White matter microstructural abnormalities in late-life depression: a diffusion tensor imaging study

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Introduction：Late-life depression refers to depressive syndromes defined in the International Classification of Diseases (ICD-10) that arise in adults older than age 65 years. In old age, depressive syndromes often affect people with chronic medical illnesses, cognitive impairment, or disability. Beyond personal suffering and family disruption, depression worsens the outcomes of many medical disorders and promotes disability. The pathogeny is very complex，many factors including neurobiochemistry, heredity, environment, psychology etc, may play important roles. Until now, it is not clearly, mostly is heterogeneity, whether result in brain pathological changes and characteristic emotional, cognitive and motor activity disorder eventually (1, 2). It is recognized that Limbic-Cortical-Striatal-Pallidal-Thalamic Tract modulates mood regulation and cognitive ability, which maybe contributes to the pathogenesis of geriatric depression. We used diffusion tensor imaging to examine the microstructure of white matter in the dorsolateral prefrontal cortex, hippocampal gyrus and the genu and the body of corpus callosum. We hypothesized that elderly depressed subjects would exhibit greater microstructural abnormalities (measured as lower fractional anisotropy value) than elderly comparison subjects who were not depressed.

Material and methods: A total of 31 depressed subjects (11 males and 20 females) and 15 data- matched healthy controls (7 males and 8 females) were included into this study. All the patients were in accordance with depression outbreak standard (F31.X) in the International Classification of Diseases (ICD-10). All axial images were acquired with a Signa 1.5T SIGNA MR system using the standard head (volumetric) radiofrequency coil. A single-shot spin-echo echo-planar imaging sequence was used for diffusion tensor analysis, b value 0/1000sec/mm2, TR/TE=8000msec/80.8msec，256×256 matrix，FOV =26×20cm, 3mm slice thickness, and slice gap=0mm. DTI were aligned with the anterior and posterior commissure plane.

The DTI were processed on GE Advantage windows workstations with FuncTool 2, a radiologist blind to the subjects' depression status placed oval regions of interest in the white matter in the dorsolateral prefrontal cortex, hippocampal gyrus and the genu and the body of corpus callosum. Each area of ROI was 40mm2. FA values were analyzed using independent t-test to test the differences between the patients and controls. Correlations between the significant changes FA values of depression and their clinical data (age, sex, course of diseases and medical illness) were calculated using Spearman's rank order correlations.

Results: Depressed subjects exhibited lower FA values than comparison subjects in all regions of interest (table1).This difference reached a level of statistical significance in the superior and middle frontal gyrus and right hippocampal gyrus. FA values difference between groups in the left hippocampal gyrus did not reach a level of statistical significance, but p=0.053 is similar to 0.05, showing a certain extent difference. There was no correlation between FA changes and clinical data.

Conclusion: Microstructural changes in the matter of frontal (superior and middle frontal gyrus) and temporal (right hippocampal gyrus) are associated with late-life depression. This study will increase the understanding of the pathogenesis of geriatric depression.

References: 1. Lockwood KA, et al. Am J Psychiatry 2002;159(7):1119-1126. 2. Cummings JL. J Clin Psychiatry 1993;54:14–20.

Brain regions	Patients	Controls	t	p
Right hippocampal gyrus	0.164±0.022	0.183±0.022	-2.805	.007**
left hippocampal gyrus	0.161±0.022	0.175±0.019	-1.991	.053
right superior frontal gyrus	0.176±0.032	0.215±0.029	-3.990	.000**
Right middle frontal gyrus	0.201±0.029	0.225±0.026	-2.614	.012*
Left superior frontal gyrus	0.196±0.314	0.220±0.358	-2.353	.023*
Left middle frontal gyrus	0.193±0.022	0.223±0.305	-3.843	.000**
Body of corpus callosum	0.538±0.059	0.570±0.043	-1.872	.068
Genu of corpus callosum	0.481±0.079	0.508±0.069	-1.151	.256

Table 1. Difference between patients and controls in regional FA values, *P<0.05 **P<0.01