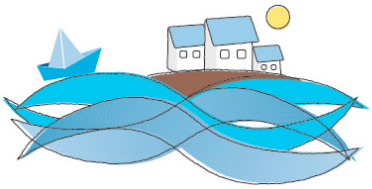

Mediterranean Thematic Workshops in Advanced Molecular Imaging

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# Precision Surgery with a novel radio-guided surgery

INTRODUCTION: Radio-guided surgery(RGS) is a technique that helps the surgeon to perform a complete lesion resection. Currently, RGS uses γ emitting tracers, to mark the cancerous tissue form the healthy organs, and a γ radiation detection probe. To overcome the limitations due to the high penetration of γ radiation, a novel approach based on β- radiation has been developed(Camillocci, Sci Rep.2014;4:4401), allowing to include cases with high uptake of nearby healthy organs, and to benefit of a low medical team exposure.

MATERIAL AND METHODS: Feasibility studies for meningioma, glioma and NETs were performed assuming administration of 90Y-DOTATOC, utilizing a simulation code based on the biodistribution estimated in 68Ga-DOTATOC-PET scans (Collamati. JNuclMed. 2015;56(1):3-8). Experimental phantoms have been prepared to tune the simulations and finally ex-vivo tests on patient specimens after surgery of meningioma have been performed to validate in clinical setting the features of the probe.

RESULTS: Considering typical tumor uptakes ranging 0.1%-1% of the injected activity, preclinical tests and simulations estimated that about 3MBq/kg administered to the patient is enough to identify in 1s a tumor volume <0.1ml. The exposure of surgeon was estimated to be 0.04μSv/h on the whole body, 0.35μSv/h on the hands. Phantom measurements confirmed the simulations. Ex-vivo tests showed excellent agreement between experimental and expected rates for lesions and healthy tissues: e.g. the bulk tumor showed signals of ˜100cps, 0.2 ml residuals signals of ˜40cps and healthy tissues of less than 1cps. Furthermore, exposure measurements confirmed the low level of radioactivity in the surgical environment (<1μSv/h at 10cm from patient abdomen).

CONCLUSIONS: The proposed RGS using β− radiation has a wide range of applications and succeeded in the first clinical test. The future goal is to study the efficiency of the probe to other radio-tracers to further extend applicability.

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