# Diffusion kurtosis image of the cerebral infarction: Time course of the axial and radial kurtosis

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**Purpose**: Diffusion kurtosis imaging (DKI) is a technique to evaluate non-Gaussian diffusion by providing tissue diffusion kurtosis, which is a dimensionless statistical parameter to quantifying the deviation of the water diffusion profile from Gaussian distribution. Kurtosis is a descriptor for the shape of a probability distribution curve, which represents "peakedness" of the curve relative to a Gaussian distribution.

Diffusion kurtosis of the brain reported to increase in the lesions of acute cerebral infarction[1]. However, time course of the diffusion kurtosis of the cerebral infarction has not been investigated enough. The purpose of the current study is to evaluate the time course of diffusion kurtosis in the cases with cerebral infarction and compare with the established diffusion images including diffusion weighted images (DWI) and apparent diffusion coefficient (ADC) images.

**Materials and Methods**: The subjects of the current study are 20 cases of the cerebral infarction in which the onset time can be identified clinically (Duration after onset: 0 day～31 days,Age :18y.o～87y.o, Male 12 cases / Female 8cases). Evaluations were made for 37 lesions in the 20 cases. We made image study by using a 3.0T clinical scanner (Magnetom Verio, Siemens, Erlangen, Germany). In addition to conventional images, we made DWI and DKI studies with EPI sequence (DKI: TR=6100ms, TE=131ms, b=0, 1000 and 2000, Motion proving gradient: 30 axes, FOV=250mm, Matrix=128x128, Slice thickness=3mm, Acquisition time=6.5minutes, Work in progress). We evaluated the correlation between the duration after the onset of infarction and the signal intensity of the lesions on DWI, ADC images and DKI including axial kurtosis to the eigenvector (Kax) and radial kurtosis to the eigenvector (Krad). Signal intensity on the images were evaluated qualitatively with 5 ranks according to relative signal intensity compared to the surrounding tissue (Very high, High, Iso, Low, Very low). We analyzed correlation between the signal and the duration after onset. We also evaluated the differences of the values on DWI/DKI by the location of the lesion including white matter and gray matter.

**Results**: Kax showed increase in the lesions of the early infarction and showed earlier decrease compared to that in the DWI. As shown in the figure, in the lesions within 10 days from the onset, Kax showed higher value. In contrast, the lesions started to show decreased Kax after 10 days. Although Krad showed various values, the cases within 2 weeks tended to show higher value. The period that Kax showed increased values roughly agreed with the time when ADC showed drops. The lesion location (white/gray matter) did not matter with the signal changes.



**Discussion/Conclusion**: The results suggest that the diffusive inhomogeneity of the axon direction increases in early stage after infarction. Thus, the change of the diffusion status in the axon may exist in the early stage of infarction. Possible mechanism for changes in the intra-axonal diffusivity induced by infarction may include increased axonal swelling or alteration of the endoplasmic structure. Additional information in the time course of infarction may be provided by this diffusion kurtosis imaging.

**Reference:** 1. Hui ES, Fieremans E, Jensen JH et al. Stroke assessment with diffusional kurtosis imaging. Stroke. 2012; 43(11):2968-73