Reconfigured hybrid imaging lowers radiation exposure

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Molecular imaging is effective for providing information about disease processes, and today's hybrid imaging systems have additional computed tomography (CT) technology on board for alignment and imaging structures. While this addition increases the amount of radiation dose a patient receives, research presented at the Society of Nuclear Medicine's2012 Annual Meeting finds that multiple molecular imaging studies need only one structural scan, which would slice off a significant amount of patient radiation exposure.

A method of molecular imaging called positron emission tomography (PET) provides information about physiological processes in almost every part of the body. State-of-the-art imaging systems combine PET with CT to add anatomical information that shows precisely where the process is occurring. The addition of CT during multiple imaging studies for one patient can dramatically increase their radiation dose, but research scientists studying brain PET/CT imaging have discovered that just one CT scan is enough to support more than one PET scan. Multiple PET scans are sometimes necessary for imaging injected biomarkers that take a long time to bind to their targets, during diagnosticstudies that require pausing or during scans to test new therapeutic drugs.

"Awareness of medical radiation exposure has increased over the past several years. In particular, the concern of additional radiation dose associated with CT in PET/CT is magnified in scans performed for investigational purposes," says Jae Sung Lee, Ph.D., associate professor of nuclear medicine at Seoul National University, Seoul, Korea.

Radiation is a natural phenomenon that is happening all the time as certain materials decay. Every year people are exposed to about 3 mSv (a measurement of exposure to radiation) of natural background radiation that comes from soil, from rocks or from high altitudes, to name some examples. As a comparison, people receive about 2 mSv during an average CT scan of the head.

"Computed tomography is useful for reducing PET scan time and improving image quality, but there is room for reducing the radiation dose—especially in brain PET studies—by avoiding the redundancy of repetitive CT scans," says Lee. "In this study, we propose a scheme to minimize the radiation dose by performing only a single CT scan per each subject and employing an image registration technique between brain PET scans."

During the study, researchers worked with five volunteers who were imaged in two sessions of dynamic brain PET/CT scanning with a new biomarker for amyloid plaque, which is implicated in cognitive decline and Alzheimer's disease. After an intermission during imaging, subjects were placed in a different position and another imaging study was performed. Both studies were 80-90 minutes long. Scientists compared images from the second PET study using the original CT image, the realigned CT image and the second CT to determine if using only the first CT scan was feasible. Researchers concluded that one CT image could be used during multiple PET studies to achieve satisfactory image quality.

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