

Gamma camera in clinical dosimetry: common practice and clinical applications

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For a safety oriented absorbed dose evaluation, non imaging procedures can be used for total body or red marrow evaluation. On the contrary, organ or lesion dosimetry requires quantitative imaging, since the absorbed dose in an organ or tumour individually depends on the initial uptake and on the time the activity resides in such region. A sequence of planar, SPET [1] or PET scan is usually necessary. Unfortunately gamma camera is not meant to be quantitative, for a series of physical effects which have to be corrected: photon attenuation in patient body, scatter, background of overlapping structures, self absorption of source object, partial volume effect for small objects, dead time count losses (only after therapeutic activity administration). In each image, counts in the Region of Interest are the starting point for the quantification. Moreover, the conversion of counts to activity (calibration of the gamma camera) is a non trivial task, in view of the just mentioned physical factors.

Planar dosimetry is usually easier to implement with respect to SPECT based dosimetry, but its accuracy is also reduced. SPECT dosimetry requires a CT based attenuation correction. The choice of using planar versus SPECT depends on the non uniformity of biodistribution in the region of interest. Agents with uniform uptake in organs, like antibodies in liver [2], ^{177}Lu dotatate in kidneys [3], could be evaluated in planar images, while ^{131}I MIBG uptake of a heterogeneous uptake lesion requires a SPECT approach.

For the Selective Intra Arterial Radiation Therapy (SIRT) of primary and secondary liver lesions, ^{90}Y loaded resin or glass microspheres (diameter 20 – 30 microns) are used. Since microspheres are permanently trapped in microcapillaries, the clearance is described by the physical ^{90}Y half-life (64.2 h), and only one scintigram is sufficient for dosimetry. Treatment planning simulation with $^{99\text{m}}\text{Tc}$ albumin macro aggregates is demonstrated to have good predictive power of the response if a SPECT approach is adopted [4].

References

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Abstracts