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Mass Casualty Management in the Emergency Department – Lessons Learned in Beirut, Lebanon - Part I

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INTRODUCTION

Over the last century, mass casualty incidents (MCIs) affected many nations and their emergency departments. The unscheduled arrival of large number of injured victims over a short period of time often causes major chaos and crowding.

When a rapid surge in operational needs overwhelms available Emergency Department (ED) resources and personnel, the chaos and overwhelming mismatch between needs and resources can quickly spread to the rest of the hospital.^{1, 2} Nonetheless, as the front door of the hospital, the ED plays a pivotal role in determining the quality and effectiveness of an institution's MCI response. This requires effective planning, which translates into preparedness. Unfortunately, many EDs are overburdened even on regular days. Damaged infrastructure further compounds the challenge.¹

DISCUSSION

Because ED personnel are the first providers in the hospital to receive mass casualties, they are often the first to recognize that an MCI is unfolding. This enables them to activate the facility's disaster plan to mobilize additional resources as they begin to triage and treat victims.^{1,3} The goal of ED care in MCIs is to identify victims with the greatest

Keywords: disaster, disaster management, emergency department, emergency management, mass casualty incident, triage

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immediate need for intervention, initiate life-saving care & stabilization while the operating room (OR), intensive care unit (ICU) and inpatient units prepare to support the response.²⁻⁵ Because the ED is the front door to the community, its personnel also interface with distressed crowds, friends and families, unexpected volunteers, media and sometimes, armed parties.⁶ Typically, it is also the first unit of the hospital to recognize that an MCI is resolving so the hospital can begin deactivating its institutional response.

Lebanon has experienced a disproportionate number of MCIs over the last 40 years due to war, civil conflicts and natural and manmade disasters. Several Lebanese studies have reported key aspects of some of those MCIs and described lessons learned from individual events.⁷⁻¹¹ In one recent study, El Sayed discussed the applicability of certain principles of management, currently implemented in the United States, to Lebanon and other developing countries.⁷ Another suggested that principles regularly used in Lebanon could be adopted by hospitals in countries that currently lack formal disaster plans.⁸ Two studies highlighted the importance of critically analyzing prior experiences with MCIs to improve preparedness and response to future incidents.^{10,11}

In the past 14 years, Beirut has been the scene of numerous armed clashes between warring militias, more than a dozen car bombs, including targeted assassinations, and a month of daily air raids. Over this period, Lebanon witnessed more than 65 conflict related MCIs.^{12,13} Responding to these events has provided the emergency department staff of the American University of Beirut Medical Center (AUBMC) with substantial experience in mass casualty management. AUBMC is the largest tertiary care center in Lebanon and its ED is the busiest among Beirut's 14 hospitals.¹⁴ Since 2005,

AUBMC's ED has managed ten mass casualty incidents, including one with more than 250 victims, two with more than 60 victims and seven with approximately 70 victims.

Given our ED's substantial involvement in managing MCIs and the importance of experience in MCI management, the hospital's ED staff has developed practical strategies we believe other EDs, hospital administrators, healthcare personnel and preparedness planners can use to optimize their own facility's response to mass casualty incidents. Obviously, every hospital and ED needs to need to tailor its MCI management plan to its particular community threats and operational needs. However, our hope is that the lessons we've learned in Beirut will be of value to others.

Lesson 1: MCIs are a “predictable surprise”.

One can tell when or where a major mass casualty incident will happen.^{3,5} “Disaster drills” can be scheduled for convenient times but *MCIs cannot*. MCIs often occur before hospital staff start their daily work in the OR, ICU or clinic, or hours after they have departed for the day. They can also strike during busiest mid-day or evening hours when hospital and ED resources are already strained. They can occur late at night, on weekends and on holidays, when hospital leadership are at home or unavailable and the facility is minimally staffed. Given particular aspects of the incident, hospital leadership may be incapacitated, or the facility may become temporarily inaccessible. Therefore, everyone must know the facility's plan and multiple individuals on all shifts must have the skills and knowledge they need to lead the response.

Lesson 2: MCI definition is based on the number of casualties relative to the resources available to treat them, the facility's level of preparedness and its surge capacity at the time.

What constitutes an MCI for one ED may not challenge another. Likewise, an unexpected surge in arrivals may be challenging during a busy shift in one ED but represent an overwhelming disaster for another. In addition, a significant surge in injured patient arrivals may not constitute an MCI in a well-staffed ED on a weekday morning. However, it could overwhelm that same ED and hospital at 2 am.

Lesson 3: Institutional disaster drills are important

Never assume an institution has an MCI response plan and never assume all individuals needed during a disaster response know or understand their roles and responsibilities. Follow the moto: “Test it and Drill it.”

A systematic review of 17 studies revealed that those that regularly drilled their response plans familiarized the staff with its procedures and identified flaws in their plans. This allowed for improving preparedness for future disasters through modifications to the plans.¹⁵

Some of the identified deficiencies include communication errors stemming from lack of authority,¹⁶⁻¹⁸ inexperienced staff committing clinical operation errors,¹⁶ mistakes made during the triage phase of casualty treatment, inaccurate documentation of events,^{17,18} and deficiencies in the use of available resources.^{18,19}

Usually, accreditation auditors ask hospitals for their external disaster response plan (EDP). Hospitals will typically provide a plan signifying that institution and staff will follow it. Hospitals may also provide reassurance or documents that indicate their readiness to participate in the national and regional disaster plans.

However, our experience in Lebanon taught us to look deeper at this. The reality is not as simple as it seems, at least in Lebanon, and perhaps in other nations. In fact, studies have reported errors and failure to adhere to triage protocols during the stressful MCI circumstances by emergency responders, regardless of their level of training.²⁰⁻²²

It is therefore critical to ask if there is an actual plan. Or, is it a simple policy or document, filed or forgotten in a drawer or a manual on the shelf of the chief of staff or accreditation office? Is it one that only a few can find when an MCI occurs? More importantly, is the plan simple enough to be understood but detailed enough to provide practical measures that can support an organized response and ensure adequate surge capacity at any time?

Has the hospital administration ever communicated the plan to the hospital staff? Do employees know (or have they ever even heard about)

the measures that pertain to their own department or clinical service? Were all stakeholders included in the initiative? Plans that are only communicated to a select few physicians, nurses and administrators (typically those involved in its drafting or preparing for a carefully staged annual drill) are often not available when a disaster strikes. As a result, those who are physically present at the time may not be sufficiently knowledgeable or empowered to act?

Ideally, a facility's plan should be communicated to all hospital staff and departments: administrators, heads of services, physicians, nurses, residents, students, pharmacists, security, clerks, admitting and finance, janitors, transporters, housekeeping, physical plant, medical engineering, central supplies, and store managers.^{23,24}

The plan should also be shared and coordinated with prehospital agencies and regional and national healthcare authorities. However, in a developing nation or conflict zone prehospital emergency medical services (EMS) systems may not exist, or they may be incapable of supporting the plan.

The picture is brighter in high-income countries like the United States of America, where the Joint Commission (TJC), compels health care organizations, including hospitals, to cooperate in disaster planning so they can deliver services to a "contiguous geographic area".²⁵ JCI requirements also include testing a facility's EDP twice yearly, with at least one drill being a community-wide.²⁵

Additionally, a better comprehension of the hospitals' abilities to respond to MCIs is possible via no-notice drills.²⁶ The US Department of Health and Human Services developed tools that can allow hospitals to run such no-notice drills.²⁶

Last but not least, will the plan work? Has it ever been tested or drilled? If so, has it ever been tested on a no-notice basis? Was its effectiveness rigorously assessed so it could be revised to address shortcomings prior to an actual MCI?

More attention should be directed to evaluating disaster training activities in a scientifically rigorous manner. According to Hsu et al., studies are needed to assess the effectiveness of certain training methods, as the current evidence is inadequate to produce solid conclusions.²³

Lesson 4: Upside-Down triage

Expect "upside-down triage"! In most MCIs, the most severely injured arrive after a first wave of less injured victims who bypass EMS and go directly to the closest hospitals.²⁷ These are the "walking wounded", typically with relatively minor injuries. They are ambulatory and hemodynamically stable, often walk to, or are driven to the closest ED, bypassing EMS triage systems.²⁸ If these individuals are taken into the EDs treatment areas and resuscitation bays, these facilities won't be available when more critically ill and injured patients begin to arrive.

Those who arrive later are often trapped or too severely injured to leave the scene. Because many will be disabled or unstable, they will need to be transported from the scene. They will rely on bystander volunteers or wait for prehospital responders to assist them. They need transportation, sometimes extrication, fire control, safe roads and access to the ED. In a military or civil conflict, these may not be readily or rapidly available.

Lesson 5: Carefully define the ED capacity to handle mass casualty as well as when and how to activate the MCI plan.

When does an external disaster warrant activation of a hospital's MCI plan?

An MCI should be declared when the ED receives an influx of casualties that exceeds its available capacity. This may vary depending on the time of the day, day of the week and on how crowded or poorly staffed the ED is. On-duty emergency physicians and the nurse-in-charge should be able to roughly estimate their available capacity at any given time and to identify when the number of mass casualty victims will exceed it. One study highlighted the importance of defining the term 'disaster' for the emergency physician and nurse-in-charge who must ultimately decide whether or not to activate the plan.²⁹

Can an institution define a specific number as a threshold to activate its own EDP?

It can, but this does not mean the number is accurate, reliable or valuable. ED capacity can vary dramatically between hospitals and within a single institution over a 24-hour span of time. Equally

important, ED capacity will also strongly depend on how busy the ED and how many ORs, ICUs and inpatient beds are available within the institution when disaster strikes.

In general, any ED with a single medical provider “team” (one qualified attending physician and one nurse) should be able to handle triaging and stabilizing 5-10 casualties arriving within a short period of time. Accordingly, our experience in Beirut indicates that MCI response activation should be considered any time the ratio of patients-to-provider exceeds 5 walking wounded per each medical provider team within 30 minutes AND the “team” secures information suggesting more victims are expected.

Quality of care should be taken into consideration when assessing the admitting capacity of a hospital. In fact, disaster planners often err by disregarding quality of care. As a result, their calculations are based only on the number of personnel and beds that can be made available without considering a hospital’s surgical resources and the number of trauma teams. Therefore, capacity estimates are usually inflated beyond a hospital’s functional capacity to properly deal with cases that require trauma-trained personnel.³⁰

How to identify reliable information about the likelihood of receiving additional casualty?

In communities that lack reliable communications with the point of injury, an initial estimate of the scale of an MCI can be determined by asking the first arriving victims, their companions and/or EMS providers to describe the scene.

In our experience, one cannot rely on the media, the hospital security officers, or the local or national police. They may not have the information needed. Those who actually know may be too busy on-scene to communicate what the ED needs to know.

Previous MCIs have shown that the timeframe during which MCI survivors present to the ED is influenced by the nearness of the hospital, EMS response (capacity and timeliness), and the time needed for rescue and evacuation. This timeframe reflects on the duration of the impact a certain MCI has on an ED and therefore has relevance for planning.³¹

Are there any patterns we can use?

During conflicts, the majority of mass casualty incidents involve two waves of casualties.²⁷ Based on our experience, it is reasonable to double the count the ED receives during the first hour of victim arrivals to roughly predict the total that the ED should expect after the “first wave” of casualties. By the end of the 3rd hour after single MCI events such as explosions, car bombs, gun assault of a crowd, and large vehicular accidents. Most patients will have been transported to healthcare facilities.

An example of that is the 1996 Oklahoma City bombing, the first wave of mildly injured casualties began arriving 15 minutes after the bombing. This was followed by a second wave of more severely injured patients who were transported by prehospital EMS.³²

If structural collapse occurs, one can also expect markedly increased severity and delayed arrival of casualties. For example, after a bombing in Buenos Aires in 1994 resulting in structural collapse, the last victim was extracted 36 hours after the bombing.³³

Lesson 6: Tiered response

To avoid unnecessary mobilization of resources, it is necessary to plan, establish and use tiered response. A two-tiered disaster plan could include two levels of activation and response.

- Level I: This is the highest level of disaster response. All health care providers & staff are called-in.

- Level II: This is the first and moderate level of activation & response. Only on-call providers/staff are called in to support the ED team on-duty. The ED team should entertain and decide calling in all emergency physicians and nursing staff to come to the ED.

Lesson 7: Tiered activation

An additional strategy that we recommend is to establish tiered activation with a two-step process that includes:

- Step 1: Alert Status

This is the first step of an activation; and this could be applied for either Level 1 or 2 response. Health care providers and staff are advised via pagers, messages and phone calls that they may be called in

to participate in a mass casualty response.

- Step 2: Activation Status

This is the second and final step of an activation; and this also could be applied for either Level 1 or 2 response. Health care providers and staff are advised via pagers, messages and phone calls that *they ARE being called in and expected* to participate in a mass casualty response.

Lesson 8: Proper call routing systems

It is key to instruct ahead of time the community, hospital and ED staff not to call the ED if they hear a disaster or possible disaster has occurred. They should remember or be reminded that at such time the ED would be particularly strained. Everyone should remember to strictly refrain from taxing the already overburdened ED staff time by forcing them to answer unnecessary phone calls. For example, during the Oklahoma City bombing, the metropolitan area witnessed 12 million call attempts within 2 hours from the bombing.³⁴

This calls for need to have proper call routing systems in the ED setting to prevent the system from crashing while simultaneously making sure of timely referral of calls to the right people. One option is adopting an automated call routing system that prioritizes calls and refers them accordingly.³⁵

Lesson 9: Pre-identify mobilization sites

Pre-identify mobilization sites and train all medical providers, staff, and leadership to use them; and drill them to make sure they remember to do so!

We recommend the following mobilization sites: the ED lounge or conference room for all on-call and ED physicians, the nursing department conference room for the nursing managers and leaders, the hospital Director Office for the institutional leadership disaster committee, and the largest hospital cafeteria or hall for all others. Ensure the large crowds do not convene close to the ED.

Lesson 10: Defining roles and responsibilities

Define roles and responsibilities for every service one may need, highlighting what they have in common with the rest of the institution and what is peculiar to them in terms of duties, response, mobilization, exceptions, etc. Normally, the ED attending should take on the responsibility of

assigning the roles and responsibilities to physicians and nurses who are called in.³⁶ For example, do not expect housekeeping staff to respond to pagers overhead, beepers or cell phones. Do they have one? Another example, does every head of service or hospital department maintain 24/7 prompt access to the contact information for all members of their unit? Will phone networks be functional during such a period notoriously overwhelmed during disasters? Plan for such details, unit by unit.

Drill them on their capacity to properly respond. Define them, communicate them and then drill them on their duties. Ensure all new staff or recruits have been properly oriented to all this. Identify one leader in the service to ensure this is coordinated in that division or unit.

Key individuals and departments include but are not limited to the following: clinical departments and services, laboratory and radiology departments, the chief of staff, chief medical officer and hospital director, the nursing director, managers and staff, protection officers, chief pharmacist, admitting head, store manager, transport and support personnel, communication, information technology, risk management, and housekeeping. They all have a role to be predefined, communicated and ready 24/7. It is vital for all staff sectors to be aware of the resources, roles, and responsibilities of all the other sectors.³⁷

Lesson 11: Secure and control entry & exit into the ED

Keep only one ED entrance and one ED exit open and make sure they are separate from one another. Additionally, restrict entry into the ED to control crowds and reduce interference and security risk.

Allow one companion per patient, if they have one, to serve as a surrogate guardian and help with patient identification, transportation, and a variety of ancillary needs that will become evident at the bedside.

Keep only one ED exit open to ensure proper ED discharge. This last check will enable the ED team to ensure the accuracy and completion of ED care, proper identification, treatment plan, documentation and discharge instructions.

When possible, have all ED staff and on-call

responders use a 3rd pre-designated restricted door to enter and exit the ED discretely and away from crowds.

A “convergence” phenomenon has been described in multiple studies referring to the large numbers of dispensable individuals who present to the ED during a MCI.^{27,38,39} These include family members, volunteers, and media personnel. Heavy-duty, lockable doors as well as gates or barricades may be used to control ED entrances and exits.⁶ Failure to do so can lead to ED disruption and inadvertent contamination.^{6,40}

CONCLUSION

Conflicts and mass casualty response have become more frequent over the last century. The establishment of the relatively new specialty “emergency medicine” has provided opportunity in the last decade that did not exist in older conflicts in the Middle East. We now have emergency nurses and physicians with real-time experience facing mass casualty events. Since they have committed life and career to the ED, emergency medicine providers can now finally retain and organize the lessons they have acquired in such adverse conditions. By experiencing repeatedly real-time mass casualty influx, they now can turn chaos into practical strategies that we have tried to organize for our colleagues. Readers who experienced mass casualty incidents will recognize in our manuscript thoughts and situations they have personally experienced. We also know that the challenges and solutions in a Beirut ED and urban tertiary care medical center may not apply in other context, situations and countries. We hope some readers can help us develop this material by providing letters to the editor. Together, we can build on this material and develop it into a format that can serve our people and patients.

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