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NEWS

RSNA Press Release

Optical Imaging Added to Ultrasound Improves Breast Cancer Diagnosis

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At A Glance

- Optical tomography produces images of the blood vessels nourishing breast tumors. The density of these vessels is closely associated with malignancy.
- Most tumors that are surgically biopsied turn out to be benign.
- Combining optical tomography with ultrasound will reduce unnecessary biopsies.

OAK BROOK, Ill.— A new study shows that combining a technology called optical tomography with standard ultrasound imaging can help distinguish early-stage breast cancer from non-cancerous lesions—and potentially reduce the number of breast biopsies performed. The study appears in the October issue of the journal *Radiology*.

Ultrasound, which uses reflected sound waves to produce images of the internal structures of the body, is often used to further evaluate suspicious breast lesions found by mammography. But its results are not always reliable enough to avoid a biopsy, in which some of the breast tissue is surgically removed and examined.

"Only 10 to 15 percent of women who undergo a breast biopsy actually have a malignant tumor, leading many women to experience unnecessary anxiety, discomfort and expense," said the study's lead author, Quing Zhu, Ph.D., associate professor of electrical and computer engineering at the University of Connecticut in Storrs.

By combining ultrasound with optical tomography, which employs diffused light in the near infrared (NIR) spectrum, the researchers were able to calculate the concentration of oxygen-carrying blood cells—or hemoglobin—and microvessels present in each lesion. A high density of microvessels in a tumor is known to be highly correlated with malignancy.

"We found that early-stage invasive cancers have a two-fold higher total hemoglobin concentration compared with benign lesions," Dr. Zhu said. "These findings demonstrate that this technique has great potential for non-invasively distinguishing malignant and benign masses to reduce benign biopsies."

In the study, 65 patients with a total of 81 breast lesions were examined with ultrasound and optical tomography. Breast lesions were then biopsied. The biopsy results confirmed eight

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invasive cancers and 73 benign lesions. The average total hemoglobin concentration within the malignant group was more than twice that of benign group.

To perform the dual imaging exam, engineers in Dr. Zhu's lab added NIR sensors to an ultrasound transducer, creating a hand-held probe capable of acquiring both ultrasound images and light waves. The collected images and optical data were then processed using a computer algorithm.

"The combination of the two technologies is key," said Dr. Zhu. "Ultrasound locates the lesion, while optical tomography helps calculate the blood volume in the lesion."

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"Benign versus Malignant Breast Masses: Optical Differentiation with Ultrasound-guided Optical Imaging Reconstruction." Collaborating with Dr. Zhu on this paper were Edward B. Cronin, M.D., Allen A. Currier, M.D., Hugh S. Vine, M.D., Minming Huang, M.S., NanGuang Chen, Ph.D., and Chen Xu, M.S. Other significant contributors to this series of studies include Scott H. Kurtzman, M.D., Susan Tannenbaum, M.D., Mark Kane, M.D., Poornima Hegde, M.D., Bipin Jagjivan, M.D., and Kristen Zarfos, M.D.

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