OMICS International
conferenceseries.com

Jiani Hu et al., OMICS J Radiol 2015, 4:4
http://dx.doi.org/10.4172/2167-7964.S1.006

3rd International Conference on
Radiology and Imaging
August 24-26, 2015 Toronto, Canada

Can we improve MRI detection sensitivity by 2 to 3 orders?

Jiani Hu[1], **Horea Calimente**[1], **Yongquan Ye**[1], **Quan Jiang**[2], **Yimin Shen**[1] and **Mark Haacke**[1]
[1]Wayne State University, USA
[2]Henry Ford Hospital, USA

Introduction: MRI features complex signals and is capable of providing both magnitude and phase information. Unlike MR magnitude information, MR phase information had been largely discarded due to its high sensitivity to susceptibility related field variations and resultant blooming effect that often severely degrades the quality of phase images. However, considering a new point of view, this information may also have the potential to provide indirect information on an ultra-small object that is two to three orders smaller in size than those currently detectable with MRI. In this study, we report our study on the feasibility of improving MRI detection sensitivity by 2 to 3 fold using the combination of phase blooming effects and high susceptibility of MRI contrast agents.

Results: The resolution of phantom images was 0.5x0.5x2 mm3. Total acquisition time was 14:52 minutes. TE was 20 ms. The susceptibility difference $\Delta\chi$ between the straw and background gel was estimated to be about 3.8ppm. Blooming effect was about 8.0 times larger in radius for the ferritin filled straw. This translated into a 512 times increase in 3D volume relative to the size shown in magnitude. There are about 14 such small bubbles in this single slice that are visible in the phase image but only two can be positively identified in magnitude image while the others were either barely visible or not seen at all. The straw phantom results strongly demonstrate the spatial extensibility of the phase blooming effect, and the capability of utilizing this effect for detecting small objects that MRI magnitude images fail to detect. It is important to note that the susceptibility changes caused by air are smaller than ferritin, P904 or other SPIO nanoparticles. This suggests that even smaller objects than those bubbles can be detected if they were filled with SPIO.

Discussion: Our theoretical investigation and in vitro model study have demonstrated the feasibility of using blooming effect to image an ultra-small object that is two to three orders smaller than those currently detected with MRI. We are currently performing in vivo experiments to determine whether this is the case for in vivo animal models. Improving spatial resolution is a constant goal in tumor detection. The significance of early cancer detection is well known: Favorable clinical outcomes can be achieved for many cancers using existing medical techniques if the cancer can be detected in its early stages.

Biography

Jiani Hu's research interests include the development of MR spectroscopy and its utilization in studying metabolic changes that take place in diseases tissue. He is currently studying: West Nile disease, Breast Cancer and Neuromuscular Disorders.

jhu@med.wayne.edu

Notes: