Susceptibility-weighted Imaging in Hyperacute Cerebral Ischemia

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INTRODUCTION: Susceptibility-weighted imaging (SWI) uses phase shift itself to enhance contrast caused by susceptibility differenceThe phase image is used to separate the dominant spectral information. The image feature is contrast caused by susceptibility difference between deoxygenated blood (deoxy-Hb) and the surrounding tissue (oxy-HB) [1]. Clinically, SWI has been applied to the detection of small vascular anomaly but microbleeds containing hemosiderin. Early detection of arterial occlusion and perfusion abnormality is necessary for effective therapy of hyperacute cerebral ischemia. We attempted to assess the clinical role of SWI in hyperacute ischemic stroke (HIS) during 24 hours from onset.

MATERIALS and METHODS: We studied 65 patients who had suffered from HIS caused by occlusion of intracranial major arteries. MR examinations were performed with a clinical whole-body imager operating at 1.5 –T (MAGNETOM AVANTO, Siemens). 3D FLASH SWI parameters were as follows: 48/40/20 ms (TR/TE/flip); field of view, 23 cm; matrix size, 320; axial sections, 1.6 mm thick; and scan time, 5 minutes 32 seconds. Minimum intensity projection was performed to display the processed data. All patients underwent diffusion-weighted imaging (DWI), MR angiography (MRA) and Gd perfusion study.

RESULTS: We have found two major findings on SWI in patients with HIS, those are “increased vessel contrast (IVC)” and “intrararterial low signal (IAL)”. IVC is remarkable hypointensities in the draining veins within perfusion abnormality. IVC was detected in 86.2 %. IVC was detected not only in the cortical veins (100%) but medullary veins (62.5%). The area with IVC agreed with an area with perfusion impairment confirmed by Gd-perfusion study in all patients. IAL was markedly hypointense dot-like signal in the occluded artery due to T2* effect representing emboli or thrombi. IAL was seen in 83.1%. IAL agreed with lack of TOF MRA and FLAIR intraarterial signal (IAS); however, in some cases, IAL is superior to FLAIR IAS for the detection of acute thrombus itself due to susceptibility effect.

CONCLUSION: IVC suggests a relative increase of intravenous paramagnetic deoxyHb and a relative reduction of oxyHb due to the impaired oxygenation (misery perfusion state). SWI can detect not only an area of perfusion impairment but also occluded artery. SWI provides important adjunct information for HIS. IVC is a useful finding to assess acute misery perfusion state without contrast media and a reliable indicator for determining whether a patient should undergo Gd-perfusion study.

REFERENCE:1. Haacke EM. Magn Reson Med. 2004 Sep;52(3):612-8

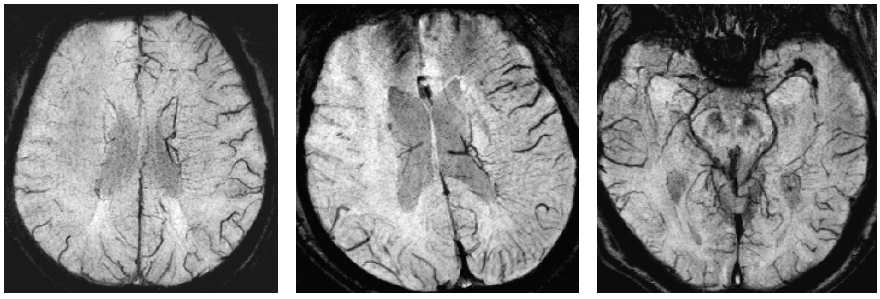

Fig.A Fig. B Fig.C

Fig. Acute cardioemolism in the left middle cerebral artery.

SWI shows increased vessel contrast (IVC) in not only cortical vein but also medullary draining vein from the area fed by the left middle cerebral artery(A and B). Acute embolus is also identified as intraarterial low signal in the left MCA M1(C).