Abstract

In radionuclide therapy it is still common to administer standard activities or to scale administered activity with blunt parameters such as body weight or surface area. This is not ideal because, due to considerable variation in kinetics, large safety margins have to be applied to avoid radiation damage to healthy organs, which causes under-treatment of many patients. To base the administered activity on individual dosimetry, as in other therapy modalities using ionizing radiation, will essentially solve this problem. However, dosimetry in radionuclide therapy is resource-demanding and debilitating for the patient because it involves a number of measurements to determine the kinetics of the therapy radionuclide and needs to be optimized for clinical feasibility.

First, the ability to measure radioactivity distributions of radionuclides for therapy was investigated. SPECT measurements of ^{177}Lu, which was later used clinically, showed good spatial resolution and a reasonable quantitative accuracy.

A new method to calculate absorbed dose to solid risk organs and tumours was developed and applied in the clinic. Kinetic data were obtained by repeated SPECT measurements. Radiation concentration determined in small volumes of interest could then be multiplied by a constant to obtain absorbed dose because it was shown that cross-fire was negligible in organs with high activity concentration. The new dosimetry method, compared to other methods, was found to give better results with less effort. In addition, a method to calculate absorbed dose to bone marrow was developed and clinically implemented.

In 200 patients, individual kinetics and absorbed dose were studied and variations were found to be large. Kidney was the dose-limiting organ in almost all patients (98.5%). Keeping the kidney dose < 23Gy, about half of the patients could receive 5, or up to 10 treatments instead of the stipulated 4.