

MODULE X

Toxic Exposures

OBJECTIVES

- Understand the increased vulnerability of children with toxic exposures
- Identify the basic goals of toxicological disaster preparedness
- Delineate the priorities of disaster scene staging and patient management when a hazardous material incident has occurred

“ALL HAZARDS” APPROACH

Creating a simultaneous plan for the more likely public health emergencies (earthquakes, floods, unintentional hazardous incidents, infectious outbreaks), as well as terrorist events.

VULNERABILITY OF CHILDREN

- Shorter stature
- Larger skin surface area to body mass ratio
- Less subcutaneous fat
- Less keratinization present in skin
- Higher minute ventilation
- Decreased fluid reserve
- Immature motor skills and cognitive functioning

GOALS: TOXIC EXPOSURE PREPAREDENESS

1. Prepare for a wide range of disasters
2. Know signs and symptoms of toxic exposures and the corresponding needed resource
3. Acquire skills and practice of proper treatment of injuries associated with toxic exposures
4. Prepare rational and effective responses, recognize and minimize dangers for personal safety
5. Provide anticipatory community education regarding the appropriate levels of community concern and community response to each type of toxicological disaster

FIRST PRIORITY

**Provide safety to the medical
and rescue personnel while
saving the greatest number of
lives possible**

UNIVERSAL PRINCIPLES

- Chain of Command
- Hot or Impact Zone
- Decontamination or Warm Zone
- Support/Cold Zone or Advanced Medical Post Zone

SECURITY

Unauthorized entry and exit between zones must be prevented



HAZARDOUS MATERIALS (HAZMAT)

Any material that can cause harm to people, property or the environment



EXPECTATIONS

1. Number of victims will potentially be overwhelming
2. Number of 'worried well' will likely exceed those with true injuries
3. The onset of symptoms and signs may be precipitous or delayed
4. Multiple toxins may be involved in a single incident
5. Victims may include EMS personnel
 - improper protection
 - unexpected events

PERSONNEL PROTECTION EQUIPMENT (PPE)

- The U.S. Environmental Protection Agency has designated 4 levels of PPE
- *Wearing a PPE requires special training*
- No PPE training, no presence at disaster scene

LEVEL A



LEVEL B



LEVEL C



LEVEL D



NEVER to be worn
in a hazardous
material incident!

RADIATION INCIDENTS

- A full-face mask with a HEPA filter should ideally be worn
- If not available, personnel should breathe through a wet cloth or handkerchief



RADIATION INCIDENTS

- Wear splash-proof clothing
- Gloves and socks should be tucked under clothes
- All seams (neck, arm cuffs, etc.) should be securely taped
- Wear a second pair of gloves over the first
- Wear water-proof shoe covers over shoes

RADIATION INCIDENTS



CLEAN-UP

- Clean all non-disposable gear with a 5% hypochlorite solution (1 part household bleach to 9 parts water)
- Protective clothing should be removed, bagged and discarded in a waste container labeled as “toxic waste”
- All personnel should then wash with copious amounts of soap and water

GENERAL APPROACH TO THE TOXICOLOGICAL PATIENT

- Always begin ABC's:
 - Airway
 - Breathing
 - Circulation
- Treat the patient first, not the poison

PHYSICAL EXAM

- Every patient must have a complete physical exam
- Note any odor on the patient's breath or skin as an aid to diagnosis
- Look for signs of trauma
- Assess mental status

DECONTAMINATION ZONE

- Goal: to prevent further patient exposure and contamination of the staff
- Should be divided into 2 groups:
 - Those who can remove their own clothing
 - Those who require assistance with clothing removal
- Clothes should be placed slowly and carefully in small bags labeled with the patient's name, address and phone number

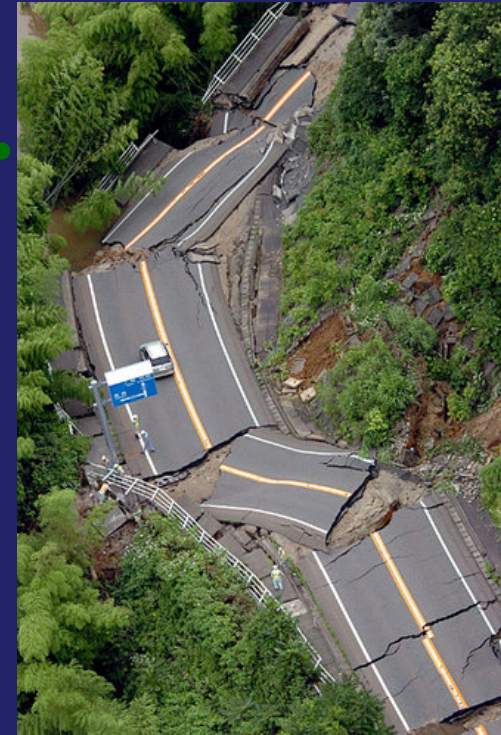
DECONTAMINATION PROCESS

- Moving from head to toe, flush the skin and hair with water for 3-5 minutes. Avoid getting water in the eyes
- Irritated eyes should be flushed with water or saline for at least 5 minutes
- Remove contact lenses when present

VOMITING PATIENTS

- With ingested chemicals, do not induce vomiting
- Encourage conscious patients to drink 4-8 ounces of water
- Vomitus: wipe up with towels and double bag the towels. These bags should also be labeled “toxic waste”

NATURAL DISASTERS



Earthquakes, volcanic eruptions

- Fatalities are due to physical injuries
- Aftershocks
- Tsunamies if close to coast
- Deaths from volcanoes usually due to ash

FIRES

- Are extremely common after any natural disaster
- Smoke inhalation claims the greatest numbers of lives
- The combustion products released are often difficult to predict and depend of what type of material is burning

FIRE VICTIM MANAGEMENT

- Strongly consider intubation in patients with soot surrounding their mouths and nares, voice changes, stridor and wheezing
- Widespread pulmonary changes usually take up to 24 hours to become evident on chest radiography
- Soot should quickly be removed from the patient's skin and eyes

CARBON MONOXIDE POISONING

- Frequently seen after natural disasters
- Use of damaged furnaces, generators, camp stoves or wood fires
- Is colorless and odorless
- Patients may complain of headache and have a flushed facial appearance

CYANIDE

- Consider cyanide exposure if synthetic materials were involved in a fire or in patients with CO monoxide poisoning who have metabolic acidosis
- Measure serum lactate, if possible
- Can get levels, but results usually delayed
- Treatment: hydroxocobalamin, or cyanide antidote kit + supplemental oxygen

ANIMAL DISPLACEMENT AFTER NATURAL DISASTERS

- Know what type of poisonous animals are prevalent in the community
- Where snakes are prevalent know bite management



MAN-MADE DISASTERS

- Chemical, Biologic, Nuclear, Thermomechanical
- Careful collection of data and reporting to the appropriate officials could be key to aiding in the most efficient detection and management of these types of disasters

CHEMICAL EXPOSURES

- Identify the state (solid, liquid, gas) of the chemical
- Identify the color, smell and/or after-taste
- Document time and place of symptom onset
- Note tasks being performed during or shortly before the onset of illness

CHEMICAL DISASTER RESOURCES

- If available, contact the regional Poison Control Center immediately
- Chemtrec (24-hour HAZMAT communication center)
 - 1 (800) 262-8200
 - <http://www.chemtrec.org>
- The internet can be a valuable tool in times of uncertainty

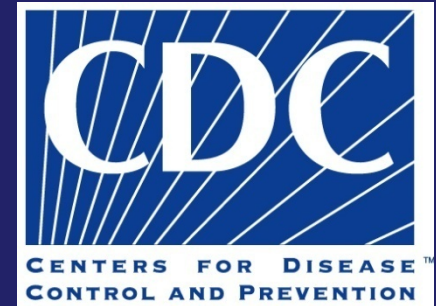


BIOLOGIC EXPOSURES

- Have significant potential to affect large portions of the population
- Symptoms develop more insidiously than chemical exposures. Therefore, patients will present at different times and locations
- Many therapies for biologic warfare agents have not been studied in children and therapeutic dosing may have to be adjusted for a child's size

BIOLOGIC DISASTER RESOURCES

- Contact the Center for Disease Control (CDC) for specific treatment and prophylactic guidelines pertaining to children
 - www.bt.cdc.gov
- Notify state and local health officials so an investigation into the possible outbreak can begin and appropriate infection control measures can be instituted



RADIATION EXPOSURES: DECONTAMINATION

- Slowly remove and double bag clothing
- Carefully scrub all open wounds with soap plus total body flushing
- All bodily fluids (urine, stool, vomit, etc.) are potentially contaminated and should be handled as toxic waste

RADIATION EXPOSURES: HOSPITAL MANAGEMENT

- Measure a complete blood count (CBC) as soon as possible
- Measure CBC's 3 times a day for the first 2-3 days to follow decline in lymphocytes
- Nasal and skin swabs along with urine and stool samples should be collected to identify external and internal contamination

DEPTH OF RADIATION EXPOSURE

- Exposed patients must have an individual radiation dose assessment calculated
- Clinical clues to the extent of exposure:
 1. Time to onset of nausea and vomiting
 2. Degree of absolute lymphocyte count decline
 3. Appearance of chromosome aberrations in the peripheral lymphocytes

ACUTE RADIATION SYNDROME

Phase	Time period	Description
Prodrome	Hours to days	Nausea and vomiting
Latent	Days to weeks	Resolution of acute symptoms
Illness Manifestation	Usually week 3-5	Intense immunosuppression
Recovery	Weeks to months	Resolution of acute symptoms

POTASSIUM IODIDE (KI)

Infants and children exposed to > 0.05 Gy (5 rads) should be treated with KI

Age	KI dosage (mg)
Birth to 1 month old	16
1 month to 3 years	32
4 years to 17 years	65
> 17 years or ≥ 70 kg	130

POTASSIUM IODIDE (KI)

Infants and children exposed to > 0.05 Gy (5 rads) should be treated with KI

Age	KI dosage (mg)
Birth to 1 month old	16
1 month to 3 years	32
4 years to 17 years	65
> 17 years or ≥ 70 kg	130

RADIATION EXPOSURES: DIETARY CONSIDERATIONS

- Radioiodine is secreted into breast-milk
 - If possible, exposed lactating mothers should not breast-feed their infants until deemed safe
- Radioiodine is also secreted into the milk of livestock and distributed on the local produce
 - These products should not be eaten until public health authorities have declared them safe for consumption

THERMOMECHANICAL DISASTERS

- Most patients will acutely present with physical injuries (head injuries, broken bones, burns, ear drum trauma)
- Watch for signs of smoke inhalation with carbon monoxide and cyanide as possible toxin exposures
- Rescue workers must remember to wear protective gears during these disasters as well

SUMMARY

1. Know your area's local industries
2. Know your area's susceptibility to all types of natural disasters
3. Know your area's venomous animal population
4. Be familiar with your community's and facility's disaster plans
5. Treat the patient first, not the poison