Radiological Preparedness & Emergency Response

Session VI

Clinical Evaluation of Acute and Subacute Radiation Injuries 2

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.
Acute Radiation Syndrome (ARS)

- Deterministic effect.
- Prodrome phase.
- Hematopoetic 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.

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.
Hematopoetic Syndrome (2-6 Gy)

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

Lymphocyte Depletion Kinetics

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


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.

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.
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.

Moist Desquamation

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

- Dose > 50 Gy.
- Occurs from days to weeks.
**REMM Website**

- Radiation Emergency Medical Management.
- [www.remm.nlm.gov](http://www.remm.nlm.gov)

**CDC Radiation Studies Branch**

- [www.emergency.cdc.gov/radiation](http://www.emergency.cdc.gov/radiation)
- Fact Sheets
- Tool Kits
- Virtual CRC
Summary Points

ARS consists of a prodrome and 3 sub-syndromes.
- The hematopoetic 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.