

## A Pilot Study of <sup>68</sup>Ga-PSMA11 and <sup>68</sup>Ga-RM2 PET/MRI for Evaluation of Prostate Cancer Response to High Intensity Focused Ultrasound (HIFU) Therapy

Heying Duan<sup>1</sup>, Pejman Ghanouni<sup>2</sup>, Negin Hatami<sup>1</sup>, Guido A. Davidzon<sup>1</sup>, Carina Mari Aparici<sup>1</sup>, Alan Thong<sup>3</sup>, Geoffrey A. Sonn<sup>3</sup>, Andrei Iagaru<sup>1</sup>

<sup>1</sup> Department of Radiology, Division of Nuclear Medicine and Molecular Imaging, Stanford University, Stanford, CA

<sup>2</sup> Department of Radiology, Division of Body MRI, Stanford University, Stanford, CA

<sup>3</sup> Department of Urology, Stanford University, Stanford, CA

**Contact author:** Heying Duan, [heyding@stanford.edu](mailto:heyding@stanford.edu)

**Introduction:** Prostate specific membrane antigen (PSMA) and gastrin-releasing peptide receptors (GRPR) are both overexpressed in prostate cancer (PC). The degree of their expression at various stages of PC is not yet well understood.

**Specific aim:** We aimed to evaluate a novel approach combining both <sup>68</sup>Ga-RM2 and <sup>68</sup>Ga-PSMA11 PET/MRI within each PC patient before and after treatment with high intensity focused ultrasound (HIFU) to assess accuracy of localization and response to treatment.

**Methods and materials:** Nine men, aged 63.7±8.8 years, with newly diagnosed PC were prospectively enrolled. Pre HIFU, patients underwent prostate biopsy, prostate multiparametric MRI (mpMRI), <sup>68</sup>Ga-PSMA11 and <sup>68</sup>Ga-RM2 PET/MRI. Response to HIFU treatment was assessed with <sup>68</sup>Ga-PSMA11 and <sup>68</sup>Ga-RM2 PET/MRI. For localization, the prostate was divided into 12 segments (apex lateral, apex medial, base lateral, base medial, mid lateral, mid medial, left and right, respectively) using PET/MRI data and MIM software (MIM Software Inc, Cleveland, OH). Maximum standardized uptake values (SUV<sub>max</sub>) of PC lesions, as well as of background uptake in each segment were collected.

**Results:** Pre HIFU biopsy revealed 16 lesions of which 12 were clinically significant with a Gleason score (GS) ≥7, and mpMRI showed 10 lesions with 9 being ≥PIRADS 4. <sup>68</sup>Ga-PSMA11 and <sup>68</sup>Ga-RM2 PET/MRI demonstrated 20 and 19 positive lesions respectively with 17 congruent in 9 patients and 6 incongruent lesions in 4 patients. HIFU treated 21 zones whereas 20 were identified with both radiotracers and one was negative in <sup>68</sup>Ga-RM2, but positive in <sup>68</sup>Ga-PSMA11. In this patient, pre HIFU biopsy showed a GS 7 and mpMRI PIRADS 4. For treatment evaluation, <sup>68</sup>Ga-PSMA11 and <sup>68</sup>Ga-RM2 PET/MRI were performed 8.59±4.23 and 9.21±2.45 months, respectively, after HIFU. In all patients PET/MRI were negative for the respective treated area. Pre-treatment PSA and PSA density were 9.04±3.59 ng/mL and 0.21±0.09 ng/ml<sup>2</sup>, respectively, and decreased significantly after HIFU to 3.93±2.62 ng/mL (*P*=0.00) and 0.10±0.07 ng/ml<sup>2</sup> (*P*=0.02), respectively. Concordantly, pre-treatment SUV<sub>max</sub> decreased significantly for <sup>68</sup>Ga-PSMA11 and <sup>68</sup>Ga-RM2 (<sup>68</sup>Ga-PSMA11: 13.80±10.72 vs 3.45±3.58 [*P*=0.03] and <sup>68</sup>Ga-RM2 12.09±9.95 vs 3.70±4.10 [*P*=0.02] before and after HIFU, respectively).

**Discussion and conclusion:** Our results show that <sup>68</sup>Ga-PSMA11 and <sup>68</sup>Ga-RM2 PET/MRI identified the dominant lesion for HIFU in 100% and 88.9%, respectively. Both radiotracers accurately verified response to treatment in all patients. The 6 incongruent lesions suggest different expression patterns of PSMA and GRPR in PC. Larger studies are needed to shed light on that.