Decontamination of Chemical, Biological, and Radiological Agents

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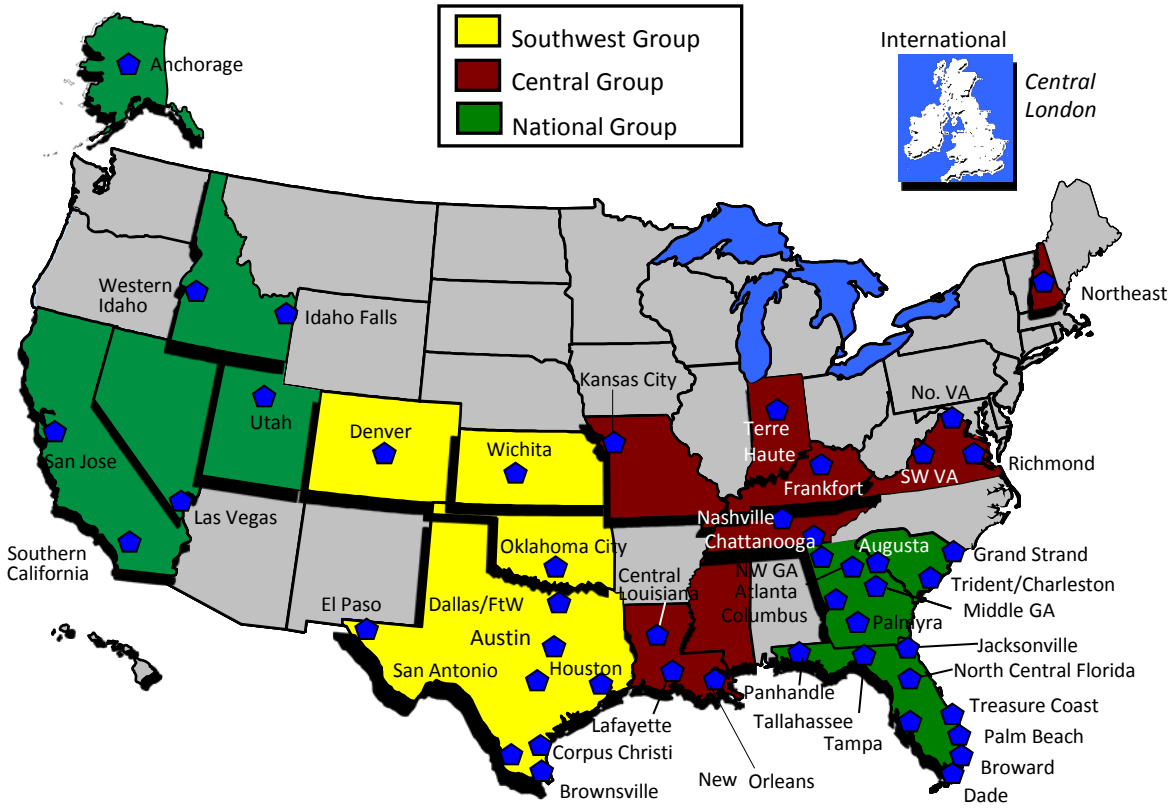
HCA Overview



- Accounted for approximately 5% of major hospital service in U.S.:
  - Admissions > 1.5 million
  - Patient Days > 7.6 million
  - Deliveries > 0.23 million
  - Total Surgeries > 1.3 million
  - ED Visits ~ 6 million
- 164 hospitals , 106 freestanding surgery centers, and 400 physician practices in 20 states and England
- Hospitals range from complex tertiary referral & academic medical centers to urban and suburban community medical centers
- ~ 194,000 employees
- 35,000 affiliated physicians
- More than 38,000 licensed beds
- ~ 150,000 Health Care Workers

Disaster Response

- 2001- Amerithrax
- 2005-Hurricane Katrina
- 2008- Hurricanes Gustav and Ike
- 2009- H1N1 Pandemic
- 2010- Haiti Earthquake, Nashville, TN Floods
- 2011- Hurricane Irene
- 2012-Virginia Storms, Hurricanes Isaac and Sandy, Fungal Meningitis Outbreak

Goal

- Discuss best practices for decontamination of patients exposed to chemical, biological, and radiological agents
- Discuss considerations during mass causality decontamination

Scope of Course

- Decontamination Overview
- Get Out of My Emergency Department
- Mass Causality Considerations
- Chemical Agent Decontamination
- Biological Agent Decontamination
- Radiological Agent Decontamination

Decontamination Defined

- Decontamination: A process that reduces toxic chemicals, pathogenic biological organisms, or radiological materials to levels that minimize the risk of (1) further harm to the victim and (2) cross contamination.

- Best Practices and Guidelines for CBR Mass Personnel Decontamination, DHHS, Sep 2004

Decontamination Methods

- There are two basic methods of decontamination
  - physical removal
  - neutralization
- Physical removal involves mechanical action with techniques such as gentle friction with a soft cloth or sponge, blotting, and washing.
- Neutralization involves methods and/or materials to counteract the harmful effects of the contaminant.

Decontamination Goals

- Remove the agent from the victim's skin and clothing, thus reducing further agent exposure and physical effects.
- Protect emergency responders, medical personnel and others from secondary transfer exposures.
- Prevent victims from spreading contamination over additional areas.

Decontamination Steps

- 1. Initial Size-Up
- 2. Victim Control and Decontamination Triage
- 3. Decontamination Setup
- 4. Decontamination Execution
- 5. Post Decontamination

Step 1: Initial Size-Up

- Performed in accordance with standard guidelines for first responders when arriving at an incident scene.
- Perform a safety assessment and attempt to identify signs/symptoms of exposure to determine whether decontamination is necessary.

Step 2: Victim Control and Decontamination Triage

- Gain initial control of the victims and direct them to area(s) of safe refuge so responders can provide guidance and instruction.
- Decontamination triage involves separating victims into prioritized groups for decontamination.
- Rapidly identifying victims who may not require decontamination can significantly reduce the time and resources needed to perform decontamination.

Step 3: Decontamination Setup

- Establish incident scene zones and set up the actual decontamination site.

Step 4: Decontamination Execution

- Perform decontamination
- Identification of victims who have been decontaminated and directing them to an area(s) of safe refuge for observation
- Decontamination with an emulsifier such as soap may be necessary if an oily liquid hazard (e.g.,sulfur mustard) is involved and initial decontamination is performed with water only.
- Use of a soap-water solution is best for physical removal of all hazards.

Step 5: Post Decontamination

- Observe victims for delayed symptoms and evidence of residual contamination;
- Perform secondary decontamination as necessary; arranging for clothing/cover for
- Recover personal items (if possible);
- Transport victims to medical facilities for follow-on care.

Hospitals

- First receivers, not first responders
- Level C for unknowns is acceptable
- Do you decontaminate again?
- “Hi, I’m contaminated!”
  - come here
- A tale of two ricins
- Tent city

HOSPITAL DECONTAMINATION

- 44,000 events reviewed / 2,562 events affected hospital workers
- Fifteen (0.05%) events were identified in which secondary contamination occurred.
- At least 17 medical personnel were injured as a result of secondary contamination while they were treating contaminated victims
- 12 were emergency medical technicians and 5 were hospital personnel.
- Respiratory irritation was the most common injury sustained.

Horton DK, Orr M, Tsongas T, Leiker R, Kapil V.; Secondary contamination of medical personnel, equipment, and facilities resulting from hazardous materials events, 2003-2006.; Disaster Med Public Health Prep. 2008 Jun;2(2):104-13.

Mass Causality Considerations

- DO NOT DELAY initial decontamination to set up decontamination tents, shelter tents, or to add soap.
- Three minutes is great, 30 seconds may be practical.
- Adequate spacing.
- Patients per hour?
- When the contamination involves oily, liquid chemical agent (e.g., sulfur mustard),rubbing without the aid of soap is not recommended

Important Tips

- Removing clothes is the single most critical step in mass decontamination and **may** remove 80-90% of physical contamination.
- Do not delay removal of clothes or application of a high-volume, low pressure water shower to set up tents, additional equipment or to create a soap-water solution.
- Conduct decontamination triage prior to administering a high-volume, low-pressure water shower.

Important Tips

- Wash time should be between 30 seconds and three minutes, depending on the situation.
- When the contamination involves chemical vapors, biological or radiological material, using gentle friction, such as rubbing with hands, cloth or sponges is recommended to aid in removal of the contamination.
- Rubbing should start with the head and proceed down the body to the feet.
- Secondary decontamination should be performed as necessary.

Special Considerations

- Non-liquid
  - If responders suspect the contamination is biological, radiological, or a gas/vapor, a water-only shower is typically adequate.
- Liquid
  - A secondary decontamination shower that includes a soap-water solution will likely be required for liquid contamination to ensure effective physical removal of agent.
  - When removing liquid chemical contamination (e.g., sulfur mustard), rubbing without the aid of soap is not recommended as it may increase spread of the agent over a larger surface area of the body, resulting in increased medical risk.

Special Considerations

- Cold Weather
  - Above 36 degrees, water is fine, and the cold can be tolerated.
  - Below 36 degrees, use dry decon (wiping, blotting, clothi) and use water when at a heated facility.

Clothing

- Removal of clothing down to the undergarments may remove as much as 80-90% contamination from the victims.
- When most of the victim's skin is covered with clothing, such as long pants and shirts, there is a greater likelihood of significant or total contamination removal.
- During warm weather when shorts and short-sleeve shirts are common, it is likely that a higher percentage of contamination will be directly on the skin of the victims.

Chemical Agents

- Include gross liquid, aerosol and vapor hazards
- Direct absorption of the chemical through the skin, and/or inhalation of aerosols and vapors.
- Effects may de immediate or delayed.
- For oily based chemical agents (e.g., VX nerve agent, sulfur mustard blister agent), decontamination with a water only shower may not remove all contamination from a victim's skin.

Chemical Agents

- Applying gentle friction, especially without soap, to oily based chemicals could cause victims to spread the agent over a larger percentage of their body and increase medical risk.
- They MUST remove clothes!

Biological Agents

- Symptoms typically delayed.
- Liquid or dry powder agent.
  - Quality counts!
- May be psychological benefit only.
- Soap and water.
- NO BLEACH!!!
- Risk of reaerosolization is low, no need to wet clothing first.

Biological Agents

Radiological Agents

- Easiest to detect (with the right equipment).
- Typically, not immediate effects, you can treat first.
- Inhalation hazard.
- Risk of reaerosolization is low, no need to wet clothing.

Radiation Doses and Dose Limits

Annual public dose limit	100 mrem
Annual natural background	300 mrem
Fetal dose limit	500 mrem
Barium enema	870 mrem
Annual radiation worker dose limit	5,000 mrem
Heart catheterization (skin dose)	26,000 mrem
Life-saving actions guidance (NCRP-116	50,000 mrem
Mild acute radiation syndrome	200,000 mrem
$LD_{50/60}$ for humans (bone marrow dose)	350,000 mrem
Radiation therapy (localized & fractionated)	6,000,000 mrem

Radiological Agents

- Carefully remove and bag patient's clothing and personal belongings (typically removes 95 percent of contamination).
- Survey patient and, if practical, collect samples.
- Handle foreign objects with care until proven nonradioactive with survey meter.
- Decontamination priorities:
  - Decontaminate wounds first, then intact skin.
  - Start with highest levels of contamination.
- Change outer gloves frequently to minimize spread of contamination.

Radiological Agents

- Protect non-contaminated wounds with waterproof dressings.
- Contaminated wounds:
  - Irrigate and gently scrub with surgical sponge.
  - Extend wound debridement for removal of contamination *only* in extreme cases and upon expert advice.
- Avoid overly aggressive decontamination.
- Change dressings frequently.
- Decontaminate intact skin and hair by washing with soap & water.
- Remove stubborn contamination on hair by cutting with scissors or electric clippers.
- Promote sweating.
- Use survey meter to monitor progress of decontamination.

Radiological Agents

- Cease decontamination of skin and wounds:
  - When the area is less than twice background, or
  - When there is no significant reduction between decon efforts, and
  - Before intact skin becomes abraded.
- Contaminated thermal burns
  - Gently rinse. Washing may increase severity of injury.
  - Additional contamination will be removed when dressings are changed.
- Do not delay surgery or other necessary medical procedures or exams . . . residual contamination can be controlled.

Radiological Agents

- Wound care, burn care, and surgery should be done in the first 48 hours or delayed for 2 to 3 months (> 100 rem).
- ALARA

Conclusion

- Do something now.
- Soap is good.
- No bleach.
- Water down to 36 degrees.
- Lots of people, or just a few, or something in between.