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Coming soon: 3-D imaging that flies 'through' and 'around' cancer

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Stanford University researchers demonstrated for the first time the ability to create 3-D positron emission tomography (PET)/computed tomography (CT) images for "fly-through" and "fly-around viewing" of cancer in the lungs and colon, according to a study in the July issue of the *Journal of Nuclear Medicine*.

This powerful ability to meld functional data with accurate anatomical information of possible cancerous tumors--from inside the body--provides a visual navigation of organs oftentimes portrayed on television crime shows like "CSI." Such visualization "may be used to detect and characterize cancer, spare someone from more invasive medical procedures, lead to better disease detection rates of colon cancer, provide surgical guidance and detect which tumors may be easier to biopsy," detailed Andrew Quon, clinical assistant professor of radiology/diagnostic radiology at California's Stanford University.

"Three-dimensional fusion provides unique views of the body that internal organs typically impede," said Quon. "Our new imaging and processing protocol can peel away the organs, highlight tumors and detect cancerous 'hot spots'--providing an omnipotent perspective of the body," he indicated. Stanford's 3-D fusion imaging "appears to have potential for presurgical visualization, particularly in guiding biopsies," explained the co-author of "'Flying Through'" and 'Flying Around' a PET/CT Scan: Pilot Study and Development of 3-D Integrated 18F-FDG PET/CT for Virtual Bronchoscopy and Colonoscopy." This imaging technique "may add important diagnostic information that may herald

new applications for the use of PET/CT," he noted. In addition, its diagnostic value was demonstrated in one case in which it revealed a cancer lesion that had not been detected by PET, CT or PET/CT imaging. "This one case shows the potential synergistic enhancement of both PET and CT when rendered into three dimensions," said Quon.

PET and CT are standard imaging tools that can be used to pinpoint the location of cancer within the body. When PET is used to image cancer, a radiopharmaceutical (such as fluorodeoxyglucose or FDG, which includes both a sugar and a radionuclide) is injected into a patient. Cancer cells metabolize sugar at higher rates than normal cells, and the radiopharmaceutical is drawn in higher concentrations to cancerous areas. The highly sensitive PET scan picks up the metabolic signal of actively growing cancer cells. The CT scan generates a detailed picture of internal anatomy, locating and revealing the size and shape of abnormal cancer growths. When these two results are fused together, the functional data from the PET imaging is correlated with anatomy on the CT images to provide a single detailed and informative image.

Standard 2-D PET and PET/CT images (with FDG) are accurate for evaluating lung and colorectal cancer; however, they lack the anatomic information that can be provided by 3-D images from a multidetector CT scan. Even so, with 3-D CT scans, small and flat lesions in the lungs and colon are difficult to see or characterize, said Quon. "Our study takes this to another level," he noted, indicating that fused PET/CT images with 3-D volume rendering may provide additional beneficial information for image interpretation and create new areas of clinical application. While this technology may become standard over the next three to five years, "it could have exciting applications in cardiovascular imaging, providing 3-D views of blood vessels and possibly identifying individuals at risk for heart disease," he predicted.

In the case of a patient with colorectal cancer--a term used to refer to

cancer that develops in the colon or rectum and is the second leading cause of cancer-related deaths in the United States--the current standard of care is a colonoscopy, a procedure where a long, flexible, lighted tube is inserted into the rectum and guided slowly into the colon. The tube or scope transmits an image of the inside of the colon onto a video screen so its lining can be examined.

While the initial findings are exciting, the researchers proved the concept rather than validated the technique. Future validation studies will be conducted and software tools need additional development, said Quon, who indicated that the technique might be expanded to include other tracers and anatomic regions besides the chest and colon.

"'Flying Through'" and 'Flying Around' a PET/CT Scan: Pilot Study and Development of 3-D Integrated 18F-FDG PET/CT for Virtual Bronchoscopy and Colonoscopy," appears in the July issue of the *Journal of Nuclear Medicine*, which is published by SNM. Besides Quon, co-authors include Sandy Napel, Christopher F. Beaulieu and Sanjiv Sam Gambhir, all with the radiology and bioengineering departments, Molecular Imaging Program, Stanford, University, Stanford, Calif.

Source: Society of Nuclear Medicine