

MRI-guided fiber-based Fluorescence Molecular Tomography for preclinical atherosclerosis imaging

Baoqiang Li,^{1,2} Philippe Pouliot,^{1,2} and Frederic Lesage^{1,2}

¹*Institute of Biomedical Engineering, École Polytechnique de Montréal, Montreal, QC, H3C 3A7, Canada.*

²*Montreal Heart Institute, Montreal, QC, HIT 1C8, Canada*

Introduction: Multi-modality imaging combining fluorescence molecular tomography (FMT) with an additional anatomical substrate, such as MRI, is expected to not only provide the information of these two modalities but also help optimize the recovery of functional information with MRI anatomical guidance.

Objectives: The objectives of this study were twofold. First, a multi-modality FMT-MRI system was developed to conduct simultaneous imaging of these two modalities. Second, this system was applied to preclinical atherosclerosis imaging with mice. **Method:** We designed an optical probe consisting of a MRI-compatible plate on both the top and bottom sides of the animal bed, respectively. In experiments, the imaging sample/animal was installed between the two plates; and then the optical probe fit in the commercial MR holder for simultaneous imaging. By mounting fibers on both sides of the optical probe, transmission measurements were performed from both sides. Moreover, we achieved an accurate fluorescence reconstruction with MRI-derived anatomical guidance.

Results: The sensitivity of the FMT system was evaluated with phantoms. It was shown that with long fibers, the detection sensitivity was sufficient to detect 10nM Cy5.5 solution with ~28.5 dB CNR in the phantom. Finally, the system was applied in in-vivo imaging of atherosclerosis. In experiments, two ATX mice and two control mice were used. With the administration of a molecular probe, MMP activity involved in atherosclerosis was imaged. The reconstruction results were in agreement with ex-vivo analysis.

Conclusion: We developed a multi-modality FMT-MRI system for preclinical atherosclerosis imaging with mice. Using MR-derived anatomical information, the fluorescence reconstruction was closely correlated with ex-vivo measurement. Therefore, the proposed FMT-MRI system associated with the reconstruction method might serve as a tool for atherosclerosis imaging of small animals.

A poster session will be given on that topic during the:

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