Dynamic whole-body PET detects more cancer

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Imaging lung cancer requires both precision and innovation. With this aim, researchers have developed a technique for clinical positron emission tomography (PET) imaging that creates advanced whole-body parametric maps, which allow quantitative evaluation of tumors and metastases throughout the body, according to research announced at the 2015 Annual Meeting of the Society of Nuclear Medicine and Molecular Imaging (SNMMI).

Scientists have developed a novel agent for cancer imaging that seeks and attaches to integrin in the body. Biochemically, integrin facilitates cellular signaling and that makes it ideal for imaging growing and metastatic tumors that have spread through blood or lymph to settle in other organs. The imaging agent, also called a radiotracer, combines a small dose of medical radionuclides, in this case gallium-68 (Ga-68), and a peptide that has a natural affinity for integrin called arginine-glycine-aspartic acid (RGD). The integrin expression in the tumor lesions can be quantified by key parameters derived from dynamic PET imaging.

Currently, clinical PET scanners have a one-bed position with a limited field of view, so dynamic scans can provide moving images of tracer uptake in only a small frame of less than a foot. They are not able to evaluate molecular targets in cancer patients with multiple metastatic lesions distributed in a range greater than that single-position field of view. In the newly developed technique, the imaging bed shuttles between different positions in each timeframe to capture metastases throughout the whole body.

Once image data have been acquired, specialized software is then used to reconstruct the dynamic image series, followed by quantitative analysis that calculates important parameters about the function of the imaging agent inside the body.

"For patients with multiple tumors, this technology could significantly improve the contrast and quantitation of their PET scans and, therefore, the quality of their care," said Ning Guo, PhD, a research fellow in the department of radiology at Massachusetts General Hospital and Harvard Medical School in Boston, Mass. "RGD imaging could contribute to earlier diagnosis and more accurate prognosis by not only discriminating between benign tumors, inflammation and malignancy but also providing insight about malignant lesions that are atypical or unclear - a common challenge when using FDG-PET."

For this study, 16 lung cancer patients were imaged using whole-body dynamic RGD-PET, including acquisition of data from four different bed positions during an hour-long scan. The resulting quantitative analysis and parametric maps cover both primary tumors in the lung and scattered metastases. The researchers used software for image reconstruction and then calculated a number of parameters, including standardized uptake value (SUV) and kinetic parameter (binding potential), which provide information about how much the agent is being taken into the tissues and how strongly it is binding to targets. Parametric maps of binding potential not only showed a six-fold increase in tumor-to-muscle ratio and significant spikes in the contrast between tumor and background when compared to static PET scans, they also provided pixel-wise quantitation of both primary and distant metastatic tumor integrin expression.

Upon further study and pending regulatory approval, this method of PET imaging could be translated to clinical imaging for lung cancer and it has the potential to be used to detect a range of other cancers.

Approximately 221,200 new cases of lung cancer will be diagnosed in the U.S. and 158,040 patients will die from the disease in 2015, according to estimates from the American Cancer Society.

More information: Scientific Paper 122: "Whole-body Parametric Imaging of Lung Cancer Patients with 68Ga-PRGD2"

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