QIPCM
Advanced Imaging Core Lab
TECHNA

The QIPCM PSMA-PET research and development program is in collaboration with UHN's Radiation Medicine Program (RMP).

PSMA-PET R&D **INCLUDES**

STANDARDIZATION

QIPCM has a strong track record in standardizing imaging and analytical techniques for clinical trials utilizing PET. Our R&D team, in collaboration with UHN's RMP, has developed several imaging phantoms for scanner validation and QA. In particular, we have tools and expertise with regards to imaging **Sensitivity** to detect small lesions, blurring of signal from small volumes (**Partial Volume Effects**) and **Scatter Effects** from high signal regions (bladder, kidneys, etc) which can affect quantification of imaging signal.

Sensitivity. PSMA-PET imaging for the detection of nodes in the whole body requires high imaging sensitivity. Many lesions are sub-2mm in diameter while most imaging phantoms are designed for a larger scale (4mm in diameter and up). Our PSMA small lesion phantom was designed to help quantify PSMA PET imaging sensitivity.

Partial volume effects. Our team has created an image derived input function (IDIF) phantom for the exploration of correction methods to partial volume effects. These effects introduce errors in quantification of small lesions, which are prevalent in PSMA-PET imaging. Its compartments mimic the sizes of the aorta, common iliac, internal iliac, and common carotid arteries as these are the most common vessels used for IDIF. This phantom will test the algorithm currently used to correct the IDIF measured in smaller vessels for dynamic PET studies. Next steps will be to perform dynamic PET scans with the phantom on our pump system in the coming weeks.

Scatter effects. Regions of high tracer uptake also present challenges. The high PET signal can dwarf signals from nearby tissue with less tracer uptake. On images it presents as spillover, where signal spills outside of the boundary of an organ, like the bladder. This issue impacts lesion quantification near the liver, kidneys, and ureters also. Our team has created an automated method of removing areas of contours impacted by spillover. We also designed a bladder/scatter phantom with 3D printing technology for testing and validation

of our method. The phantom consists of compartments of bladder, tumor, and muscle. The distance between bladder and tumor are adjustable, so we can observe how spillover changes with activity differences and linear distances.

IMAGE ANALYSIS

We are exploring image analysis techniques for both PET/CT and PET/MR. By applying what we learn from above, we have developed methods to correct for sensitivity issue, partial volume effect and scatter effect to improve lesion detection, SUV quantification, tumor staging and response tracking.

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