## GM AND WM CHANGES CORRELATION WITH DURATION IN MSA-P: COMPARISON WITH DTI CHANGES

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## Introduction

Several previous studies using voxel-based morphometry (VBM) have shown multiple gray matter (GM) and white matter (WM) loss in parkinson variant of multiple system atrophy (MSA-P), which was consistent with the histological changes of this disease. Correlation of GM and WM with disease duration may help to predict the process of brain atrophy in MSA-P. Diffusion tensor imaging (DTI) known as a method to demonstrate microstructural changes, which has revealed brain changes in patients with MSA-P in some studies, was also thought to be more sensitive to show early brain abnormality ahead of the actual brain atrophy. Both regression and DTI changes could help to predict the brain changes, while comparison of the two methods was rare for a same MSA-P group. In this study, VBM, VBM correlation with disease correlation and voxel-based diffusion tensor analysis were all performed in one MSA-P group, to show the differences between the three methods in demonstrating brain changes in MSA-P.

According to the consensus criteria[1], Twenty-four patients with probable MSA-P (12men and 12women; age:  $54.3\pm5.5$  years; disease duration:  $24.1\pm13.2$  months) and 26 healthy controls (11men and 15women; age:  $53.4\pm3.9$ years) were recruited in this study. All the subjects were right-handed.

MRI was performed on a 3.0 T scanner (GE Signa VHi Excite) with an 8-channel phase array head coil. An axial T1-weighted 3-dimensional fast spoiled gradient echo sequence (TR=6.9ms, TE=3.3ms, flip angle=15°, matrix=256×256, FOV=24×18cm, slice thickness=1.6mm, slice gap=-0.8mm) was applied to acquire structural images of whole brain, and DTI was performed with an EPI sequence (TR=11000ms, TE=72ms, b value=0/1000 s/mm<sup>2</sup>, 15 diffusion-encoding gradients, matrix=128×128, FOV=24×24cm, slice thickness=3mm, no slice gap). DTI images were processed with the standard procedure of FSL (http://www.fmrib.ox.ac.uk/fsl/) to generate fractional anisotropy(FA) and mean diffusivity(MD) maps. With SPM 8, VBM between MSA-P and controls was performed to show GM and WM loss in MSA-P with the DARTEL method. One way regression was performed between GM and WM concentrations and disease duration respectively. Voxel-based analysis of FA and MD maps was performed after creating a customized template and normalization. **Results** 



Fig.1 GM (top) and WM (bottom) loss in MSA-P compared with controls



Fig.2 GM (top) and WM (bottom) loss associated with disease duration in MSA-P

MSA-P patients showed significant GM and WM loss bilaterally in brain stem, cerebellar hemispheres, insular, parietal, frontal lobes and putamen(P < 0.05, FDR)(Fig.1). GM showed significant negative correlation with disease duration in multiple areas, such as cerebellar hemispheres, anterior temporal, insular, frontal lobe, and basal ganglia (P < 0.05, uncorrected) (Fig.2). WM showed significant negative correlation with disease duration in inferior olives,



**Fig.3** FA (top) and MD (bottom) changes in MSA-P compared with controls

cerebellar hemispheres, pons, mesencephalon, internal capsule, and some frontal, temporal and parietal WM (P<0.05, uncorrected) (Fig.2). MSA-P patients showed significant FA decrease bilaterally in brain stem, cerebellar hemispheres, insular, parietal, frontal, temporal and occipital lobes (P<0.01, FDR) (Fig.3), and white matter was more severely involved than gray matter. MD increase in MSA-P could be seen in bilateral brain stem, cerebellar hemispheres, basal ganglia, insular, frontal, temporal and occipital lobes (P<0.01, FDR) (Fig.3). **Discussion and Conclusions** 

Voxel-based DTI analysis and regression with duration were both consistent with VBM results well, However, the former two methods showed more extensive involved areas, particularly the DTI maps. As a statistical way, regression revealed the potential trend by correlating the GM and WM concentration with disease duration, While DTI results demonstrated actual abnormalities by calculating the diffusion parameters. The results of the study showed that DTI could reveal early brain changes due to its sensitivity to the microstructural changes. Longitudinal studies would verify the results of regression and the DTI reults.

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