Reply to Letter re: General Theory of Predictive Dosimetry for Yttrium-90 Radioembolization to Sites Other Than the Liver

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We fully approve the content of this Letter, as it provides a comprehensive roadmap on predictive dosimetry and aims at standardisation and good clinical practice for ^{90}Y -radioembolization to sites other than the liver. The field of application is well defined in the dosimetric assumptions and general points. The formulas are clear and applicable at any site.

As stated in the introduction of this Letter, the safety and efficacy of selective internal radiotherapy (SIRT) is a combination of “technical” and “clinical” success. In this Reply, we would like to highlight some technical aspects that need special attention in order to achieve a therapeutic success.

Before simulation with digital subtraction angiography and $^{99\text{m}}\text{Tc}$ -macroaggregated albumin (MAA), presimulation imaging should be performed by CT- (or MRI-) angiography to detect vascular variants and abnormalities, to direct additional embolization of vessels, and to plan the most appropriate positioning of the catheter [1]. It is obvious that the position of the catheter and the flow rate should be similar for simulation and treatment. Therefore, it is important to choose a stable position of the catheter,

as far as possible from any arterial bifurcation and to store the position of the tip of the catheter (e.g., by means of a screen capture) during simulation to assure a similar distribution of the $^{99\text{m}}\text{Tc}$ -MAA and ^{90}Y -microspheres.

Posttreatment imaging can assess the distribution of the ^{90}Y -microspheres and should be used to verify and validate the predictive dosimetry, especially in the setting of radioembolization to sites other than the liver. 3D distribution of the ^{90}Y -microspheres can be assessed by ^{90}Y -Bremsstrahlung Emission Computed Tomography (BECT) [2, 3] or ^{90}Y -Time of Flight Positron emission tomography (TOF-PET) [4, 5]. Although the latter technique provides high-resolution images enabling quantification and real posttreatment dosimetry, its application is restricted to a research setting due to the very long acquisition times (at least the double compared to BECT) to obtain sufficient counts.

As tissue mass is an essential component of the equations used for dosimetry, accurate delineation of volumes-of-interest (VOI) is another technical challenge. For organs, the most obvious choice for estimation of the tissue mass is the volumes and radiographic densities derived from CT. However, the use of CT for delineation of viable tumour tissue, especially in small or necrotic target lesions often is less obvious. In this setting, functional imaging might be more appropriate for accurate VOI-delineation. Hybrid imaging by SPECT/CT is indeed a minimal technical requirement for optimal tissue delineation in SIRT-dosimetry, but also requires standardization of the methodology used for VOI-delineation in order to enhance reproducibility and comparability of published data.

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Conflict of interest Kristoff Muylle and Bruno Vanderlinden have no conflict of interest to declare.

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