

Radiological Preparedness & Emergency Response

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INTERNATIONAL
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ATOMIC ENERGY

Radiological Preparedness & Emergency Response

Session VI

Clinical Evaluation of Acute and Subacute Radiation Injuries 2

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Objectives

- Discuss the diagnosis of acute radiation syndrome (ARS).
- Describe the management of ARS.
- Discuss the Cutaneous Radiation Syndrome (CRS) and Local Radiation Injury.
- Describe the management of CRS.

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Acute Radiation Syndrome (ARS)

- Deterministic effect.
- Prodrome phase.
- Hematopoietic syndrome.
- Gastrointestinal syndrome.
- CV/CNS syndrome.



Prodrome

- Vague Sx: nausea, vomiting, headache.
- Help predict the dose: the higher the absorbed dose the earlier and the more frequent the Sx occur.

Dose Estimate	Victims with Vomiting	Time to Onset of Vomiting
Gy	%	h
0	-	-
1	19	
2	35	4.63
3	54	2.62
4	72	1.74
5	86	1.27
6	94	0.99
7	98	0.79
8	99	0.66
9	100	0.56



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Time to Vomiting:

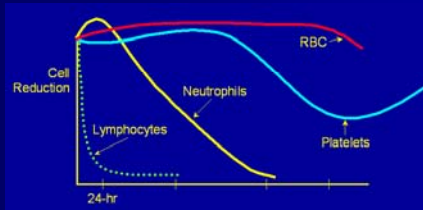
- Patients experiencing a time to vomiting less than 4 hours after their exposure should receive immediate medical care, and those that vomit in less than 1 hour often die.
- Patients who vomit after 4 hours will require less urgent care.



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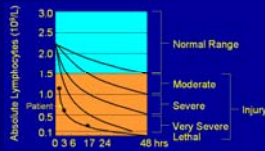


Hematopoietic Syndrome (2-6 Gy)



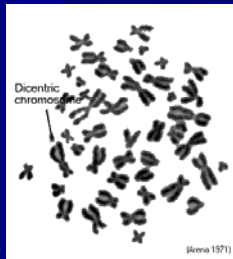
Lymphocyte Depletion Kinetics

- Andrew's nomogram helps estimate the dose of radiation.
- WBC with differential every 6 hrs for first 24-48 hours.



Cytogenetics

- Rate of dicentric chromosomes in peripheral lymphocytes.
- Available at REAC/TS and AFRR1
- Takes up to a week.



Management of the Hematopoietic Syndrome

- Complications: infection and bleeding.
- Treatment is primarily supportive:
 - Reverse isolation
 - IVF
 - Blood products (irradiated)
 - Antibiotics before the onset of fever
 - Colony stimulating factors such as filgrastim or G-CSF (300 mcg s/c per day)
 - GM-CSF and peg-G-CSF
 - Stem cell transplant for severe cases (save early blood sample)



ARS: Gastrointestinal Syndrome

- Dose > 800 rads (8 Gy).
- Vomiting, diarrhea, hemorrhage and CV collapse.
- Treatment is supportive.
- Analgesia, antiemetics, IVF.
- Prognosis is bad.



ARS: CV/CNS Syndrome

- Dose > 2,000 rads (20 Gy).
- Cerebral edema, coma and death.
- Treatment is palliative.
- Prognosis is very poor.



Scenario from Grady Hospital

- Male patient presents with
- He denies any thermal or electrical injury.
- Works as a Janitor at GA Tech.
- Time of onset is uncertain.



Schwartz M, Morgan B. Response to a Suspected Victim of a Weapon of Mass Destruction. Clin Tox September 2000;38.No. 5:577



Local Radiation Injury/Cutaneous Radiation Syndrome

- Deterministic effect.
- Burn that occurs with or without systemic manifestations including immune dysfunction.
- Complications may be delayed and secondary to vascular insufficiency, multiorgan malfunction and sepsis.
- Management includes analgesia, early surgical grafting, topical steroids and prophylactic antibiotics.
- Hyperbaric oxygen therapy has had mixed reviews.



Local Radiation Injury/CRS

- May be divided into several types:
 - Erythema
 - Epilation
 - Dry desquamation
 - Wet desquamation
 - Necrosis



Worker in Gilan, Iran-1996

- Worker at a fossil fuel plant found a loose iridium radiography source on the ground and placed it in his right breast pocket for 1.5 hrs.
- He removed it due to dizziness, lethargy, burning feeling in the chest, and nausea.



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Erythema

- Manifests at different stages.
- If dose is 3 Gy, then onset at 3 weeks.
- If dose is 6 Gy, then onset at 24-48 hours. It then disappears to reappear days later.





Start of redness of the right side of the chest and upper abdomen on Day 6.

PHOTO 2. Dark erythema with dry desquamation starting at the nipple on Day 12.



Source IAEA



Epilation

- Body hair loss.
- Dose > 3 Gy.
- Takes 2-3 weeks to develop.



Dry Desquamation

- Dryness or peeling of the skin.
- Dose > 10 Gy.
- Time to expression 2 to 4 weeks.



PHOTO 1. Skin, erythema with dry desquamation starting at the upper chest (Fig. 2).



Moist Desquamation

- Blisters.
- Dose 15-25 Gy.
- Occurs between 2-8 weeks.



28 Large holes in palm surface of the hand. Skin wet desquamation.

Pt from Goiânia Incident (IAEA)



Moist Desquamation





PHOTO 7. Moist desquamation on the medial side of the right antecubital fossa on Day 25.





Necrosis

- Dose > 50 Gy.
- Occurs from days to weeks.



PHOTO 3. Necrosis of the epidermis on Day 53 (the white spots refer to silver nitrate).





PHOTO 6. Loss of epidermis on the right side of the chest on Day 70.

PHOTO 11. An epidermal graft from the edge of the chest skin on Day 70.



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PHOTO 17. Chest graft (made on Day 63) well taken on Day 85.



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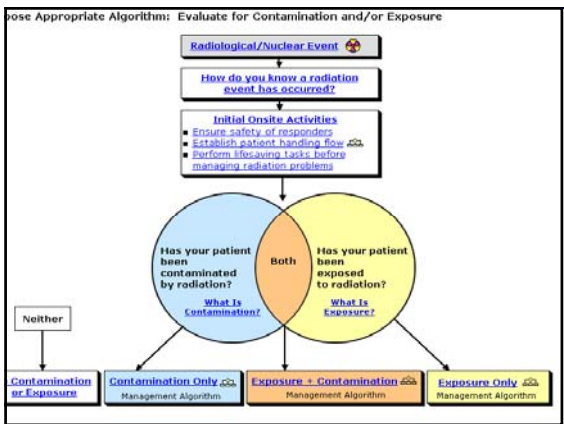


Helpful Resources

REMM Website



- Radiation Emergency Medical Management.
- www.remm.nlm.gov



CDC Radiation Studies Branch

- www.emergency.cdc.gov/radiation
- Fact Sheets
- Tool Kits
- Virtual CRC

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The screenshot shows the CDC Radiation Emergencies website. At the top, it states: "http://radiationemergencies.cdc.gov CDC has a key role in protecting the public's health in an emergency involving the release of radiation that could harm people's health. This site provides information to help people protect themselves during and after such an event. It also provides information for professionals involved in planning for and responding to this type of emergency." On the right, there is a banner for "EMERGENCY TMS SQUAD: Public Health and Radiation Emergency Preparedness" with the text "PLAN TO ATTEND March 21 - 24, 2011, Conrad Plaza Hotel, Atlanta, Georgia" and logos for EDC and NACCR. The main content includes sections for "Your Health and Safety (/radiation/healthandsafety.asp)", "Protecting Yourself and Your Family", "Health Effects and Treatment", "Radiation and Pregnancy", "Types of Radiation Emergencies", "Training and Tools for Professionals (/radiation/training.asp)", and "Info for Professionals (/radiation/groups.asp)".

REACTS

- Radiation Emergency Assistance Center/Training Site
- *orise.orau.gov/reacts*

The slide also features the logo for NACCR (National Association of Certified Radiation Technicians) at the bottom right and the text "Radiological Preparedness & Emergency Response" at the bottom.

Summary Points

- ARS consists of a prodrome and 3 sub-syndromes.
- The hematopoietic syndrome is survivable.
- The onset of vomiting and serial absolute lymphocyte counts can assist in triage of victims.
- The cutaneous radiation syndrome is delayed in onset.
- Supportive care is key.

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Any Questions?

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