





Radiological Preparedness & Emergency Response



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Session VI



Clinical Evaluation of Acute and Subacute Radiation Injuries 2



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Objectives

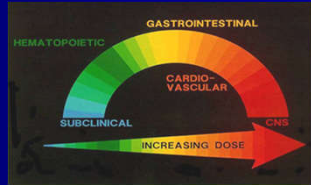
- Discuss the diagnosis of acute radiation syndrome (ARS).
- Describe the management of ARS.
- Discuss the Cutaneous Radiation Syndrome (CRS) and Local Radiation Injury.
- Describe the management of CRS.



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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:

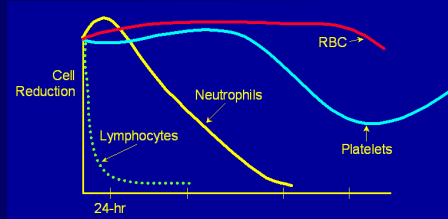
- Patients experiencing a time to vomiting less than 4 hours after their exposure should receive immediate medical care, and those that vomit in less than 1 hour often die.
- Patients who vomit after 4 hours will require less urgent care.



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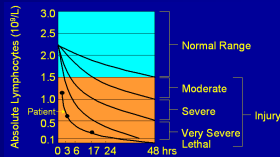


Hematopoietic Syndrome (2-6 Gy)



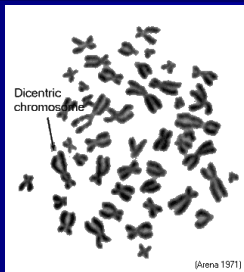
Lymphocyte Depletion Kinetics

- 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 AFRR
- 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.





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

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



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



Moist Desquamation

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



24 - Erythema and moist desquamation on palmar surface of the hand. Skin not desquamated.

Pt from Goiania Incident (IAEA)



Moist Desquamation



19. Both hands showing vesicles over and around the 2nd and 5th fingers.



Photo 12. Blistering of the right hand palmar surface of the 2nd, 4th and 5th fingers (23 April 1999).



16. Palmar swelling of lesion on palmar surface of the hand.





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



PHOTO 6. Erythema and vesicicles on the left palm on Day 25.





PHOTO 15. Moist desquamation on the left palm on Day 25.



Necrosis

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



PHOTO 9. Necrosis of the epidermis on Day 15 (the white spots refer to adhesion).





PHOTO 8. Loss of epidermis on the right side of the chest on Day 25.

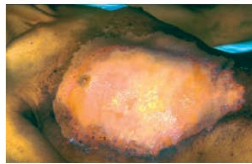


PHOTO 11. Re-epithelialization from the edges of the chest lesion on Day 25.



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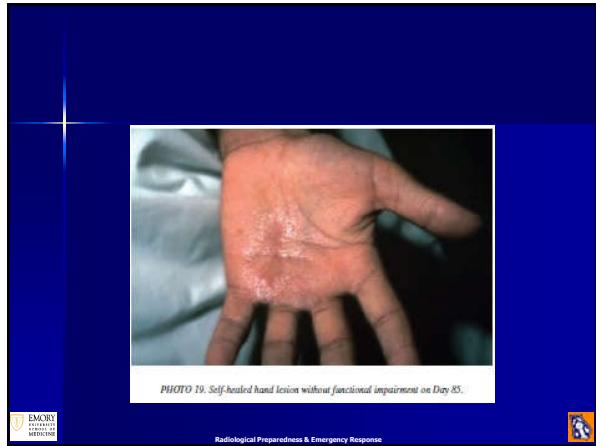


PHOTO 17. Chest graft (made on Day 63) well taken on Day 85.



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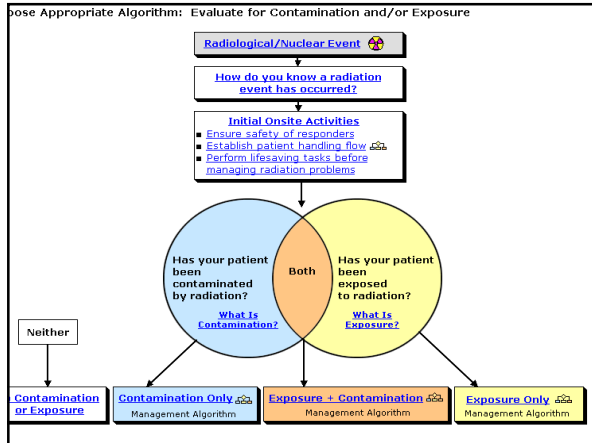




REMM Website

- 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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Any Questions?



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