Washington University in St. Louis
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MULTI-ENERGY WINDOW APPROACHES FOR QUANTITATIVE SPECT

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Technology Description

Researchers from the laboratory of Abhinav Jha at Washington University have devised a method to reliably obtain and significantly improve quantification of alpha-particle based SPECT tracer uptake, particularly in applications involving

Thorium-227 (^{227}Th), Radium-223 (^{223}Ra), and Actinium-225 (^{225}Ac). Administered activities in these α-particle radiopharmaceutical therapies (α-RPT) are orders of magnitude lower than conventional SPECT procedures, resulting in very low detected counts and subsequently challenges to reconstruction and quantification.

The method integrates multiple-energy-windows and directly estimates regional activity uptake from the projection data, and circumvents reconstruction-related information loss. It has been extensively validated *in silico* and yielded reliable regional uptake estimates superior to state of the art methods.

Stage of Research

Radiotracers imaged on conventional triple-line insert, NEMA phantoms, and realistic anthropomorphic phantoms mimicking vertebral lesions. Virtual imaging trials conducted against standard reconstruction methods in the field. Evaluation of variability across multiple platforms, physical phantoms, and patient data from ongoing clinical trials (such as NCT03724747) are on-going.

Publications

Li et al. (2023) Joint regional uptake quantification of Thorium-227 and Radium-223 using a multiple-energy-window projection-domain quantitative SPECT method.

Li et al. (2022) A multiple-energy-window projection-domain quantitative SPECT method for joint regional uptake quantification of Thorium-227 and Radium-223.

Li et al. (2022) A Projection-Domain Low-Count Quantitative SPECT Method for α-Particle-Emitting Radiopharmaceutical Therapy.

Applications

- **Applicable to personalized medicine within the context of SPECT, particularly post-therapy management, outcome prediction, & adverse events monitoring.**

Key Advantages

- **Radically new method for quantitative SPECT with improved accuracy, speed, and (MB vs TB) computational efficiency.**

- **Jointly estimates both** ^{227}Th & ^{223}Ra.

Patents

Patent application filed & published (WO2023287857A1)