Abstract Ref: 23

Radio-wave detection of breast cancer using pulse-synchronized imaging

Abstract-Content:

Differences in vascularity between benign and malignant structures have been investigated as a means of differentiating between breast lesions using techniques such as hand-held Doppler ultrasound [1]. More generally, electromagnetic imaging modalities seek to exploit signal differences due to variations in oxygenated blood flow.

A commercial radio-wave breast imaging system (MARIA, Micrima Limited, Bristol) has been modified to support triggered data capture in systolic and diastolic statesas part of amulti-sitesymptomatic clinical trial (Ethicsapproval- Yorkshire&TheHumberandSouthYorkshireREC15/YH/0084,ClinicalTrials.gov NCT02493595). [2]

Results for the whole-breast, non-compressing device already show a significantly higher lesion detection sensitivity for cancer in dense tissue than x-ray mammography [3]. Data from MARIA is routinely presented to the clinician in the form of a contrast map which reflects the dielectric variations in tissue throughout the breast. Currently tissue differentiation is performed by correlating to other diagnostic data including localized ultrasound.

This new acquisition mode exploits the gross differences in vascularity between malignant and benign breast lesions. Pulse-synchronized data capture takes approximately 3 minutes resulting in a series of 10-12 3D volumes. Automatic differencing across the volumes achieves simultaneous masking of benign features and temporally-coherent highlighting of malignant structures.

Examples will be presented that show effective segmentation of malignant lesions from benign, suggesting potential for this radio-wave technology to form part of a future screening regime while providing a greater level of diagnostic capability in its current symptomatic setting.

References:

[1] Wei Tse Yang, Jenny Chang, and Constantine Metreweli Patients with Breast Cancer: Differences in Color Doppler Flow and Gray-Scale US Features of Benign and Malignant Axillary Lymph Nodes. Radiology 2000 215:2, 568-573

[2] Mike Shere, Lyn Jones, Iain Lyburn, Rebecca Geach, Helen Massey, Luci Hobson, Sarah Taylor, Peter Bannister, Nicholas Ridley. Radio-wave radar-based breast imaging system: an initial multi-site clinical evaluation. Proceedings Symposium Mammographicum, 2016. Liverpool. British Journal of Radiology.

[3] Nicholas Ridley, Mike Shere, Iain Lyburn, Peter Bannister#894 Cancer detection in dense tissue using radiofrequency imaging: a clinical evaluation. Proceedings European Congress on Radiology, 2017, Vienna. European Radiology.