First semiconductor-based PET scanner demonstrates potential to aid in early diagnosis of disease

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Evaluations of the first-ever prototype positron emission tomography (PET) brain scanner that uses semiconductor detectors indicate that the scanner could advance the quality and spatial resolution of PET imaging, according to researchers at SNM's 55th Annual Meeting. The prototype scanner already has proven successful in better characterizing partial epilepsy and nasopharyngeal cancer. Eventually, the technology could be used to provide early-stage diagnoses of other cancers, neurological disorders and cardiovascular disease; assess patients' responses to therapies; and determine the efficacy of new drugs.

"This is an exciting development in the field of nuclear medicine," said Yuichi Morimoto, senior researcher for the Central Research Laboratory of Hitachi Ltd., Tokyo, Japan, and lead researcher of the study, Performance of a Prototype Brain PET Scanner Based on Semiconductor Detectors. "Our research indicates semiconductor scanners show great potential because of their high energy resolution and flexibility in both sizing and fine arrangement of detectors. These characteristics should lead to improved PET images and, in turn, major advances in the practice of nuclear medicine."

Molecular imaging procedures such as PET scans are noninvasive and painless medical tests that help physicians diagnose medical conditions or conduct research. PET scans involve the use of radioactive materials called radiopharmaceuticals or radiotracers, which eventually collect in

the area being examined and give off energy in the form of gamma rays. This energy is detected by a PET scanner and/or probe. These devices work together with a computer to measure the amount of radiotracer absorbed and to produce special pictures offering details on the function of organs and other internal body parts down to the cellular and molecular levels.

Semiconductor-based detectors could improve PET imaging capabilities because the smaller, thinner semiconductors are easier to adjust and arrange than conventional scanners. The new technology allows for even higher spatial resolution and less "noise," or irrelevant images. The prototype semiconductor brain scanner also employs a depth of interaction (DOI) detection system, which reduces errors at the periphery of the field of view.

Researchers evaluated the physical performance of the prototype scanner and studied the technology's clinical significance in patients suffering from partial epilepsy and nasopharyngeal cancer—a relatively rare form of cancer that develops at the top of the throat, behind the nose. The results indicate that the PET scanner is feasible for clinical use and has good potential for providing the higher spatial resolution and quantitative imaging required in nuclear medicine. This device, which has been installed in Hokkaido University Hospital, is a result of successful collaboration with staff from the Department of Nuclear Medicine at Hokkaido University in Sapporo, Japan.

Source: Society of Nuclear Medicine