Differential diagnosis of Acute Radiation Syndromes by Enzyme Immune-Assay (EIA)

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Differential diagnosis of Acute Radiation Syndromes by the method of immune enzyme assay is a very efficient tool of biological dosimetry and evaluation of acute radiation disease. We use as biological markers the group of essential Radiotoxins - high molecular weight glycoproteins with specific antigenic properties. A molecular weight of radiation toxins was 200-250 kDa. High doses of radiation induce the formation of radiation toxins in the organs and tissues of irradiated animals. After whole body irradiation, cellular macromolecules and cells and mitochondrial outer and inner wall membranes are damaged by long-lived radiation-induced free radicals, reactive oxygen species and fast, charged particles of radiation. High doses of radiation induce breaks in the chemicals bonds of macromolecules (proteins,lipids,carbohydrates,DNA molecules) and cross-linking reactions via chemically active processes. These processes result in creation of novel modified macromolecules that possess specific toxic and antigenic properties defined by the type and doses of irradiation by which they are generated. After formation, Radiation toxins migrate from irradiated tissues to interstitial fluid and accumulate in the lymphatic and blood transportation system. Radiation toxins isolated from the lymph of irradiated animals are classified as hematotoxic, neurotoxic, and enteric non-bacterial(GI) Radiation Toxins, and they play an important role in development of Hematopoietic, Cerebrovascular, Cardiovascular and Gastro- Intestinal Acute Radiation Syndromes(ARS). Four Groups and Seven distinct Toxins derived from post-irradiated animals have been designated as Specific Radiation Determinants (SRD): SRD-1(Neuro-toxic radiation toxin generated by Cerebrovascular ARS), SRD-2(Vascular-toxic radiation toxin generated by Cardiovascular ARS), SRD-3(Enteric non-bacterial radiation toxins generated by the Gastrointestinal form of ARS), and SRD-4(Hematotoxic radiation toxins generated by hematological, bone marrow form of ARS). SRD-4 is further subdivided into four groups depending on the severity of the ARS induced: SRD-4/1, mild ARS; SRD-4/2, moderate ARS; SRD-4/3, severe ARS and SRD-4/4, extremely severe ARS. We postulate that the SRD-1 and the SRD-2 radiation toxins produce toxicity for central and peripheral nervous system. Determination of high levels of SRD-1, SRD-2,SRD-3 and SRD-4 in the periferal blood allowed to recognize early periods of Cerebrovascular, Cardiovascular, Gastrointestinal and Hematopoietic forms of ARS. The important goal of an early assessment with Enzyme Immune Assay is the accurate description of the Acute Radiation Syndromes at initial phases. Early and precise differential diagnosis allow doctors to provide an effective medical management of ARS.

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