

Acute Radiation Syndrome (ARS) Fact Sheet

Respond:

- Contact the Radiation Emergency Assistance Center/Training Site (REAC/TS) at 865-576-1005 to speak to a health physicist, if you do not have one immediately available, to discuss high-dose radiation exposures.
- Call Minnesota Duty Officer 800-422-0798 (Greater MN only) or 651-649-5451 (Twin cities metro & outside MN).
- Refer patient to a level 1 trauma center (if concurrent traumatic injuries) or a tertiary care institution if needed.
- Consider neutropenic precautions and antibiotic prophylaxis protocols for lymphopenic patients. Discuss with radiation health physicist and infectious disease staff.

Recognize:

- Obtain a history of the event, dose of exposure and likely isotopes. ARS should be expected to result from nuclear detonations, large exposures to radioactive particulates or from a significant occupational irradiation event, but not usually from radiological dispersal devices (RDD's). Because burns, blast injuries and other trauma may be present, plan for a multidisciplinary approach involving the health physicist, surgeons, oncologists and critical care specialists.
- Internal and external contamination may be present. See RDD Fact Sheet for details of initial assessment and decontamination.

Pathophysiology/Triage Information (1):

- ARS is due to the effect of ionizing radiation dose, most commonly in the form of gamma ray exposure to the DNA of rapidly dividing cells.
- Increasing radiation doses sequentially trigger sub-syndromes due to cell damage in this order: hematopoietic, GI, and neurovascular. Three phases are identified in sequence: prodrome, latency and illness. The sooner these organs display symptoms (minutes or hours vs. days), the more likely a lethal exposure. Exception: hematopoietic GI prodrome.
- **Hematopoietic sub-syndrome:** due to stem cell death. LD50 (the amount of a material given all at once which causes the death of 50% of a group of test animals)= 3 Gray (Gy) (1 Gy=100 rads). LD 50 is one way to measure acute toxicity of a material.
 - Prodrome= nausea/vomiting/diarrhea in 1-2 days.
 - Latent period= gradual pancytopenia with peak effects at 12-30 days; however, a marked drop of lymphocytes within 48 hours (>50%) suggests lethal potential.
 - Illness =ongoing GI symptoms, infection and sepsis due to pancytopenia, acute respiratory distress syndrome and multisystem organ failure syndrome.
- **GI sub-syndrome:** due to death of cells lining GI tract. Progressively worse from 3-30 Gy.
 - Prodrome = vomiting and diarrhea after a few hours, lasting 1-2 days.
 - Latent period from days 2-7 = improved GI symptoms.
 - Illness after days 7-9 = bleeding, fluid losses and sepsis due to loss of GI mucosal protection. The extent of illness depends on the dose.
- **Neurovascular sub-syndrome:** due to CNS vascular endothelial damage >20 Gy.
 - Symptoms/signs include confusion, vomiting, brain edema, seizures and early death.
 - Neurological symptoms due to radiation imply a fatal prognosis; however, be careful to look for traumatic, toxic, and other causes of similar symptoms.
- Long-term radiation effects include cancer and psychological impairment.

Treat:

- Address life-threatening conditions and significant injuries first. Involve a health physicist and surgeon for wound care to assure maximal debridement and removal of contamination when particulates are a concern.
- Initial treatment priorities involve good critical care and bone marrow support/rescue including: the ABC's of resuscitation, usual trauma/burn care and fluid management. After the first few days, blood product replacement and infection control will predominate for the next 3 months.
- 48-hour post-exposure absolute lymphocyte counts are highly predictive of outcome.
- Trauma surgeries should be done early (within the first week). Further surgeries may need to be delayed up to 3 months due to bone marrow suppression. Consult with surgeon and health physicist about timing.

(1) Radiological and Nuclear Terrorism: Medical Response to Mass Casualties, January 2004, Retrieved May 10, 2008 from: <http://www.bt.cdc.gov/radiation>



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