Time Courses and Correlation of Diffusion-weighted MR and CT Imaging in Acute MCA Ischemia with Rat Model

H. Seo[1], and D. Na[2]

[1]radiology, dongguk university international hospital, goyangsi, kyunggido, Korea, Republic of, [2]radiology, Seoul National University College of Medicine, Seoul, Korea, Republic of

Purpose : To evaluate the time courses of the diffusion-weighted MR imaging (DWI) signal, the apparent diffusion coefficient (ADC) value and the CT density in acute ischemic brain parenchyma, and to determine the relativity between the changes of DWI signal and ADC value and the CT density change in rat model.

Materials & Methods : 11 in total 29 Sprague-Dawley rats completed the scheduled CT and DWI studies for 9 hours with acute left middle cerebral artery (MCA) ischemia by the intraluminal suture occlusion method. CT and DWI images were obtained at 1, 3, 5, 7 and 9 hours after MCA occlusion. Relative values of DWI signal (rDWI), ADC (rADC) and CT density (rCT) were obtained by dividing the values of ischemic lesion with the value of normal contralateral hemisphere. The time courses of each mean relative values and the correlation of rDWI and rADC to rCT were evaluated. The difference of absolute values of ADC (dADC) and CT density (dCT) were also obtained between the ischemic lesion and normal contralateral hemisphere. The correlation between both of them was evaluated.

Results : rCT showed a continuous linear decrease with time after ischemia ($r=0.82$, $P<0.05$) and rDWI showed a continuous linear increase up to 9 hours ($r=0.56$, $P<0.05$), whereas the decrease of rADC was almost completed within 3 hours. rDWI and rCT were correlated with statistical significance ($r=-0.59$, $P<0.05$), whereas rADC and rCT, and dADC and dCT were not correlated ($P=0.76$).

Conclusion : Unlike ADC value, DWI signal in acute cerebral ischemia increases with time and correlates with CT density, which decrease with time. It means that the signal change of DWI after 3 hours is influenced by net water uptake in ischemic edema rather than by restricted water diffusion and DWI will be used as the predictor of ischemic injury severity like CT.