Comparison of Post-Therapy 4 and 24-hour [177Lu]Lu-PSMA SPECT/CT and Pre-Therapy PSMA PET/CT in Assessment of Disease in Men with Metastatic Castrate-Resistant Prostate Cancer.

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No disclosures

BACKGROUND

- [^{177}Lu]Lu-PSMA is an effective treatment for metastatic castrate-resistant prostate cancer (mCRPC).

- Studies have confirmed the ability of [^{177}Lu]Lu-PSMA SPECT/CT at 24 and 48 hours to predict response to [^{177}Lu]Lu-PSMA as early as of 6 weeks (1-3).
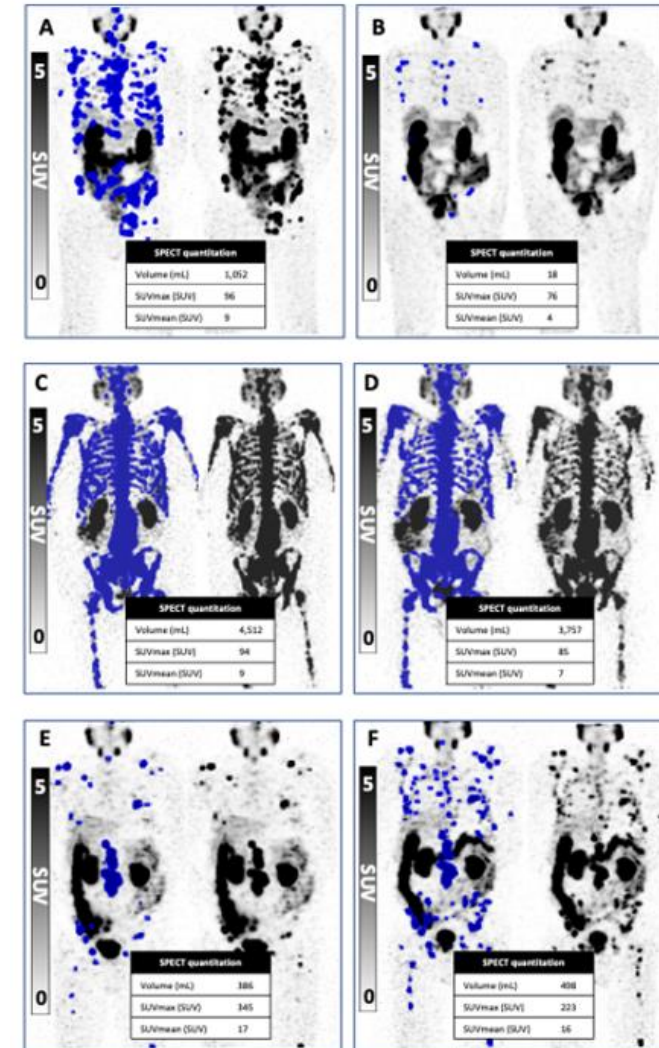
[1] Emmett L, et al. Ther Adv Med Oncol. 2023;15:17588359231156392.
[2] John N, et al. J Nucl Med. 2023;64:410-415.
[3] Neubauer MC, et al. Eur J Nucl Med Mol Imaging. 2024;51:1185-1193.

AIM

- However, SPECT/CT at 24 hours post therapy can be inconvenient for patients requiring overnight stay for rural/distant patients.

- The aim of this study was to evaluate the 4-hour [^{177}Lu]Lu-PSMA SPECT/CT as an alternative to 24-hour [^{177}Lu]Lu-PSMA SPECT/CT for evaluation of treatment response.
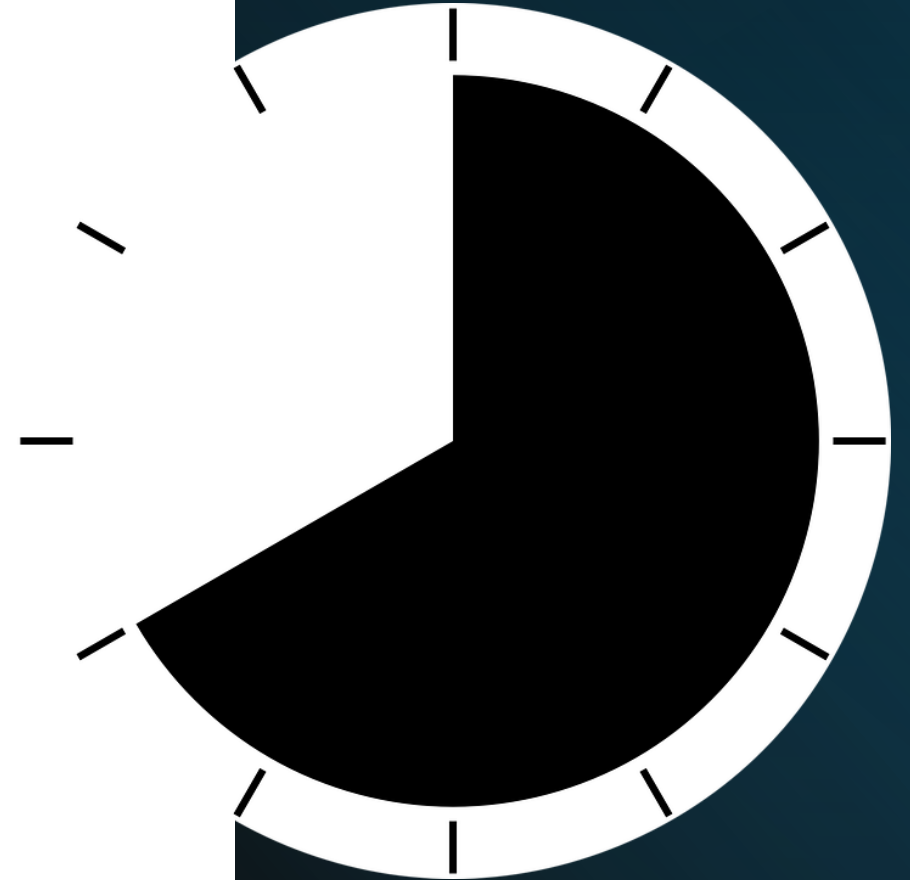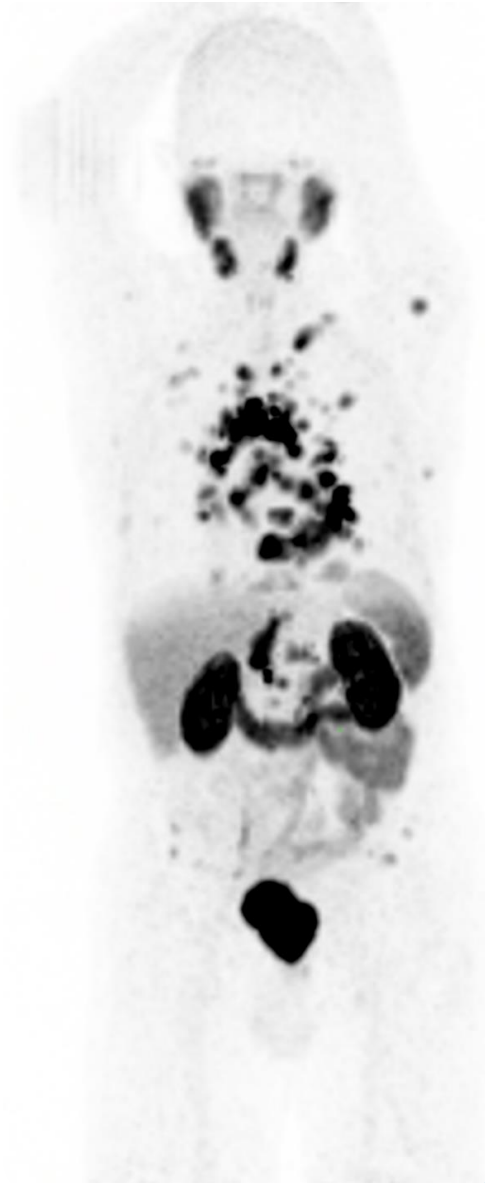
METHODS

- Prospective ethics approved pilot study.

- 23 men with mCRPC treated with [^{177}Lu]Lu-PSMA-I&T between May and November 2023 (HREC 2022/ETH00924).

Inclusion criteria

- [^{68}Ga]Ga-PSMA-11 PET/CT(SUVmax ≥ 15 and SUVmax ≥10 at all the measurable lesions(> 2cm))

- mCRPC post ARPI and taxane chemotherapy or unfit for taxane.

- Eastern Cooperative Oncology Group (ECOG) ≤ 2.

METHODS

- Post-therapy SPECT/CT (Discovery NM/CT 870 DR, GE Healthcare) acquired at 4- and 24-hours after the first dose and 4 hours following the second dose.

  ✓ Vertex to mid-thigh

  ✓ 3 fields of view,

  ✓ 10s/frame

  ✓ Energy window 208 keV ± 10%

  ✓ Scatter window 165 keV ± 6.5%.

METHODS

- Acquisition time was 25 minutes at each timepoint.

- Reconstruction of SPECT projections performed with an iterative ordered subset expectation maximization (OSEM) algorithm using 4 iterations and 10 subsets.

METHODS

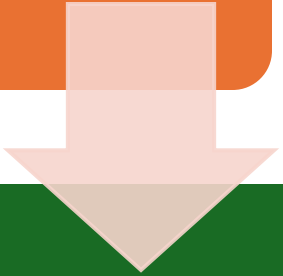Standard dose 8.5 GBq [^{177}Lu]Lu-PSMA-I&T prior to SPECT/CT imaging timepoints.

2/23 patients excluded (incomplete imaging data).

Baseline [^{68}Ga]Ga-PSMA-11 PET/CT, 4-hour, and 24-hour [^{177}Lu]Lu-PSMA SPECT/CT were analyzed visually and semi-quantitatively.

Visual analysis assessed lesion number, size and site (organ based).

METHODS

Quantitative analysis performed using (LesionID; MIM Software Inc.) to derive standardized uptake value (SUV)mean, SUVmax and total tumor volume (TTV).

Moreover, quantitative analysis of the change in the total tumor volume (Δ Volume) on the 4-hour [^{177}Lu]Lu-PSMA SPECT/CT after the first and second doses was correlated to patient outcomes.
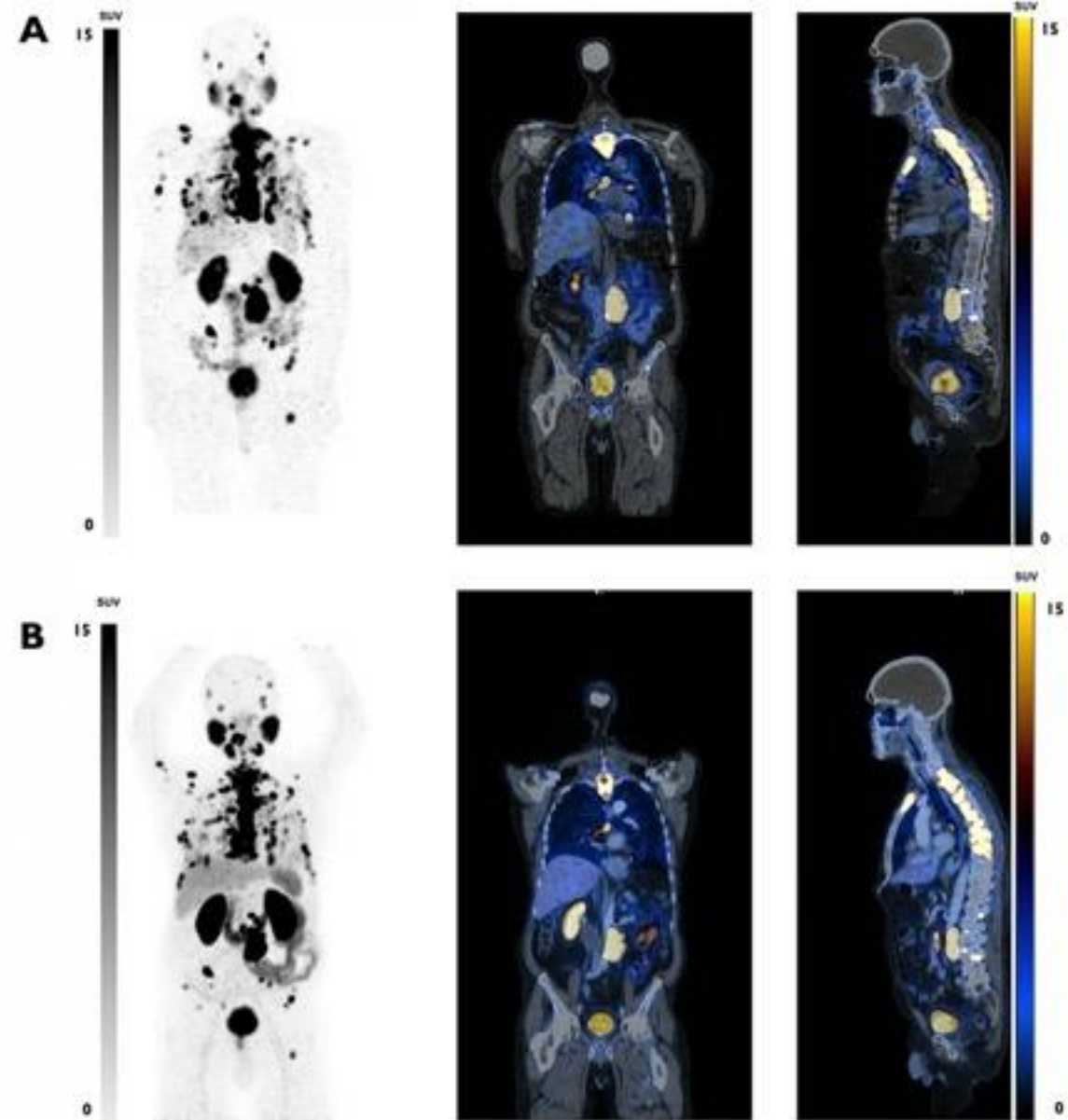
RESULTS

Characteristic	Value (n = 21)
Age at first [^{177}Lu]Lu-PSMA cycle, years	78 (70-81)
ECOG Status	
0-1	14 (67)
2	7 (33)
Baseline PSA, ng/ml	54 (15-510)
eGFR ml/min/1.73m^2	83 (71-90)
Previous Systemic Treatments	
ARPI	21 (100%)
Docetaxel	11 (52%)
Cabazitaxel	5 (24%)

PATIENTS CHARACTERSTICS

Duration between PSMA-PET/CT and first [¹⁷⁷Lu]Lu-PSMA I&T cycle	34 (24-37)
Disease Volume (PSMA-PET/CT)	
<20 metastases	7 (33)
≥ 20 metastases	14 (67)
Sites of Disease	
Bone	19 (90)
Nodal (pelvic and/or distant)	12 (57)
Visceral	4 (19)

RESULTS

- Disease distribution was unchanged between the 4-hour, 24-hour [177Lu]Lu-SPECT/CT and screening [68Ga]Ga-PSMA-11 PET/CT.

RESULTS

Visually the background activity was higher on the 4-hour [^{177}Lu]Lu-PSMA SPECT/CT compared to 24-hour [^{177}Lu]Lu-PSMA SPECT/CT and [^{68}Ga]Ga-PSMA PET/CT.

Baseline ^{68}Ga-PSMA PET/CT   4 h ^{177}Lu-PSMA SPECT/CT   24 h ^{177}Lu-PSMA SPECT/CT
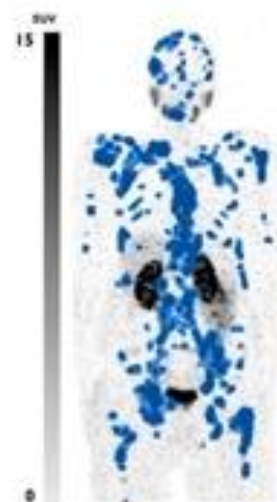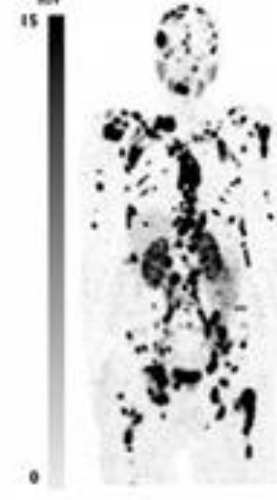
Baseline ^{68}Ga-PSMA PET/CT   4 h [177]Lu- PSMA SPECT/CT   24 h [177]Lu- PSMA SPECT/CT
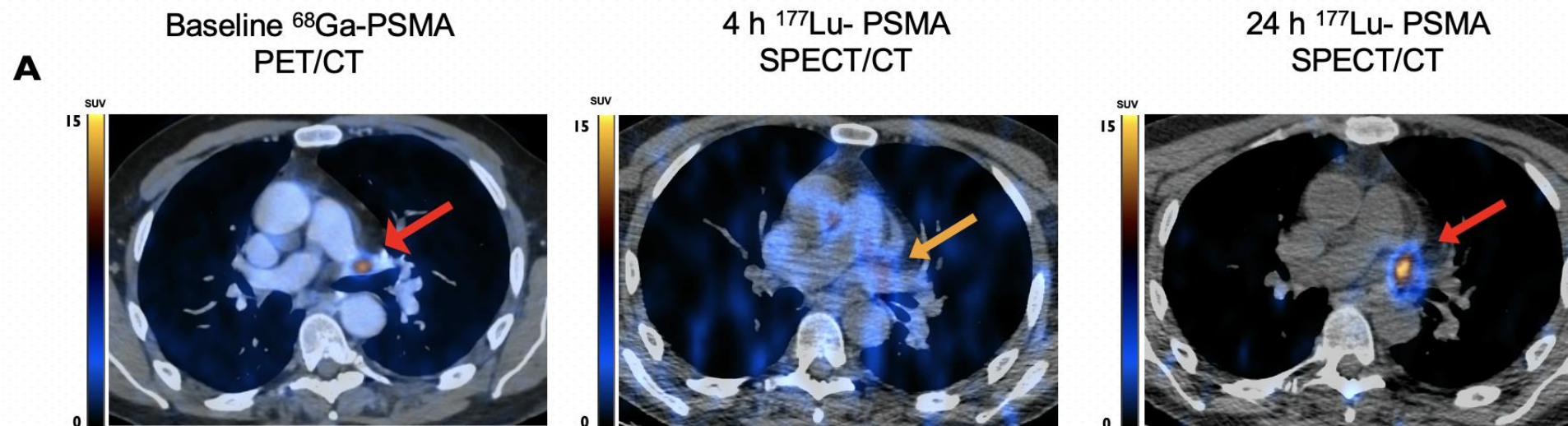
RESULTS

- 52% (11/21) patients had few small missed lesions on 4-hour [^{177}Lu]Lu-PSMA SPECT/CT compared to 24-hour [^{177}Lu]Lu-PSMA SPECT/CT.

- Median number of missed lesions 1(IQR 0-1) and all (< 2cm). The median SUVmax of the missed lesions is 5 (IQR 4-8).

- 75% of the missed lesions were osseous, and 25% nodal lesions. No visceral lesions were missed.

Baseline ^{68}Ga-PSMA PET/CT   4 h ^{177}Lu- PSMA SPECT/CT   24 h ^{177}Lu- PSMA SPECT/CT
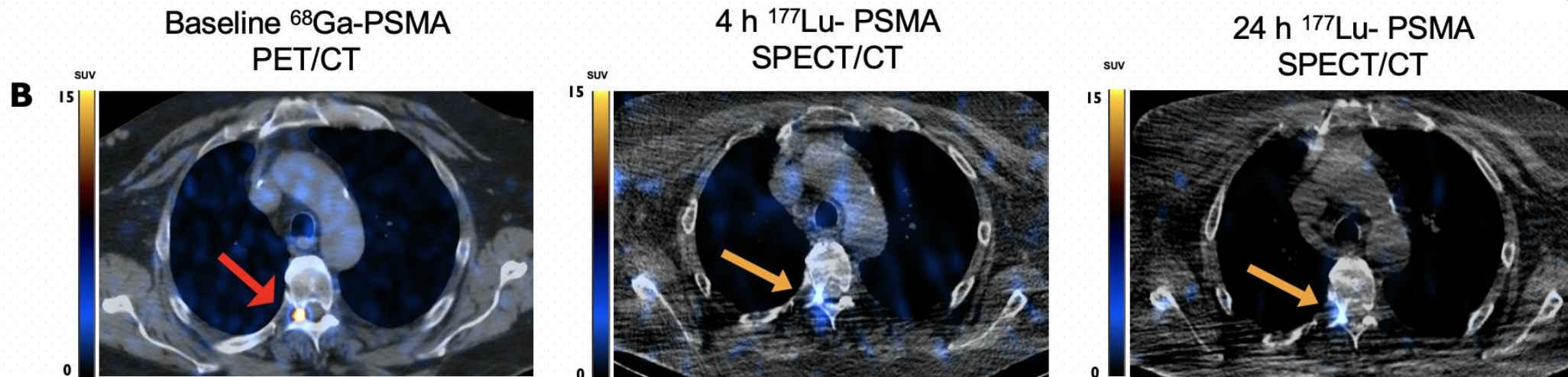
RESULTS

- 67% (14/21) of patients had lesions not identified on both 4-hour and 24-hour [^{177}Lu]Lu-SPECT/CT compared with [^{68}Ga]Ga-PSMA PET/CT.

- The median number of missed lesions on post-therapy [^{177}Lu]Lu-PSMA SPECT/CT at 4 hours compared to the reference [^{68}Ga]Ga-PSMA PET/CT was 3 (IQR 0-5).
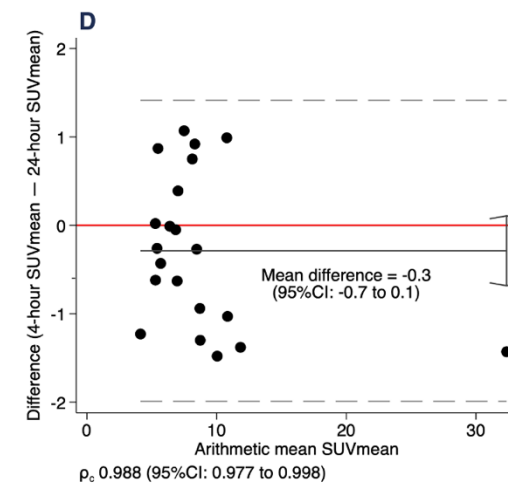
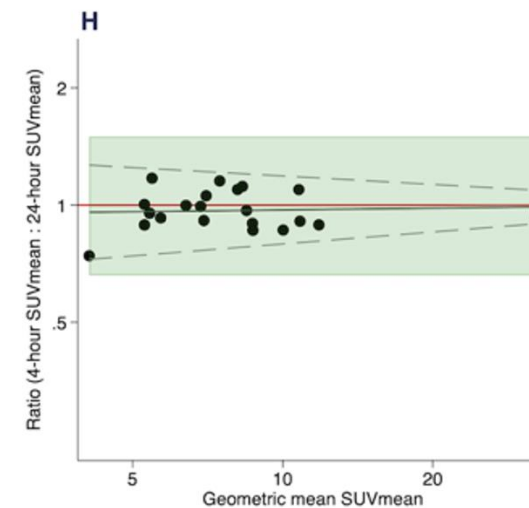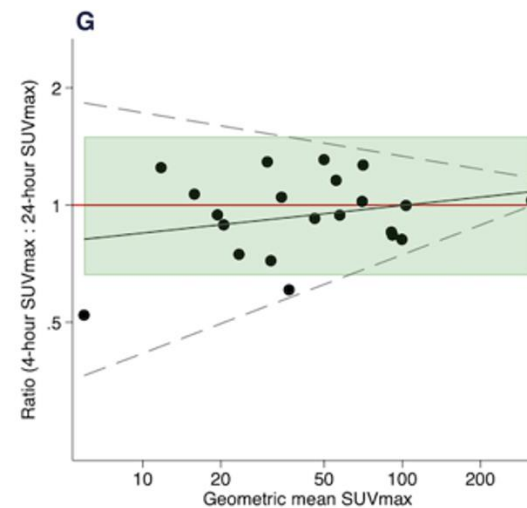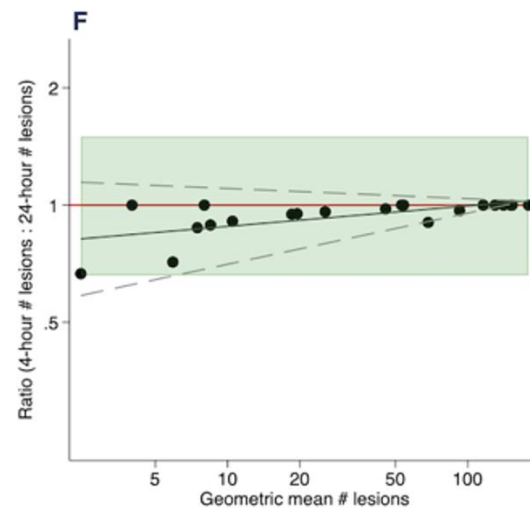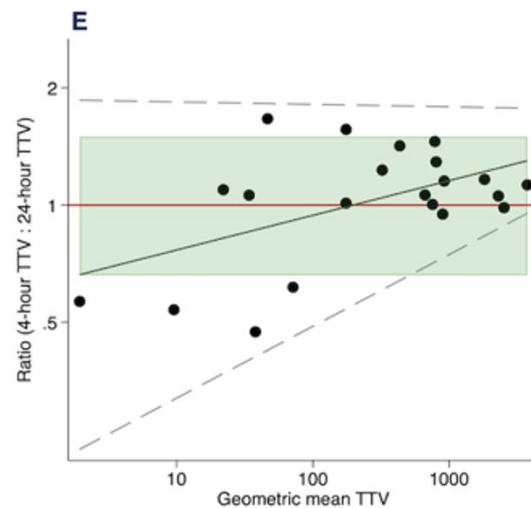- All missed lesions were small (< 2 cm)
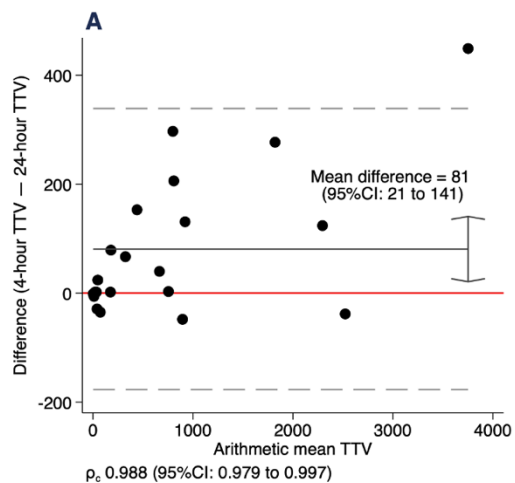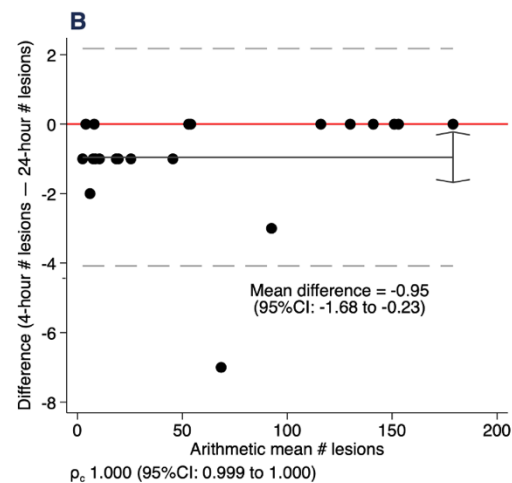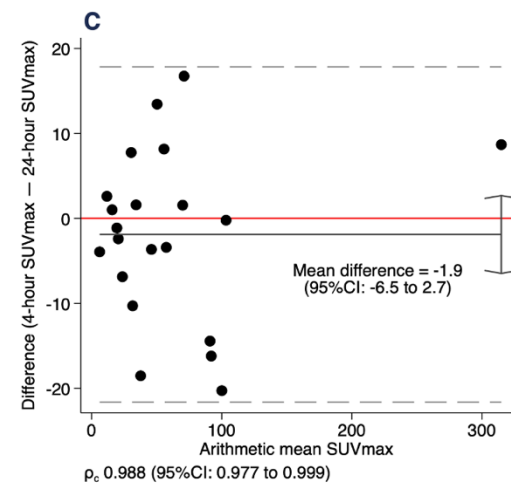
$\rho_c = 0.988$ $\rho_c = 1.0$ $\rho_c = 0.988$ $\rho_c = 0.988$

RESULTS

- TTV, number of lesions, SUVmax, SUVmean concordance correlation between 4-hour and 24-hour SPECT/CT was almost perfect to substantial.

RESULTS

- The mean difference in number of lesions, SUVmax and SUVmean was not statistically significant. While the mean difference shows higher variation at smaller TTV.
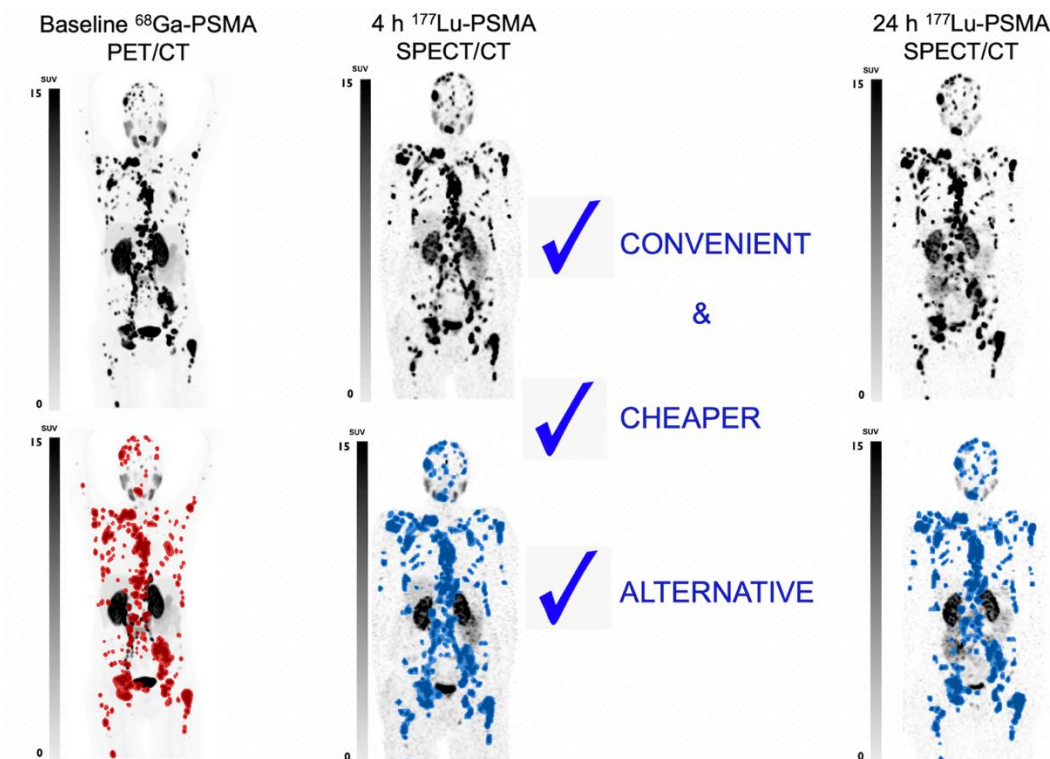
RESULTS

- Of the 7 patients with Δ TTV > -30%, 2 achieved PSA-50 (29%), versus 10 out of 13 (77%) with Δ TTV ≤ -30%.

- There were 13 patients with PSA progression or death recorded by July 2024. The median time from cycle 2 was 3.9 months overall, 1.8 months in those with < 30% reduction in TTV, and 8.2 months with ≥ 30% reduction in TTV.
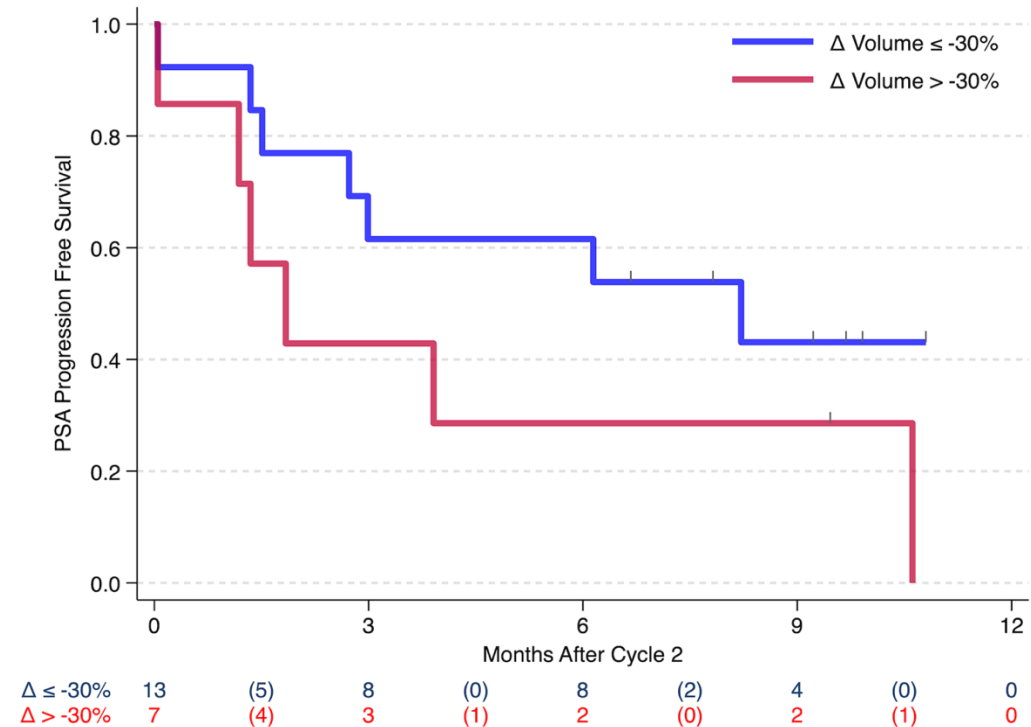
CONCLUSION

- 4-hour [^{177}Lu]Lu-PSMA SPECT/CT appears of sufficient quality and reproducibility for clinical use and appears a reasonable alternative to 24-h SPECT/CT .

- It is important to use the same post injection timepoint (either 4 or 24 hours) for serial analysis of total tumor volume due to variation at low tumor volumes between the 4- and 24-hour images.

- The change in TTV (Δ Volume) between dose 1 and 2 [^{177}Lu]Lu-PSMA SPECT/CT predicted PSA-50 and PSA progression-free survival.

THANK YOU