

# Lesion Insertion Tool to Assess PET-MR Attenuation Correction Methods: Matched Contralateral Uptake Lesion Insertions in Pelvis PET-MR Data

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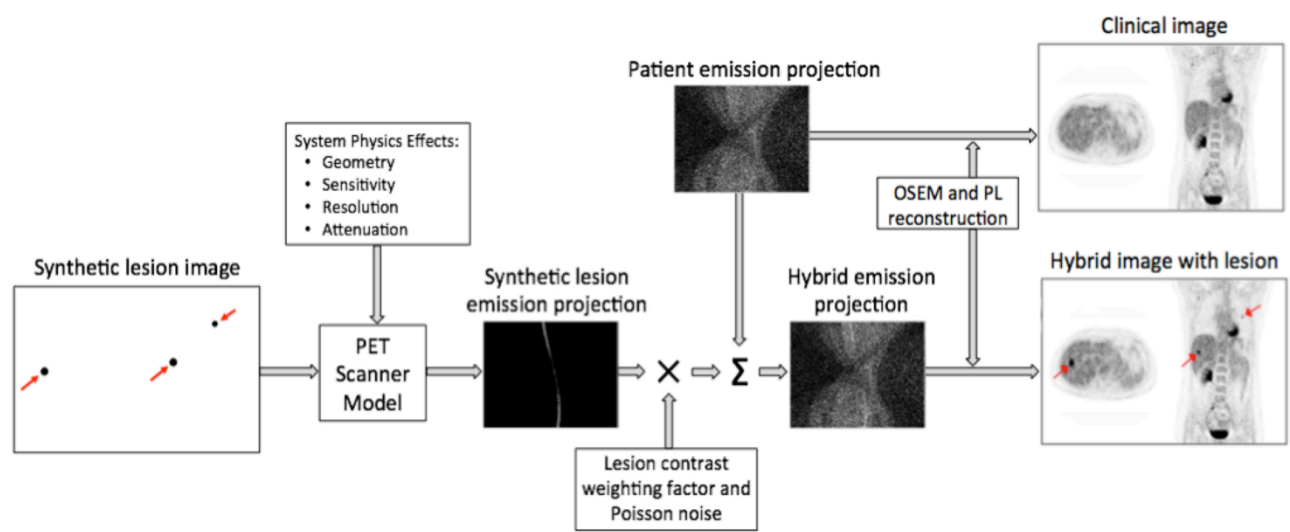
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## INTRODUCTION

PET quantification depends on accurate attenuation correction (AC) methods, which is a major challenge for the PET-MR systems that use MR images to calculate the 511 keV photon attenuation (1).

To evaluate different AC methods, we employed a PET/MR lesion insertion tool (2) that simulates lesions in a patient cohort that has both PET/MR and PET/CT images. These lesions were processed through the PET scanner model, and the CT-based AC (CTAC) was served as the ground-truth.



## AIM

The current study assesses standard uptake value (SUV) accuracy of different PET/MR AC methods using contralaterally matched synthetic lesions with the PET/MR lesion insertion tool.

## METHOD

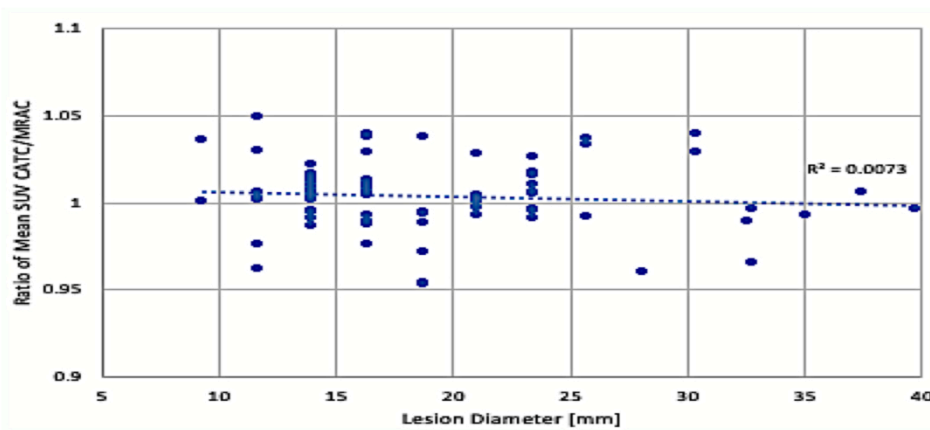
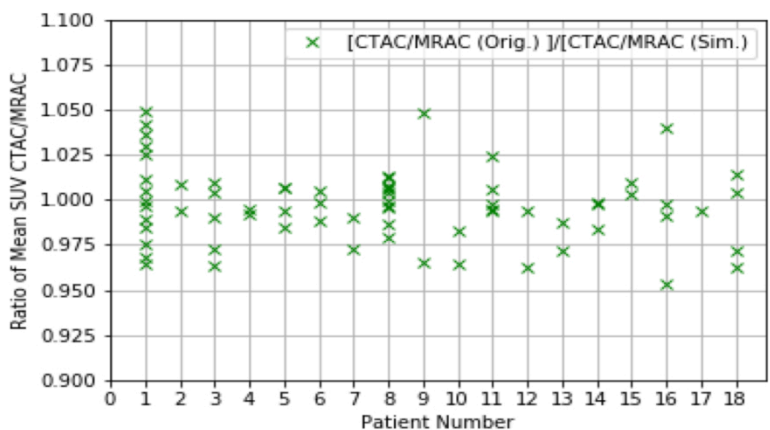
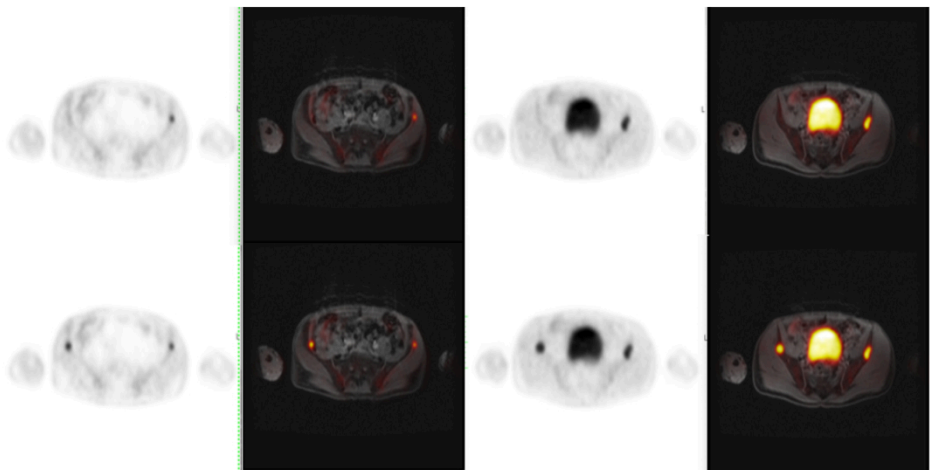
71 lesions were identified in 18 pelvic PET/MR patient data and synthetic contralateral lesions were generated. The generated lesions matched the contrast (mean SUVs in the original lesion VOI) and size (matched spherical diameter) of the true lesions and were inserted contralaterally on the same axial slice.

The CTAC and the MR-based AC (MRAC) were used for the reconstructions, and the SUV error (ratio of the VOI mean of SUV\_CTAC to mean of SUV\_MRAC) was calculated for all lesions.

The matched pairs of the original and the inserted lesions' error values were divided (error ratio) and analyzed across the lesion pairs

## RESULTS

- Intended contralateral lesions are successfully inserted, and the values are calculated.
- The error ratios are unity (mean error ratio = 1.004, stdev  $\pm 0.020$ ) and has not shown lesion diameter dependence ( $R^2=0.0073$ ).
- These results indicate that the lesion insertion tool can successfully replicate the patient uptake lesions that has the same characteristics with ACs, and the tool is valid for any reasonable lesion diameter ranges (anywhere from 9mm to 40mm).



## CONCLUSIONS

The lesion insertion tool can simulate uptake in pelvic lesions and their SUV characteristics.

This further strengthens the confidence in using this tool for simulating lesions at any sites and for evaluating novel AC methods that have the potential to improve the quantitative accuracy in simultaneous PET/MR systems.

## REFERENCES

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[2] K Wangerin, S Ahn, S Wollenweber, S Ross, P Kinahan and R Manjeshwar. Evaluation of lesion detectability in positron emission tomography when using a convergent penalized likelihood image reconstruction method. JMI 4(1) 011002 (2017)