Brain Structural Abnormalities associated with Rapid Eye Movement Sleep Behaviour Disorder in Parkinson's Disease

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INTRODUCTION

BACKGROUND INFORMATION

- In Parkinson's disease (PD), 15 to 47% of patients develop Rapid Eye Movement Sleep Behavior Disorder (RBD).[1] PD patients with RBD (PD+/RBD+) have distinct clinical characteristics compared to PD patients without RBD (PD+/RBD-), e.g. decreased cognitive performances and more hallucinations[2];
- Limitations of previous structural neuroimaging data in RBD include relatively small sample sizes. Moreover, there is few data on structural alterations associated with RBD in PD patients;
- Deformation-Based Morphometry (DBM) allows a sensitive detection of subtle volume differences in both grey and white matter.[3]

METHODS

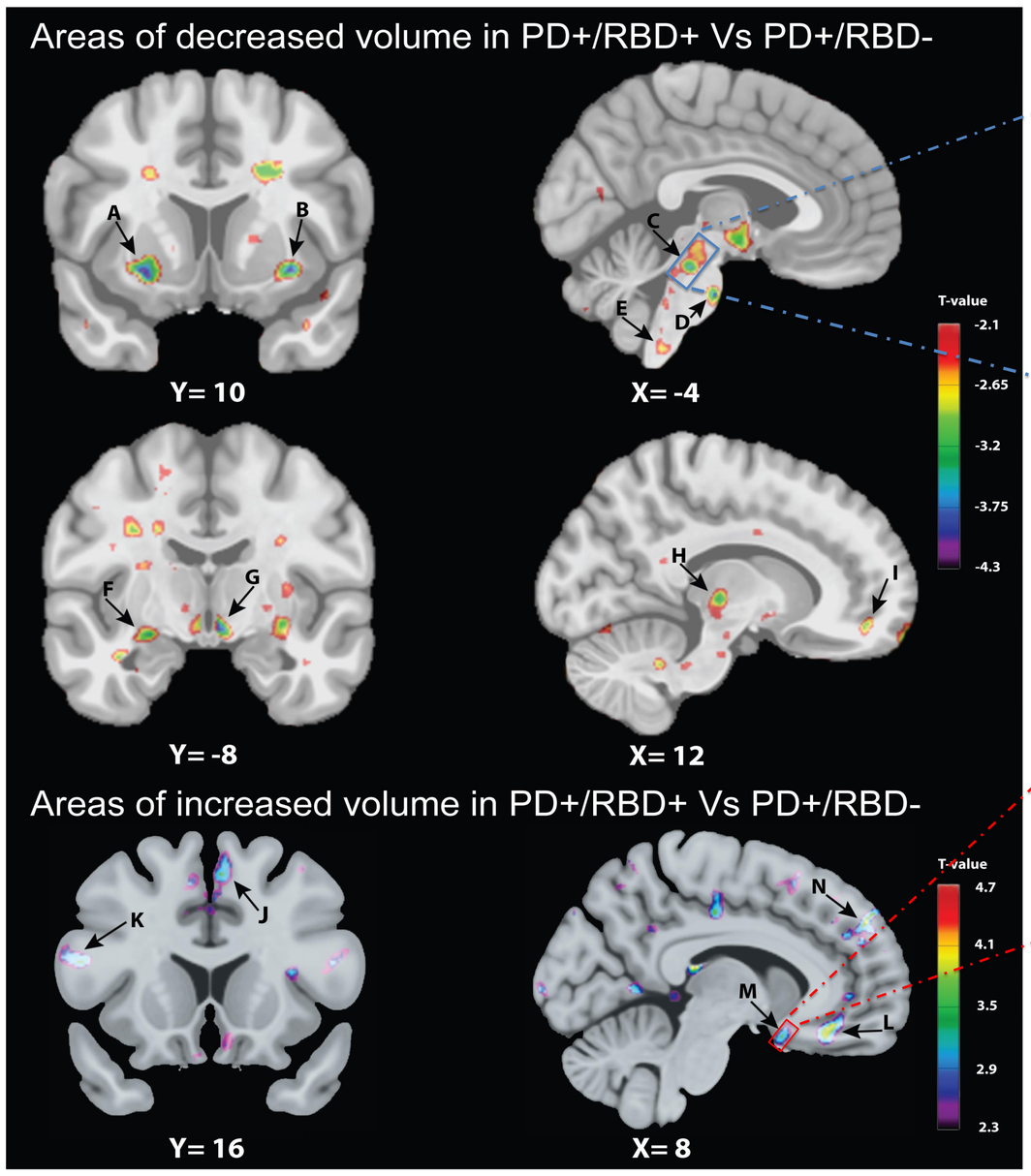
- MRI and clinical data of 334 early-stage diagnosed PD patients were extracted from the Parkinson's Progression Markers Initiative database[4];
- Based on the RBD screening questionnaire (RBDSQ)[5] and using criteria with demonstrated 96% sensitivity and 85% specificity*, 74 patients were categorized as PD+/RBD+ and 260 as PD+/RBD-;
- DBM analyses were conducted on T1-weighted MRI images and identified significant differences in regional brain volumes between PD+/RBD+ and PD+/RBD- groups ($p<0.05$ corrected for multiple comparisons);
- A group of 148 healthy controls (PD-/RBD-) were compared to the group of PD+/RBD-, to identify neurostructural changes in PD not related to RBD.

* i.e., RBDSQ score ≥ 5 and a positive response to item 5, 6.3 or 6.4

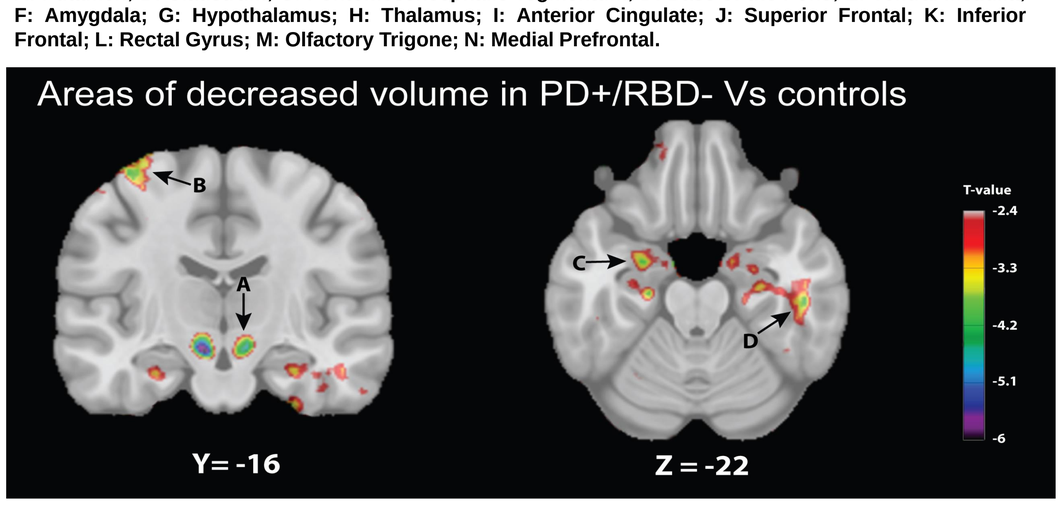
PURPOSE

To detect neurostructural abnormalities in grey and white matter associated with RBD in a large sample of PD patients by using DBM analyses of MRI data.

RESULTS



A: Putamen; B: Claustrum; C: Pontomesencephalic Tegmentum; D: Base of the Pons; E: Ventral Medulla; F: Amygdala; G: Hypothalamus; H: Thalamus; I: Anterior Cingulate; J: Superior Frontal; K: Inferior Frontal; L: Rectal Gyrus; M: Olfactory Trigone; N: Medial Prefrontal.



A: Substantia Nigra; B: Precentral Gyrus; C: Hippocampus; D: Fusiform Gyrus.

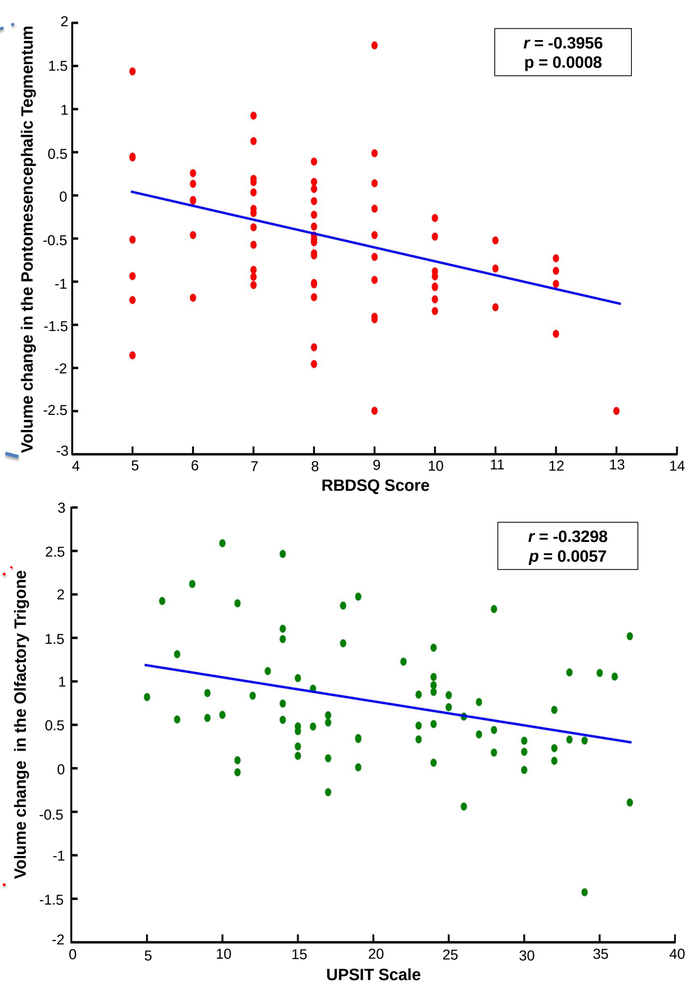


Table 1: Clinical characteristics of the subjects

Parameters	PD+RBD	PD-RBD	p-value
	(N = 74)	(N = 260)	
Demographics			
Age	61.20 ± 9.37	61.30 ± 9.93	0.940[a]
Sex (M:F)	55:19	162:98	0.056[b]
Education (Years)	15.76 ± 2.39	15.55 ± 3.04	0.546[a]
Parkinson's Disease Duration (Months)	6.42 ± 6.59	6.71 ± 6.66	0.737[a]
RBD Score	8.23 ± 1.98	2.46 ± 1.16	0.000[a**]
Parkinson's disease rating scales			
UPDRS I	8.09 ± 4.79	4.83 ± 3.53	0.000[a**]
UPDRS II	8.68 ± 5.40	5.28 ± 3.84	0.000[a**]
UPDRS III	22.54 ± 9.56	20.98 ± 8.91	0.191[a]
Modified Schwab and England Activities of Daily Living Scale	92.00 ± 5.68	93.97 ± 5.99	0.012[a*]
Other clinical scales:			
Epworth Sleepiness Scale	6.91 ± 4.53	5.45 ± 3.24	0.012[a*]
University of Pennsylvania Smell Identification Test	20.53 ± 8.67	22.97 ± 8.19	0.026[a*]
Montreal Cognitive Assessment	27.80 ± 2.60	28.18 ± 2.33	0.225[a]
Symbol Digit Modalities Test	39.46 ± 10.46	42.42 ± 9.53	0.022[a*]
Semantic Verbal Fluency (Scaled Score)	10.07 ± 2.72	10.97 ± 3.04	0.023[a*]
Visuospatial skills (Benton's Judgment of Line Orientation)	12.27 ± 2.31	12.95 ± 1.97	0.013[a*]
SCOPA-Autonomic	12.65 ± 6.59	8.15 ± 5.23	0.000[a**]

CONCLUSIONS

- The changes associated with RBD in PD patients were located in the pontomesencephalic tegmentum in line with the role of these nuclei in the control of muscle tone during REM sleep, and thereby support their involvement in the pathophysiology of RBD;
- The identified regions might also corroborate the more pronounced clinical deficits (e.g., altered olfaction, daytime sleepiness, cognitive impairments…) observed in PD with RBD.

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