Improved lesion detection with time-of-flight PET scans affirmed

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For the first time, quantitative -- not qualitative -- data analysis has demonstrated that time-of-flight (TOF) positron emission tomography (PET) scans can improve cancer detection. Research published in the March issue of the *Journal of Nuclear Medicine* shows that oncologic TOF fluorodeoxyglucose (FDG) PET scans yielded significant improvements in lesion detection of lung and liver cancers over all contrasts and body mass indexes.

Conventional PET scans create images by detecting gamma rays produced by radioisotopes that are injected into the body. Although these conventional scans track where the gamma rays go, they don't consider the time it takes for each gamma ray to reach the detector. TOF PET scans do take into account the travel time, which results in improved image signal-to-noise.

"What's aimed to objectively quantify the improvement in lesion detection that can be achieved with whole-body TOF FDG PET," said Joel S. Karp, one of the authors of the study "Improvement in Lesion Detection with Whole-Body Oncologic Time-of-Flight PET." "In contrast with previously published studies that reported comparison of TOF and non-TOF PET using simulated data or measured data with physical phantoms, this study used whole-body patient data in order to encompass unique about this study is that we a large range of realistic activity distributions and patient body types."

To create a lesion-present clinical study while ensuring perfect

knowledge of the presence and location of each lesion, 10-mm spheric lesions were added to disease-free bed positions, yielding fused lesion-present studies. These studies appropriately corrected for the body's attenuation so that the presence or absence of the lesions was similar to that of actual patient studies.

TOF PET scans were done, and researchers used a numeric observer—as opposed to a human observer—to rapidly detect a large number of conditions. The TOF PET images were compared to conventional PET images (the same data reconstructed without TOF information) to determine improvement in lesion detection as a function of lesion location, scan time, contrast and body mass index.

Improved lesion detection was observed in the TOF PET scans, with the greatest gains achieved in the shortest-acquisition studies and in the subjects with a BMI of 30 or more. Also of note—the greatest gain in performance was achieved at the lowest lesion contrast and the smallest gain in performance at the highest lesion contrast.

Nuclear medicine technologists and physicians may be able to take advantage of the gain achieved with TOF PET to reduce scanning time, therefore increasing patient comfort and minimizing patient motion. They may also be able to reduce the injected radiopharmaceutical dose, thereby reducing the exposure of patients and health professionals to radiation.

More information: "Improvement in Lesion Detection with Whole-Body Oncologic Time-of-Flight PET", *Journal of Nuclear Medicine* .

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