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NEWS

RSNA Press Release

"Optical Mammography" Can Find and Evaluate Small Breast Cancers with No Need for X-rays

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Up to now, gauging the aggressiveness of a particular breast cancer has required an invasive surgical or biopsy specimen of tissue or, at the least, a mammogram, which uses x-rays. Now, as disclosed in a study reported in the March 2002 issue of the journal *Radiology,* there is a promising method called "optical mammography" that uses not x-rays, but an optical probe that zeroes in on a particular enzyme found in large amounts in tumors that are invasive and prone to spread to other body sites.

As described by one of the investigators, Christoph Bremer, M.D., from the Department of Clinical Radiology at the University of Muenster in Germany, ""We designed a new optical sensor which sensitively picks up molecules (proteases) that are associated with aggressive forms of cancer."" The targeted enzyme, called cathepsin B, breaks down the protein that supports cell walls and, in effect, digests healthy tissue. This makes more room for tumor tissue, and also helps the tumor cells to invade blood vessels and form metastases. All these effects make for a more aggressive tumor and a less optimistic clinical outcome.

The test, so far only done in tumor-bearing mice, is a two-step process. First, an enzyme-sensitive imaging probe containing potentially fluorescent molecules called fluorochromes is injected intravenously. After 24 hours, fluorescent imaging ""lights up"" tissues containing the enzyme. The more enzyme, the more intense the fluorescent signal. Highly aggressive breast cancers generally have much more cathepsin B than less dangerous tumors, so that enzyme imaging holds promise for identifying those tumors that require correspondingly aggressive treatment.

When samples of a less aggressive human breast cancer and a highly invasive, metastatic tumor were implanted into mice, both types were readily detected by imaging. Comparing tumors of equal size, fluorescent signals from the aggressive lesions were 50% more intense than those from the less threatening tumors. Chemical testing and microscopic study of tissue samples confirmed this difference in enzyme content. Dr. Bremer estimates that a clinical version of optical mammography may be available in about three to five years.

An optimistic view also is expressed by Umar Mahmood, M.D., Ph.D., from the Center for Molecular Imaging Research at Massachusetts General Hospital in Charlestown, Massachusetts. "Optical imaging hopefully will not only detect cancers at a smaller, more treatable stage, based on their molecular signatures," states Dr. Mahmood, "but also will result in more tailored, individualized therapy for women unfortunately diagnosed with breast cancer." Dr. Mahmood further postulates that it may be possible in the not too distant future to adjust dosage or therapy just days after the start of treatment, or even to choose the initial drug combination based on enzyme expression levels.

Radiology is a monthly scientific journal devoted to clinical radiology and allied sciences. The journal is edited by Anthony V. Proto, M.D., School of Medicine, Virginia Commonwealth University, Richmond, Virginia. It is owned and published by the Radiological Society of North America, Inc. The Radiological Society of North America (RSNA) is an association of more than 30,000 radiologists and physicists in medicine dedicated to education and research in the science of radiology. The Society's headquarters is located at 820 Jorie Boulevard, Oak Brook, IL 60523-2251.

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"Imaging of Differential Protease Expression in Breast Cancers for Detection of Aggressive Tumor Phenotypes." Collaborating with Dr. Bremer on this report are Ching-Hsuan Tung, Ph.D., Alex Bogdanov, Jr., Ph.D., and Ralph Weissleder, M.D., Ph.D.