RADIATION EXPOSURE.

By Cassidy Messer



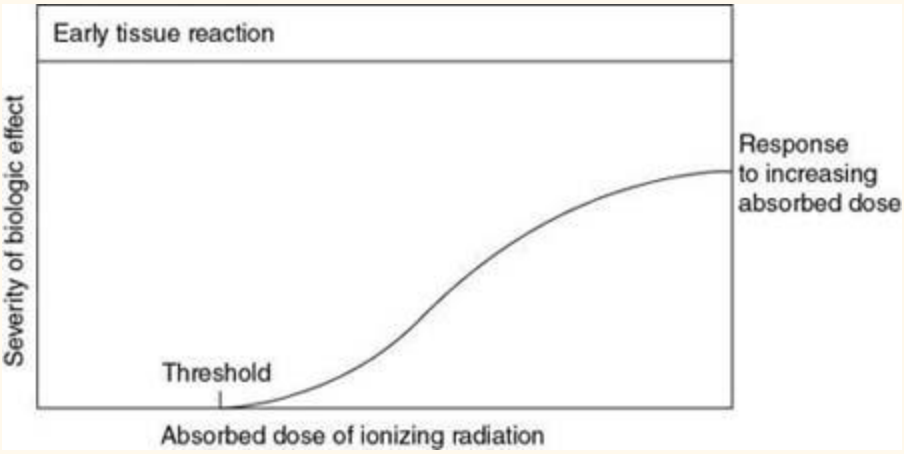
INTRODUCTION

Somatic originates from the Greek term “soma” meaning “body”, meaning somatic effects are effects to the body. Somatic effects depend on the time radiation exposure occurred in relation to when symptoms of radiation damage start to take place. Today we will dive into early somatic effects, acute radiation syndrome (ARS) and lethal dose.

Somatic effects

Early somatic radiation affects the organ systems. The primary person affected is the person who was exposed. The primary result is cancer which is why it is sometimes called the carcinogenic effect. This includes killing cells, which is directly connected to the dose received. As the dose increases the intensity of early somatic tissue reaction will also increase. The more ionizing radiation absorbed the higher chance of a biological damage occurring. Early tissue reactions are caused by cell death. These reactions vary over the duration of time after being exposed.

Fig 1. Here is a graph explaining " the existence of a threshold whereby early tissue reactions of an absorbed dose of ionizing radiation begin and increase in severity as the dose of radiation received increases." from **Radiation Protection in Medical Radiography by Mary Alice Statkiewicz.**



Early somatic effects can happen within minutes, hours, days and weeks. consequences are nausea, fatigue, erythema, epilation, blood disorders, fever, dry and moist desquamation, depressed sperm count, injury to the central nervous system and intestinal disorders.

Fig 2. Radiation burn or erythema on the arm of a former worker, who was present at the Chernobyl nuclear power plant during the 1986 radiation accident. **Radiation Protection in Medical Radiography by Mary Alice Statkiewicz.**



Acute radiation syndrome (ARS)

ARS or radiation sickness occurs when there has been exposure to a big amount of ionizing radiation, usually delivered to the whole body. This can happen over the span of a few hours up to a few days. Examples of this would be nuclear radiation accident victims and patients that have had radiation therapy. There are four stages in response to ARS. The initial stage occurs within hours of being exposed and can last from a few hours to days. It causes nausea, vomiting, diarrhea, fatigue and leukopenia. The latent period starts roughly one week after exposure and there are no visible symptoms that occur. Usually recovery will begin or lethal effects will. Manifest illness are symptoms that become visible. There are multiple symptoms in this stage. Apathy, fluid loss, fever, headaches, infection hemorrhage and many others. The last stage is recovery or death. The recovery may start to happen but there could still be damage done to the body from the radiation. Usually occurs around 3 months.

ARS is an accumulation of symptoms directly related to extreme radiation exposure. There are three conditions that can be caused by acute radiation syndrome.

Hematopoietic syndrome : 1-10 Gy and affects the bone marrow. The body becomes weak and more prone to infection and hemorrhage. After 6-8 weeks death could happen. Depending on dosage that was given.

Gastrointestinal syndrome : it's 6-10 Gy. Possible death after 3-10 days. Severe N-V-D for 24 hours and latent for up to 5 days. Death can be a result from damage to the epithelial cells that line the GI tract.

Cerebrovascular syndrome : occurs if 50 Gy or more are exposed to the CNS and cardiovascular system. Symptoms include excessive nervousness, confusion, loss of vision, burning sensation of the skin and loss of consciousness. Death can be a result after a few hours to a few days. Its latent can last up to 12 hours long.

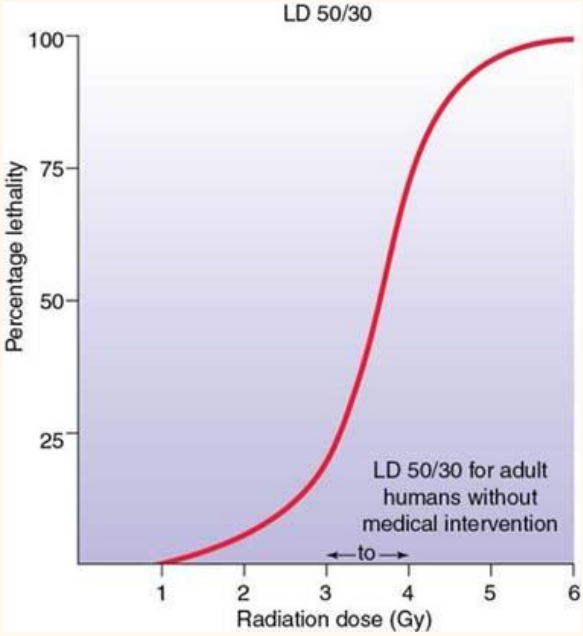
Fig 3, table overview of acute radiation lethality. **Radiation Protection in Medical Radiography by Mary Alice Statkiewicz.**

stage	Dose (Gy)	Average survival time	symptoms
Promdromal	1	N/A	nausea, vomiting, diarrhea, fatigue and leukopenia
Latent	1-100	N/A	none
Hematopoietic	1-10	6-8 weeks	Nausea, vomiting, diarrhea, decrease in number of red blood cells, white blood cells, and platelets in the circulating blood, hemorrhage, infection.
Gastrointestinal	6-10	3-10 days	Severe nausea, vomiting, diarrhea, fever, fatigue, loss of appetite, lethargy, anemia, leukopenia, hemorrhage, infection, electrolytic imbalance, and emaciation
Cerebrovascular	50 +	Hours to 2-3 days	Same as hematopoietic and gastrointestinal, plus excessive nervousness, confusion, lack of coordination, loss of vision, burning sensation of the skin, loss of consciousness, disorientation, shock, periods of agitation alternating with stupor, edema, loss of equilibrium, meningitis, prostration, respiratory distress, vasculitis, coma

Lethal Dose

The dose of radiation that is expected to cause death to 50 % of an exposed population within 30 days. (LD 50/30). Lethal dose is a way to measure a short-term poisoning potential of a material. Testing of this theory is done to a group of animals, typically rats and mice. The first test to be conducted was in the 1920s by a British pharmacologist, J. W. Trevan. For humans it would be getting a dose of 3-4 Gy, which would cause death without medical support. With intense medical support a human could still survive if they received up to 8.5 Gy.

Fig 4. LD 50/30 shown below. **Radiation Protection in Medical Radiography by Mary Alice Statkiewicz.**



There are also other measurements of lethal dose, including LD 10/30, LD 50/60 and LD 100/60. So these numbers refer to the amount of people who died after a specific number of days.

Conclusion

Radiation exposure can lead to serious somatic effects that harm the body. At very high doses, this can result in acute radiation syndrome (ARS), which develops quickly and can be life-threatening. The concept of lethal dose (LD50/60) helps measure how much radiation is likely to cause death in half of those exposed. Understanding these effects highlights the importance of radiation protection and safety in both medical and environmental settings.

References / Resources

U.S.NRC NRC library on website

Biologic effects of radiation By U.S.NRC technical training center

Textbook ; Radiation Protection in Medical Radiography by Mary Alice Statkiewicz.