COMBINED USE OF MAMMOGRAPHY AND ULTRASOUND VISUALIZATION USING A LABORATORY-MODIFIED COMMERCIAL BREAST SCANNER TO IMPROVE DIFFERENTIAL DIAGNOSIS*

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ıtroduction

A clinical breast cancer detection program is ıderway with emphasis on the use of mammography and ltrasound visualization as complementary methods. n that regard, x-ray images and acoustic images of he breast are compared on all breast patients exam-ned to determine (1) whether ultrasound imaging im-roved the differential diagnosis of lesions observed n film mammograms, and (2) whether information shown n film mammograms was significant to the interpreta-ion of acoustic images.

nstrumentation and Procedure

The basic ultrasound unit applied in this pro-ram is a commercial instrument, specifically de-signed for breast examination with the patient in a supine position. This instrument is a linear scan, B-mode visualization system which includes automatic transverse, longitudinal, or oblique scanning at 5 mm space intervals, time gain compensation, water bag coupling, a 5 MHz, 1 cm diameter focused transducer and, (in addition to standard recording of images such as Polaroid), automatic recording of images on 35 mm film from a CRT display. As designed, the linear travel of the transducer covers a tissue view-ing distance of 12 cm, and nine such sweeps are auto-matically taken with a 5 mm distance spacing between each interval. The time required to complete this nine-scan series is 30 seconds. After use on a num-ber of patients in its original form, the automatic motion system was modified to provide a choice of 1 mm or 5 mm spacing intervals. The motion system can be stopped at any of the nine intervals scan ser-ies for the purpose of examining a region of interest in 1 mm steps. In order to carry out a detailed study of the characteristics of overt masses, a 0-60 dB rotary type attenuator with 1 dB step intervals was incorporated into the basic unit. Additionally, a scan converter, large television image display, and a system for recording the echograms on 8x10 x-ray film was added to the system. Provision was also made for insertion of transducers of other de-signs than that provided with the basic unit.

Discussion and Results

In a significant number of patients, masses that were indeterminate in appearance on mammograms, even after thorough examination with magnification techniques, proved to be cystic, as clearly shown by ultrasound visualization. With the use of the modi-fied scanner, it was possible to visualize the walls of the cysts at intervals as small as 1 mm. This is particularly valuable in the case of small cysts. It was found that many more cystic lesions can be appreciated with acoustic imaging than with radio-graphic imaging on patients with fibrocystic disease. It is concluded, therefore, that ultrasound imaging should be the initial examination performed, partic-ularly in the case of the young patient with symp-toms of fibrocystic disease of the breast.

The now-classical acoustic image pattern recog-nition signs used by many investigators for differ-entiating between the most common type of malignant breast mass (scirrhous carcinoma) and that of a be-nign mass (i.e., primarily acoustic shadowing and jagged wall structure, in the case of a malignancy and smooth wall contours with internal echoes in the case of a benign solid tumor), were found to be the general case, but exceptions were found, partic-ularly in regard to attenuating characteristics of benign tumors. These image patterns should be used with an awareness that non-malignant tissues within the breast can also cause acoustic shadowing, par-ticularly at frequencies of 5 MHz. Work is in pro-gress on studying the characteristics of solid tum-ors using transducers of different frequencies, scanning at close (1 mm) intervals, and attempting to quantitate attenuation values.

Conclusion

The opportunity to compare x-ray breast images and acoustic breast images, with both images record-ed on x-ray film, is a significant advantage. With the exception of cysts, it was found that this com-bined approach is more effective in differential diagnosis of palpable breast masses than either technique used exclusively. In view of present lim-itations of both x-ray and acoustic imaging, partic-ularly in regard to absolute differentiation of solid masses less than 0.5 cm in diameter, it is recommended that patients with a palpable mass or having other signs of a possible malignancy be exam-ined by both techniques. An exception to this re-commendation is the case of a patient with a clearly defined cyst, as imaged with the ultrasound visuali-zation system. The mammogram examination (particu-larly in the case of a young subject) may be omitted in such cases.

*References to the significant work of many authors cannot be included here because of lack of space.

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