SHEAR WAVE ELASTOGRAPHY – OUR INITIAL EXPERIENCE

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Introduction
Ultrasound has an important role in the diagnosis of breast pathology. Real time B mode imaging provides high spatial and contrast resolution but has a limited ability to differentiate the mechanical properties of tissues. Tissue strain analytics (elastography) provides a qualitative and quantitative assessment of the mechanical stiffness (elasticity) of tissues. These properties are important in assessing the morphology/physiology of focal and diffuse disease and differentiation of benign and malignant lesions.

Shear Wave
Within our unit we are currently using the Siemens’ ACUSON S Family ultrasound system to perform conventional ultrasound and elastography. In order to measure the stiffness of a lesion a push pulse is generated by the hand held transducer. This generates shear waves within the area of interest. The velocity of travel of the shear wave is proportional to tissue stiffness, the stiffer the lesion the faster the shear wave travels. Colour scale images are generated illustrating the tissue stiffness and accurate velocity measurements can be obtained from the source image. An image illustrating the quality of the shear waves generated within the lesion can also be obtained and aid in diagnosis. Good quality images are seen as completely green on the quality scan.

Our Experience
There is little published in the literature regarding the use of breast elastography as an adjuvant to conventional imaging to differentiate benign and malignant lesions. We have been performing elastography in both the screening and symptomatic setting and are compiling a case series. Presented below are examples of our initial experience.

Case 1: Ductal carcinoma. Grey scale ultrasound demonstrating US mass (a). Elastography shows lesion to be stiff red (b).

Case 2: Ductal carcinoma. Very hard malignant lesions absorb and attenuate the shear wave and disrupt ability to estimate shear wave velocity. Elastogram velocity measurements (b) show highly attenuating lesion, reasonably high shear wave ring (green and red), poor shear wave in the centre of the lesion seen as orange on the quality scan (c).

Case 3: Lobular carcinoma. Symptomatic mass in right upper outer breast. Grey scale US shows US lesion (a) which is stiff on elastography (b) and proven lobular cancer. MRI picked up second focus in right lower outer quadrant (d) Second look grey scale US showed subtle U4 lesion (e), stiff on elastography (f). Biopsy proven lobular cancer. Elastography useful here in assessment of subtle lesion.

Case 4: Prostate metastasis. Symptomatic man referred with possible gynaecomastia but stiff on elastography- biopsy proven prostate cancer metastasis.

Case 5: Lipoma. Softer than the background tissues.

Case 6: Fibroadenoma. Well defined U2 mass on grey scale US. Same stiffness as background tissues on elastography.

Case 7: Fat necrosis. Hypoechoic mass with echogenic halo on grey scale US. Elastography shows lesion to be stiff.

Case 8: Breast Cyst. Fluid contained within a cyst exerts equal pressure in all directions. This means that shear waves cannot be generated within the fluid. Shear wave velocity – black area and quality map poor quality.

Conclusion: We have found elastography a useful adjunct to other imaging techniques and will compile a larger database of cases as we continue to use it.
