NINTH INTERNATIONAL CONGRESS
ON THE
ULTRASONIC EXAMINATION OF THE BREAST

INDIANAPOLIS BREAST CENTER
INDIANAPOLIS, INDIANA USA
SEPTEMBER 28 - OCTOBER 1, 1995

PRESENTED BY THE INTERNATIONAL ASSOCIATION FOR BREAST ULTRASOUND
CLINICAL EVALUATION OF MANUAL, AUTOMATED AND 3-D ULTRASOUND IMAGING OF BREASTS COMPRESSED IN THE SAME POSITION MODES APPLIED IN X-RAY MAMMOGRAPHY

*Indianapolis Breast Center, **XDATA Corp.

From a diagnostic standpoint, the differences in the orientation of internal breast structures for a patient being examined by x-ray mammography, in comparison to a patient undergoing ultrasound breast imaging, are such that correlation of imaging data from these two modalities is often difficult and sometimes can be in error. The primary purpose of this study is to clinically evaluate a breast imaging instrumentation system(1-3) designed to provide direct correlation between x-ray and ultrasound mammography. An additional purpose is to demonstrate the significant advantages of this new ultrasound instrumentation technique, in comparison to current ultrasound mammography methods, for patients who only require ultrasound examinations.

MATERIAL AND METHODS:
The subject instrumentation system designed to ultrasonically image the breast in standard x-ray mammography positions has been described by two previous presentations(2,3). This system includes: 1) A Bennett Contour X-Ray Mammography Unit; 2) A high-frequency, linear array transducer (7.5 to 13 MHz) that can be manually (hand-held) or automatically moved across a specially designed ultrasound transmitting compression paddle inserted in the Bennett unit; 3) A prototype, automated ultrasound system that is capable of scanning the breast in the craniocaudal mode to yield 3-D image data which is in registration with the x-ray mammography views.

Twenty-two patients who had received prior x-ray and standard ultrasound mammography examinations were ultrasonically imaged with the experimental instrumentation to evaluate the clinical practicality of the manual ultrasound scan technique. All of these twenty-two patients had abnormalities which required surgery. Thus, pathological correlation with the experimental imaging findings was made. Ten patients who did not require x-ray mammography imaging, but had received prior standard ultrasound examinations, were also ultrasonically imaged, using the manual-scanning, experimental instrumentation. Experimental ultrasound scans were performed in either the craniocaudal, mediolateral oblique, or anteroposterior mode (a unique position that will be described in the presentation). Since the experimental scans in the craniocaudal and mediolateral oblique views do not include the pectoral muscle (because of scan geometry), evaluation of these images was based on resolving all parenchymal tissues from skin-to-skin.

A computer controlled system for automating the motion of the linear array transducer as it moves across the compression paddle, was designed and clinically evaluated(3). An automated, 3-D imaging system was also designed to provide ultrasound B-mode, C-mode and side views of the breast, as reconstructed on a Sun Sparc computer(3). A human subject, with a known fibroadenoma, was ultrasonically scanned in the craniocaudal view, to test this 3-D system.

RESULTS:
Images obtained with the experimental ultrasound method demonstrate good resolution of breast parenchyma, similar to that obtained with standard clinical methods. All breast masses that were visualized by standard ultrasound mammography also were clearly imaged by the experimental scanning method. Images obtained with the experimental system at a frequency of 13 MHz had slightly higher resolution than images obtained with experimental scans at 10 MHz and 7.5 MHz. Only a small loss in the depth of penetration, in comparison to standard clinical imaging, was observed. Compressed-breast

45
images obtained by the experimental method demonstrated more ductal structures than routine clinical imaging.

All palpable masses were detected by both methods of ultrasound scanning. Subareolar masses and masses that were superficial were best seen in the anteroposterior view mentioned above. For one patient, with a malignant group of calcifications measuring 1 cm on x-ray mammography, no mass was detected on the clinical ultrasound examination. When the same patient was examined, using the 7.5 MHz. transducer in the experimental system, the mass was well-visualized.

Two patients were evaluated with the newly developed automated breast ultrasound scanning system. There was no significant loss of resolution in the images obtained with the automated system. From a clinical standpoint, the convenience and standardization which is offered by automated scanning is clearly superior to manual methods, and has the potential to change the way ultrasound examinations are performed by the wider mammographic community. (1,3-5) For the patient with a known fibroadenoma examined with the 3-D automated system, C-mode and side view images of the mass were compared to the B-mode images. This automated 3-D system presented no serious difficulties and proved to be an effective and convenient means to comprehensively examine the entire breast volume.

+Research sponsored by the National Cancer Institute, SBIR Phase I Grant No. 1 R43 CA65225-01.
**INDIANAPOLIS BREAST CENTER, 1950 W. 86th St., Indianapolis, Indiana, USA 46260
**XDATA CORPORATION, 6124 N. Chester Avenue, Indianapolis, Indiana, USA 46220

REFERENCES


A.P. Romilly-Harper  Indianapolis Breast Center  Indpls., IN  FAX # 317-872-9856