Internal Dose Assessment using Bayesian Inference and Markov Chain Monte Carlo Simulation

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Objective: The objective of this work is to present an uncertainty evaluation methodology to solve problems of inverse internal dosimetry.
Introduction: The International Commission on Radiological Protection, ICRP, has issued biokinectic models that have been developed to give guidance on monitoring programmes and interpretation of results for selected radionuclides of importance in occupational exposure. In a routine monitoring programmes the in vivo or in vitro bioassay method are applied according to the sensitivity of the measurement technique for a specific radionuclide. Assessment of doses from intake of radionuclides due to the inhalation or ingestion of radioactive materials is often based on the results of the measurements in a body tissue and in excreta.
Methodology: The uncertainty in the dose estimation using biokinectic models recommended by ICRP is a combination of uncertainties present in each parameter involved in this calculation and is quite dependent on the quality and quantity of experimental data. The objective of this work is to present an uncertainty evaluation methodology to solve problems of inverse internal dosimetry. The method uses Bayesian inference together with Markov chain Monte Carlo simulations to treat statistically the inverse problem of internal dosimetry.
Results and conclusion: A case study involving the Am-241 is presented and the results compared with the traditional deterministic approach to the problem. The results obtained were consistent with those found using traditional evaluation methods and show that the methodology could be useful tool for internal dose evaluation mainly when few experimental data are available.

Topics: Dosimetry and Nuclear Instrumentation