

Alternative breast imaging techniques sort abnormal from normal tissue

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Dartmouth physicians and engineers have published a paper with results from a five-year project testing three new imaging techniques to examine breast abnormalities, including cancer. The study finds that the new methods of electromagnetic imaging offer a high contrast and the ability to distinguish between healthy breast tissue and abnormal tissue. Their study appears in the May 2007 issue of *Radiology*, the journal of the Radiological Society of North America.

The interdisciplinary team includes researchers from Dartmouth's Thayer School of Engineering and Dartmouth Medical School working with experts at the Norris Cotton Cancer Center and the Department of Radiology at Dartmouth-Hitchcock Medical Center (DHMC). The electromagnetic techniques are electrical impedance spectral imaging (EIS), microwave imaging spectroscopy (MIS), and near infrared (NIR) spectral imaging.

A total of 150 women participated in this study, 97 of whom had an abnormal conventional breast image that was suspicious or highly suggestive of malignancy and were scheduled for a biopsy. The women with abnormal breast images underwent electromagnetic exams prior to biopsy. The researchers compared the abnormal area with the background breast tissue and with a mirror image area in the opposite breast and correlated the data with the biopsy findings. Further analysis led the researchers to determine that the new imaging techniques provided an increase in contrast between 150 to 200 percent to discriminate between breast cancer and benign tissue.

“We put our new imaging techniques to the test to quantify their effectiveness,” said Steven Poplack, associate professor of radiology and OB/GYN at Dartmouth Medical School, and co-director for breast imaging/mammography at DHMC, and the lead author of the paper. “Our results show the potential power of using a variety of imaging techniques to get the best possible view of what’s going on in the breast tissue.”

Specifically, the three techniques demonstrated significant differences in region-of-interest image summaries of normal versus abnormal breasts for EIS, across diagnostic groups for NIR, and for MIS when analysis was restricted to lesions larger than one centimeter. The electromagnetic imaging modalities appeared even more accurate when all are used in concert.

EIS: This painless test uses a very low voltage electrode system to examine how the breast tissue conducts and stores electricity. Living cell membranes carry an electric potential that affect the way a current flows, and different cancer cells have different electrical characteristics.

MIS: This exam involves the propagation of very low levels (1,000 times less than a cell phone) of microwave energy through breast tissue to measure electrical properties. This technique is particularly sensitive to water. Generally, tumors have been found to have more water and blood than regular tissue.

NIR: Infrared light is sensitive to blood, so by sending infrared light through breast tissue with a fiber optic array, the researchers are able to locate and quantify regions of oxygenated and deoxygenated hemoglobin. This might help detect early tumor growth and characterize the stage of a tumor by learning about its vascular makeup.

Source: Dartmouth College

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