Grey matter atrophy in Parkinson's disease with Mild Cognitive Impairment: a VBM study.

Donzuso G[1]., Monastero R[2]., Luca A[1]., Cicero C.E[1]., Mostile G[1]., Baschi R[2]., Angileri L[1]., Sciacca G[1].,Fierro B[2]., Zappia M[1]. and Nicoletti A[1].

[1]Department "GF Ingrassia", Section Neuroscience, University of Catania, Catania, Italy.
[2]Department of Experimental Biomedicine and Clinical Neurosciences, University of Palermo, Palermo, Italy.

XLVII CONGRESSO NAZIONALE
14-17 OTTOBRE 2017
NAPOLI

Objectives

Mild cognitive impairment (MCI) is common in Parkinson's disease (PD), but the underlying pathological mechanism has not been fully understood. Neuroimaging studies showed the presence of atrophy or abnormal networks involving several cortical and subcortical area in patients with PD and cognitive impairment. Voxel-based morphometry (VBM) is a fully automated quantitative magnetic resonance imaging (MRI) technique and could be used to reveal in vivo early neuropathological changes leading to MCI.

Patients and Methods

Patients with diagnoses of Parkinson's disease according to the UK Brain Bank criteria were recruited from a larger cohort of PD patients of the Parkinson's Disease Cognitive Study (PaCoS). Motor severity was assessed using the Unified Parkinson's Disease Rating Scale-Motor Examination (UPDRS-ME) and Hoehn–Yahr (H-Y) stage. Structural brain MRI data were acquired using a 3-D T1-weighted spoiled gradient (SPGR) echo sequence and each subjects underwent a complete neuropsychological evaluation. Patients were divided into PD with normal cognition (PD-NC) and PD with MCI (PD-MCI) according to the Litvan's criteria.

	PD-NC N=66	PD-MCI N=40	Total N=106	p-value
Sex (male)	30 (45,5%)	27 (67,5%)	57 (53,8%)	NS
Age	63,8 ± 10,4	66,6 ± 7,6	64,8 ± 9,5	NS
Education	10,7 ± 4,5	8,9 ± 4,3	9,7 ± 4,6	0.006
Age at onset	60,8 ± 10,6	63,9 ± 7,8	62,0 ± 9,7	NS
Disease duration	2,9 ± 2,5	2,7 ± 2,2	2,8 ± 2,4	NS
UPDRS-ME	28,7 ± 11,0	31,0 ± 9,9	29,6 ± 10,6	NS
H-Y Score	2,0 ± 0,5	2,1 ± 0,6	2,1 ± 0,5	NS

Table 1: demographic and clinical characteristics. NS, not significant.

Results

See table 1 for demographics characteristics of study population. VBM analysis showed significant differences in several brain regions ($p<0.001$ uncorrected) (table 2). Analysis was also restricted to PD patients with a short disease duration (≤ 2 years) including 37 PD-NC and 25 PD-MCI. Early PD-MCI showed reduction in GM density in bilateral medial frontal gyrus, right cingulate gyrus, left cerebellum (lobule IV-V), right paracentral lobule and left supplementary motor area (figure 1).

ROIs	Emisphere	Cluster	Peak activation	Peak coordinates			P uncorected
				x	y	z	
Frontal superior	L	170	3.92	2	50	27	< 0.001
Frontal superior	L	16	3.43	2	39	43	< 0.001
Precuneus	L	11	3.69	-18	-49	48	< 0.001
Angular gyrus	R	42	3.69	36	-58	51	< 0.001
Temporal lobe	R	46	3.59	38	-40	-5	< 0.001
Temporal lobe	L	43	3.36	-39	-40	-2	< 0.001
Cerebellum 4-5	L	67	3.56	-10	-36	-15	< 0.001
Cerebellum 4-5	L	44	3.45	-10	-49	-8	< 0.001
Cerebellum 3	R	149	3.52	12	-34	-21	< 0.001

Table 2: VBM results.

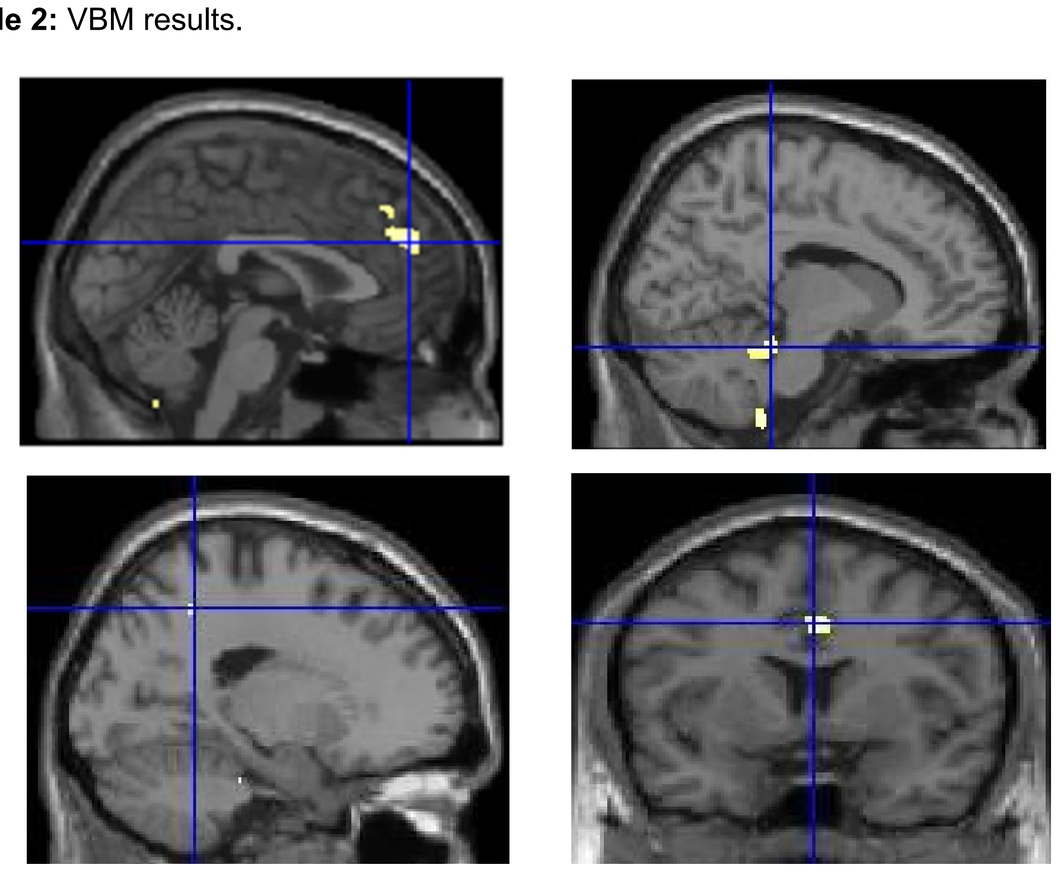

Figure 1: significant cluster of atrophy in PD-MCI.

Discussion and conclusion

Main findings of this study is the reduction of GM density in the frontal gyrus, precuneus, and angular gyrus. Previous findings, including fMRI and DTI studies, showed the involvement of these peculiar brain cortical areas in the development of MCI in PD patients. This study showed the presence of widespread anatomical changes in PD-MCI compared with PD-NC. The detection of frontal atrophy, even at an early stage of disease, could be used as an early marker of PD-related cognitive impairment.

References

Chen FX, Kang DZ, Chen FY, Liu Y, Wu G, Li X, Yu LH, Lin YX, Lin ZY. Gray matter atrophy associated with mild cognitive impairment in Parkinson's disease. Neurosci Lett. 2016;617:160-5.

Zhang J, Zhang YT, Hu WD, Li L, Liu GY, Bai YP. Gray matter atrophy in patients with Parkinson's disease and those with mild cognitive impairment: a voxel-based morphometry study. Int J Clin Exp Med 2015;8(9):15383-15392.

Galantucci S, Agosta F, Stefanova E, Basaia S, van den Heuvel MP, Stojković T, Canu E, Stanković I, Spica V, Copetti M, Gagliardi D, Kostić VS, Filippi M. Structural Brain Connectome and Cognitive Impairment in Parkinson Disease. Radiology. 2017;283(2):515-525.