CO-REGISTRATION NIR/MR IMAGING OF CELLULAR SPHEROIDS

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ABSTRACT :

Multimodal imaging is a combination method of different techniques to complement data information and compensate for the limitations of different techniques in terms of sensitivity, spatial-temporal resolution, or scales for better understanding the objects of interest [1-2]. Magnetic resonance imaging (MRI) is considered the most beneficial one because it provides high tissue contrast as well as great signal-to-noise (SNR) ratio images at anatomic scales. The optical microscopic imaging, in contrast, can obtain functional or molecular information but refrains in large volume object. Using near-infrared (NIR) emission and excitation is a technique being able to image large samples because the refractive index of the tissue allows NIR light going deeper [3]. Spheroid is an appropriate model for mimicking the tissue structures, and they help to clarify some basic landmarks for dual imaging such as sample volume, size, spatial resolution, etc. and primary parameters can be determined.

A designed experiment for conducting NIR/MRI co-registration imaging at the cellular scale combined a confocal NIR microscope with 980 nm excitation with NIR-I emission and a high-field MRI system 11.7 T, unconcurrently, as a favor NIR/MRI dual probe. In brief, Hela cellular spheroids were cultured in a U-shaped plate for 24 hours. The dual NIR/MRI imaging probe was introduced into the plate and co-incubated for 24 hours. The cellular spheroids were then fixed by formaldehyde. A sample holder was made from a hollow plastic tube 5 mm in diameter with a cover-glass attached at the bottom. The cellular spheroids were mixed with 2% agarose gel and transferred into the sample holder. The sample was acquired by MRI and a region 2 mm was selected for acquiring by NIR confocal microscope. The results showed the resemble of images obtained from both techniques and the overlay image was fairly consistent.

In conclusion, we demonstrated the feasibility of co-registration NIR/MR imaging for probing the biological objects at different scales. This heralds a potential application of NIR/MRI for molecular imaging biomedical. The technique will be continued to apply for larger-scale objects such as organs or bodies of mice.

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