ACUTE RADIATION SYNDROME

Background:

Acute radiation syndrome (ARS) ARS is an acute illness caused by irradiation of the entire body (or most of the body) by a high dose of penetrating radiation (gamma rays, certain x-rays and neutrons) in a very short period of time (usually a matter of minutes). The major cause of this syndrome is depletion of immature parenchymal stem cells in specific tissues. Examples of persons who suffered from ARS are the survivors of the Hiroshima and Nagasaki atomic bombs and the firefighters that first responded after the Chernobyl Nuclear Power Plant event in 1986. All suspected or confirmed cases of acute radiation exposure must be reported to the local department of public health and the Illinois Department of Public Health (IDPH).

Signs/Symptoms:

ARS usually presents in four phases. There also are three classic ARS syndromes described.

Prodromal Phases:

1) Prodromal stage (N-V-D stage): The classic symptoms for this stage are nausea, vomiting and possibly diarrhea (depending on dose) that occur from minutes to days following exposure. The symptoms may last (episodically) for minutes up to several days. Symptoms which begin soon after exposure indicate a higher exposure and a poor prognosis of the patient.
2) Latent stage: In this stage, the patient generally looks and feels healthy for a few hours or even up to a few weeks.
3) Manifest illness stage: In this stage, the symptoms depend on the specific syndrome and last from hours up to several months.
4) Recovery or death: Most patients who do not recover will die within days to several months after exposure. The recovery process may last from several weeks up to two years.

ARS Syndromes:

1) Bone Marrow Syndrome (also referred to as hematopoietic syndrome): The full syndrome usually will occur with a dose between 0.7 and 10 Gy (70 - 1,000 rads) though mild symptoms may occur as low as 0.3 Gy or 30 rads. The survival rate of patients with this syndrome decreases with increasing dose. The primary cause of death is the destruction of the bone marrow, resulting in sepsis and hemorrhage.
2) Gastrointestinal (GI) syndrome: The full syndrome usually will occur with a dose between 10 and 100 Gy (1,000 - 10,000 rads) though some symptoms may occur as low as 6 Gy or 600 rads. Survival is extremely low with this syndrome. Destructive and irreparable changes in the GI tract and bone marrow usually cause infection, dehydration and electrolyte imbalance. Death usually occurs within two weeks.
3) Cardiovascular (CV)/Central Nervous System (CNS) syndrome: The full syndrome usually will occur with a dose greater than 50 Gy (5,000 rads) though some symptoms may occur as low as 20 Gy or 2,000 rads. Patients experience confusion, disorientation, seizures, cerebral edema and coma. Death occurs within three days.

Laboratory and Diagnostic Testing:

1) CBC, basic blood chemistries.
2) Geiger counter: Individuals exposed to ionizing radiation only will not register. Individuals contaminated with radioactive liquids or solids will register with the Geiger counter.

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Treatment:

Call the Radiation Emergency Assistance Center/Training Site (REAC/TS) at (865) 576-3131 (M-F, 8 am to 4:30 am EST) or (865) 576-1005 (after hours) to record the incident in the Radiation Accident Registry System.

Decontamination:

Individuals exposed to ionizing radiation only do not need decontamination. Individuals contaminated with radioactive liquid or solids will need removal of clothes and irrigation. Success of decontamination can be measured with a Geiger counter.

Supportive Care:

1) Treat associated traumatic injuries first.

2) GI symptoms: IVF replacement, antiemetics, anti-diarrheals, prophylaxis for potential GI ulceration.

3) Monitor CBC (especially the lymphocyte count) every 2 to 3 hours for the first 8 to 12 hours following exposure (and every 4 to 6 hours for the following 2 or 3 days). See Andrew's Lymphocyte Curve for prognosis at end of guideline.

4) Record all clinical symptoms, particularly nausea, vomiting, diarrhea, and itching, reddening or blistering of the skin (especially the time of onset).

5) Comfort measures with attention to pain management

6) Consider tissue, blood typing, and initiating prophylaxis for infectious agents if warranted.

7) Consult with radiation, hematology, and radiotherapy experts in regards to dosimetry, prognosis and treatment options.

After consultation, consider:

a. Supportive care in a clean environment (e.g., burn unit)

b. Prevention and treatment of infections in neutropenic patients

c. Cytokine Therapy (GM-CSF or G-CSF)

d. Transfusion of red cells or platelets as needed. Must use irradiated blood to prevent graft vs. host disease in the immunosuppressed ARS patient.

e. Stem cell transplant

f. Psychological support

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Patterns of early lymphyocyte response in relation to dose.