

# Diffusion Patterns of the Putamen and Globus Pallidus, Evaluated with DTI

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**Introduction** Diffusion Tensor Imaging (DTI) has widely been used in detecting various degenerative changes in cerebral white matter with normal aging and pathological status.<sup>1,2</sup> In the literature, the putamen and globus pallidus were usually regarded as the lenticular nuclei, a whole structure<sup>2</sup> to be evaluated. Because of the different phylogenesis and function, putamen and globus pallidus may have differentiate diffusion property. In this study, the putamen and globus pallidus were evaluated using DTI, in order to quantify the diffusion patterns of the putamen and globus pallidus with aging, respectively.

**Methods** Sixty seven normal volunteers (37men, 30women, age range:20~80, mean age:41.07), divided into three groups by age:  $\leq 30$  years, 31~50 years,  $\geq 51$ years, were studied. DTI was performed using a 1.5T Signa EXCITE II (GE Medical System, Milwaukee, WI, USA) with an 8-channel head coil. The parameters were as follows: 240\*240mm FOV, 256\*128 matrix, 3.0mm thickness with 0mm space, TR/TE: 10000/83ms, NEX:2, b-value:0,1000, diffusion direction:13. The values of fractional anisotropy (FA), ADC, eigenvalues ( $\lambda_1$ ,  $\lambda_2$  and  $\lambda_3$ ) in putamen and globus pallidus were calculated on DTI. The differences of the FA, ADC,  $\lambda_1$ ,  $\lambda_2$  and  $\lambda_3$  values among groups and their relationship with age were studied.

**Results** In the all age groups, the value of FA in the putamen was lower than that in the globus pallidus, but the ADC value was higher in the putamen than that in the globus pallidus. The FA value in the putamen was significantly elevated with aging ( $r=0.585$ ,  $p=0.000$ ), while the FA value in the globus pallidus was well preserved ( $r=0.213$ ,  $p=0.084$ ). Furthermore,  $\lambda_3$  in the putamen showed age-related decline ( $r=-0.472$ ,  $p=0.000$ ). The differences of the FA value among age groups were significant in the putamen ( $p<0.05$ ), but not in the globus pallidus ( $p>0.05$ ).

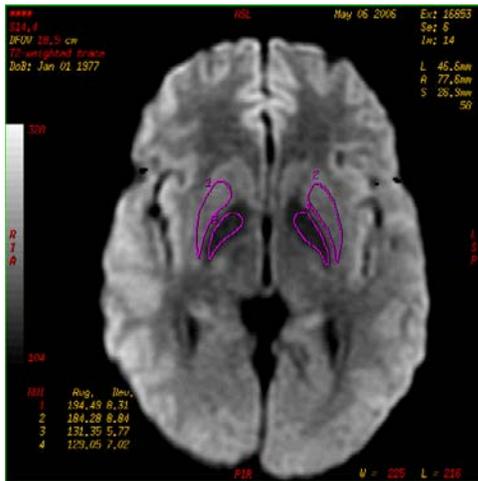


Figure 1. ROI 1, 2: putamen, ROI 3, 4: globus pallidus.

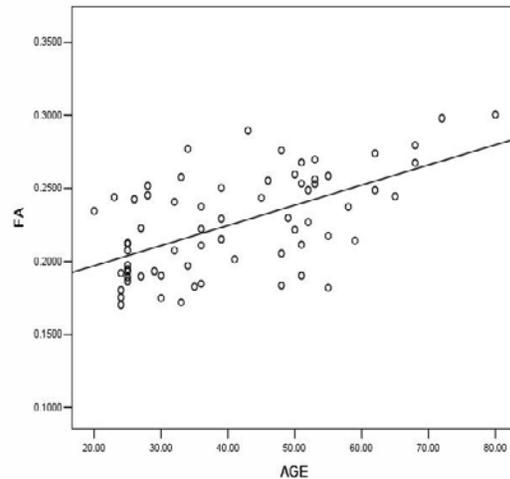


Figure 2. Scatter plots of the FA value in the putamen regressed with age

**Conclusion** The phenomenon of age-related elevation of the FA value lied in the putamen, not in the whole lenticular nclei. The different diffusion patterns of the putamen and globus pallidus may reflect the microstructure feature of these two. We should pay attention to the different diffusion property of the putamen and globus pallidus, when we study the basal ganglia with DTI.

## References:

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2. Abe O, Aoki S, Hayashi N, et al. Normal aging in the central nervous system: quantitative MR diffusion-tensor analysis. *Neurobiol Aging*, 2002, 23: 433–441.

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