Radiation exposure

Aliases

None noted

Patient care goals

1. Prioritize identification and treatment of immediately life-threatening medical conditions and traumatic injuries above any radiation-associated injury.
2. Identify and appropriately treat acute radiation injury.
3. Reduce risk for contamination of personnel while caring for patients potentially or known to be contaminated with radioactive material.

Patient presentation

Inclusion criteria

1. Patients who have been acutely exposed to ionizing radiation from accidental environmental release of a radioactive source.
2. Patients who have been acutely exposed to ionizing radiation from a non- accidental environmental release of a radioactive source.
3. Patients who have been contaminated with material emitting ionizing radiation.

Exclusion criteria

1. Patients exposed to normal doses of ionizing radiation from medical imaging studies.
2. Patients exposed to normal doses of ionizing radiation from therapeutic medical procedures.

Patient management

Assessment

1. Don standard PPE capable of preventing skin exposure to liquids and solids (gown and gloves), mucous membrane exposure to liquids and particles (face mask and eye protection), and inhalational exposure to particles (N95 face mask or respirator).
2. Identification and treatment of life-threatening injuries and medical problems takes priority over decontamination.
3. Do not eat or drink any food or beverages while caring for patients with radiation injuries until screening completed for contamination and appropriate decontamination if needed.
4. Use caution to avoid dispersing contaminated materials.
5. Provide appropriate condition-specific care for any immediately life-threatening injuries or medical problems.

Treatment and interventions

1. If patient experiences nausea, vomiting, and/or diarrhea:
    a. Provide care, per Nausea-Vomiting Guideline**.**
    b. Document the time gastrointestinal symptoms started.
2. If seizure occurs:
    a. Consider a primary medical cause or exposure to possible chemical agents unless indicators for a large whole-body radiation dose (greater than 20 Gy (Gray)), such as rapid onset of vomiting, are present.
    b. Treat per Seizures Guideline**.**

Patient safety considerations

Treat life-threatening medical problems and traumatic injuries prior to assessing for and treating radiation injuries or performing decontamination.

Notes and educational pearls Key considerations

1. Irradiated patients pose no threat to medical clinicians.
2. Contaminated patients pose very little threat to medical clinicians who use appropriate PPE including N95 masks or respirators, gloves, gowns, and face and eye protection.

3. Sources of radiation
    a. Legal
        i. Industrial plants
        ii. Health care facilities that provide radiologic services
        iii. Nuclear power plants
        iv. Mobile engineering sources (i.e., construction sites that are installing cement)
    b. Illegal
        i. Weapons of mass destruction
        ii. "Dirty bomb" design to contaminate widespread areas
4. Physiology of radiation poisoning
    a. Contamination: Poisoning from direct exposure to a radioactive source, contaminated debris, liquids, or clothing where radiation continues to be emitted from particles on surface
    b. Exposure: Poisoning from radioactivity, in the form of ionizing rays, penetrating through the bodily tissues of the patient
5. Common types of radioactivity that cause poisoning
    a. Gamma rays
        i. Highest frequency of ionizing rays
        ii. Penetrates the skin deeply
        iii. Causes the most severe radiation toxicity
    b. Beta rays: can penetrate up to 1 cm of the skin's thickness
    c. Alpha rays
        i. Lowest frequency of ionizing rays
        ii. Short range of absorption
        iii. Dangerous only if ingested or inhaled
    d. Radioactive daughters
        i. Products of decay of the original radioactive substance
        ii. Can produce gamma and beta rays (i.e., uranium decays into a series of radon daughters)
6. In general, trauma patients who have been exposed to or contaminated by radiation should be triaged and treated based on the severity of their conventional injuries.
7. A patient who is contaminated with radioactive material (i.e., flecks of radioactive material embedded in their clothing and skin) generally poses a minimal exposure risk to medical personnel, although should not be placed in a contained space before decontamination.
8. EMS clinicians may be asked to assist public health agencies in the distribution and administration of potassium iodide in a mass casualty incident involving radiation release or exposure.
9. Stages of radiation sickness
    a. Prodromal: nausea, vomiting, diarrhea, fatigue, fever, agitation, starting hours up to 4 days after initial exposure
    b. Latent: May last up to four weeks (this is the maximum period for immunocompromise due to radiation exposure); however, time span may be less as dose of radiation exposure increases. Symptoms include anorexia, fever, weakness, bleeding, diarrhea, potentially altered mental status after two to three weeks
    c. Recovery: may take weeks to months

Pertinent assessment findings

1. Treatment of life-threatening injuries or medical conditions takes priority over assessment for contamination or initiation of decontamination.
2. Time to nausea and vomiting is a reliable indicator of the received dose of ionizing radiation. The more rapid the onset of vomiting, the higher the whole-body dose of radiation.
3. Tissue burns are a late finding (weeks following exposure) of ionizing radiation injury. If burns are present acutely, they are from a thermal or chemical mechanism.
4. Seizures may suggest acute radiation syndrome if accompanied by early vomiting. If other clinical indicators do not suggest a whole-body dose of greater than 20 Gy, consider other causes of seizure.
5. Delayed symptoms (days to weeks after exposure or contamination)

a. Skin burns with direct contact with radioactive source
b. Skin burns or erythema from ionizing rays
c. Fever
d. Bone marrow suppression presenting as:
    i. immunosuppression
    ii. Petechiae
e. Spontaneous internal and external bleeding