First-in-Human ^{212}Pb-PSMA–Targeted α-Therapy SPECT/CT Imaging in a Patient with Metastatic Castration-Resistant Prostate Cancer

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There is significant interest in the development of ^{212}Pb-PSMA–based targeted α-therapy for patients with metastatic castration-resistant prostate cancer. A previous phantom study has shown that ^{212}Pb SPECT is feasible by imaging the 238.6 keV and 75 to 91 keV γ-emissions produced after the β-decay of ^{212}Pb to its α-emitting progeny (*1*).

Here we present—to the best of our knowledge—the first human ^{212}Pb SPECT/CT images published to date. They were acquired after administration of 60 MBq of ^{212}Pb-ADVC001 to a 73-y-old man with metastatic castration-resistant prostate cancer. This study was approved by the local institutional review board. Imaging was at 1.5, 5, 20, and 28 h after infusion. Two simultaneous triple-energy window acquisitions (78 keV ± 20% with 20% scatter [31% abundance] and 239 keV ± 10% with 10% scatter [43% abundance] were obtained using a Siemens Intevo Bold (high-energy collimators at 30 s per view for 120 views per rotation at 2 bed positions with noncircular orbits; total time, 60 min). Each energy window was reconstructed independently, and the resulting images were summed with removal of Compton-based orbit artifacts.

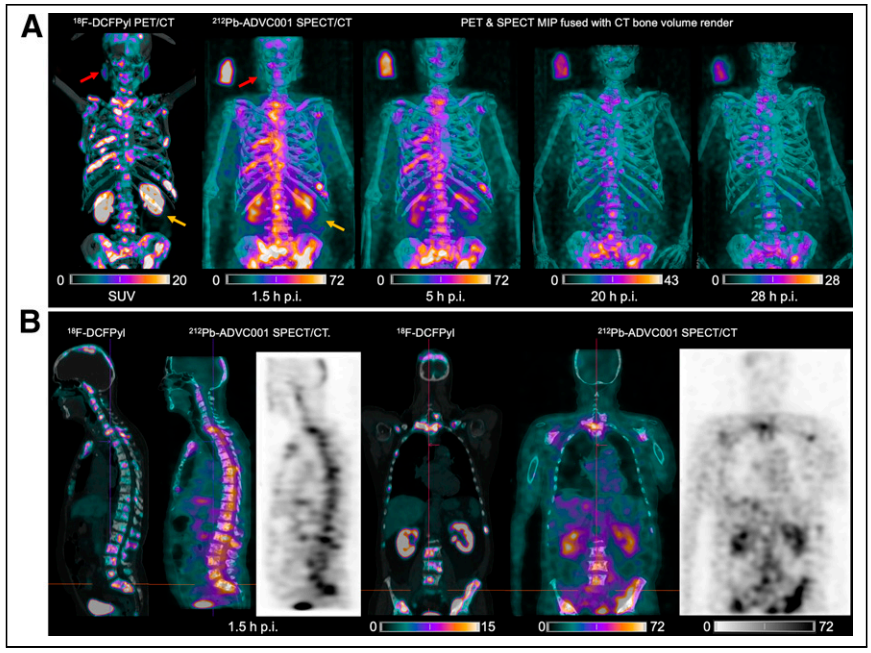

FIGURE 1. (A) ^{18}F-DCFPyl PET/CT and ^{212}Pb SPECT/CT images showing concordant tumor biodistribution with low salivary gland uptake (red arrow) and rapid kidney clearance of 60 MBq of ^{212}Pb-ADVC001 (structure of ^{212}Pb-ADVC001 available as supplemental material at http://jnm.snmjournals.org). A 3-MBq standard solution (100 mL) was included. (B) Sagittal and coronal images at 1.5 h after injection (p.i.). MIP = maximum-intensity projection.

Representative ^{212}Pb SPECT/CT images (Fig. 1) showed rapid tumor uptake of ^{212}Pb-ADVC001 highly concordant with tumor burden delineated on the pretreatment ^{18}F-DCFPyl PET/CT images. Images acquired after 20 h showed persistent tumor uptake despite low counts due to ^{212}Pb decay (10.6 h half-life).

^{212}Pb is a challenging isotope to image because of the high-energy γ-rays from the lead progeny generating Compton scatter from the patient and collimator (*1*). Our approach of summing images reconstructed from both energy windows shows the feasibility and benefit of ^{212}Pb SPECT/CT imaging in providing postinfusion radiopharmaceutical biodistribution and patient-specific dosimetry for clinical development of ^{212}Pb-targeted α-therapy.

DISCLOSURE

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