Cognitive-motor interference correlates and brain structural involvement in Multiple Sclerosis

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Introduction:

CMI correlates have been widely investigated in patients with MS.
Discrepancies in methods, CMI paradigms and samples, leaded to an incomplete interpretation of this process [1].
This study tried to overpass these limits by comparing CMI in patients with MS and HC under different cognitive conditions.
About brain structural involvement we focused on GM.

Methods and Results:

Participant characteristics:

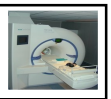
	HC	MS
N	10	15
Age	39.0 (11.8)	44.4 (6.3)
Sex (F/M)	6/4	8/7
Education (years)	13.8 (3.1)	12.5 (3.3)
MS phenotype (RR/SP)	-	15/5
EDSS	-	3.5 (1.0-6.5)
DD	-	11.92 (9.9)

For Age, DD, Education, mean (SD) are shown.
For EDSS, median (range) are shown.

DT paradigm:

- DT was composed by three two-minutes trials in which subjects were asked to walk fast along an established route in a quite hallway: in trial-N subjects only had to walk, in trial-C they had to backward counting from 100 by subtracting 3, in trial-W they had to perform a semantic Word List Generation task. Covered distance, correct scores, and errors were counted for each trial.

MR acquisition @ 3T (Philips Achieva):



- FLAIR & Dual-echo scans for T2L identification
- T1-3D weighted MPRAGE

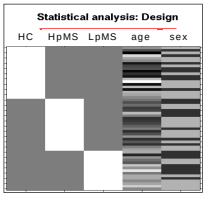
MRI DATA preprocessing:

- MPRAGE data were processed according to VBM8 protocol [2,3], using SPM8 toolbox (www.fil.ion.ucl.ac.uk/spm/), to produce a GM probability map in Montreal Neurological Institute (MNI) coordinates for each subject.

DT Results:

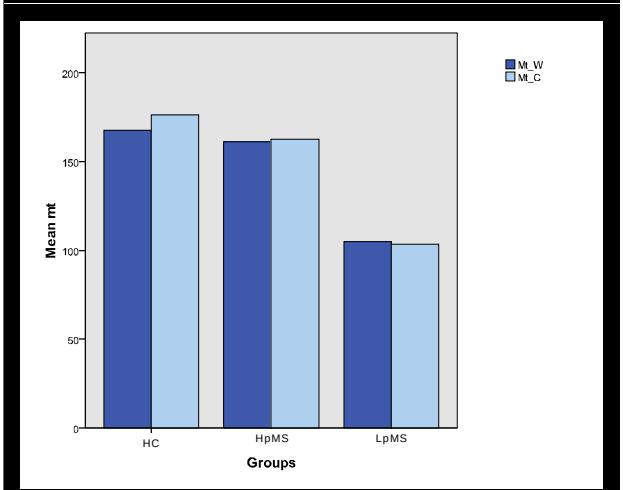
- Preliminary data show that both groups decreased their walking performance from trial-N to -C and –W; patients with MS showed significantly greater decrease than HC in both interference conditions. No difference in cognitive performances between patients with MS and HC was found. The covered distance in the trial-N were then converted into z-scores by using the mean and the SD of HC. Patients with MS were then divided into high performers (Hp>1.5 SD) and low performers (Lp<1.5 SD).

MRI Statistical Analysis:



GM voxel-wise between-group comparison (HC, HpMS, LpMS) was carried out in SPM8 (www.fil.ion.ucl.ac.uk/spm/), adjusting for age and sex.

DT Results



MRI GM Results: HC > LpMS (p<0.05 FWE-cluster-level-corrected)

Discussion and Conclusions:

Results show that CMI also exists in HC, but is significantly more evident in patients with MS. In both groups, motor performance seems to be disadvantaged more than cognitive one independently from task condition.
MRI data suggest that patients with MS, who show this disadvantage, have also bilateral GM loss in thalami.
Further analysis are ongoing in order to explain structure/performance relationships.

Abbreviations:

CMI= Cognitive-Motor Interference
DD= disease duration
DT= Dual-Task
EDSS= expanded disability status scale
F/M = female/male
GM= gray matter
HC= healthy controls
HpMS= MS patients with DT hight performance
LpMS= MS patients with DT low performance
MS= multiple sclerosis
MPRAGE= magnetization prepared rapid acquisition gradient echo
MRI= magnetic resonance imaging
Mt_W= walking mt performance during DT trial-W
Mt_C= walking mt performance during DT trial-C
RR = relapsing-remitting MS
SD= standard deviation
SP= secondary-progressive MS
T2L= T2-weighted visible lesions
Trial-C= DT counting trial
Tiral-N = DT neutral trial
Trial-W= DT word trial

References:

[1] Leone C, Patti F, Feys P. Measuring the cost of cognitive-motor dual tasking during walking in multiple sclerosis. Mult Scler. 2015;21:123-31.
[2] Ashburner J, Friston KJ. Unified segmentation. Neuroimage 2005; 26:839-851.
[3] Ashburner J, Friston KJ. Voxel-based morphometry--the methods.Neuroimage. 2000;11:805-21. Review.