Changes of Indices in Diffusion Tensor Images of Patients with Depressive Symptoms in the Elderly with Dementia

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Introduction

Recent studies suggested that the change of indices in diffusion tensor images (DTI) is common in Alzheimer's disease (AD) (1, 2). Recently, a high prevalence of the comorbidity of dementia and depression was reported in the literatures. However, little is known about how these two different types of disease interfere with each other. This study aims to investigate white matter changes in patient of Alzheimer's disease without depressive symptoms (AD, Control) and those with depression (DAD, Case) using diffusion tensor imaging (DTI), as well as analyzed the clinical cognitive tests.

Methods

This study included 26 patients with depression under Alzheimer's disease and 20 sex and age-matched subjects with Alzheimer's disease only. All participants completed the neuropsychological tests: Montreal Cognitive Assessment (MoCA) and Commission on Dietetic Registration (CDR). DTI data were acquired on a 1.5T Siemens MR system with following parameters: TR/TE=10000/107ms, b-value=1000 s/mm^2, 30 directions, NEX=3 and voxel size=2*2*2mm^3. Brain ROI-based value of the FA and MD were carried out using FMRIB Software Library v5.0 (FSL) (4) and Statistical Parametric Mapping (SPM) (5). White matter ROIs were created from Susumu Mori (6). The statistical analysis of the DTI indices of 68 ROIs were performed using a parametric permutation test and P<0.05 for significance. Subsequently, partial Pearson correlation analyses were performed to correlate the clinical evaluations with the regional DTI values within patient groups.

Results

Demographic of case and control groups was showed in Table 1. In this study, the results showed that the FA of control group in some specified regions of interest (ROI) in white matter areas was significantly lower than case group. The values of MD showed higher in the control group than the case group (independent t- test, P<0.05). Table 2 and Table 3 showed the detail ROI areas with significantly different DTI indexes in two study groups. Figure 1 showed the areas with significantly different in FA and MD. The negative correlation showed between FA in left anterior corona radiata and the naming test in MoCA. The positive correlation observed between the naming test in MoCA and MD in left retrolenticular part of internal capsule, left anterior corona radiate and left superior corona radiate. (Table 4)

Demographic	*Case (n=26)*	*Control(n=20)*
Age (years)	75.00±7.78	78.65±7.07
Sex (male/female)	7/19	8/12

Table 1. Demographic of subjects

MD	*Case (n=26)*	*Control(n=20)*
Superior cerebellar peduncle left	0.947±0.045	0.987±0.071
Cerebral peduncle right	0.728±0.023	0.747±0.027
Cerebral peduncle left	0.726±0.026	0.744±0.025
Posterior limb of internal capsule left	0.711±0.024	0.729±0.036
Retrolenticular part of internal capsule left	0.773±0.031	0.811±0.058
Anterior corona radiata left	0.811±0.046	0.854±0.079
Superior corona radiata left	0.760±0.050	0.797±0.068
External capsule right	0.787±0.051	0.830±0.074
Inferior fronto-occipital fasciculus left	0.775±0.033	0.808±0.053
Uncinate fasciculus right	0.756±0.037	0.798±0.046
Uncinate fasciculus left	0.755±0.033	0.787±0.052
Inferior frontal blade right	0.745±0.029	0.784±0.067
Inferior frontal blade left	0.745±0.035	0.773±0.055

Table 2. The areas with significantly differences in MD. (10^{-3})

FA	*Case (n=26)*	*Control(n=20)*
Cerebral peduncle right	0.698±0.034	0.681±0.043
Anterior limb of internal capsule right	0.549±0.026	0.548±0.029
Anterior corona radiata left	0.410±0.026	0.392±0.033
External capsule right	0.399±0.019	0.382±0.018
External capsule left	0.407±0.018	0.393±0.024
Inferior fronto-occipital fasciculus left	0.478±0.021	0.461±0.027
Uncinate fasciculus left	0.460±0.030	0.430±0.037
Inferior frontal blade right	0.441±0.027	0.409±0.036
Inferior frontal blade left	0.420±0.020	0.402±0.038
Occipital blade left	0.503±0.043	0.474±0.046

Table 3. The areas with significantly differences in FA.

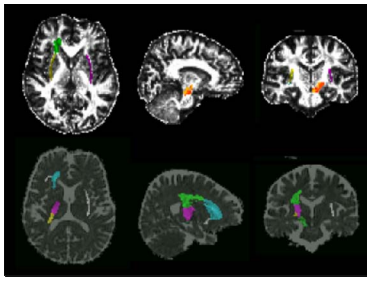

Figure 1. The areas with significant differences in FA (up) and MD (down)

ROI of Brain areas	*Case (n=26)*	*Control(n=20)*
FA of		
Anterior corona radiata left	-0.4128	0.3429
MD of		
Retrolenticular part of internal capsule left	0.5991	-0.3525
Anterior corona radiata left	0.5965	-0.3890
Superior corona radiata left	0.4972	-0.3010

Table 4. The correlation coefficient of brain areas with significantly differences in MD/FA and the naming test of MoCA

Conclusions

There were significant differences of white matter DTI indexes between both groups. Correlations between those white matter abnormalities and MoCA (Montreal Cognitive Assessment) and CDR (Commission on Dietetic Registration) supports white matter alteration may be involved in the psychopathology and pathophysiology of these two major co-morbidities in Alzheimer's disease. Both FA and MD showed the differences in right cerebral peduncle, left Anterior corona radiate, right external capsule, left inferior fronto-occipital fasciculus, left uncinated fasciculus, right and left inferior frontal blade. The different lateralization existed in our results. It may relate to the handedness. In the correlation between FA values, MD values and the naming test in MoCA suggests that WM deficits in these regions may be a specific biomarker.

References

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