Yttrium-90 TOF PET scan demonstrates high-resolution biodistribution after liver SIRT

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The decay of ^{90}Y has a minor branch to the 0^+ excited state [1], followed by an internal e^+e^- creation which happens in 32 out of one million decays [2]. Consequently, ^{90}Y PET scan was proposed in order to assess the biodistribution [3] of ^{90}Y -labelled therapeutic agents. A 61-year-old woman was referred for treatment of chemorefractory colorectal liver metastasis. Based on the pretreatment evaluation (including a diagnostic FDG PET/CT scan on day 1, and a prophylactic embolization of the right gastric and gastroduodenal arteries followed by a $^{99\text{m}}\text{Tc}$ -MAA SPECT/CT scan on day 8), 1.3 GBq of ^{90}Y -labelled SIR-Spheres were administered by sequential catheterization of both liver lobes (day 15). Subsequently, a 30-min ^{90}Y TOF PET/CT scan was performed using a Philips GEMINI TF camera. In order to prevent saturation of the detectors, a copper ring of 2.5 mm thickness was inserted into the gantry to absorb the bremsstrahlung x-rays. The TOF data were reconstructed with attenuation and scatter correction using Philips RAMLA software (eight iterations, three subsets). An additional 20 min bremsstrahlung ^{90}Y -SPECT was acquired

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using a Trionix XLT20 triple head camera (medium energy collimator, 30% window centred on 90 keV). Data were reconstructed using OSEM (four iterations, six subsets). As illustrated, despite the differences in their respective uptake mechanism, ^{90}Y -PET better reflects the tumour heterogeneity assessed by FDG PET/CT (a necrotic core surrounded by active tumour margins) than traditional bremsstrahlung ^{90}Y -SPECT. This gain in resolution should therefore contribute to increasing the accuracy of the dose distribution into the tumours and their surrounding healthy tissues.

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