Tunable receiver distinguishes fibroadenoma, malignancy

NEW ORLEANS—With a tunable receiver, sonographers may detect small breast masses, as well as differentiate between normal breast tissue and lesions, and between fibroadenomas and malignancies.

“Advantages of the tunable receiver are increased resolution, controlled contrast, and possible tissue characterization,” explained Elizabeth Kelly-Fry, a physicist at the Indiana University School of Medicine and the Indianapolis Center for Advanced Research (ICFAR).

FIBROADENOMA PATTERN

Preliminary indications are that the US scanner can be tuned so that fibroadenomas exhibit a distinctive pattern. “We are particularly enthusiastic about its possibilities in terms of fibroadenoma masses,” she said.

However, “at this time, we do not claim that all fibroadenoma masses will have this type of pattern; we need to do a great deal more investigation,” she added.

Coauthors of this paper, presented at the 24th National Conference on Breast Cancer, sponsored by the American College of Radiology, are Valerie P. Jackson, MD, of IUSM, and Narendra T. Sanghvi, MS, of ICFAR.

The basic unit used in this study was a Labsonics automated scanner, which normally uses a frequency of 7.5 MHz, and which can scan a mass in both the longitudinal and transverse planes, presenting the acquired data in a single image, so-called bimplane scanning. This unit also has the unique ability of pulsing an 11 MHz transducer in a manner which allows center frequency outputs of either 11.0, 6.5, 4.5 or 3.5 MHz.

MORE RESOLUTION

Into this automated scanner, the researchers plugged a tunable receiver to control both the center frequency of the receiver (3.5-15 MHz) and the fractional bandwidth (35-100%).

“We want to increase resolution, which we hope to do by biasing the receiver system for very high-frequency programs, to show solid masses within the breast. These researchers did not simply set the tuner at the high-frequency end, but often compared tuned images to a mass with a shadow adjacent to it.

Although using this system to detect small masses is definitely in the works for this team, “at this moment, we would like to concentrate our efforts on using this system to influence backscattering,” Dr. Kelly-Fry said.

Backscattering refers to the ultrasound energy “scattered back to the ultrasound probe; the degree of backscattering is related to the frequency,” she said.

IDENTIFYING THE MASS

This study only included women whose x-ray or standard US mammograms showed a solid mass within the breast. These researchers did not simply set the tuner at the high-frequency end, but often compared tuned images to form a diagnosis.

However, in several cases, the high-frequency signal gave the scanner “enough contrast resolution to differentiate, for example, a mass from a shadow adjacent to it.”

Although using this system to detect small masses is definitely in the works for this team, “at this moment, we would like to concentrate our efforts on using this system to influence backscattering,” Dr. Kelly-Fry said.

Backscattering refers to the ultrasound energy “scattered back to the ultrasound probe; the degree of backscattering is related to the frequency,” she said.

FUNCTIONAL DIFFERENCES

“Since the extent of the frequency dependence of backscattering varies according to the basic structure of the tissue, we hope we can get tissue characterization based on frequency dependence,” she added.

She offered the case of a woman with a very fatty breast, which had a mass that defied definition on mammography or standard US imaging. “We could not see the internal structure, so we simply narrowed the bandwidth, to a small degree. In other words, we didn’t use the highest frequency, and we could see immediately that there was a solid mass,” Dr. Kelly-Fry said.

She also offered images of a mass that proved, on biopsy, to be a fibroadenoma. “There is considerable backscattering from all regions of the breast, but there also is a characteristic pattern in the internal structure of the fibroadenoma,” she pointed out.

This pattern was highlighted by using the tunable receiver to attain a very narrow bandwidth, biased toward a higher frequency. The phenomenon was reproducible.

Applying the same parameters to a medullary carcinoma yielded different results. “We certainly saw the celled wall; it was not completely attenuating,” she noted. “With the medullary carcinoma, we did not get this intensive backscattering” that the fibroadenoma produced.

So, “Applying the system to a ductal carcinoma offered similar results. “In this case, we only slightly narrowed the bandwidth; we did not try for the highest frequencies for this image,” Dr. Kelly-Fry said.

The image showed “the rather dense interior wall characteristic of a medullary carcinoma,” she said.

Dr. Kelly-Fry concluded.

For more information, please write: Dr. Elizabeth Kelly-Fry, Indianapolis Center for Advanced Research, 600 N. Capitol Ave, Indianapolis, IN 46202.

reported by Bill Robinson, RT staff writer