

Study of the Behavior of Focused Ultrasound Lesions with MRI and Histology

This work was aimed at investigating the behavior of focused ultrasound (FUS) lesions with MRI and comparing lesion size measured on MRI with the actual tissue damage measured on histological sections. Experiments were carried out on 5 rabbit brains *in vivo* under general anesthesia. An approximately 25mm x 20mm of skull was removed surgically, leaving the dura mater intact. Two separate FUS lesions were created on the same imaging plane (sagittal) in the brain. T1-, T2-weighted fast spin echo and FLAIR sequences were used to detect the ultrasonic lesions after the treatment. Imaging was performed for 4-8 h after treatment, after which the animals were immediately sacrificed. Ultrasonic lesion diameter was measured on MRI and histological sections after correction for tissue shrinkage during the histological processing. It was found that T1-weighted images showed lesion formation poorly while both T2-weighted and FLAIR images showed the lesion clearly. The lesion diameters on both T2 and FLAIR images correlated well with measurements from histology. The difference between the lesion diameter measured from MRI and that from histology is 0.1-0.7 mm which is approximately one MRI pixel value (0.625 mm) for this study. The time delay before lesions appeared on T2-weighted was 0.25-1.0 h. There was a strong correlation between time delay for lesion formation on T2 and exposure location in the brain.

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