A ^{131}I biokinetic model to reconstruct dose to a cohort of hyperthyroid patients

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Abstract

We have proposed and evaluated an iodine biokinetic model to reconstruct the organ doses of hyperthyroid patients. The biokinetic model has compartments that represent thyroid, iodide, protein-bound iodine, salivary glands, stomach, small intestine, urine and feces. The model was developed using archival measurement data from 3138 patients treated with ^{131}I between 1946 and 1965 in thirty different hospitals for hyperthyroidism and other thyroid conditions. These subjects represent a subset of a much larger population studied for many years as part of the Thyrotoxicosis Therapy Follow-up Study (TTFUS, about 35,000 patients). Our measurement database has results of individual measurements of ^{131}I activities in the thyroid, blood (inorganic and organic iodine), and urine for the 3138 patients at various times after administration of ^{131}I, though not all patients have complete data. Information is also available on the administered activity, as well as estimates of the thyroid mass of each patient. The model rate constants have been derived to date, for several hundred patients using the ^{131}I measurements and using the SAAMII computer code to build the biokinetic model. The proposed model takes into account the available patient data along with normative data from the literature. For patients with complete data, the organ doses are calculated based on the administered activity and the predictions of the amounts of iodide and protein-bound-iodine present in each organ and tissue as well as the biological behavior of ^{131}I in the body. Presently, we are estimating the absorbed doses to major organs and tissues of the body for all 3138 patients who will make it possible to estimate organ doses to all hyperthyroid patients in the TTFUS according to type of disease, level of severity, age and gender. This paper will describe the proposed systemic model that fits the available data and will present the estimated organ and tissue doses.

KEYWORDS: biokinetic model, iodine, internal dosimetry, dose reconstruction.