Right frontal cortical atrophy is associated with visual hallucinations in dementia with Lewy bodies

Giulio Bicciato[1,2], Matteo De Marco[2,3], Giovanni Zorzi[1], Federica Fragiacomo[1], Sara Pompanin[1], Stefania Pezzoli[2], Renzo Manara[1,4], Annalena Venneri[2,3], Annachiara Cagnin[1,3]

1 Department of Neurosciences (DNS), University of Padova, Padova, Italy
2 Department of Translational Medicine, University of Sheffield, Sheffield, UK
3 IRCCS San Camillo Research Hospital, Venice, Italy
4 Radiology Unit, University of Salerno, Salerno, Italy

Introduction

Visual hallucinations (VHs) affect up to 70% of patients with dementia with Lewy Bodies (DLB) and they represent one of the core features necessary for its diagnosis. Only few studies have so far dealt with the anatomical correlates of VHs in DLB.

Objectives

To assess the regional cortical atrophy differentiating DLB from AD and the structural neural correlates of VHs in DLB.

Methods

PATIENTS

30 DLB patients:

- 12 with VHs (DLBvh+)
- 18 without (DLBvh-)

19 patients with Alzheimer's disease (AD)

30 healthy controls (CTRL)

All groups were matched for age, sex and educational level

CLINICAL EVALUATION

All participants underwent clinical examination and extensive neuropsychological testing. Fluctuations of attention, REM sleep behaviour disorder symptoms, extrapyramidal signs and behavioural disturbances were studied with dedicated clinical scales.

MRI STUDY

MRI T1-weighted scans were acquired from all the participants (Scanner Philips Achieva 1.5 T). Grey matter volume was examined according to Voxel Based Morphometry (VBM) method. Comparisons of grey matter volume among groups were performed by means of Statistical Parametric Mapping 8 (SPM8) running on MatLab 7

Results

Compared to CTRLs, DLB group showed widespread fronto-temporo-parietal atrophy (fig.1) and AD group showed temporo-parietal atrophy (fig.2).

VHs in DLB patients were associated with bilateral grey matter loss (P <0.001,unc.) in prefrontal cortex (BA 47, BA10/11, BA 44, BA 6), more extensively spread in the right ventrolateral prefrontal cortex: middle frontal gyrus, inferior frontal gyrus (p=0.006,unc.). Grey matter loss was also found in the right insula (p=0.009,unc.) and in the left caudate nucleus (p=0.006,unc.) of DLB patients with VHs (fig 3-4).

A reduction of visual attention was specifically associated to VHs (p=0.003).

Fig.1 DLB<CTRL

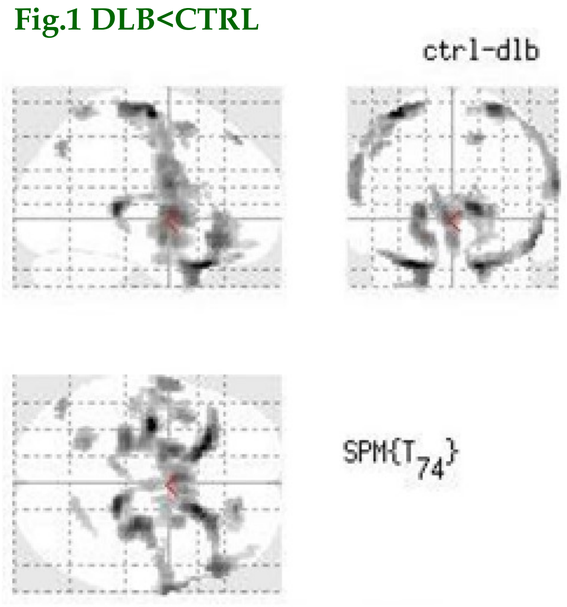


Fig.2 AD<CTRL

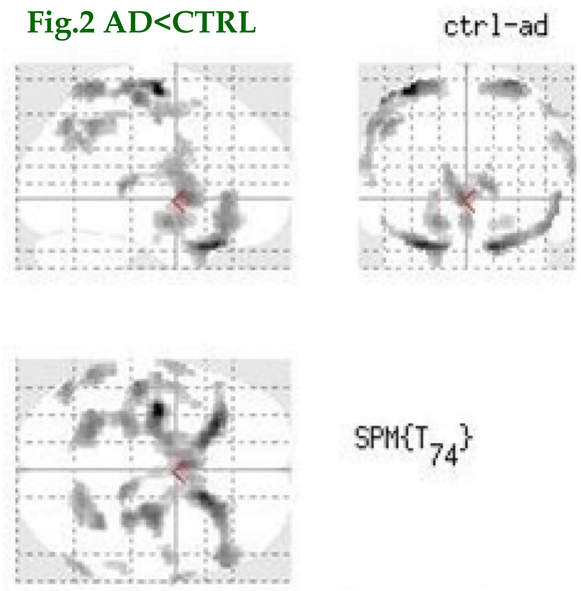


Fig.3 DLBvh⁺<DLBvh⁻ axial slices

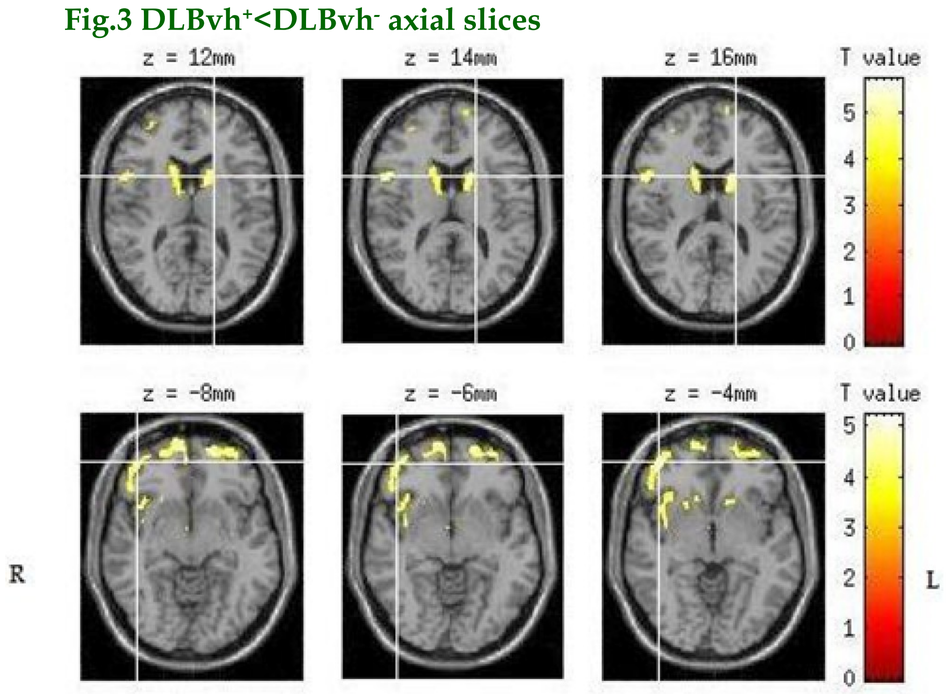
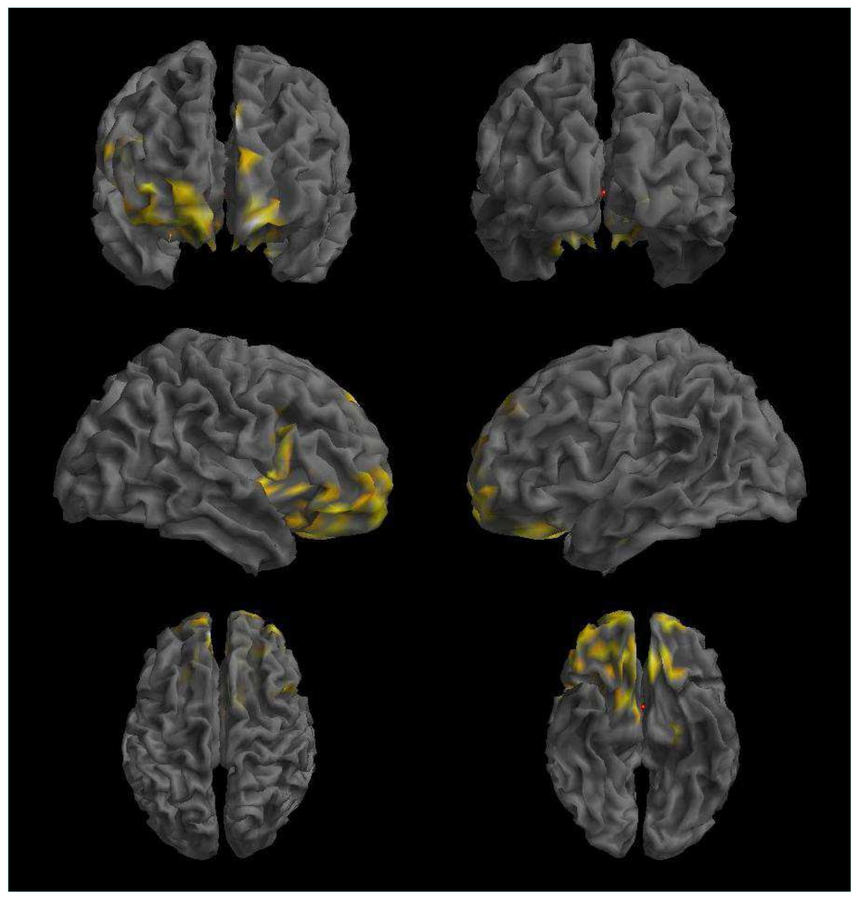


Fig.4 DLBvh⁺<DLBvh⁻ 3D Map



Discussion: The differences in MRI-VBM features between DLB and AD are in line with the spatial patterns of cortical atrophy reported in the literature for these diseases and corroborate the clinical diagnosis. The association of atrophy in the prefrontal regions with VHs has been reported in PD patients. The right ventrolateral prefrontal cortex is thought to be an integration area, where the dorsal and the ventral attention network communicate with each other. Abnormalities in the connection between the two attention networks, already reported in PD patients with VHs, could have a crucial role in the pathogenesis of VHs.

CONCLUSIONS

Frontal lobe atrophy, along with attentional deficits, are specifically associated with VHs, in accordance with the cognitive model for VHs of a combined top-down (visual attention) and bottom-up (visual perception) deficits. We suggest a role of an atrophic right ventrolateral frontal cortex in the pathogenesis of VHs in DLB.