

Similar Microstructure abnormality of Anterior Cingulate Region in Depressed and Undepressed Parkinson's Disease: Evidence from Diffusion Tensor Imaging

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Introduction

Depression in Parkinson's disease is a common complication, but the exact pathophysiology of depression in Parkinson's disease still remains obscure. The cortical-limbic circuit abnormalities play an critical role in de novo depressive disorder and depression has been postulated to arise due to imbalances in connectivity in this circuit leading to decreased regulatory effect of the cortical areas such as the anterior cingulate cortex (ACC) over the limbic regions. Evidences suggest that depressed Parkinson's disease (DPD) and de novo depression might share the similar pathological changes on emotion circuit inside the brain. Using diffusion Tensor Imaging (DTI) we compared DPD, undepressed Parkinson's disease (UDPD) and normal controls (NC) by FA measurement in regions probably representing ACC bundle and we hypothesized that depressed and non-depressed PD may have similar ACC bundle microstructure changes revealing the decreased ACC connectivity with other regions.

Material and methods

15 DPD, 14 UDPD and 21 normal controls were included in the present study. Diagnosis of depression was made using the DSM-IV criteria for major or minor depression. Patients in the 3 groups were matched for Hoehn Yahr stage. All patients fulfilled the UK Parkinson's Disease Society Brain Bank criteria for idiopathic PD. All patients had received dopaminergic treatment and no depressed patients had any anti-depressive medication. No patients had other central nervous diseases proved by MRI. the Mini-Mental State Examination (MMSE), Hamilton Depression Scale (HAMD), DSM-IV evaluation was implemented 1-2 hours before MRI scan. Written informed consent was obtained and all patients agreed to participate in the study.

Magnetic resonance imaging was carried out at 3.0-T MRI (Trio Tim system; Siemens Medical Solutions, Erlangen, Germany). In addition to conventional T2-weighted images, diffusion tensor images were obtained. The DTI sequence was as follows: field of view 256 mmx100 mm; voxel size: 2x2x4; TR/ TE = 6000/93; b values: 0 and 1000 s/mm²; Bandwidth (Hz/Px): 1396; Accel.factor: 2; 4/0 mm slice/gap. Diffusion sensitisation was carried out in 20 directions.

The FA values of regions of interest (ROI) probably representing the ACC bundle were compared for the two groups (Figure 1). unpaired two-tailed t-tests were used for comparison between the two groups. SPSS (version 10.0) was used for statistical analysis, and significance level was set at $p < 0.05$.

Results

Comparing with NC group, DPD and UDPD group both showed significant reductions in FA values in the bilateral ROIs representing the ACC bundles. The DPD group has lower FA value in the bilateral ROIs comparing with UDPD group.

Discussion

Few imaging studies have documented depression in PD. The present study is the first to describe similar changes of ACC bundle microstructure in depressed and nondepressed Parkinson's disease comparing with normal controls. Using the DTI method researchers recently found reductions in FA values in the prefrontal region^[1] and anterior cingulate region^[2] in patients with de novo depression. Hideaki et al recently compared DPD and UDPD patients and found reductions in FA values in the bilateral anterior cingulate bundles in DPD patients^[3]. Our present results indicate that although the UDPD does not show clinical significant depressive symptoms, it may have cortical microstructure changes involved in part of the emotion regulation circuit revealed by DTI. Difference of FA value between DPD and UDPD might explain the clinical depressive symptoms in Parkinson's disease.

References

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