Medical care of victims from Hazardous Material Incidents

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Hazmat medical care and daily-life emergency medicine

- Daily life emergency medicine
- Hazmat medical care
  - Chaos, confusion and unpredictability
    - Number of patients
    - Risk of chemical contamination
    - Lack of information
    - Urgency of medical needs

Common misunderstandings about hazardous material accidents (1)

- Hospitals will be notified in advance of arrival of chemically exposed patients
- Hazardous chemical substance will be rapidly identified
- On-scene and emergency department care providers will give specific and appropriate treatment

Experiences and lessons from the past

Norfolk Southern freight train wreck: Graniteville, South Carolina: January 2005
- Misleading information
- Toxidrome recognition

Common misunderstandings about hazardous material accidents (2)

- Dispatchers will send emergency response units to the scene
- Trained personnel will triage, treat, and decontaminate victims
- Casualties
  - Will be transported by ambulance
  - First transport the most serious patients
  - Already decontaminated

Consequences of misunderstandings

- Failure to treat the most seriously injured patients
- Mistaken diagnoses
- Medication errors
- Misdirected medical response resources

Experiences and lessons from the past

Norfolk Southern freight train wreck: Graniteville, South Carolina: January 2005
- Misleading information
- Toxidrome recognition
Tokyo sarin gas attack: March 1995
- Lack of accurate information/information from mass media
- Self-referring victims
- Secondary contamination to medical staffs


Indianapolis: 1995
- Mass sociogenic illness
- Unnecessary use of antidote with adverse effects


Medical care of hazmat victims: Reality(1)
- During the early stages of many chemical events, medical personnel may find themselves operating “in the blind” with little or no understanding about the nature of the crisis they are facing.
- Lack of:
  - Accurate communication
  - Personnel on scene
  - Experts
  - Victims and witnesses
  - Laboratory support


Medical care of hazmat victims: Reality(2)
- Emergency response personnel seldom have adequate tools or resources to effectively triage, decontaminate, and treat the large numbers of victims of chemical exposure.
- Too generic training and plans to be of practical use during an event


Medical care of hazmat victims: Reality(3)
- Victims arriving at the hospital during early periods often arrive under their own power without
- Direct involvement from emergency response personnel on the scene
- Systematic transferring

Medical care of hazmat victims: Reality

- General public can behave in ways that significantly erode the effectiveness of the emergency medical response
- After each mass chemical exposure, large numbers of people will seek medical care
- The greatest numbers of patients seeking care are often those who perceive they have been poisoned, but do not exhibit obvious signs or symptoms of poisoning
- Symptoms based solely on fear or anxiety “Mass hysteria”
- Actual toxic effects

Train medical personnel for response to chemical events based on community-specific risk analysis
- The chemicals with the greatest risks in the community
- The potential high-impact scenarios involving those chemicals
- Identifying potential chemical classes based on toxic syndromes (toxidromes)

Application of Toxicology principles in medical practice

- Toxic syndrome recognition for rapid diagnosis and empiric therapy
  - Tens of thousands of toxic chemicals
  - Impossible to learn all specific toxic effects
  - Classification of chemical substances by toxic effects: “toxidromes”

- A tool for rapid detection of the suspected cause and can focus the differential diagnosis to consideration of only a few chemicals with similar toxic effects
- Specific laboratory investigation
- Empiric antidotal and supportive treatment
- Effective communication

Common toxidromes in mass chemical exposures

- Chemical burns
- Irritant gas syndrome
- Acute solvent syndrome
- Methemoglobinemia
- Cholinesterase inhibition
- Metabolic toxicity

Toxidrome recognition:

- A chemical’s physical state and the route of exposure influence toxicity
  - Toxic effect
  - Severity
  - Onset of toxicity

Application of Toxicology principles in medical practice

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  - Toxic effect
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Application of Toxicology principles in medical practice

- The dose makes the poison.
- “What is it that is not poison? All things are poison and nothing is without poison. The right dose differentiates a poison from a remedy” - Paracelsus
- Dose: concentration duration of exposure

The dose determines the poison during triage and decontamination decision:
- Direct contact
- Relative distance from areas with the highest concentrations
- Time a patient was in a toxic environment

Recognition of chemical exposure incidents

- Lead to action and plan activation
- ED evacuations/closures have been related to lack of early recognition and high levels of concern about the potential for secondary contamination, and not the lack of a written protocol or dedicated decontamination equipment

Clues for chemical exposure incidents

- Signs and symptoms of specific toxic syndromes
- Sudden onset of illness in large groups of people from crowded areas
- Industrial accidents, fires, or explosions
- Transportation accidents
- Agricultural accidents
- Victims noticing chemical odor or vapor cloud

Closing the silent gap

- Awareness of chemical substances at risk of chemical exposure in the local areas
- Evidence-based preparation suiting the local situations
- Communication and information network
  - Responders
  - Hospitals
  - Poison centers

Different types of medical need in victims from chemical exposure events

- Decontamination need
- Purposes of decontamination
  - to prevent further harm to the patient
  - to swiftly deliver a “clean” patient to the treatment area

**Decontamination**

- Hospital and emergency departments are required to have decontamination capability
  - Facility
  - Training
  - Equipments and personal protective equipments
  - Removal of clothing
  - Water, soap and brush

- Need for immediate life-saving care
  - Some critically ill patients need immediate care before decontamination
  - After decontamination, treatment of victims exposed to toxic chemicals primarily involves symptomatic and supportive care
  - Antidotes may be used if the indication is fulfilled.

**Secondary contamination in emergency department personnel**

- The psychological needs of patients, families, care providers, media, and the community
- Differentiating chemical toxicity and psychological effects
- During a mass chemical exposure, the diagnosis of fear and anxiety is by exclusion only
- Delivering information and reassurance
  - Goal: to provide people with accurate information and alleviate anxiety that stems from rumor and misinformation

**Personal protective equipment of emergency room personnel**

- PPE level C
- Adequate protection
- Ability to perform essential tasks and procedures

**Medical care of chemical exposed victims**

- Recognition
- Triage
- Decontamination
- Life support
- Supportive treatment
- Specific treatment

- Only 3% of ED personnel experienced secondary contamination
- Symptoms: mild respiratory irritation
- Organophosphate, hydrofluoric acid and chlorine gas

- Antidotes may be used if the indication is fulfilled.

- Emergency department staff can effectively resuscitate in level C

- Water, soap and brush

- Decontamination of mass casualties:
  - Evaluating existing dogma.

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Conclusion

- The hazardous chemical exposure incident may create chaos, confusion and unpredictability, especially without appropriate preparedness.
- Application of toxicology principles and knowledge from previous incident are crucial parts of an effective response strategy.