

BREAST IMAGING WITH SHEARWAVE™ ELASTOGRAPHY

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An advanced ultrasound technique is helping reduce false positives in breast imaging.

The technology, ShearWave™ Elastography (SWE), has been shown to reduce the number of benign lesions incorrectly flagged for biopsy. Even more important, this technique can help avert false negative diagnoses in patients who are ultimately found to have breast cancer.

Clinical breast diagnosis is in part based on the stiffness or hardness of a palpable mass, which provides information about its etiology. When the stiffness of the lesion and its surrounding tissue are quantified with ShearWave Elastography, a physician can use that information for the diagnosis. In cases at our clinic in Florida, these measurements have made it possible to reliably downgrade a sonographic lesion from one of low suspicion requiring biopsy (classified as Breast Imaging-Reporting and Data System, or BI-RADS, 4a) to one of low suspicion not requiring biopsy (classified as BI-RADS 2 or 3).

Further, with SWE's quantified visualization of lesion stiffness, we are able to zero in immediately on the patients who require biopsy, giving priority to women most likely to harbor a malignancy and getting them into treatment sooner. This aspect of SWE is particularly important for women who have dense breast tissue, for whom mammograms can be less accurate.

How does SWE work?

SWE sends a series of ultrasound pulses into the breast from a transducer, resulting in the formation of a shear wave that extends into the tissue perpendicular to the pulse. The speed of the wave is proportional to the tissue stiffness; with soft lesions, the wave moves more slowly than in stiffer lesions. In the case of the Aixplorer ultrasound system from SuperSonic Imagine, the technology pioneer, the speed of the shear wave can be imaged, quantified and color-coded by its UltraFast™ scanner. The platform can acquire images as fast as 5,000 frames per second, about 200 times faster than conventional ultrasound systems.

The Aixplorer received FDA clearance in 2013 for its real-time quantification of tissue elasticity in kilopascals (kPa) and m/s providing reliable, reproducible information non-invasively. The system generates a two-dimensional, color-encoded map of tissue elasticity superimposed on a B-mode image of the same area for anatomical correlation.

What are its clinical advantages?

By generating examinations that are accurate and reproducible, ShearWave Elastography enables better management of breast cancer patients.

Using the Aixplorer system in a study of 1800 patients, SWE was shown to help reduce negative biopsies and lesions could be downgraded, thereby avoiding an unnecessary invasive procedure.

Because increased stiffness is found in tumors of higher grade and larger mass, elastography also has prognostic potential. Greater stiffness may correspond to a greater likelihood of invasion to the lymphatic system and possible nodal involvement. The stiffer tumors are also more apt to be HER2+ and triple negative.

Other advantages of SWE

USER INDEPENDENCE

One critical advantage of SWE, especially in any site where new technologists are trained, is that it captures and records reliable information without being dependent on the user's expertise.

ASSESSING DENSE BREASTS

Florida is not one of the "breast density" states requiring that patients be informed of their breast density. Our clinic has nonetheless been educating patients about their breast density at the time of their exam, and has made available an appropriate personalized screening plan for interested women.

As many women with high breast density are not at extreme risk and therefore requiring MRI, bilateral whole breast ultrasound has been offered to the majority of patients. In the last decade several studies have found an improved sensitivity in breast cancer detection when ultrasound is added to mammographic screening of patients with dense breasts. These studies also show a high false positive rate and low PPV3 of generated biopsy. SWE can help minimize biopsy of benign lesions and maximize the number of patients who truly need biopsy by providing supplemental information of the local tissue stiffness.

Conclusions

By reducing false positives and helping to avoid false negatives, ShearWave Elastography has significantly improved physicians' overall diagnostic performance and the subsequent quality of patient care.