PN 456

MULTIMODAL MRI ASSESSMENT OF BRAIN DAMAGE IN MULTIPLE SYSTEM ATROPHY AND PARKINSON'S DISEASE

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INTRODUCTION

- Multiple system atrophy (MSA) is characterized by a variable combination of autonomic dysfunction, parkinsonism, and cerebellar ataxia. The predominant clinical feature (parkinsonism [MSA-p] *vs* cerebellar ataxia) determines the MSA phenotype.
- MSA-p at onset is often misdiagnosed with Parkinson's disease (PD).
- There is a great interest in the development of reliable biomarkers able to detect specific features and evolution of MSA-p.

MATERIALS AND METHODS

Table 1. Demographic and clinical features of patients and controls

	HC	MSA-p	PD
Number	33	27	39
Gender, males (%)	13 (39%)	10 (37%)	22 (56%)
Age at MRI, years	61.3 ± 6.7	58.2 ± 7.0	58.8 ±4.5
Education, years	13.5± 2.9	10.9 ± 2.9*#	12.3 ± 2.5*
Age at onset, years	-	52.9 ± 6.6	55.3 ±5.4
Disease duration, years	-	4.5 ± 2.5	3.9 ± 2.6
Hoehn and Yahr	-	3.3 ±0.6#	1.5 ±0.7
UPDRS III-motor	-	46.6 ± 9.8#	24.1 ± 14.9
UMSARS II-motor	-	-	25.6 ± 5.0

Values denote means ± standard deviations or frequencies (%)
*p< 0.05 PD *vs* HC or MSA-p *vs* HC
#p<0.05 MSA-p *vs* PD
Abbreviations: HC=Healthy Controls; H&Y:; MSA-p: multiple system atrophy-parkinsonian variant; NA=Not applicable; PD: Parkinson's disease; UMSARS: Unified MSA Rating Scale; UPDRS III: Unified Parkinson's disease Rating scale III.

METHODS

- **1.5 T MRI**: dual-echo, 3D T1-weighted fast field echo, pulsed-gradient SE echo planar with sensitivity encoding and diffusion gradients applied in 65 non-collinear directions.
- **Cortical atrophy:** surface-based morphometry analysis (Freesurfer, version 5.3).
- **WM damage**: [fractional anisotropy (FA), and mean (MD), axial (axD), and radial diffusivities (raD)]: Voxel-wise analysis with Tract-Based Spatial Statistics (TBSS) version 1.2 in FSL (age-adjusted).

OBJECTIVE

- To explore structural cortical and white matter (WM) alterations in patients with MSA-p compared to patients with PD and healthy controls (HC).

RESULTS (1)

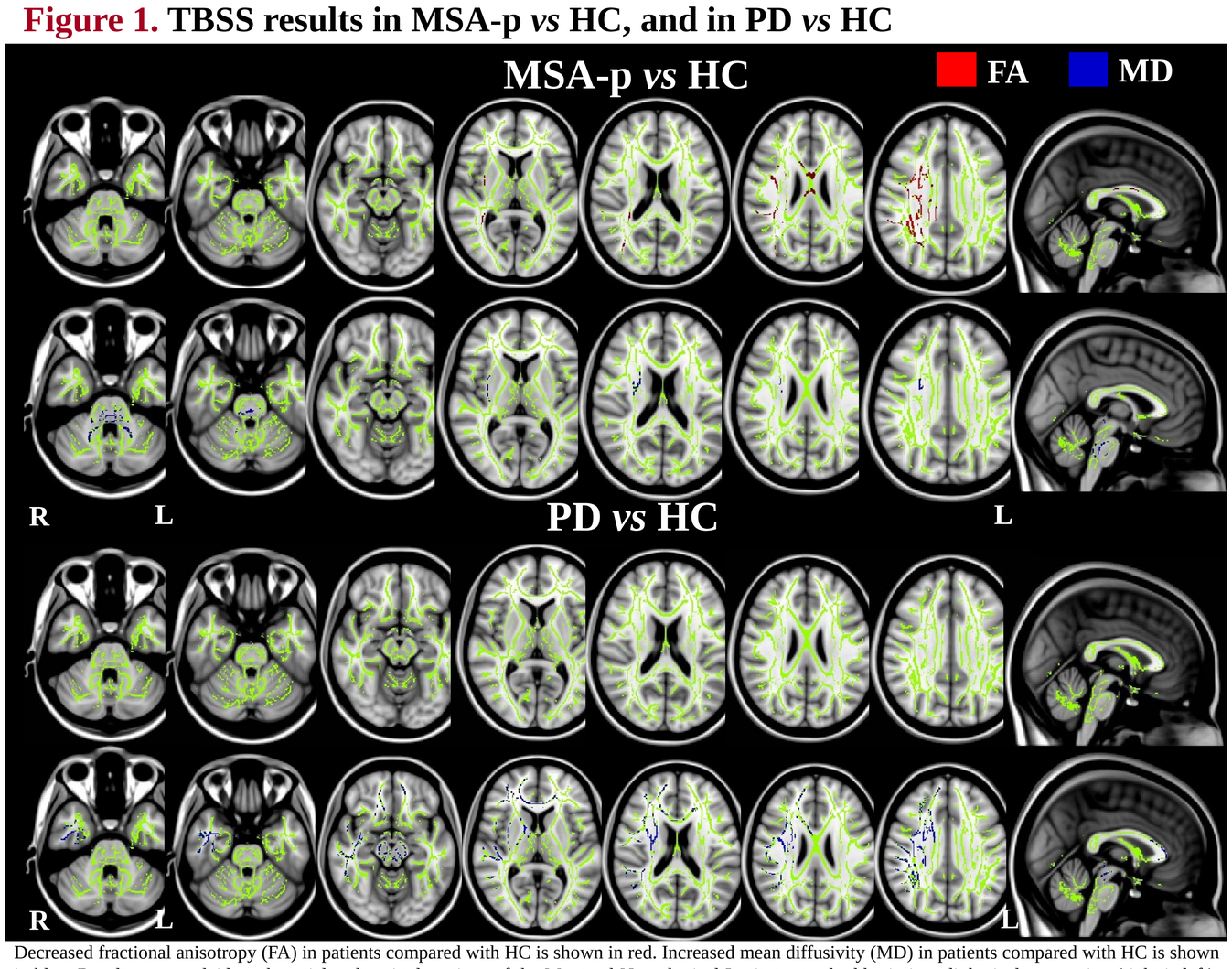
Table 2. Cognitive features of patients and controls

	HC	MSA-p	PD
Cognitive test			
MMSE	29.7±0.6	27.3 ± 2.0*#	28.9 ± 1.0*
ACE-R total score	96.9 ± 2.5	85.3 ±7.7*#	91.8 ± 4.3*
ACE-R attention	17.9 ± 0.2	16.2 ± 1.4*#	17.5 ± 2.1
ACE-R fluency	11.7 ± 1.6	8.2 ± 2.6*#	10.6 ± 1.8*
ACE-R language	25.9 ± 0.3	24.5 ± 2.0*	24.6 ± 1.6*
ACE-R visuospatial	15.9 ± 0.3	14.2 ± 2.0*#	15.6 ± 0.8
ACE-R memory	25.4 ± 2.0	21.8 ± 3.2*#	23.4 ± 2.4*
Behavioural scale			
HAMA	3.4 ± 4.0	13.0 ± 5.8*#	5.7 ± 5.4
AES	1.5 ± 3.1	14.6 ± 8.0*	10.7 ± 7.8*
HAMD	2.8 ± 3.9	16.9 ± 7.3*#	5.8 ± 5.0*
BDI	2.9 ± 4.2	21.1 ± 9.9*#	7.2 ± 6.8*

Values are means ± standard deviations.
*p< 0.05 PD *vs* HC or MSA-p *vs* HC
#p<0.05 MSA-p *vs* PD
Abbreviations: ACE-R: Addenbrooke's Cognitive Examination–Revised; AES: Apathy Evaluation Scale; BDI: Beck Depression Inventory; HAMD: Hamilton Depression Rating Scale; HAMA: Hamilton Anxiety Rating Scale; MMSE: Mini-mental State Examination; MSA-p: multiple system atrophy-parkinsonian variant; PD: Parkinson's disease.

RESULTS (2)

Figure 1. TBSS results in MSA-p *vs* HC, and in PD *vs* HC

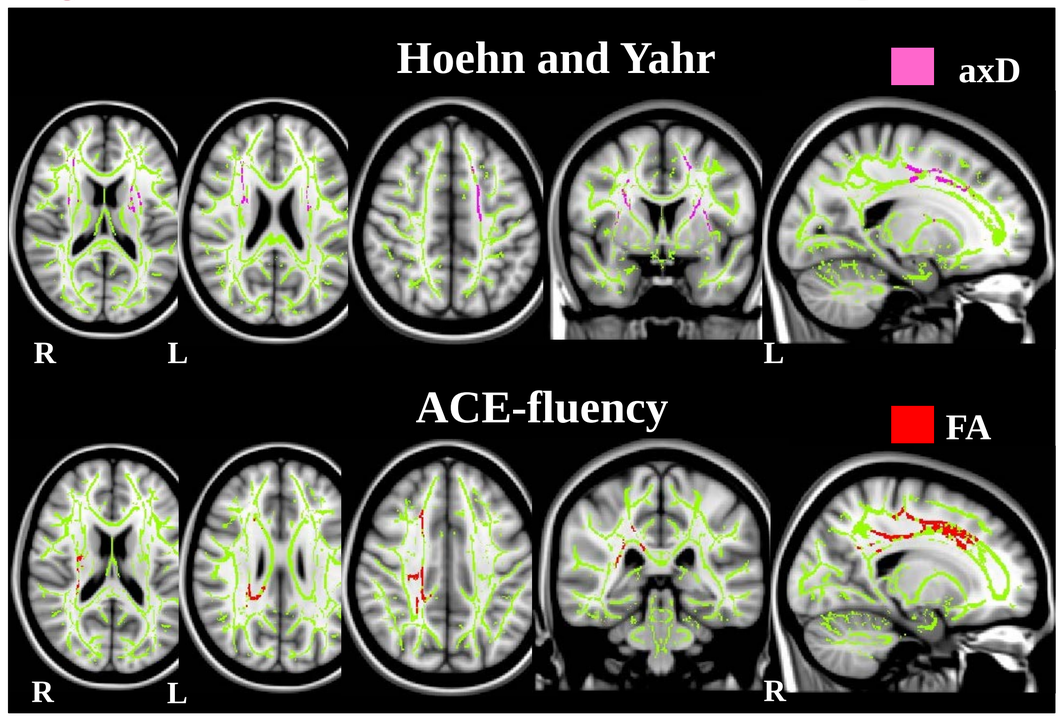


Decreased fractional anisotropy (FA) in patients compared with HC is shown in red. Increased mean diffusivity (MD) in patients compared with HC is shown in blue. Results are overlaid on the axial and sagittal sections of the Montreal Neurological Institute standard brain in radiological convention (right is left), and displayed at p<0.05 Family-wise error corrected for multiple comparisons. The white matter skeleton is green.

- **Cortical thickness**

  No significant differences in cortical thickness measurements were found comparing MSA-p and PD patients with controls.

Figure 2. Clinico-anatomical correlations in MSA-p



White matter tracts where axial diffusivity (axD) values correlated with Hoehn &Yahr scores are shown in pink. White matter tracts where fractional anisotropy (FA) values correlated with ACE-fluency subscores are shown in red. Results are overlaid on the axial and sagittal sections of the Montreal Neurological Institute standard brain in radiological convention (right is left), and displayed at p<0.05 Family-wise error corrected for multiple comparisons. The white matter skeleton is green

CONCLUSIONS

- In MSA-p patients, the WM microstructural damage is prominent compared to cortical damage.
- In MSA-p patients, WM damage was significantly related to motor and cognitive symptoms.
- The differences of WM damage between MSA-p and PD patients might reflect the different distribution of underlying alpha-synuclein pathology.
- DT MRI has the potential to offer promising markers in MSA-p for an early and differential diagnosis, improving patients' selection for clinical trials.