Breakthrough ultrasound solutions for breast imaging in clinical practice

eL18-4 PureWave linear array transducer

Category
Breast assessment

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"The addition of elastography to every breast ultrasound has now produced a positive biopsy rate in excess of 80% because fewer biopsies that are later found to be unnecessary are performed."

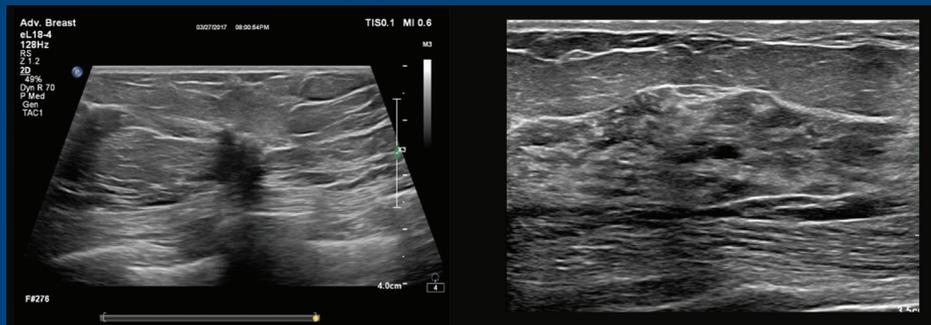Richard G. Barr, MD, PhD, FACR, FSRU, FAIUM

Overview

The eL18-4 PureWave linear array transducer is used by clinicians at Southwoods Imaging as a state-of-the-art solution for breast imaging that enhances diagnostic confidence through powerful tools such as excellent B-mode imaging **(Figure 1)**, integrated ElectroMagnetic (EM) tracker, strain and shear wave elastography, and MicroFlow Imaging.

In addition, panoramic imaging is useful to assess diffuse disease, identify large amounts of fibrocystic change, and mark the distance between two lesions **(Figure 2)**. Whenever we are doing breast imaging, excellent image quality and full solution elastography are essential to make a confident diagnosis and aid in patient care.

The Philips eL18-4 PureWave linear array transducer is our first high-performance transducer featuring ultra-broadband PureWave crystal technology with multi-row array configuration, allowing for fine-elevation focusing capability.

Figure 1 The eL18-4 transducer features exceptional detail resolution and tissue uniformity (right), with seamless trapezoid imaging (left).

Figure 2 Panoramic imaging (left) captures information beyond a single field of view (right) and aids surgical planning.
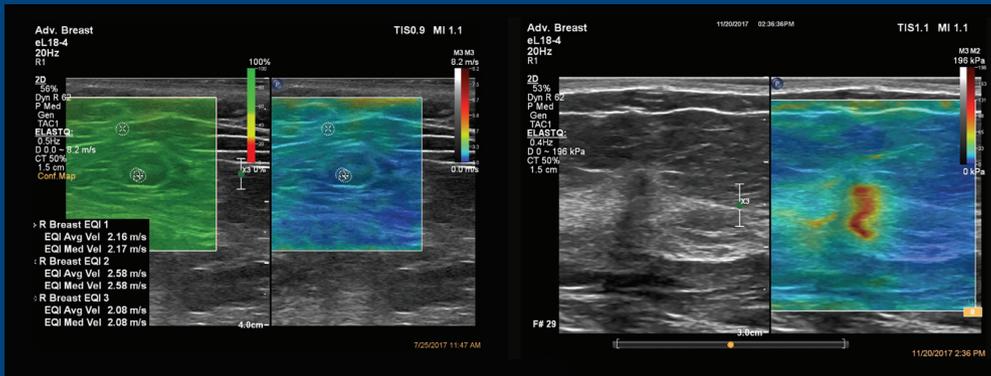
Figure 3 The resultant stiffness can be measured in either kPa or m/sec. This fibroadenoma on the left demonstrates a low stiffness value versus the malignancy on the right, which shows very high stiffness values.
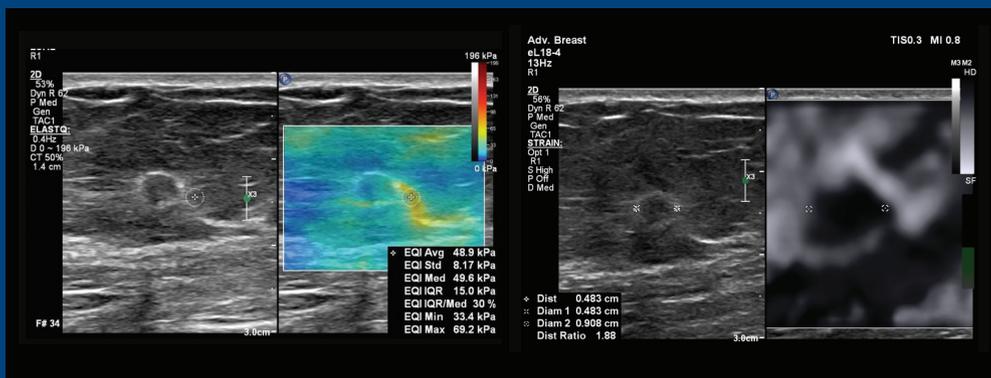

Figure 4 One of the challenges of shear wave elastography is that very stiff cancer lesions may be displayed as soft, which results when a lesion is so hard that the shear wave does not propagate through it and is then represented as soft. Using a combination of strain and shear wave elastography allows determination of true positives for greater diagnostic certainty.

ElastQ Imaging shear wave elastography during biopsy

The eL18-4 transducer offers 2D shear wave imaging in real time. Using elastography during biopsy allows the stiffest area in a lesion to be targeted. Also, several cases that at first suggested a single lesion on B-mode were revealed to be two lesions (benign and malignant) when elastography was also used. Without the additional information offered by elastography, there is potential to biopsy a fibroadenoma that happens to be situated close to a malignant lesion, rather than the malignancy itself **(Figures 3 and 4)**.

ElastQ Imaging confidence map

The ElastQ Imaging confidence map smartly analyzes echo and shear wave signal and provides an indication of quality across the stiffness map. This assists the user in obtaining measurements from the areas with the highest shear wave quality with designating areas as green ("Go"), yellow ("Caution") and red ("Stop") **(Figure 5)**.
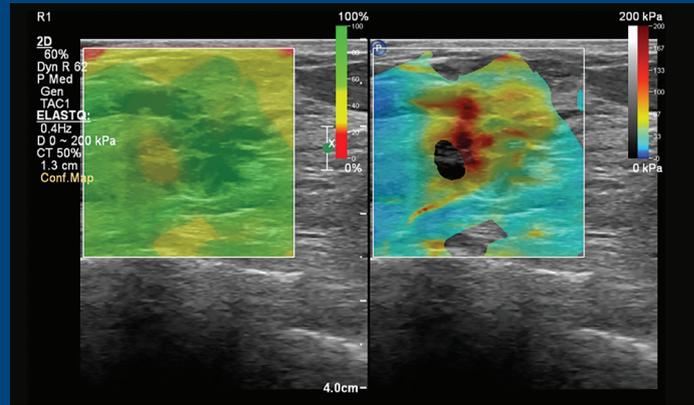

Figure 5 The yellow area (confidence map on the left) indicates that the shear waves are not adequate for acquiring a stiffness measurement.

Quantitative ElastQ Imaging[1]

Choose stiffness values either in kPa or m/sec. Values of 60 kPa, corresponding to 4.5 m/sec, mark the practice's cutoff value between benign and malignant lesions **(Figure 6)**.
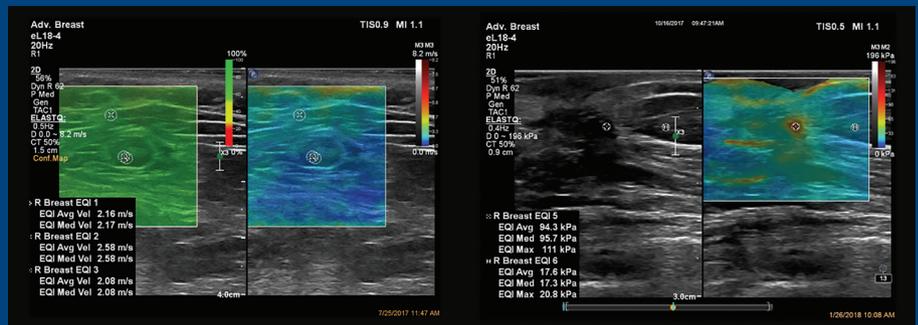

Figure 6 Benign breast lesion on the left side (stiffness value lower than 4.5 m/s) and malignant breast lesion on the right side (stiffness value above 60 kPa).

Strain elastography

Philips Strain elastography algorithm requires very little motion to produce strain maps. In most cases, the practice finds that just holding the transducer very still or using the patient's breathing offers enough motion for an excellent elastogram. Use of the elastographic lesion length to B-mode lesion length ratio has been found to be a sensitive technique for cancer diagnosis **(Figure 7)**.
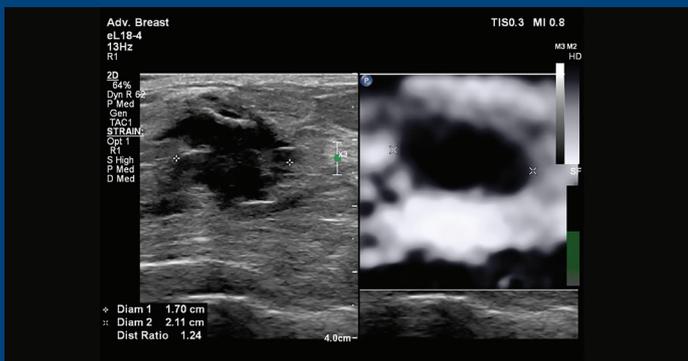

Figure 7 Malignant breast lesion as confirmed by a strain Size Compare ratio above 1.0.

Full solution elastography (strain and ElastQ Imaging)

In this case **(Figure 8),** both strain and shear wave elastography were negative for malignancy, and the lesion was a fibroadenoma upon biopsy. Diagnostic confidence is enhanced when both techniques produce the same results.
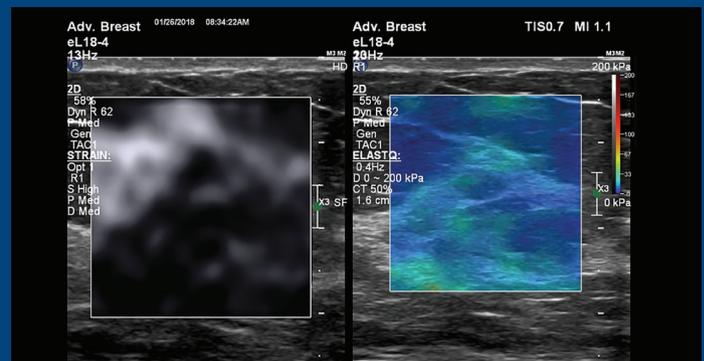

Figure 8 Strain elastography (left) and ElastQ Imaging (right) displayed side by side for ease of documentation.
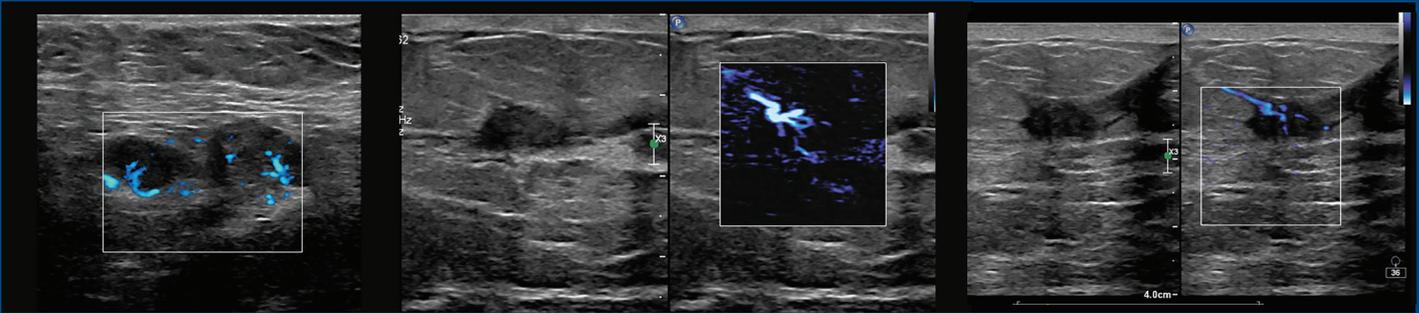
Figure 9 Higher vessel definition with MicroFlow Imaging.

MicroFlow Imaging

MicroFlow Imaging allows visualization of flow in small vessels in higher definition than color or power Doppler **(Figure 9)**. The ability to see flow in small vessels is useful in assessing the lymph nodes. Blood flow entering the hilus is considered normal, while blood flow to the cortex suggests metastasis, which requires biopsy to target the area and determine the presence of a focal metastasis.
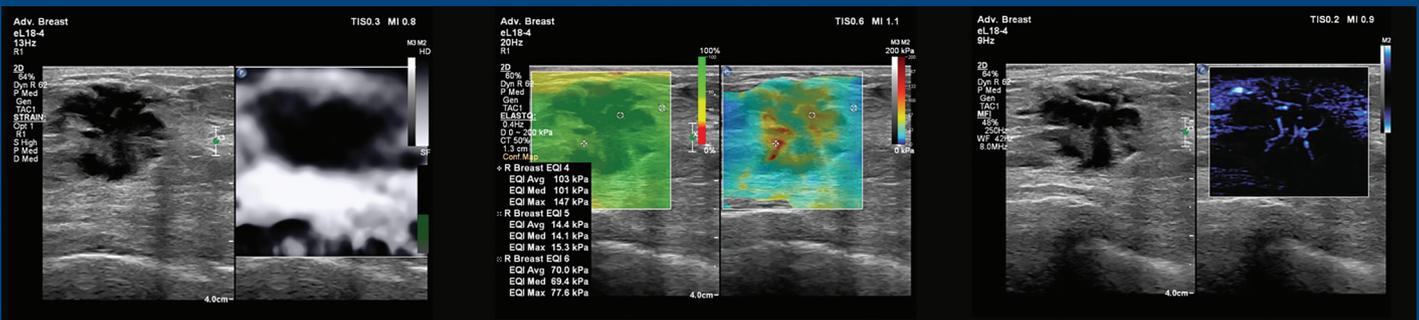

Figure 10 ElastQ Imaging, excellent B-mode imaging, strain elastography and MicroFlow Imaging, all in one transducer, for enhanced confidence.

Conclusion

Tools such as excellent B-mode imaging, integrated EM tracker (EMT supports fusion imaging and AI Breast solution), shear wave elastography, strain elastography and MicroFlow Imaging – all embedded in one transducer solution, the eL18-4 – enhance diagnostic confidence when making a diagnosis **(Figure 10)**. The practice's published experience with elastography over the past 15 years shows an initial positive breast biopsy rate of approximately 20%. The addition of elastography to every breast ultrasound has now produced a positive biopsy rate in excess of 80% because fewer biopsies are performed that are later found to be unnecessary.

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Reference
1 Barr RG, Zhang Z. Shear-Wave Elastography of the Breast: Value of a Quality Measure and Comparison with Strain Elastography. Radiology. April 2015;275(1):45–53.

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