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Funding Source: National Institutes of Health Molecular Imaging Program

Development of breast tissue phantoms for multimodality molecular imaging

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Multimodality molecular imaging that combines anatomical and functional information has demonstrated great potential in the detection of breast cancer. Among different biomedical imaging modalities, fluorescence molecular tomography (FMT) is an emerging optical modality for non-invasive functional imaging. Three-dimensional FMT is able to differentiate tissue physiological changes in vivo and when combined with a selectively targeting probe, can provide highly sensitive detection in early events of breast carcinogenesis. The technology is economic and can be made portable, thus ideally suited for small animal imaging and clinical applications such as breast imaging. However, FMT has relatively low resolution and its algorithm for tomography is challenging without prior knowledge of tissue. In order to overcome this problem, FMT has been combined with magnetic resonance imaging (MRI). The multimodality FMT/MRI system can provide functional imaging coupled with an anatomical map of high resolution. In addition, by using dual modality probes, fusion images can be acquired simultaneously. Currently there is no phantom on the market that demonstrates ability to be used in simultaneous multimodal imaging. Development of these phantoms will allow for the creation of multimodal systems to proceed, as their development is contingent on being able to use a phantom appropriate for all modalities. In this investigation we present preliminary multimodality phantom studies via the use of a novel AF 680-G-G-G-BBN [7-14] NH2 probe; this probe has demonstrated ability to selectively internalize in breast cancer cells and has now been coupled with an optical probe for multimodality imaging. Phantom creation occurred by harvesting xenograft tumors from T-47D breast tumor baring SCID mice and then positioning those tumors in an agarose gel solution. After development the phantoms were analyzed by both magnetic resonance and optical imaging modalities.