DKI manifestation in patients with acute ischemic stroke

Gang Guo[1] and Liuhong Zhu[1]

[1]*Radiology, Xiamen Second Hospital, Xiamen, Fujian, China*

Abstract

Purpose: Diffusion MRI has been widely used for detecting cerebral cytotoxic edema in acute stroke. However, it remains challenging to stratify the heterogeneous cytotoxic edema commonly found with conventional DWI deficits. Emerging diffusion kurtosis imaging (DKI) improves tissue characterization and complements conventional DWI. The goal of this study is to preliminarily evaluate DKI in stratifying heterogeneous acute stroke DWI lesions.

Material and methods: Fifty-nine patients ((64.7±16.2) Y, 20 women, 39 men) with acute ischemic stroke underwent routine MR scanning with additional DKI sequence scanning (b=0, 1000, 2000s/mm^2 with 15 directions). Seventy-two lesions were identified with high signal in DWI and low signal in the corresponding ADC maps. According the signal intensity of both DTI and DKI abnormities, four types were classified arbitrarily: type I: DTI positive with DKI positive in equal size (DTI low signal with DKI high signal in equal size); type II: DTI positive with DKI negative (DTI hypointensity with DKI iso- or hyperintensity)；type III: DTI positive with smaller DKI positive in size; type IV: DTI positive with different DKI metrics positive in size (i.e. MK, KA, and KR showed different positive size). Both DTI and DKI metrics in four types were calculated.

Results: Both ages and time from onset to initial MRI examination in four types were not significant differences. The change of MK was significant difference between type I (cases: 31, lesions:35) and type II(cases:14, lesions:16); five metrics changes (MD, DA, DR, MK, and KA) between type I and type III(cases:16 , lesions:18) were significant differences; four metrics changes (DA, DR, MK, and KA) between type I and type IV(cases:4 , lesions:5) were significant differences. Comparison type II with type III, the changes of MD and DA were significant differences; the changes of MD, DA, and KA between type II with type IV were significant differences, and only change of KA between type III and type IV was significant difference.

Discussion: In the current study, the changes of the DKI signal intensity were classified 4 types within acute stroke lesions, which showed hyperintensity on DWI and hypointensity on the corresponding ADC maps. Additionally, the quantitative changes of DKI metrics were significant differences in all types. Our results indicated that DKI could stratify heterogeneous acute stroke DWI lesions.

Conclusion: DKI augment conventional DWI for enhanced detection of microstructure changes in brain tissue with acute ischemic stroke. Our case report serves as proof of concept and warrants further investigation.
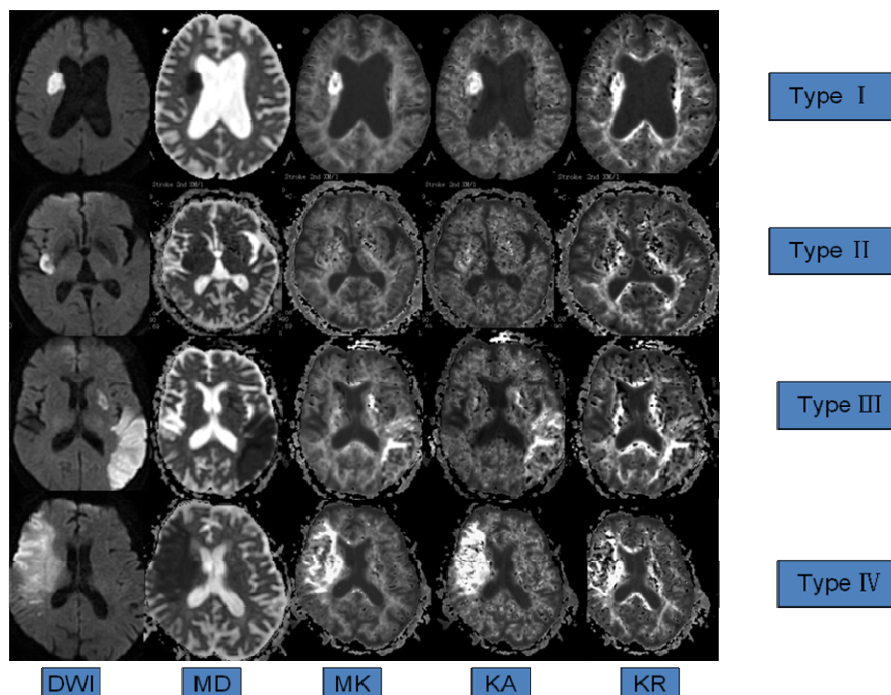
Figure1. Metrics for four types