Magnetic Resonance Imaging Findings of Generalized Tonic Clonic Seizure Induced Transient Brain Changes

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Introduction
The purpose of this study was to evaluate the transient MRI signal changes in the brain induced by generalized tonic clonic seizure. We analyzed the MR imaging findings in the initial MRI obtained within 3 days after GTC seizure and that in the follow-up MRI obtained after the seizure control.

Materials and methods
Six patients who underwent MRI within 3 days after GTC seizure were retrospectively reviewed. Six patients underwent electroencephalography within 3 days after GTC seizure and EEG showed seizure activity. T1-weighted images, T2-weighted images and Gadolinium-enhanced T1WIs were obtained in six patients. Diffusion-weighted images were added in three patients during the initial examination. After the seizure control, follow-up MRI was performed in six patients 9 days to 5 months after the seizure onset. Follow-up EEG performed at the same time with follow-up MRI showed resolved (n=5) or decreased (n=1) seizure activity. We evaluated patterns of the signal change, location of the signal change, degree of contrast enhancement and the signal change on the DWI. On the DWI, apparent diffusion coefficient was determined for region of interest. To obtain baseline ADC value, three healthy volunteers were imaged on DWI as control. ADC of lesion was compared with that of comparable area in controls. We also compared the signal changes on initial and follow-up MRI.

Results
The initial MR images showed focally increased T2 signal intensity, swelling and increased volume of the involved cortical gyrus in all six patients. The lesion was mainly located in the cortical gray matter and subcortical white matter in five patients; bilateral frontal, bilateral parietooccipital, left parietal, left frontoparietal, and left temporal lobe. The lesion was located in the right hippocampus in the remaining one patient. Two patients showed bilateral lesions and a patient showed multiple lesions. T1WIs showed decreased signal intensity in the same locations in four patients. Gyral contrast enhancement was noted in one patient on Gd-enhanced T1WI. On the DWIs, all three patients showed increased signal intensity and reduced ADC in the same locations; left temporal, right hippocampus and bilateral parietooccipital lobe. An increased signal intensity on the DWI correlated with a reduction of ADC. The ADC values were reduced 40%, 32% and 8% with respect to controls. Six patients showed complete resolution of the signal change (n=5) or decrease in signal change (n=1) on follow-up MRIs.

Discussion
The increased signal intensity on T2WI reflects the vasogenic edema and the increased signal intensity on DWI reflects the cytotoxic edema induced by the GTC seizure. The reversibility of the signal changes may be helpful for differentiation between seizure induced brain change and neoplasm.

Conclusions
The transient increase of MR signal intensity with increased volume was noted in cortical and subcortical white matter on T2WI and DWI in the patients of GTC seizure and these findings are transient changes in brain induced by GTC seizure.

References