

Renal Dosimetry and Creatinine Clearance Trends in ^{177}Lu -PSMA Therapy: A Single-Institution Analysis

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INTRODUCTION

- ^{177}Lu -PSMA is a radiopharmaceutical-based therapy for treatment of metastatic prostate cancer in either castration sensitive or castration resistant populations.
- This study investigates the association between renal dose and clinically significant renal toxicity for 18 patients. 9 patients had prior treatment with ^{177}Lu -PSMA and 9 had not.

BACKGROUND

- The association between renal dose received over treatment with ^{177}Lu -PSMA and renal toxicity is not yet well understood, due to the novelty of the therapy.
- The predominant elimination method for ^{177}Lu -PSMA is through renal excretion. Additionally, proximal tubular cells express PSMA. This results in exposure of the kidneys to radiation, leading to concerns surrounding renal toxicity.

METHODS

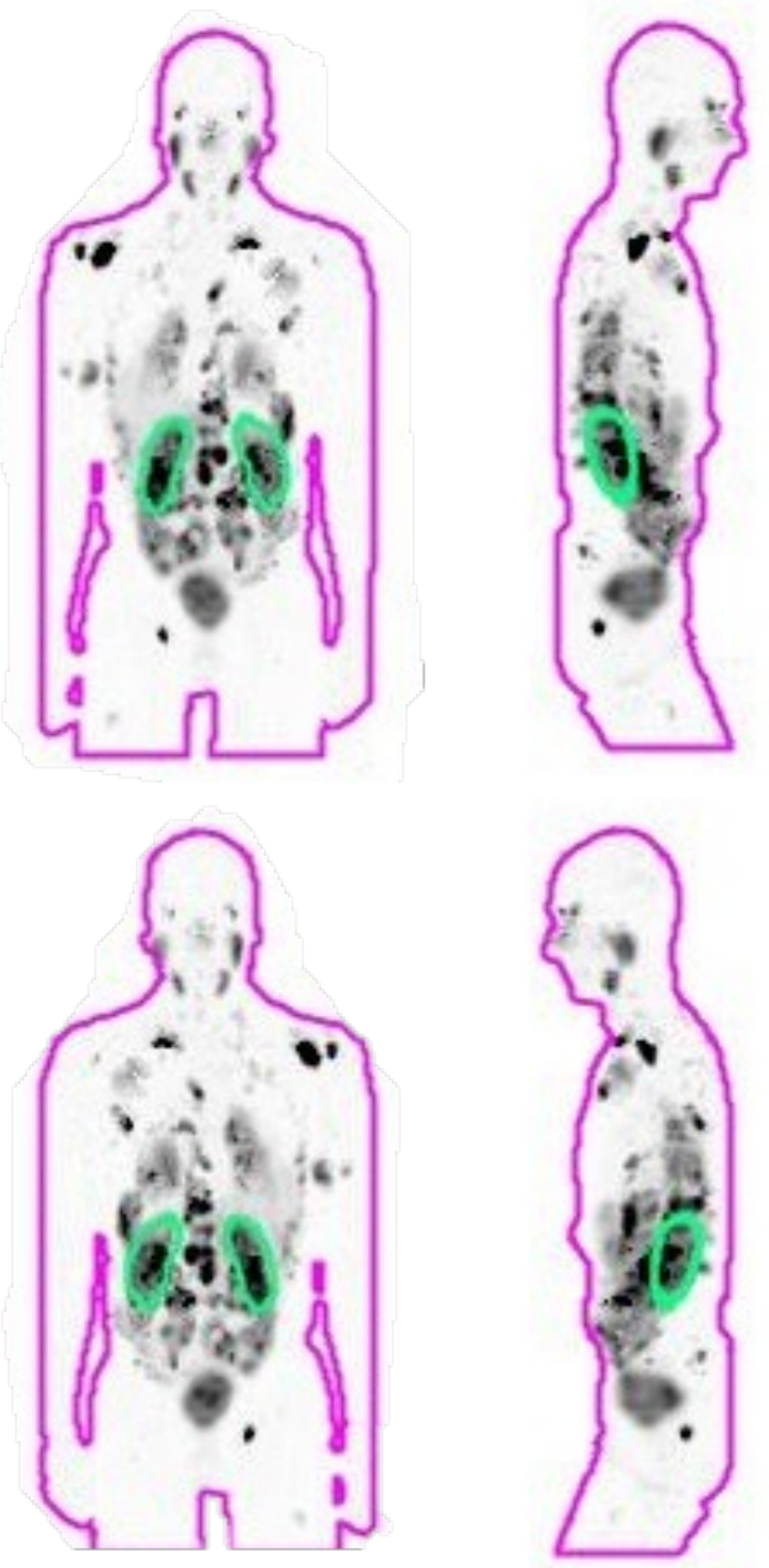


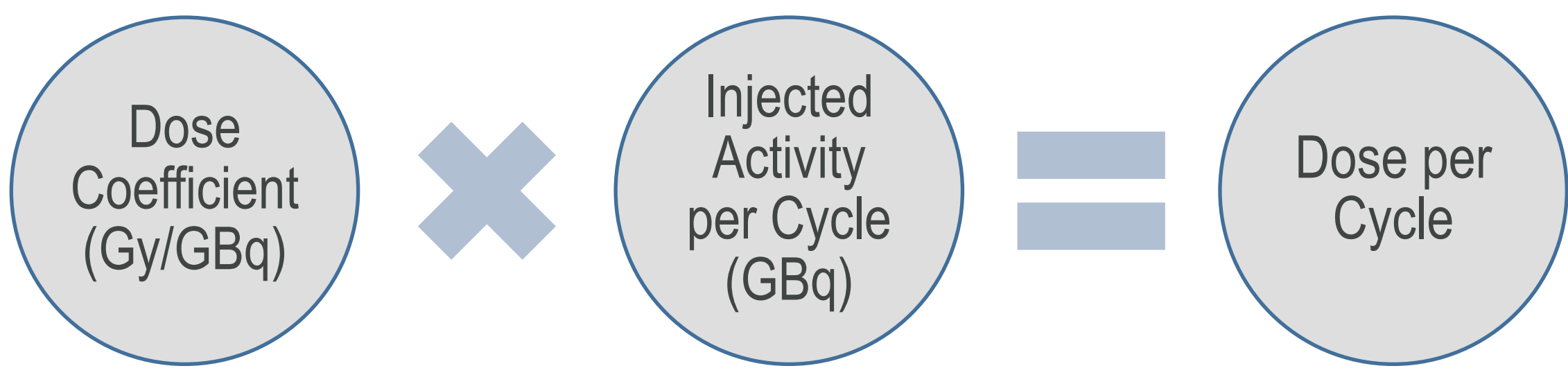
Figure 1: ^{177}Lu SPECT MIPs of dosimetry patient 1 in the coronal and sagittal planes, with the kidney ROI displayed.

SPECT/CT-based Dosimetry

- Images were obtained at 4 timepoints: 4-, 24-, 48-, and 72- hours following administration of ^{177}Lu -PSMA.
- MIMSurePlan MRT was used to perform dosimetry calculations.

Calculating Renal Absorbed Dose

- The dose coefficient (Gy/GBq) was determined from the calculated dose and known injected activity for the dosimetry cycle.
- The dose coefficient from the first cycle was to approximate the dose from subsequent cycles. [1]



- Total dose was determined by summing the dose from all cycles.
- Longitudinal dose was calculated for each cycle as the cumulative dose up to that cycle.

Estimating Creatinine Clearance

- Creatinine clearance was estimated from serum creatinine measurements with the Cockcroft-Gault formula [2]
- $$\frac{(140 - \text{age}) \times \text{mass (kg)}}{72 \times \text{serum creatinine (mg/dL)}}$$

Defining clinically significant toxicity

Clinical Significance was assessed with the ^{177}Lu -PSMA Prescription Guidelines

40% increase in serum creatinine **AND**

40% decrease in creatinine clearance

RESULTS

Percent Change vs Total Absorbed Dose

- A not significant, moderate negative association was detected between percent change in creatinine clearance from baseline to final follow-up and total renal absorbed dose ($r_s(16) = -0.44$, $p = 0.06$)
- A significant, moderate positive association was detected between percent change in creatinine from baseline to final follow-up and total renal absorbed dose ($r_s(16) = 0.52$, $p < 0.05$)

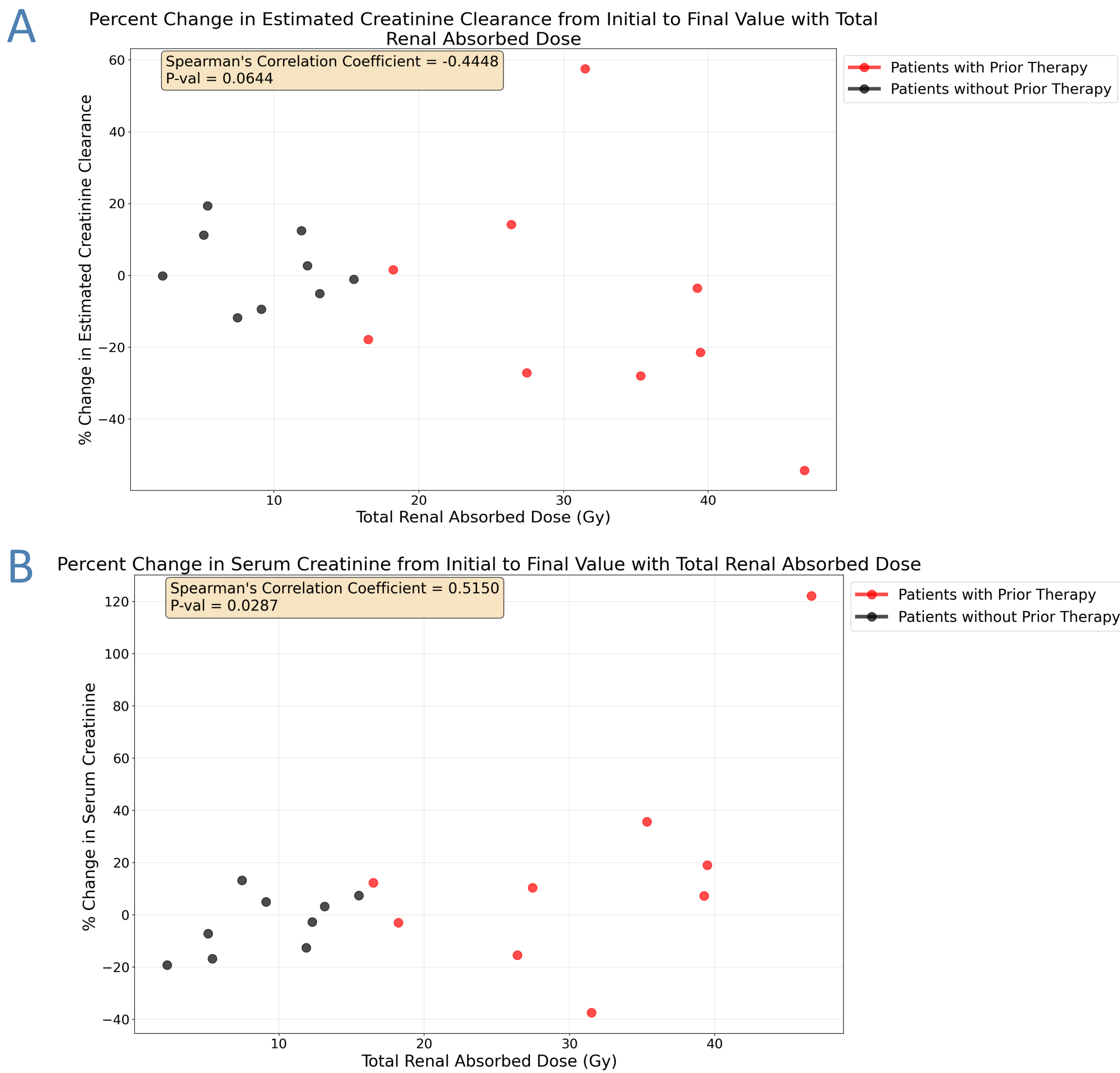


Figure 2: Plots of percent change from initial to final value of estimated creatinine clearance (A) and serum creatinine (B) with total renal absorbed dose.

Percent Change vs Longitudinal Absorbed Dose

- The plot for percent change in creatinine clearance displays an overall visual decreasing trend.
- The plot for percent change in creatinine displays an overall visual increasing trend

Patient 13 experienced a clinically significant potential decline in renal function according to the prescription guidelines and received a diagnosis of acute kidney injury. The total estimated renal dose received by this patient was >45 Gy.

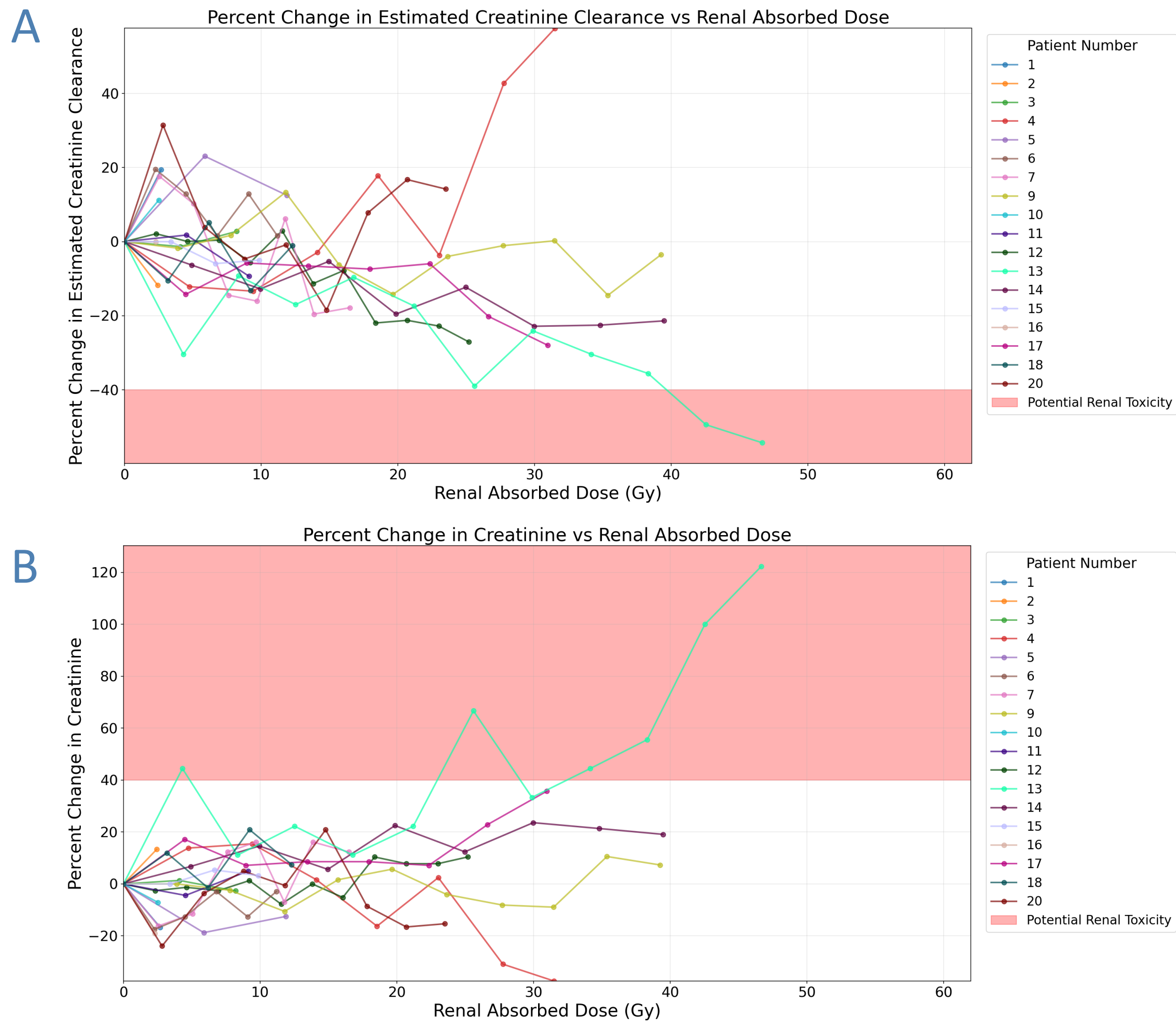


Figure 3: Plot of percent change of estimated creatinine clearance (A) and absolute change in creatinine (B) with longitudinal renal absorbed dose. The red region indicates a clinically significant change in renal function.

CONCLUSION

- A statistically significant increase in serum creatinine was detected, indicating that renal function potentially worsened with increasing dose.
- One patient experienced a clinically significant decline in renal function according to the ^{177}Lu -PSMA prescribing guidelines, receiving a diagnosis of acute kidney injury. This patient received the highest renal absorbed dose (>45 Gy) out of the cohort of 18 dosimetry patients studied.
- These results suggest that there may be an important association between renal dose received over treatment with ^{177}Lu -PSMA and decline in renal function.

REFERENCES

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