USTUR Case 0846: Modeling Americium Biokinetics after Intensive Decorporation Therapy

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One method to avert dose after incorporation of transuranium elements is decorporation therapy with chelating agents such as diethylenetriamine pentaacetate (DTPA). Administration of the therapeutic agent temporally enhances the excretion of the radionuclides. Biokinetic models, which describe the behavior of the radionuclides in the human body, need to be adapted to take into account the effect of the therapy. In this study, biokinetic modeling of decorporation therapy following americium oxide (^{241}AmO2) inhalation was studied using USTUR Case 0846 (voluntary donor). The modeling of this case is a challenge given that the exact date of exposure is unknown. Previously, the case was evaluated using the assumption of chronic inhalation over a 2-year period. However, a possibility of acute intake cannot be dismissed. Initial ^{241}Am whole-body deposition was estimated to be 66,600 Bq. The Registrant was extensively treated with Ca-DTPA over a period of 7 years. A total of 313.5 g DTPA was administered in 342 i.v. injections. At the time of death, 2,740±274 Bq of ^{241}Am was measured in the lungs, 333±33 in the liver, and 19,570±1,957 in the skeleton by external gamma counting. Based on post-mortem radiochemical analysis results, 219.2±1.9 Bq and 29,600±195 Bq of ^{241}Am were retained in the liver and the skeleton, respectively. For this study, a complete set of data including 106 fecal and 1,130 urine measurements was compiled. The CONRAD (Coordinated Network for Radiation Dosimetry) approach was applied to model americium decorporation using the excreta data only. Based on assumptions about the action and distribution of the administered DTPA, different modifications of the model were tested. To solve the compartmental model equations and fit the data, the ModelMaker4 and the SAAMII® software were used. To improve the modeling, tissue radiochemical analysis results were fitted simultaneously with the excretion data. The Bayesian approach was applied to characterize intake scenario and determine initial distribution of americium in the body prior to the therapy. This presentation provides preliminary results on americium biokinetic modeling after intensive decorporation treatment with Ca-DTPA.

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