

## ► Dosimetry in Radionuclide Therapy

### G. Flux (Sutton Surrey)

Cancer has been treated with radiopharmaceuticals for over 60 years, with the first published study being a treatment for thyroid cancer metastases with radioiodine (Seidlin). A tracer study was performed to estimate the uptake for a therapeutic procedure, various biomarkers of response were measured and the absorbed dose delivered to tumours was estimated from external measurements. Since that time a variety of criteria have been employed to govern treatments. The majority of treatments are performed by consideration of radiopharmaceuticals as drugs, generally administering fixed activities, sometimes modified according to body weight or surface area. A minority of treatments have been administered as for external beam radiotherapy (EBRT) or brachytherapy, that is by calculating the absorbed doses delivered to target volumes (tumours) or normal organs (critical organs at risk).

Internal dosimetry falls into the second category, but the methods of calculating the absorbed doses delivered varies from that seen in EBRT (Lassmann). It is necessary to calculate from sequential imaging the time course of activity from the point of administration from which the total number of radioactive decays can be determined. This value, the cumulated activity, is then multiplied by a factor (the *S* value) that gives the mean absorbed dose to the target from the source organ containing radioactivity for a single decay.

At a time that personalised and evidence based medicine is becoming a focus for research and clinical implementation, the need for dosimetry is receiving increasing attention. A major factor impeding adoption of treatment is the need for a series of scans of a patient, ideally SPECT/CT data, which is not commonly obtained in centres. This problem is exacerbated by the need to image uncommon radioisotopes including I-131, In-111 and Lu-177. Therapy procedures currently subject to dosimetry investigations include I-131 mIBG for neuroblastoma (Buckley), Lu-177 and Y-90 Dotatate for adult neuroendocrine tumours (Garkavij) and Y-90 microspheres for intra-arterial treatments of liver disease (Cremonesi).

It is likely that the use of dosimetry in therapy will increase and become routine for many procedures. Successful implementation of new techniques for patient management require a concerted effort from a multidisciplinary team and offer the prospect of an exciting new era for nuclear medicine.

#### References

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