV, Anderson GV, Rozycki GS, Ingram WK, Ansley JP, Namias N, Salomone JP, Cantwell JD: Management of casualties from the bombing at the centennial Olympics. Am J Surg 1998;176:538–543
13. Klein JS, Weigelt JA: Disaster management lessons learned. Surg Clin Am 1991;71:257–266
14. Waeckerle JF: Disaster planning and response. N Engl J Med 1991;324:815–821
15. Mahoney EJ, Harrington DT, Biffl WL,Metzger J, Oka T, Cioffi WG: Lessons learned from a nightclub fire: Institutional preparedness. J Trauma 2005;58:487–491
16. Biancolini CA, Del Bosco CG, Jorge MA: Argentine Jewish Community Institution bomb explosion. J Trauma 1999;47: 728–732
17. Briggs SM, Brinsfield KH: Advanced Disaster Medical Response. Boston, Harvard Medical International Trauma and Disaster Institute, 2003
18. Federal Emergency Management Agency (FEMA), National Emergency Training Center, Emergency Management Institute: Exemplary practices in Emergency Management: the California Firescope Program. Monograph series No 1. Emmitsburg, MD, 1987
19. Chase RA: FIRESCOPE: A new concept in multi-agency fire suppression coordination. USDA Forest Service Pacific Southwest Experiment Station General Technical Report PSW-40; 1990
20. Lilienfeld R: The rise of systems theory. Eds. John Wiley & Sons. New York, New York, 1978
21. Wenger D, Quatrantelli EL, and Dynes RR: Is the Incident Command System a plan for all seasons and emergency situations? Hazards Monthly 1990; 8–12
22. Brewster P: Clear understanding of ICS proves value for emergency management. Hazards Monthly 1990; 7–9
23. http://www.fema.gov. Accessed March 21, 2005.
24. http://www.osha.gov. Accessed March 21, 2005
25. The San Mateo County Health Services Agency, Emergency Medical Services: The Hospital Emergency Incident Command System. 3rd Edition. San Mateo, California, 1998
26. Cantwell JD: The Olympic medical experience: an overview. J Med Assoc Georgia 1997;86:13–14
27. Cushman JC, Pachter HL, Beaton HL: Two New York City hospitals' surgical response to the September 11, 2001, terrorist attack in New York City. J Trauma 2003;54:147–155
28. Hirshberg A, Holcomb JB, Mattox KL: Hospital trauma care in multiple casualty incidents: A critical review. Ann Emerg Med 2001;37:647–652
29. http://www.WNBC.com. Accessed September 6, 2005
30. http://www.CNN.com. Accessed September 6, 2005

Received: October 4, 2005