

OPTO-ACOUSTIC BREAST IMAGING, A NEW TECHNOLOGY

A. Thomas Stavros, MD, Arthur Lerner, MD, William Burak, MD, Richard Fine, MD, Beth Boyd, RN, Tom Miller, B. Don Herzog, Bryan Clingman, Remie Smith, Jason Zalev, Phil Lavin, PhD, Michael Ulisse, MD

Objectives

The purpose of this study is to present a novel emerging imaging technology that combines B mode ultrasound and opto-acoustic imaging (OA).

Methods

High resolution ultrasound images of breast abnormalities are combined with short pulses of laser energy at two separate wavelengths directed at the solid breast lesion. One laser wavelength interrogates oxygenated hemoglobin while the other wavelength excites the de-oxygenated hemoglobin. The opto-acoustic data, color-coded (green = oxygenated hemoglobin, red = deoxygenated hemoglobin) is co-registered with the B mode ultrasound allowing the reader to not only describe the morphology of the lesion but evaluate the physiologic properties as well. A predominance of oxygenated hemoglobin suggests a benign process and the predominance of de-oxygenated hemoglobin content suggests a malignant process. Additionally, total blood flow is represented by the presence or absence of neo-vascularity (yellow).

Results

Combining both morphologic and physiologic information, a feasibility study of 79 cases was performed, from which these examples have been taken. Evaluating the probability of malignancy (POM) BIRADs 4B cases had an OA POM of 30.2% greater than more conventional mammography and ultrasound combined. BIRADs5 malignancies were 10% more accurate than combined mammography and ultrasound. Of more significance, data indicates OA could have spared 24% of all negative biopsies by increasing specificity as well as sensitivity.

Conclusion

This unique new imaging modality, currently being evaluated in a multicenter clinical study has the potential to significantly increase diagnostic accuracy in malignant lesions, while at the same time, increasing specificity of benign ones. The technology seems to have the potential to spare biopsies in cases where the opto-acoustic data suggests either favorable physiologic findings.

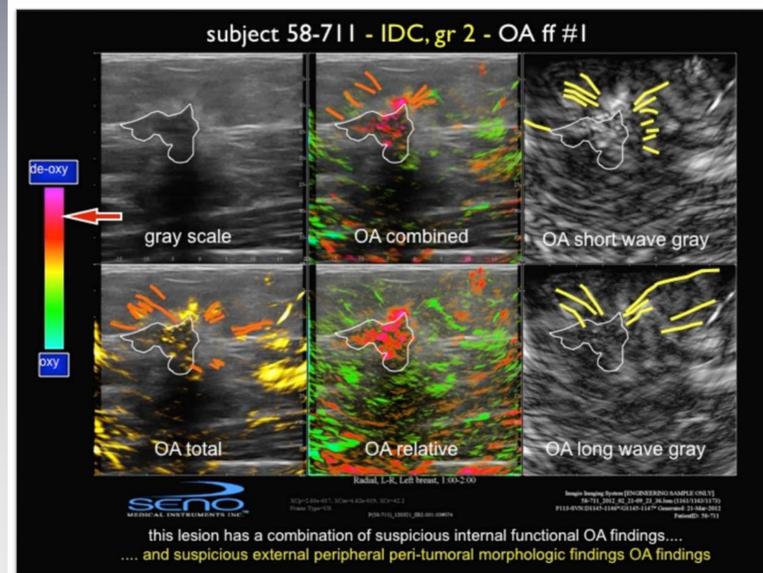


Figure 2 reveals an irregular solid lesion that demonstrates a combination of suspicious internal and external peri-tumoral morphologic findings. This was a grade 2 invasive ductal carcinoma.

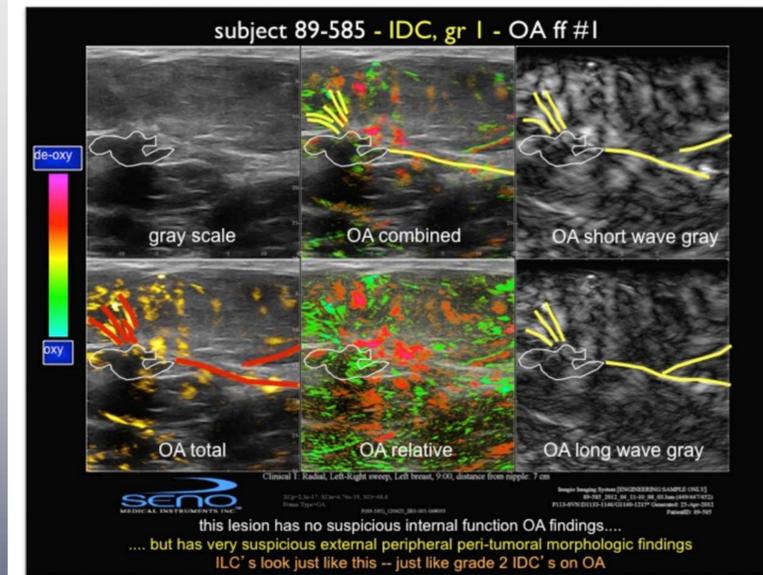


Figure 3 a solid lesion with no suspicious internal opto-acoustic pattern, but very suspicious external peri-tumoral morphologic findings. This was a Grade 1 invasive ductal carcinoma.

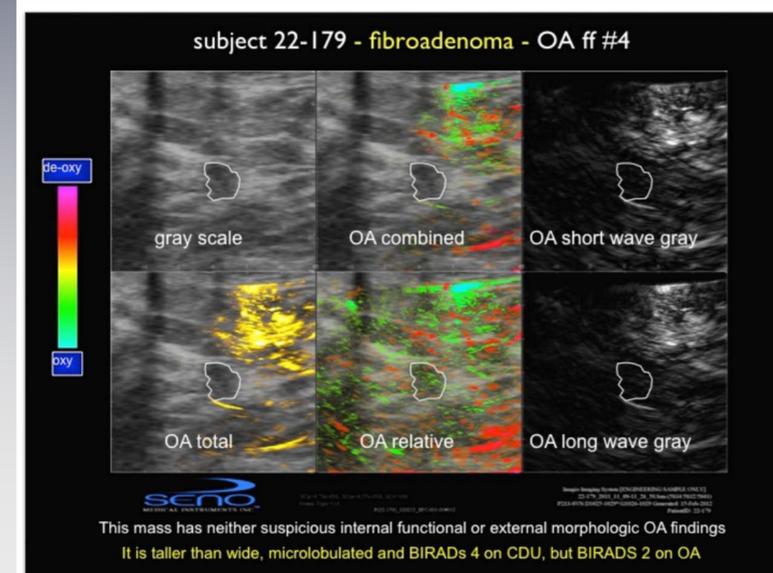


Figure 1 A taller than wide suspicious solid lesion on ultrasound, with no suspicious internal or external functional morphologic opto-acoustic findings. Read as a BIRADs4 on ultrasound, this was a fibroadenoma on biopsy

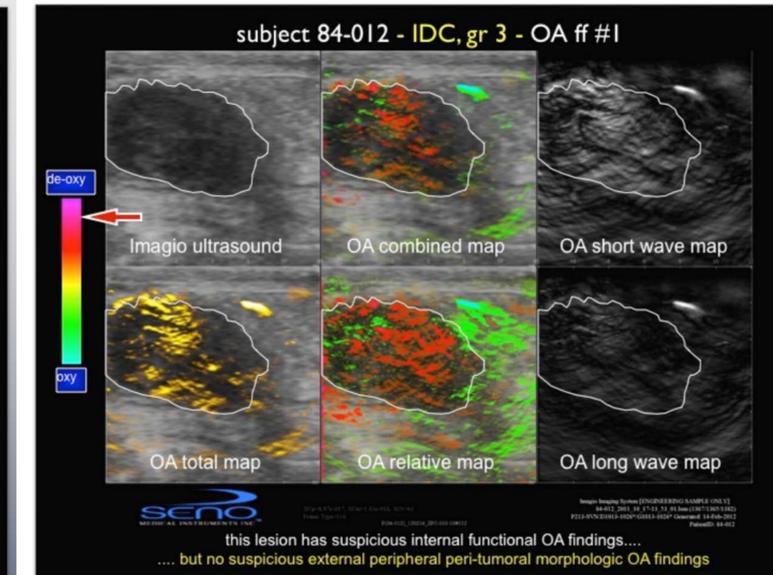


Figure 4 reveals a solid breast lesion with suspicious internal opto-acoustic but no suspicious external peri-tumoral morphologic opto-acoustic findings. This was a grade 3 invasive ductal carcinoma.

