[Poster] #0051

Monitoring tumor size using PET with a collimator during boron neutron capture therapy: Simulation study

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INTRODUCTION

❖ Purpose

- This study was aimed to demonstrate the feasibility of sensing changes in a tumor during BNCT using optimized an “adaptively-designed collimator” (ADC) that is suitable for the PET scanner.

MATERIALS & METHODS

❖ Simulation setup and running

- For the simulation, MCNPX simulation code was used.
- A simulation configuration for image acquisition before and during BNCT as shown in Fig.1(a).
- Prompt gamma rays of 478 keV were emitted from the neutron capture reaction points in the BURs(35 μg/g) and were detected using the collimator added in the PET detector. The projection acquisition progressed for approximately 8 min, with 32 projection data.

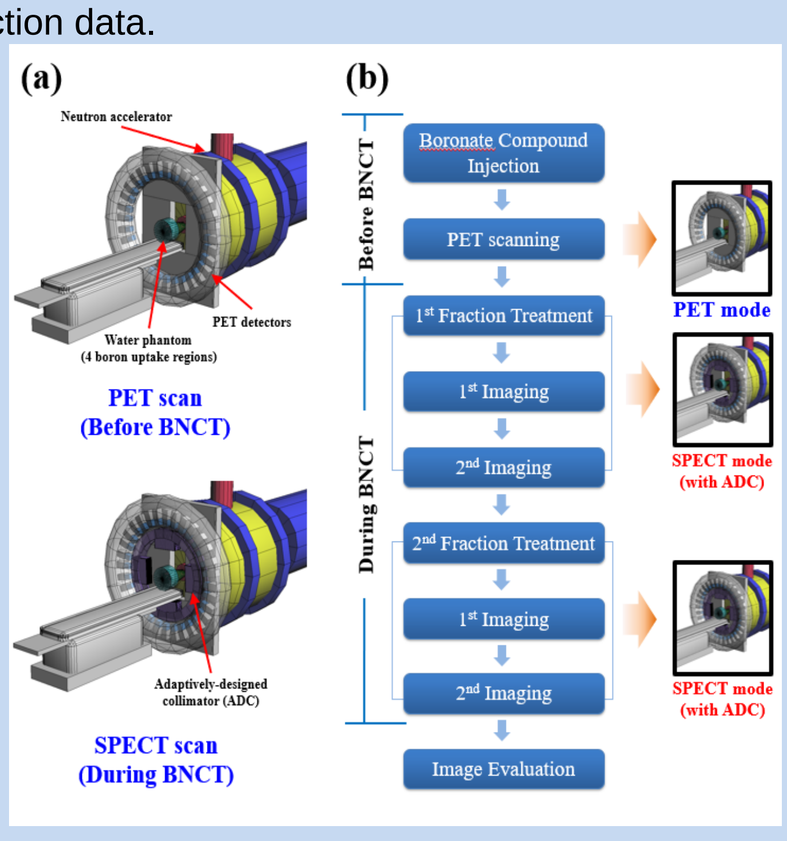

Fig. 1. Simulation configuration of the acquisition of two image types before (top in (a)) and during BNCT (bottom in (a)) and a diagram of the proposed BNCT procedure (b).

❖ Acquisition of tomographic images and analysis

- To reduce the image reconstruction time, the modified OSEM reconstruction algorithm was applied using GPU acceleration. After image reconstruction, image evaluation was assessed.

RESULTS & DISCUSSION

- Fig. 2 shows the images acquired at each stage of the proposed treatment procedure.
- To analyze the signal intensity, the image profiles were extracted from each of the reconstructed images. The image profiles indicated the relative count ratio of each BUR region (Fig.3).

(Cont.)

RESULTS & DISCUSSION

- As expected, the ratios of the relative counts are approximately proportional to the size of the BUR. We confirmed the variance of tumor size in the tomographic images and demonstrated that the tumor size decreased with each additional radiation fraction.

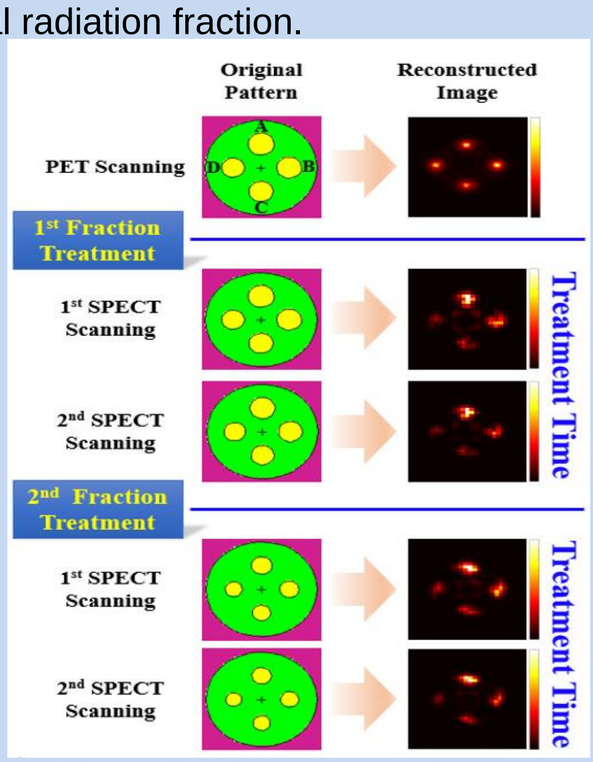

Fig. 2. A diagram of the original patterns and reconstructed images depending on the proposed BNCT procedure.

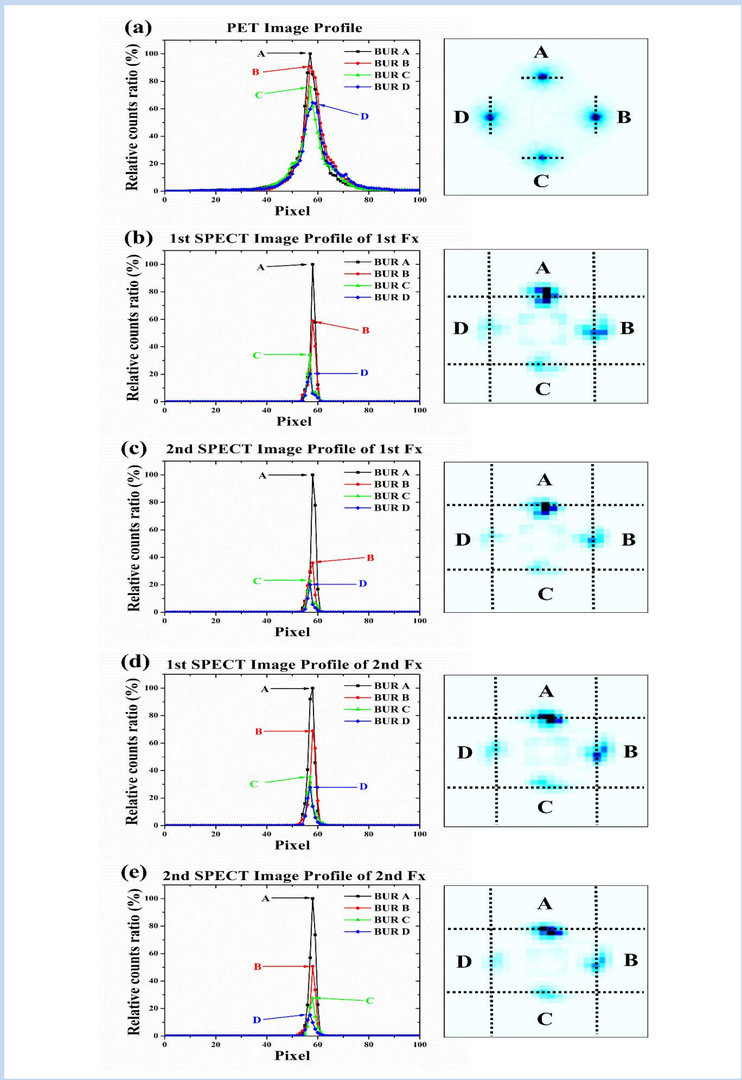

Fig. 3. The image profiles (left column) obtained from four boron uptake regions (BURs) in the reconstructed image with black dotted guidelines (right column).

CONCLUSION

- In this study, we optimized an ADC and acquired both PET and SPECT images using its before and during neutron beam delivery using a Monte Carlo simulation tool.
- This study demonstrates that it is feasible to monitor the tumor status during BNCT using both PET and an ADC.

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