A Wearable Ultrasonic Device for the Early Detection of Tumor Recurrence

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Cancer recurrence affects a large percentage of patients who have finished initial treatment. Unfortunately, with current detection methods, the chance of tumor regrowth can be high. Therefore, methods are critically needed to cost-effectively detect early cancer recurrence. Relapses of cancer often occur when circulating tumor cells (CTCs) spread throughout the body via the circulatory system resulting in new tumors. CTCs often express epithelial cell adhesion molecules (EpCAM) on their surface, which can be targeted using antibodies. I hypothesized that gas-filled microbubbles can be modified to bind to receptors on cells and be used in conjunction with an ultrasound wristband device to efficiently detect CTCs, thereby leading to detection of cancer relapse at its earliest stages. I modified microbubbles by coating them with several antibodies through a streptavidin-biotin bond, and demonstrated the ability of aVB3 antibody functionalized microbubbles to bind to U87 glioblastoma cells expressing aVB3 integrins in culture. Flow chamber results demonstrated that targeted microbubbles could bind to U87 cells while flowing in the chamber while control microbubbles did not show statistically significant binding in culture or the flow chamber. Ultrasound imaging demonstrated statistically higher signal when using targeted microbubbles as compared to control microbubbles. This work demonstrates the ability of microbubbles functionalized with antibodies to target surface markers in both cell culture and in a flow chamber to simulate realistic conditions. This sets the foundation for using ultrasound-based detection of CTCs for early detection of recurrent cancers.

Awards Won:
Fourth Award of $500