AbstractID: 9346 Title: Ultrasound Inverse-Scatter Tomography of the Breast

Purpose: To present the design and performance of a new automated whole-breast ultrasound computed tomography (USCT) system that employs 3D inverse-scatter reconstruction.

Method and Materials: The scanner (Techniscan Medical Systems, Inc., Salt Lake City, Utah) is installed at the University of California, San Diego to evaluate clinical performance including ability to detect and analyze breast masses. Patients lie prone on a table while opposing transmitter and receiver transducer arrays rotate 360º around the breast. Ultrasound plane waves (300 kHz-2MHz) are emitted every 2 degrees while the scattered beam is detected by a 960-element six-row transducer. In the same plane three B-mode linear arrays acquire backscatter data from wideband signals (3.6-8.4 MHz). The arrays move up the breast in 2mm increments to scan the entire breast. Discrete frequency domain data is used by a proprietary 3D inverse-scattering algorithm that incorporates multiple scattering within and between the planes. 2-D coronal images of the entire breast are reconstructed as accurate quantitative maps of sound speed and attenuation along with aberration-corrected high-resolution reflection tomograms.

Results: To date, more than 50 subjects were scanned with wide range in age (20-78), breast density and diagnostic outcome. Representative cases will be presented comparing mammography, sonography and multi-planar USCT images. Included are benigns (cysts, fibroadenomas, fibrocystic disease) and biopsy-proven malignancies (invasive ductal carcinomas, invasive tubular carcinoma and mixed lobular/ductal carcinoma). System performance and tissue characterization are excellent. Accuracy and linearity of sound speed measurements by USCT is very high (R^2=0.988) over the range of 1400 to 1600 m/sec.

Conclusion: The USCT system provides rapid, automated scanning with quantitative 3D images of the breast and substantially new information for characterizing breast masses.

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