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Hybrid scanner brings molecular functioning to the forefront

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A major barrier to developing a hybrid positron emission tomography (PET)/magnetic resonance (MR) imaging system could be removed by using a novel approach for reconstructing data, according to researchers at SNM's 56th Annual Meeting in Toronto. Many researchers view fused PET/MR as an important next step in improving imaging capabilities and believe that PET/MR could become a viable alternative to hybrid PET/computed tomography (CT) systems.

"Providing both PET and MRI capabilities in a single room could be a powerful tool for research and, eventually, for patient care," said André Salomon, Molecular Imaging Systems, Philips Research, Aachen, Germany. "Our successful approach to addressing a major shortcoming in data reconstruction could be an important breakthrough in the development of such a system."

A combined PET/MR system could deliver the specific molecular information related to cell surface reactors, enzymes and gene expression that PET provides. At the same time, physicians could use MRI to see important anatomical data, soft-tissue contrast and information about perfusion and permeability. However, a combined PET/MRI cannot provide accurate, reliable images unless it includes a method to account for PET attenuation. Attenuation refers to the scattering of photons that should be detected by PET scanners, but fall out of their range or are absorbed by the body instead.

In combined PET/CT systems, attenuation mapping is performed

routinely based on available CT transmission data. Researchers are working on many alternatives to provide attenuation for PET/MR imaging. Most of these involve methods of segmentation, atlas-based registration and computer learning techniques using databases with MR and corresponding CT images.

In this study, a novel new method for estimating attenuation uses a data reconstruction approach that simultaneously computes the activity and the attenuation distribution using the MR image as a geometrical reference. In this way, the true physical attenuation of the photons provided by the PET data is measured. Preliminary results from simulated and measured clinical data that were compared to reference data from CT attenuation maps indicate excellent agreement between the two techniques. In addition, performing time-of-flight reconstruction—which measures how long gamma rays produced by radionuclides reach PET detectors—also improves accuracy.

Source: Society of Nuclear Medicine