Medical Issues in Disasters: Worries and Concerns

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Lecture Objectives

- Evidence based review of our understanding of public’s views in DM.
- “Medical Flow” in DM.
- How “Ideal Agents” were utilized.
- PPE/Decon
- Chemical Agents
- Radiation in the “real world”

Understanding the Public Response to Disasters

- National Science Foundation study conducted on events between 1984–1994.

<table>
<thead>
<tr>
<th>Event</th>
<th>Location</th>
<th>Fatalities</th>
<th>Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquake</td>
<td>CA</td>
<td>62</td>
<td>373-7</td>
</tr>
<tr>
<td>Train Derailment</td>
<td>SC</td>
<td>8</td>
<td>63</td>
</tr>
<tr>
<td>Plane Crash</td>
<td>NY</td>
<td>27</td>
<td>24</td>
</tr>
<tr>
<td>Natural Gas Explosion</td>
<td>TX</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Underground gas explosion</td>
<td>Mexico</td>
<td>200+</td>
<td>4000+</td>
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<tr>
<td>Hurricane Andrew</td>
<td>FL</td>
<td>34</td>
<td>1400+</td>
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<tr>
<td>Bombing</td>
<td>NY</td>
<td>6</td>
<td>1042</td>
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<tr>
<td>Tornado</td>
<td>OK</td>
<td>7</td>
<td>143</td>
</tr>
<tr>
<td>Train Derailment</td>
<td>AL</td>
<td>47</td>
<td>181</td>
</tr>
<tr>
<td>Earthquake</td>
<td>CA</td>
<td>58</td>
<td>9000+</td>
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Lesson #1
Disaster Planning Does Not Go as Planned

- Formal response system often breaks down.
  - Not chaotic, just not as planned
  - Communication often breaks down.
  - EMS improvises
- Planning for the wrong needs.
  - Trauma instead of large number of minor injuries.
- Disaster drills without externalities
  - At night, with traffic, without administration, without manpower.

Lesson #2
Victims Respond with Collective Resourcefulness

- “Yellow-tape” effect
  - Public as unwanted nuisance
- Emergent collective behavior
  - Spontaneous groups with roles, rules, leaders, and divisions of labor

Lesson #3
Panic is Rare

- Exception: Fire where people are trapped
- First World Trade center bombing
  - “Eerie feeling of calm.”
- Panic happens in disaster films not in real life.
  - Work group mentalities
  - Pre-existing personal knowledge inoculates against panic.
Lesson #4
The Majority of Lives are Saved by the Public

- The “golden 24 hours”
- EMS often arrives late in multisite events
- The public is often the “first responder.”

Lesson #5
Social Factors Important in Planning

- Rumors fill the information gap.
  - Correct, and early, information is extremely important.
- Trust.
  - Patients will go to the hospitals they trust the most: local community hospitals
- Pre-existing social relationships
  - Anticipate minimum 28% reduction in staff.

Assumptions
Missed...Opportunities Lost

- Extent of the destruction: catastrophic terrorism
- Lack of “Capitalism” in planning
- Technical society: cell phone, e-mail, PDAs
- Bioterrorism would really occur!
  - “Kill one—terrorize a million”
- Healthcare “Sitz en leben”
  - Decline of Public Health infrastructure
  - Cheaper healthcare at the cost of surge capacity
  - Ability to detect the “Index Case”
Surveillance “Syndrome Analysis”
- Hospitals typically see ED, ED sees prehospital—“Like runs/like cases”
- Consideration to “pre” pre-hospital
  - Local pharmacies—OTC
  - PCPs getting more calls
    - Home health calls
  - Schools with increased absence:
    - EMS-C school nurse programs
  - Employers with increased call-ins.

Healthcare’s Role
- All disasters begin locally
- Physicians are critical first line of defense
- Disease recognition
- Treatment of cases
- Prompt notification of local health department
- Assist with public health control measures
- Cooperate with law enforcement

Public Health Terms
- **Isolation:**
  - Separation of ill persons with contagious disease
  - Often in a hospital setting
  - Applied to individual level
- **Quarantine:**
  - Restriction of persons presumed exposed
  - Applied at individual or community level
Recognition of Event

- Delay in recognition likely
  - Delay between exposure and illness onset
  - May resemble naturally occurring disease
- Look for:
  - Temporal or geographic clustering of illness
  - Unusual age distribution
  - Infectious disease occurring in otherwise healthy persons

What to Expect

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<tr>
<th>Waves of Victims</th>
<th>Psychological Impact</th>
<th>Injury Risk</th>
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<tbody>
<tr>
<td>1st Wave: Walking wounded, self presenters, least injured</td>
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<td></td>
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<tr>
<td>2nd Wave: Bystander presentation, vast array of injuries</td>
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<td></td>
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<tr>
<td>3rd Wave: EMS presentation, trapped, critical to moribund</td>
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Ideal Agents for Bioterrorism

- Can be easily disseminated or transmitted person-to-person;
- Cause high mortality, with potential for major public health impact;
- Might cause public panic and social disruption; and
- Require special action for public health preparedness
Anthrax: what are the risks?

2001 U.S. Postal Experience.

Washington D.C.
- 1,961 postal employees worked for 10 days in a heavily contaminated environment.
- Four developed inhalational anthrax, and two died.
- Two of the employees worked on sorting machinery when the letter was processed, one cleaned machinery by blowing air into it, and one handled the envelope containing anthrax after processing.

Anthrax: Main Points
1. NOT contagious person-to-person
2. Can be fatal.
3. Treated using antibiotics
4. Early treatment is important, and may prevent death.
5. Medication is required for up to 60 days after known exposure to prevent infection.

Chemical Agents: Background
- Historical perspective
- Gulf War, Tokyo subway incident 1995, World Trade Center 1995, Y2K
- Availability and ease of production
- Escape detection
- Easily disseminated
- Overwhelm healthcare resources
Personal Protective Equipment
Level A
- Level A: SCBA, fully encapsulating and resistant to liquid and vapor penetration

Personal Protective Equipment
Level B
- Level B: SCBA, adequate vapor penetration, less liquid (splash) protection

Personal Protective Equipment
Level C
- Level C: air purifying device, chemical resistant
Personal Protective Equipment
Level D

- Level D: no respiratory protection

Decontamination

- Ambulatory - prioritize
  1) Symptomatic
  2) Asymptomatic, evidence of contamination
  3) Asymptomatic, no apparent contamination

- Non-ambulatory
  - In separate litter-based corridor
  - Persons requiring immediate care first

Decontamination

- Initial decontamination performed in the warm zone, near the hot zone
- Additional decontamination may be required
- Water
- Soap and water
- Bleach and water
Chemical WMD

- Industrial agents
- Military agents

Chemical WMD

- Lethal
  - Pulmonary (Choking agents)
  - Vesicants (Blister agents)
  - Cyanide (Blood agents)
  - Nerve agents
- Incapacitating and Riot control agents
Incapacitating Agents

- CS
- CR
- CN (Mace®)
- pepper spray (capsaicin)

Radiation & The Public’s Perceptions

We Live in Radioactive World

- Naturally occurring radioactive elements abound
- Cosmic radiation
- Man-made radiation accounts for less than 1% of total radiation
- Average human dose 150 to 170 mR/year
- Dose varies by geographic location
The Bad News

- Almost nothing creates more terror than radiation
  - It's invisible to touch, taste, and smell
  - Most people have unrealistic ideas about radiation
  - Most physicians don't even understand it
  - The objective of the terrorist is as much or more panic than it is physical harm

What Can We Expect?

- Radiological/Nuclear Terrorism
  - A true nuclear detonation
  - A failed nuclear detonation
  - Radiation dispersal device
  - Power Plant attacks

The Unthinkable

- Effects of a 1 megaton detonation in Chicago
  - 30% of all hospitals destroyed in 50 mile radius
  - Transportation and infrastructure compromised
  - Emergency vehicles and professionals unable to respond
  - Walking wounded with burns may have been fatally irradiated - unknown effects for days to weeks
The Weather

Direction of the wind can make all the difference.

Aerial photograph shows the smoke from 9/11 traveling south.

Normal wind direction (arrow) is northeast.

The Good News

- Nuclear Medicine and Radiation Therapy professionals are well trained in the fundamentals of radiation
- Respect radiation, but do not fear it
- Understand what radiation can and cannot do
- There have been industrial radiation accidents that we have learned much from
- It is easily detected in contrast to biological and chemical agents
Methods of Decreasing Exposure to Staff

- Time – linear relationship
- Distance – geometric relationship
- Shielding – half value layers

Acute Radiation Syndrome

- Group of signs and symptoms that develop after acute total body irradiation (> 100 rads)
- Most probable following exposure to penetrating radiation (i.e., gamma or x-rays, neutrons)
- May occur from internal contamination
- Symptoms are predictable depending on the dose
- Severity related to how quickly symptoms develop

Acute Radiation Syndrome

- Prodromal phase - onset is related to the total dose of radiation and can be minutes to hours post exposure. Characterized by nausea, vomiting, and anorexia. At doses below about 500 rads lasts 2 to 4 days. At higher doses may be persistent with increasing severity.
- Latent period - follows the prodromal phase and lasts for a few days to two or three weeks depending on total dose.
- Illness phase - period when overt illness develops
- Recovery phase or death - may take weeks or months
Acute Radiation Syndrome

- Treatment options
  - Prevention of incorporation
    - Limit uptake of radioactive material
  - Decorporation
    - Facilitate removal of radioactive material
  - Burn care
  - Pain control
  - Supportive

 Radiation Injuries

- Dependent on dose
  - Non-Stochastic effects (Dose related)
    - Decrease in sperm count – 15 R
    - Hematological effects – 150 R
    - Gastrointestinal effects, epilation – 300 R
    - CNS effects – 1000 R
  - Stochastic Effects (Non-dose related)
    - Increase in cancer risk
    - Genetic abnormalities

Burns From Radiation

- Generally do not appear immediately
- Healing is extremely poor
- Not likely to be seen in the acute setting
Treatment of Exposure

Localized
- The damage is already done
- Reconstruct the accident to determine dosage
- Effects depend on area exposed
- Surgical management may be needed for burns or long term complications.

Total Body
- The damage is already done!
- Provide supportive care
- Reconstruct accident to estimate the exposure level (biologic dosimeters)
- Reverse isolation may be needed
- Fluid and electrolyte maintenance
- Follow blood levels of platelets and WBC's
- If exposure is high, consider BMT (consult)

Contamination
Internal vs External
- **External** (Done acutely)
  - *Remove contaminated clothing*
  - *Wash affected areas*
  - *Avoid harsh agents that may compromise skin*
- **Internal** (Done later)
  - *Decontamination efforts require knowledge of the chemistry and biologic properties of the contaminant*
  - *Requires that specimens were obtained initially*
Internal Contamination

- Saturate the organ
- Dilute the isotope
- Displace the isotope
- Bind or chelate the isotope

Closing Thoughts

- Management commitment is required—need to sell
- Planning is critical—It is more about the planning than the plan
- Use of common standards and terminology will help everyone
- Exercising is a performance measurement/improvement tool
- Learning from incidents/exercises is key to performance improvement
- We may be better prepared, but we may not be prepared

Is there a role for Emergency Medical Services in the big picture of a community disaster?
Questions