THE UNIVERSITY of ADELAIDE

Cell-Sensitive Elastography Imaging

A new elastography imaging model with cellular-level resolution

Background

For the past 30 years, x-ray mammography has been the mainstay of early breast cancer detection. However, it is widely recognised within the breast cancer clinical, research, and policy communities that mammography has substantial limitations around sensitivity and specificity considering ~20% of breast cancers are missed by mammography.

Elastography is a non-invasive medical imaging technique that uses low-frequency vibrations caused by ultrasound waves to measure tissue stiffness. The vibrations are reported back to a sensor and then a poroelasticity mathematical model interprets the signals into a heatmap image (Figure 1). The technique can detect breast cancer, however it is not accurate enough to be used routinely in the clinic.

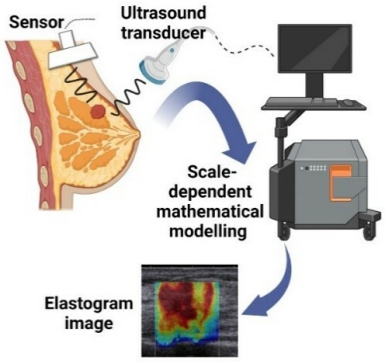

Figure 1: Elastography imaging

Technology overview

Our ground-breaking research has revealed the problem - conventional elastography assumes vibrations come from bulk tissue, not from individual cells. We have shown that the mechanical properties of cells are substantially different to the properties of bulk tissue, and this affects the vibrations that are created by ultrasound waves. Our preliminary data demonstrates that when cell-sensitive vibrations are incorporated into the mathematical model, the sensitivity of elastography to detect cancer is dramatically increased (Figure 2).

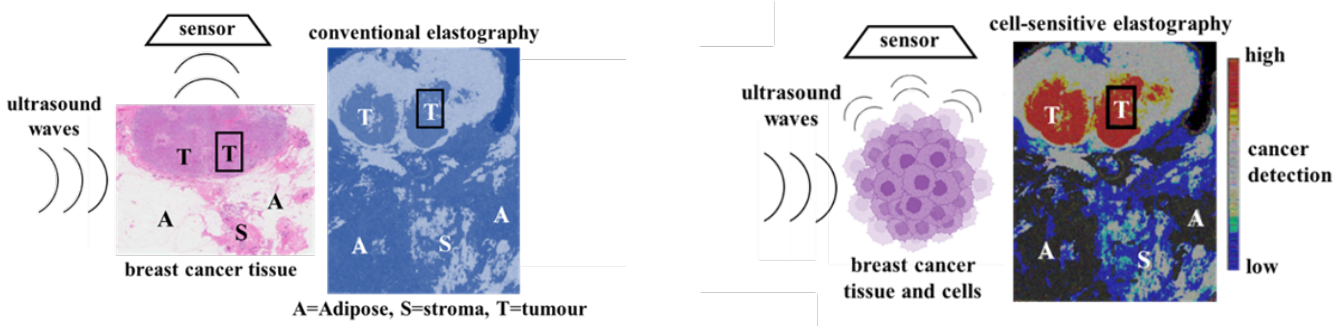

Figure 2: Representative summary of imaging invasive ductal carcinoma using (a) conventional and (b) cell-sensitive poroelastography modelling.

Development status

The cell-sensitive mathematical model of advanced non-local poroelasticity has been developed and tested on the valid available clinical dataset.

Applications

Our cell-sensitive elastography technique has broad applications beyond breast cancer, encompassing the assessment of liver fibrosis and the evaluation of tissue stiffness in other solid cancers. By providing non-invasive insights into tissue characteristics, this approach holds promise for improved diagnosis and monitoring across various medical conditions.

IP Status

A Provisional Patent [2022902519] was filed on the 1 September 2022.

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