Radiological Terrorism

Emergency Management Pocket Guide for Clinicians

Centers for Disease Control and Prevention
2005

Emergency Management Pocket Guide
This pocket guide is designed for clinicians, including physicians, nurses, and other health care professionals, who will provide emergency care in a hospital setting following a radiological terrorism incident. This guide is designed as a supplement to the CDC training program *Radiological Terrorism: Just in Time Training for Hospital Clinicians.*

ADDITIONAL RESOURCES

Radiation Emergency Assistance Center/Training Site (REAC/TS)
Phone: (865) 576-3131
M-F, 8am – 4:30pm EST
(865) 576-1005 (after hours)
Web: www.orau.gov/reacts

Centers for Disease Control and Prevention (CDC)
Phone: (800) CDC-INFO
Web: www.bt.cdc.gov/radiation

Armed Forces Radiobiology Research Institute, Medical Radiobiology Team
Phone: (301) 295-0530
Web: www.afrri.usuhs.mil

State and Local Emergency Response (record below):

RADIATION PRINCIPLES

Radiation cannot be detected by the human senses. A radiological survey conducted with specialized equipment is the only way to confirm the presence of radiation. If a terrorist event involves the use of radioactive material, both patient exposure and contamination must be assessed.

Exposure occurs when a person is near a radiation source. People exposed to a source of radiation can suffer radiation illness if their dose is high enough, but they do not become radioactive. For example, an x-ray machine is a source of radiation exposure. A person does not become radioactive or pose a risk to others following a chest x-ray.

Contamination occurs externally when loose particles of radioactive material are deposited on surfaces, skin, or clothing. Internal contamination occurs when radioactive particles are inhaled, ingested, or lodged in an open wound.

Contaminated patients should be decontaminated as soon as possible, without delaying critical care. Patients who have been exposed to radiation, but are not contaminated with radioactive material, do not need to be decontaminated.

MEDICAL MANAGEMENT PRINCIPLES

- Addressing contamination issues should not delay treatment of life-threatening injuries.
- It is highly unlikely that the levels of radioactivity associated with a contaminated patient would pose a significant health risk to care providers.
- In certain rare instances, the presence of imbedded radioactive fragments or large amounts of external contamination may require expedited decontamination.
- Include in-house radiation professionals on the response team.

STAFF PROTECTION GUIDELINES

Establish an ad hoc triage area.
- Base the location on your hospital's disaster plan and the anticipated number of casualties.
- Establish a contaminated area and clean area separated by a buffer zone.
- Remove your contaminated outer garments when leaving the contaminated area.
- Have your body surveyed with a radiation meter when exiting a contaminated area.

Use standard precautions to protect staff.
- Follow standard guidelines for protection from microbiological contamination.
- Surgical masks should be adequate.
- N95 masks, if available, are recommended.
- Survey hands and clothing at frequent intervals with a radiation meter.
- Due to fetal sensitivity to radiation, assign pregnant staff to other duties.

DECONTAMINATION GUIDELINES

Survey the patient with a radiation meter.
- Perform surveys using consistent technique and trained personnel.
- Note exceptionally large amounts of surface or imbedded radioactive material.
- Handle radioactive objects with forceps and store in lead containers.
- Record location and level of any contamination found.

Remove patient clothing.
- Carefully cut and roll clothing away from the face to contain the contamination.
- Double-bag clothing using radioactive hazardous waste guidelines, label, and save as evidence.
- Repeat patient survey and record levels.

Cleanse contaminated areas.
- Wash wounds first with saline or water.
- If facial contamination is present, flush eyes, nose, and ears, and rinse mouth.
- Gently cleanse intact skin with soap and water, starting outside the contaminated area and washing inward.
- Do not irritate or abrade the skin.
- Resurvey and note levels.
- Repeat washing until survey indicates radiation level is no more than twice background or the level remains unchanged.
- Cover wounds with waterproof dressing.
- Dispose of waste water through normal channels.
- For mass casualties, consider establishing separate shower areas for ambulatory and non-ambulatory patients.

RADIATION-RELATED ILLNESS/INJURY

Acute radiation syndrome (ARS)
ARS is caused by high doses of radiation being rapidly delivered to large portions of the body. The most probable terrorist events, such as the use of a dirty bomb, will likely generate low levels of radiation exposure. If ARS cases are seen, small casualty numbers are likely.

- Time of exposure, distance from radioactive source, and duration of exposure should be noted.
- Patients can present individually if exposed to radioactive sources hidden in the community.
- Symptoms can be immediate or delayed, mild or severe, based on radiation dose.
- Nausea, vomiting may occur minutes to days after exposure. Time of onset of vomiting is a major factor in diagnosis and dose estimation (See Table 1).
- Early onset of vomiting followed by symptoms of bone marrow suppression, gastrointestinal destruction, and/or cardiovascular/central nervous system effects is indicative of acute illness.
- Depending on the stage of illness, a patient may be asymptomatic.

Diagnosis and treatment

- Perform sequential CBCs with differential to assess progressive declines in lymphocyte levels (See Andrews Lymphocyte Nomogram).
- Monitor for fluid and electrolyte balance and evidence of hemodynamic instability.
- Treat symptomatically with focus on prevention of infection, including antibiotics.
- Consider cytokines, e.g. Neupogen®, and hematopoietic growth factors.
- Perform surgical interventions within the first 48 hours or delay until after hematopoietic recovery.
- Consider use of biodosimetry dose assessment software from www.afrri.usuhs.mil.

Cutaneous radiation injury (CRI)
CRI is acute radiation injury to the skin.

- Skin damage can manifest within hours, days, or weeks after radiation exposure.
- Transient itching, tingling, erythema, or edema may be seen within hours or days after exposure, and is usually followed by a latent period.
- Lesions may not be seen for weeks to months post exposure, but then can be debilitating or even life-threatening.
- Delayed occurrence of lesions is a differentiating factor from thermal burns.
- Note time of occurrence of signs and symptoms and progressive changes in appearance.
- Treat localized injuries symptomatically, focusing on pain and infection control.

Internal contamination
Internal contamination should be considered if persistently high survey readings are noted following decontamination. Internal contamination generally does not cause early symptoms.
Nose or mouth contamination may indicate inhalation or ingestion.

- Assessment may include analysis of urine, blood, and fecal samples or whole body counts. Consult with radiation experts.
- Radiation experts may recommend early administration of radionuclide-specific decorporation agents such as Prussian Blue, DTPA, or Bicarbonate.
- Gastric lavage, antacids, and cathartics assist in clearing ingested contaminants.

Psychosocial issues

- In urban areas, hundreds to thousands may seek care. The majority will self-refer to the nearest hospital. Many will need decontamination. Many may seek radiological screening, but will not be contaminated. Many will simply seek reassurance.
- Psychogenic illness symptoms, such as nausea or vomiting, may manifest.
- Vomiting due to radiation exposure is usually recurrent rather than episodic.
- Include mental health professionals on the response team.
- Have radiation exposure fact sheets available for patients and families.
- Pregnant patients require special counseling.
- Separate areas for radiation screening and counseling could be needed for patients with minimal risk of exposure or injury.

MANAGEMENT OF DECEASED

- If exposed to a lethal dose of radiation without contamination, a patient is not radioactive and no special precautions are needed.
- Special precautions may be necessary for contaminated deceased.

Table 1.

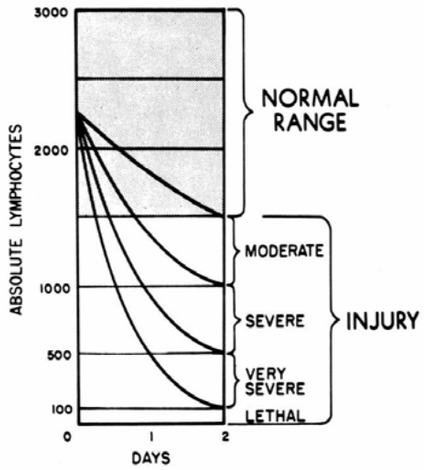
Estimation of External Radiation Dose Related to Onset of Vomiting*

Vomiting Post Incident	Estimated Dose	Degree of ARS
Less than 10 minutes	> 8 Gy	Lethal
10-30 minutes	6-8 Gy	Very Severe
Less than 1 hour	4-6 Gy	Severe
1-2 hours	2-4 Gy	Moderate
More than 2 hours after	Less than 2 Gy	Mild

* For acute external exposures only.
Gray (Gy) is the SI unit of measurement for radiation absorbed dose.

Adapted from: Berger ME, Leonard RB, Ricks RC, Wiley AL, Lowry PC. *Hospital Triage in the First 24 Hours After a Nuclear or Radiological Disaster*. REAC/TS (Radiation Emergency Assistance Center/ Training Site); http://www.orau.gov/reacts: 2004.

Andrews Lymphocyte Nomogram



From: Andrews GA, Auxier JA, Lushbaugh CC. *The Importance of Dosimetry to the Medical Management of Persons Exposed to High Levels of Radiation.* In *Personal Dosimetry for Radiation Accidents*. Vienna: International Atomic Energy Agency; 1965.

Pocket Guide Web Access:
www.bt.cdc.gov/radiation/pocket.asp.

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