Pre- and Post- Gadolinium Enhanced Susceptibility-weighted Imaging at 1.5T for Intracranial Neoplasms: Contrast of Pathologic Lesions.

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Introduction: Three-dimensional (3D), high-spatial resolution susceptibility-weighted imaging (SWI) [1] is an MR imaging technique providing complementary information of venous vasculature, hemorrhage, and iron in the brain [2]. This sequence has also showed promise for evaluating brain tumors [3]. However, its contrast of pathologic lesions remains to be known in clinical cases, compared with conventional MR sequences. The purpose of this study was to evaluate pre-and post- gadolinium enhanced SWI in patients with brain neoplasms, compared with conventional imaging.

Methods: A total of Twenty-three patients (11 women and 13 men, mean age 55 y.o.) with intracranial neoplasms participated in this study. All MR imaging were performed on a 1.5 Tesla MR imager (Signa HD ver.12, GE Healthcare, Milwaukee, Illinois) .MR imaging protocol consisted of conventional MR sequences (T1-weighted spin-echo imaging, T2-weighted fast spin-echo imaging, FLAIR imaging, T2*-weighted gradient-echo imaging and echo-planar diffusion-weighted imaging), pre- and post-gadolinium enhanced SWI and post-gadolinium enhanced 3D T1-weighetd gradient-echo imaging. Imaging parameters of SWI were as follows: TR/ TE =53/ 40 ms, matrix=384x256, bandwidth = 15.6 kHz, FOV = 240x180 mm, slice thickness/gap=1.5/0 mm, flip angle=30° and number of average=1. All SWI images were evaluated visually by two neuroradiologists, compared with conventional sequences and post-contrast 3D on a slice by slice. For quantitative analysis, contrast-to-noise ratio (CNR) was measured between enhanced pathologic lesion and normal brain white matter on post-contrast SWI and 3D T1-weighetd images.

Results: Both low and high signal structures, which were showed as enhanced area on contrast enhanced T1-weighted images, were observed at the pathologic lesion on post-contrast SWI images in patients with intra-axial tumors. Rim of the intra-axial tumor was more clearly visualized on post-contrast SWI images than pre-contrast SWI images in all cases. Post-contrast SWI images showed bright enhancement that suggested leakage of contrast material due to breakdown of the blood brain barrier surrounding the intra-axial tumors (i.e. malignant lymphoma) and showed no enhancement around the extra-axial tumors (i.e. meningioma). SWI images showed the edema surrounding tumors to the same extent, compared with T2-wighted and FLAIR images and revealed blood products more clearly than T2*-weighted images. CNR of post-contrast 3D T1-wehigted images (50.4±15.5, mean±SD) was statically superior to that of post-contrast SWI images (17.9±9.20).

Discussion: SWI clearly visualized the characteristics and architecture of brain neoplasms. This imaging technique provides more information in addition to conventional sequences and is useful for evaluation of brain tumors in vivo, with contrast-enhancement in particular. Even more studies regarding imaging-pathologic correlation will be needed, this technique has potential to replace some conventional sequences in routine clinical study.

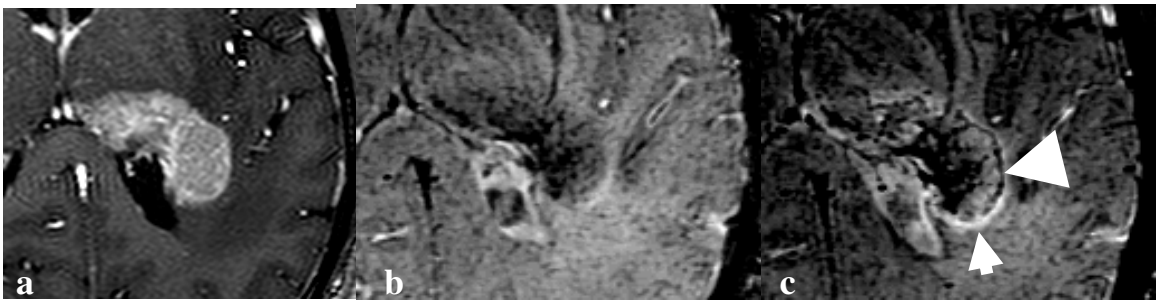

Figure. CNS malignant lymphoma. Post-contrast 3D T1-weighted image (a) shows enhanced mass lesion around the left lateral ventricle. Pre-contrast SWI (b) shows internal structures and blood products in the tumor. Post-contrast SWI (b) shows low intensity rim (arrowhead) and surrounding enhancement (arrow), which suggests breakdown of the blood brain barrier.

Reference: [1] Haacke EM, et al. Susceptibility weighted imaging (SWI). Magn Reson Med. 2004 Sep;52(3):612-8. [2] sehgal V, et al. Clinical applications of neuroimaging with susceptibility-weighted imaging. J Magn Reson Imaging. 2005 Oct;22(4):439-50. [3] sehgal V, et al. Susceptibility-weighted imaging to visualize blood products and improve tumor contrast in the study of brain masses. J Magn Reson Imaging. 2006 Jul;24(1):41-51.