The Boston Marathon Bombings

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In addition to his roles at Massachusetts General Hospital and the Harvard School of Public Health Emergency Preparedness and Response Exercise Program, Dr. Biddinger chairs the Massachusetts Medical Society’s Committee on Preparedness and is a medical officer for the MA-1 Disaster Medical Assistance Team (DMAT) in the National Disaster Medical System for the U.S. Department of Health and Human Services. Dr. Biddinger has lectured nationally and internationally and authored numerous articles and book chapters on topics related to emergency medical services and disaster medicine. In April 2013, Dr. Biddinger was working at a medical station when two bombs exploded near the finish line of the Boston Marathon. He arrived in the emergency department to respond as the first patients appeared.
Overview

- Discuss existing prehospital, hospital, city and state planning efforts and systems
- Identify lessons already learned before April 15th
- Review Boston Marathon bombing response
- Examine the effects of the citywide lockdown on April 19th

Emergency Planning Efforts

- Since the 1980’s, prehospital, hospital, and other health entities in the metropolitan Boston area have been meeting and planning for disasters
  - City
    - COBTH
    - UASI
    - MMRS
    - BHPC
  - State
    - OEMS
    - MDPH
Conference of Boston Teaching Hospitals – Emergency Preparedness Coalition

- COBTH is a trade association composed of 14 member Boston hospitals.
- Emergency Preparedness Committee:
  - Brings together all of the Emergency Preparedness Coordinators from those hospitals to discuss hospital readiness, regional planning, and exercises.
  - The EP Committee also addresses gaps within planning and creates strategies to improve those plans.
- The COBTH Emergency Preparedness Coordinator and two individuals from the Office of Public Health Preparedness act as the Region 4C (Boston) Hospital Coordinators.
- COBTH has many other functions including government relations with the hospitals, a CEO’s committee and a Domestic Violence Committee. It acts as a cohesive lobbying unit for the Boston Hospitals.

Boston Healthcare Preparedness Coalition
Medical Intelligence Center

- Conglomeration of healthcare entities come together to discuss pertinent preparedness issues for the region.
- Members of this coalition include, but are not limited to: Hospitals, Healthcare Centers, Long-term Care, Coalition for the Homeless, Home Health Agencies.
- Within the coalition there is a Training and Exercise Workgroup that coordinates and guides curriculum at the DeValle Institute.
- Medical Intelligence Center (MIC) is staffed during an incident to give hospitals a conduit to the MEMA (Mass Emergency Management Agency) incident command desk and act as a liaison to other local, state, and federal agencies.

MA DPH OEMS

- The Massachusetts DPH Office of Emergency Medical Services has been involved in Emergency Preparedness planning for decades.
  - Creation of statewide ambulance task forces in 2003.
  - Asked to mobilize resources to treat and transport 500 people per one million population: 3,500 patients in a 3 hour period.
    - 58 Task Forces
    - Each Task Force has 5 ambulances and a Leader or Alternate Leader assigned to it.
    - Total of 290 ambulances.
### MA DPH OEMS

- In addition to the Task Forces, OEMS also has the cooperation of the local regional transportation authorities
  - The buses can transport 25-60 non-acute ambulatory patients (certified EMT’s would be assigned to the buses)

### MA DPH Emergency Preparedness Bureau

- Formalized in 2007
- Serves as the ESF-8 lead for all health entities in Massachusetts during emergencies
- Assists with planning and coordination activities pre-event:
  - Community-based planning
  - MA Responds
  - SNS management
  - Coalition support and development
  - Planning for individuals with access and functional needs
  - Exercises and training
  - Other activities

### Emergency Preparedness Plan at Mass General

- Combines internal and external disaster plans into one “umbrella” plan
  - All MGH departments have a formal plan
- All-hazards approach to manage any incident
  - Additional “annexes” focus on specific threats and their unique qualities (e.g. MCI, HAZMAT, bio-threats, radiation, evacuation)
- Adopts the use of the Hospital Incident Command System (HICS)
- The substance of the plan does the following:
  - Identifies “CODE DISASTER” as phrase to activate disaster response
  - Describes the concept of operations for disaster response
  - Outlines the authority to obtain resources for disaster response
  - Describes coordinating activities with external community agencies
MGH Specialty Responses

- Specialty plans have been developed to respond to unique situations that require pre-planning coordination:
  - Nuclear/Radiological
  - Chemical/Hazmat
  - Infectious Diseases
  - Hospital Evacuation
  - MCI protocol
  - Mass Screening Process
  - Hospital Surge
- Special Considerations:
  - Facility “lockdown” (controlled access) procedures for MCI
  - Special evidence handling procedures for contaminated articles
  - Building evacuation plans that differ from the “fire” plan

Hospital Incident Command System (HICS)

Exercises and Trainings

- In the past 5 years MGH has conducted over 150 exercises and training sessions
  - Weekly New Employee Orientation Session
    - [www.massgeneral.org](http://www.massgeneral.org)
  - Administrator On-call training and continuing education
  - 10-15 tabletop, functional, or full scale exercises per year
- Participants include:
  - Materials Management, Environmental Services, Patient Care Services, Emergency Departments, Perioperative Services, Buildings and Grounds, Engineering, Information Systems, Telecom, Police & Security, Safety Department
  - External partners: Boston Police Department, Boston EMS, Boston Fire department, and other local and regional hospitals
Lessons from Colleagues Imbedded in MGH Plan

- We had learned key lessons from colleagues who have experience managing similar events
  - Israeli disaster management conference in 2005
  - Aurora, CO mass shooting incident
  - Medical staff members with military experience
  - MCI research
  - Harvard School of Public Health
  - Deployment experience (DMAT, IMSURT)

Lessons from Colleagues Imbedded in MGH Plan

- Notification interval will be very short, if it exists at all
- Early information will be inaccurate, incomplete, or both
- Patient distribution may be uneven
- Patients will arrive by mechanisms other than EMS
- The ED and hospital will likely be full
- Many response actions have to happen very, very quickly
- Triage must be brief, but must also be repeated
- Chaos and disorganization are inevitable, but must be managed as quickly as possible
- Practice is essential

The Boston Marathon

- 2013
The Boston Marathon, Monday, April 15, 2013

• 117th Boston Marathon
• 26.2 miles
• 26,839 runners
• Over 500,000 spectators
• Coincides with a Red Sox home game

Boston Marathon Scene

• http://bcove.me/x80d3xqi

Boston Marathon Bombing Notification

• At 2:50 pm two explosive devices were detonated near the finish line of the Boston Marathon
• At 2:55 pm Boston EMS and COBTH disaster radios transmitted notification of the explosion to all area hospitals. Additional notifications reported casualties
• Hospital CODE DISASTER activated at 3:03 pm. Disaster plan and mass casualty protocols implemented
• Hospital Emergency Operations Center (EOC) opened in administrative conference room per plan
• First patient arrived at 3:04 pm
Non-Traditional Notification and Early Situational Awareness

- Twitter and Facebook posts from the scene immediately picked up by some hospital personnel
- Text messaging
- Cell phones
  - Communication from the incident site (temporarily disabled)
  - Provided photos, video, GPS
  - Improved incident command communication
- MGH utilized homepage, Twitter, and Facebook to push updates and status reports

Scene Response
### Scene Response

- Medical tents were staged at the finish line to care for injured runners
- EMS and other medical responders rushed to the scenes to attend to victims
  - Some victims moved well away from the initial blast area
  - Significant bystander efforts as well
- Victims received mostly BLS interventions
  - Open airway
  - Control hemorrhage (largely with tourniquets)
  - Transport

### EMS Response

- Updated command and area hospitals with situational awareness data
- Numerous additional EMS units mobilized by Boston EMS
- Loading officer managed most of the transport destination decisions
  - Scene was cleared of critical victims in 18 minutes
  - Numerous victims transported 2, 3, 4 per ambulance
- Some area hospitals established ambulance resupply carts in their ambulance bays

### Patient Arrivals at the Hospital

- Hospitals along the marathon route had been receiving some usual Marathon-related patients throughout the day (dehydration, dizziness, sprains/strains)
- First bombing related patients arrived at affected hospitals shortly after 3:00 pm
- Additional patients with amputations, open fractures, multiple trauma, and extreme blood loss
- Patients with limited minor injuries continued to arrive into the evening and for several days after the incident
### First MGH Patients

<table>
<thead>
<tr>
<th>Date of arrival</th>
<th>Time of arrival</th>
<th>Status</th>
<th>Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/15/2013 15:04</td>
<td>3:04:00 PM</td>
<td>Admitted</td>
<td>AMPUTATION</td>
</tr>
<tr>
<td>4/15/2013 15:05</td>
<td>3:05:00 PM</td>
<td>Admitted</td>
<td>KNEE INJ</td>
</tr>
<tr>
<td>4/15/2013 15:15</td>
<td>3:15:00 PM</td>
<td>Admitted</td>
<td>AMPUTATION</td>
</tr>
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<td>4/15/2013 15:17</td>
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<td>Discharged</td>
<td>LH AND INJ</td>
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<td>4/15/2013 15:20</td>
<td>3:20:00 PM</td>
<td>Admitted</td>
<td>AMPUTATION</td>
</tr>
<tr>
<td>4/15/2013 15:22</td>
<td>3:22:00 PM</td>
<td>Admitted</td>
<td>AMPUTATION</td>
</tr>
<tr>
<td>4/15/2013 15:23</td>
<td>3:23:00 PM</td>
<td>Admitted</td>
<td>SHRAPNEL/FOOT</td>
</tr>
<tr>
<td>4/15/2013 15:27</td>
<td>3:27:00 PM</td>
<td>Admitted</td>
<td>AMPUTATION</td>
</tr>
<tr>
<td>4/15/2013 15:27</td>
<td>3:27:00 PM</td>
<td>Discharged</td>
<td>EXPLOSION INJ</td>
</tr>
<tr>
<td>4/15/2013 15:30</td>
<td>3:30:00 PM</td>
<td>Admitted</td>
<td>EXPLOSION</td>
</tr>
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<td>4/15/2013 15:31</td>
<td>3:31:00 PM</td>
<td>Admitted</td>
<td>TRAUMA</td>
</tr>
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<td>4/15/2013 15:52</td>
<td>3:52:00 PM</td>
<td>Discharged</td>
<td>DISASTER</td>
</tr>
<tr>
<td>4/15/2013 16:22</td>
<td>4:22:00 PM</td>
<td>Admitted</td>
<td>EXPLOSION</td>
</tr>
<tr>
<td>4/15/2013 16:30</td>
<td>4:30:00 PM</td>
<td>Discharged</td>
<td>DISASTER</td>
</tr>
</tbody>
</table>

### Patient Injuries

- Multiple below and above the knee amputations
- Severe blood loss
- 2nd and 3rd degree burns
- Open fractures, open wounds, lacerations, embedded shrapnel with tissue injury
- Closed fractures with contusions, sprains and strains
- Head injuries, post-concussion syndrome
- Hearing loss with tympanic membrane injury
- Acute anxiety

### Acute Hospital Response

- The Acute area of the Emergency Department was cleared of all existing patients to make room for the injured
- Existing ED boarders were quickly accepted by inpatient units with limited handoff to decompress the ED
- Triage disaster protocols implemented and led by ED attending physicians. Trauma teams staged outside of each bay
  - External triage on the ambulance ramp staffed by EM MD and RN
  - Internal triage area created in ED waiting room
- Perioperative services reserved several operating rooms for expected incoming cases. Anesthesia, nursing, and surgical teams alerted staff
  - Six patients underwent surgery within 30 minutes of ED arrival
- Security secured the ED, ambulance bays, and front entrances
Emergency Department Decompression

ED Census
April 15, 2013

- ED volume decreased 97 to 39 patients within 1.5 hours

Operating Rooms

- Images of operating rooms with healthcare professionals in scrubs.
Site of Injuries

<table>
<thead>
<tr>
<th>Site of Injuries</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burns</td>
<td>11</td>
</tr>
<tr>
<td>Shrapnel</td>
<td>11</td>
</tr>
<tr>
<td>Fractures</td>
<td>5</td>
</tr>
<tr>
<td>Severe soft tissues</td>
<td>7</td>
</tr>
</tbody>
</table>

5 Emergent Operations (Average Values)

- First SBP: 95 mmHg
- First HR: 105 beats/min
- First RR: 23 breaths/min
- First GCS: 15
- ED to OR: 21 min
- OR duration: 90 min
- EBL: 1300 ml

Reoperations: 9 patients

- 1st to 38th postop day (most within 10 d)
- 1 to 11 re-operations
- Total reoperations: 28
- Amputations, orthopedic procedures, debridements, skin grafts
Collaboration and Practice

- Boston EMS did an outstanding job distributing patients to local hospitals and trauma centers so that no hospital was inundated with complex critical patients
  - 275 total injured, well distributed based on acuity
- Regular large drills and trainings including emergency response, emergency notification, HICS roles, and flexible incident command
  - Previous exercises have included airplane accidents at Logan, train crashes and incidents involving hazardous materials
  - Longstanding, collaborative relationship between State and City agencies and Boston teaching hospital

Mitigating Factors

- This event occurred during the day near shift change, which facilitated the response (essentially double coverage of staff). Emergency plans need to consider rapid 24/7 response when staffing will be more limited
- Bombs were detonated outdoors and did not cause any structural collapse requiring extrication
- Bystanders on scene immediately assisted the injured
- Finish line staffed with emergency responders and medical tents
- Close proximity to 6 level-1 hospital trauma centers (BIDMC, BMC, BWH, Children’s, MGH, Tufts)
The Manhunt, Friday, April 19, 2013

- At 6:00 am residents of Boston and adjacent communities told to stay home, not report to work, and shelter in place
- All public transportation shut down
- Hospital CODE DISASTER called

Shelter In Place — Considerations

- The unprecedented Shelter In Place order presented unique challenges and valuable learning opportunities
  - Staffing shortages due to public transportation shutdown created significant challenges
    - EP leadership investigating ways to use PHS transportation assets in future events
  - The decision to cancel/reschedule ambulatory visits is complex and requires preplanning
    - Organizations should ensure contact information (cell phone, home phone) is available for leaders of all ambulatory areas
  - Efficient use of the Labor Pool requires detailed planning and ongoing support
    - Must communicate early and often during an incident to ensure essential staff stay on site until released

Additional Considerations — Shelter in Place

- Securing hospital access is complicated and requires significant resources from Security staff
  - Major impact on staff, patients, families, visitors, and deliveries of hospital supplies
- Inpatient discharges will be close to zero
  - Major impact on ED, ORs, and other procedural schedules
- Onsite staff may not be relieved: sleeping arrangements will be necessary
- Ongoing, repeated clarifications needed from State authorities
  - Essential healthcare workers
  - Ambulance traffic to and from hospital
### Days Following the Bombing

- Assess long-term impact on patients
  - Consider psycho-social support needs after initial euphoria of surviving
  - Anticipate long-term, significant rehabilitation needs
- Assess impact on staff
  - Expect increased stress
  - Mobilize EAP (Employee Assistance Program) resources
  - Open communication; hold multiple debriefings
- Unexpected outpouring of support for patients, families, staff
  - Manage visits by dignitaries (POTUS, governor, other politicians, sports celebrities, etc.)
  - Wonderful cross-hospital support

### Initial Lessons

- Internal notification issues were complex
  - Leadership personnel versus critical staff
  - Use of social media
  - Confirmation of HAZMAT information
- Important to streamline ICS use/structures
- Ongoing communication issues with all staff, public, media
  - Challenging to maintain updated situational awareness
- Need to review disaster patient registration process
  - Similar MRNs
  - Unreliability of information

### Initial Lessons

- Need to continue our development of MCI protocol
  - Important to partner ED and surgery leadership
- Manage Emergency Department crowding during event
- Patient/family reunification
- Law enforcement issues with interrogation of patients, families, visitors
### Areas for Improvement

- Public transportation challenges
- Labor pool management
- Ongoing inpatient hospital operations
- Ongoing ambulatory hospital operations
- Communication with research community
- Release of information process/procedures; HIPAA
- Ongoing employee support (PTSD)
- Recovery, business continuity, tracking of expenses
  - Employee pay policy modification

### Areas for Long-Term Development

- Advocacy for funding related to emergency preparedness
  - Federal and state funds that support drills, EMS coordination, and hazmat training and supplies have diminished. ASPR (Assistant Secretary for Preparedness and Response) funding has been reduced
  - Concern for being able to maintain, improve, and enhance emergency preparedness and response
- Continued focus on integrated planning, multidisciplinary exercises, and a variety of drills (MCI, hazmat, technology and communication systems failure)