EPR Dosimetry in Recent Radiation Accident Cases

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The use of Electron Paramagnetic Resonance (EPR) for dosimetry is based on the capability of the technique specifically and sensitively to measure unpaired electron species and the fact that ionizing radiation creates such species in exact proportion to absorbed dose. The lifetimes of these radiation-induced species can be extremely stable in non-aqueous media, such as teeth and bone (years). In addition, EPR signal in teeth and bones exhibits a good sensitivity to radiation dose, compatible with radiation accident dose level. Thus, teeth and bone are used as bio-indicator of the absorbed dose. EPR dosimetry on these materials can be very pertinent, especially when no dosimeter is worn by the victims and/or when irradiations are localized or highly heterogeneous, because giving absorbed dose in one or several localizations in the victim's organism. In two recent cases of radiation accident, EPR dosimetry gave pertinent information for the medical management of the victims. The lost of 192Ir sources from a gammagraphy equipment is at the origin of the accident in both cases. First case occurred in December 2005 in Chile, involving one victim (patient A), and the second one, in Africa (Senegal and Ivory Coast) from June to August 2006 with four main victims (patients B, C, D, E). All victims were hospitalized in France at the Percy military training hospital. EPR dosimetry was performed on bone biopsies for patient A (left hand thumb) and B (left arm) who exhibited severe localized radiation burns. Tooth enamel samples were also measured from 4 patients (patients A, B, C, D). The methodology used for the dose assessment and the obtained results is presented. The contribution of EPR dosimetry in the management of radiation accident and the complementarity with the other techniques of dose reconstruction (biological dosimetry, numerical simulation) is discussed.

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