PET techniques provide more accurate diagnosis, prognosis in challenging breast cancer cases

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In two new studies featured in the February issue of the *Journal of Nuclear Medicine*, researchers are revealing how molecular imaging can be used to solve mysteries about difficult cases of breast cancer. One article focuses on an imaging agent that targets estrogen receptors in estrogen receptor–positive breast cancer patients with formerly inconclusive assessments, and the second highlights a different imaging agent's ability to help predict the prognosis for patients undergoing chemotherapy for a very aggressive type of breast cancer.

Conventional imaging and biopsy are not always enough to diagnose and characterize suspected metastatic breast cancers, especially for patients who cannot receive repeated biopsies due to the location of the cancer or other existing illnesses. It is estimated that 75 percent of breast tumors show estrogen receptor activity at the point of diagnosis, and that estrogen receptor expression is an indicator of not only active cancer lesions, but patients' potential response to therapy, as well.

Researchers found that whole-body positron emission tomography (PET) with 16a-18F-fluoro-17b-estradiol (18F-FES), a molecular imaging technique, provides an entirely non-invasive means of capturing estrogen receptor expression in estrogen receptor–positive metastatic breast cancer. It has the potential to help physicians make more accurate judgments about extent of disease, specifically whether anti-hormonal therapies would be beneficial for patients who had inconclusive

assessments using more conventional methods.

"Physicians are routinely faced with uncertainty about diagnosis or treatment decision-making," says Geke Hospers, MD, PhD, professor of medical oncology, University Medical Center Groningen, The Netherlands. "These problems result in delays in diagnosis and institution of the right treatment, and this remains true for patients of breast cancer. The specificity of the FES-tracer for estrogen receptors makes this technique ideal for aiding physicians working with clinical dilemmas in estrogen-receptor positive breast cancer patients and could potentially lead to faster diagnoses and earlier implementation of appropriate treatments."

In this study, 33 women with a history of estrogen-receptor positive breast cancer and a formerly inconclusive assessment were imaged with 18F-FES PET to evaluate whether the technique improved diagnosis and clinical decisions about treatment. In 88 percent of subjects, 18F-FES PET was found to improve diagnostic information, and in 48 percent, it prompted a change in treatment. This molecular imaging technique was especially helpful for detecting bone metastases.

The second article is a prospective study of patients with triple-negative breast cancer receiving chemotherapy before scheduled surgery. This type of breast cancer is an aggressive type of breast tumor that accounts for 15 percent of invasive breast cancers. In this study, researchers evaluated 18F-FDG-PET/CT, a molecular imaging method that allows physicians to gauge how metabolically active tumors are in order to gauge a patient's predicted therapy response and prognosis after treatment. This information is valuable because very metabolically active tissues indicate active tumor growth and can signal potential failures and relapse after treatment.

Participants—20 patients with triple-negative breast cancer—underwent

PET imaging with 18F-FDG at the outset of chemotherapy and again after the second cycle of treatment and were evaluated to determine metabolic changes in tumors during therapy. At the point of surgery, six patients showed that their therapy had been completely successful, and 14 others were found to have remaining tumors after therapy. Researchers found that patients with a less than 42 percent decrease in metabolism of the agent after two cycles of chemotherapy still had some residual cancer after treatment and were therefore at high risk of early relapse.

"If these findings are confirmed by other teams, interim 18F-FDG-PET/CT could become a major tool for early response assessment of this aggressive cancer, similar to the role that 18-FDG plays in assessing aggressive lymphomas," says David Groheux, MD, a principal researcher in the department of nuclear medicine at Saint-Louis Hospital in Paris, France. "Also, if these data are confirmed, patients not responding to chemotherapy prior to surgery could be switched to novel treatments that are now being investigated for this specific subtype of breast cancer, which could potentially improve the prognosis for these patients."

This research presents 18F-FES and 18F-FDG as two valuable molecular imaging agents for physicians assessing breast cancer patients with diagnostic dilemmas and those with triple-negative breast cancer undergoing neoadjuvant chemotherapy (therapy prior to surgery). Further research would expand the use of these agents for more accurate diagnosis, tumor characterization, therapy monitoring and prognosis for patients with aggressive, complex and challenging breast cancer cases. Increasingly precise characterization, showing specific genetic or other physiological features using molecular imaging techniques, will continue to further personalize breast cancer imaging in the near and distant future.

According to the National Cancer Institute, an estimated 230,480 women

were diagnosed with cancers of the breast and 39,520 women will have died of breast cancer in 2011.

More information: Authors of the article "PET imaging of estrogen receptors as diagnostic tool for breast cancer patients presenting with a clinical dilemma" include Michel van Kruchten, Carolien P. Schroder, Elisabeth G.E. de Vries and Geke A.P. Hospers, Department of Medical Oncology, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands; Andor W.J.M. Glaudemans, Erik F.J. de Vries, and Rudi A. Dierckx ,Department of Nuclear Medicine and Molecular Imaging, University Medical Center Groningen, University of Groningen, Groningen, The Netherlands; and Regina G.H. Beets-Tan, Department of Radiology, Maastricht University Medical Center, Maastricht, The Netherlands.

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