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Imaging of Ra-223 with a small-pixel CdTe detector: potential for improved image quantification for radionuclide dosimetry

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Ra-223 Dichloride (Xofigo™) is a promising new radiopharmaceutical offering survival benefit and palliation of painful bone metastases in patients with hormone-refractory prostate cancer [1]. The response to radionuclide therapy and toxicity are directly linked to the absorbed radiation doses to the tumour and organs at risk respectively. Accurate dosimetry necessitates quantitative imaging of the biodistribution and kinetics of the radiopharmaceutical. Although primarily an alpha-emitter, Ra-223 also has some low-abundance x-ray and gamma emissions, which enable imaging of the biodistribution in the patient. However, the low spectral resolution of conventional gamma camera detectors makes in-vivo imaging of Ra-223 challenging. In this work, we present spectra and image data of anthropomorphic phantoms containing Ra-223 acquired with a small-pixel CdTe detector (HEXITEC) [2] with a pinhole collimator. Comparison is made with similar data acquired using a clinical gamma camera. The results demonstrate the advantages of the solid state detector in terms of scatter rejection and quantitative accuracy of the images. However, optimised collimation is needed in order for the sensitivity to rival current clinical systems.

As different dosage levels and administration regimens for this drug are explored in current clinical trials, there is a clear need to develop improved imaging technologies that will enable personalised treatments to be designed for patients.

References:

[1] C Parker et al. *Alpha emitter Radium-223 and Survival in Metastatic Prostate Cancer*, N Engl J Med, 2013 (369), 213-223.

[2] P Seller et al. *Pixellated Cd(Zn)Te instrument*, JInst, 2011, C12009

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