

Divergent Perfusion-Cognition Coupling in Alzheimer’s Disease and Dementia with Lewy Bodies



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Background

AD and DLB are difficult to differentiate because of overlapping symptoms and frequent co-pathology. How disease-specific cognitive decline relates to regional cerebral perfusion remains unclear.

Objective

To investigate disease-specific associations between regional cerebral perfusion and domain-specific cognitive performance in AD and DLB.

Methods

- Subjects:** 57 AD, 72 DLB, and 44 healthy controls.
- Criteria:** Probable AD (NIA-AA) with positive amyloid PET or low CSF Aβ_{42/40}. Probable DLB (2017 criteria¹) with abnormal DAT and/or MIBG scan.
- Cognitive assessment:** MMSE and ACE-III² domains: attention, memory, fluency, language, and visuospatial function.
- Imaging:** ¹²³I-IMP perfusion SPECT; spatial normalization and smoothing in SPM12; global mean proportional scaling.
- Statistical analysis:** Voxel-wise group comparisons and regression analyses between perfusion and ACE-III scores.
- Covariates:** Age, sex, and scanner type.
- Threshold:** Voxel-level p < 0.001 uncorrected with cluster size >30 voxels.

Results

Table 1. Patient Demographics

	Alzheimer’s Disease (n = 57)	Dementia with Lewy Bodies (n = 72)	Healthy Controls (n = 44)	Group difference (p-value)
Women (%)	54.4	41.7	50.0	0.335
Age (y)	70.9 ± 9.9	76.4 ± 7.4	66.8 ± 9.3	<0.001*
Education (y)	13.4 ± 2.5	13.2 ± 2.8	13.3 ± 2.1	0.869
Disease duration (y)	3.1 ± 3.0	4.0 ± 3.4	-	0.112
MMSE	20.2 ± 5.7	21.9 ± 5.9	29.5 ± 0.7	<0.001**
ACE-III total	62.4 ± 18.9	63.4 ± 20.1	93.7 ± 4.7	<0.001**
Attention	12.6 ± 3.6	12.6 ± 3.8	17.7 ± 0.8	0.007**
Memory	10.1 ± 5.3	13.3 ± 7.2	24.8 ± 2.0	<0.001**
Fluency	7.6 ± 3.2	5.8 ± 3.3	12.5 ± 1.3	<0.001**
Language	20.7 ± 7.2	21.1 ± 5.0	25.8 ± 0.4	0.131
Visuospatial	11.0 ± 4.8	10.4 ± 4.3	15.0 ± 0.9	0.058

Values are mean ± SD or percentage. Group differences were tested using one-way ANOVA or Fisher’s exact test.

Post-hoc p < 0.05: * DLB > AD and HC; ** HC > AD and DLB.

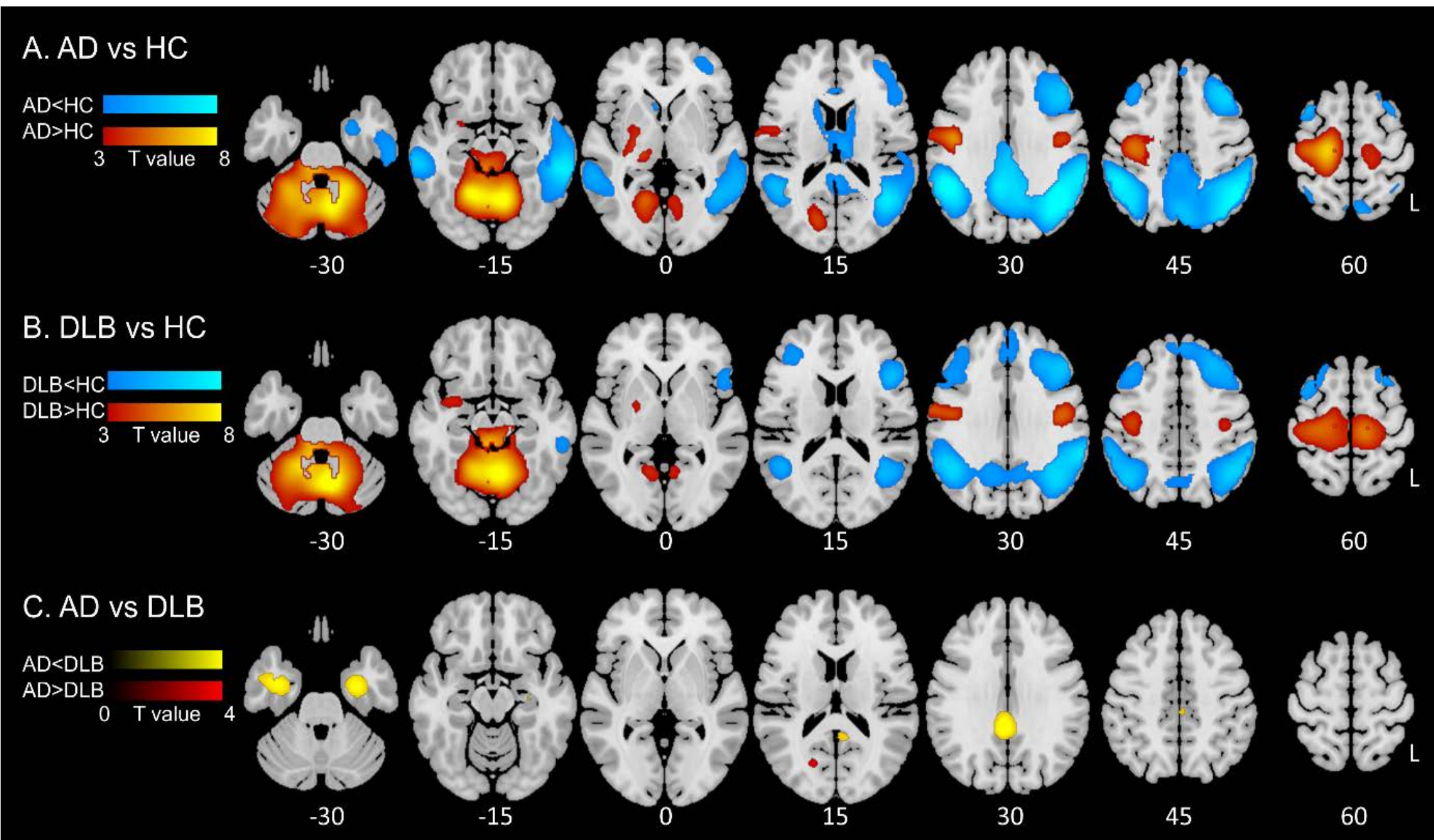


Figure 1. Group comparisons of cerebral perfusion among AD, DLB, and HC. Voxel-wise two-sample t-tests assessed group differences in regional perfusion. Covariates: age, sex, and scanner type. Threshold: uncorrected p < 0.001, cluster >30 voxels. Numbers indicate MNI z-coordinates. L = left.

Discussion

- AD and DLB showed comparable cognitive performance.
- AD and DLB showed overlapping hypoperfusion in the frontal and posterior cortical regions, but direct comparison revealed disease-specific differences in the posterior cingulate, medial temporal, and occipital regions, consistent with AD-related temporo-parietal dysfunction and the cingulate island sign in DLB.^{3, 4}
- In AD, cognitive decline was broadly linked to left temporo-parietal and perisylvian hypoperfusion, suggesting involvement of language, semantic, and multimodal association networks.
- In DLB, perfusion–cognition coupling was limited, except for a strong association between visuospatial impairment and bilateral posterior temporo-parietal–occipital hypoperfusion.
- These findings suggest that domain-specific perfusion–cognition mapping may provide complementary information for understanding disease-specific network dysfunction in AD and DLB.

References

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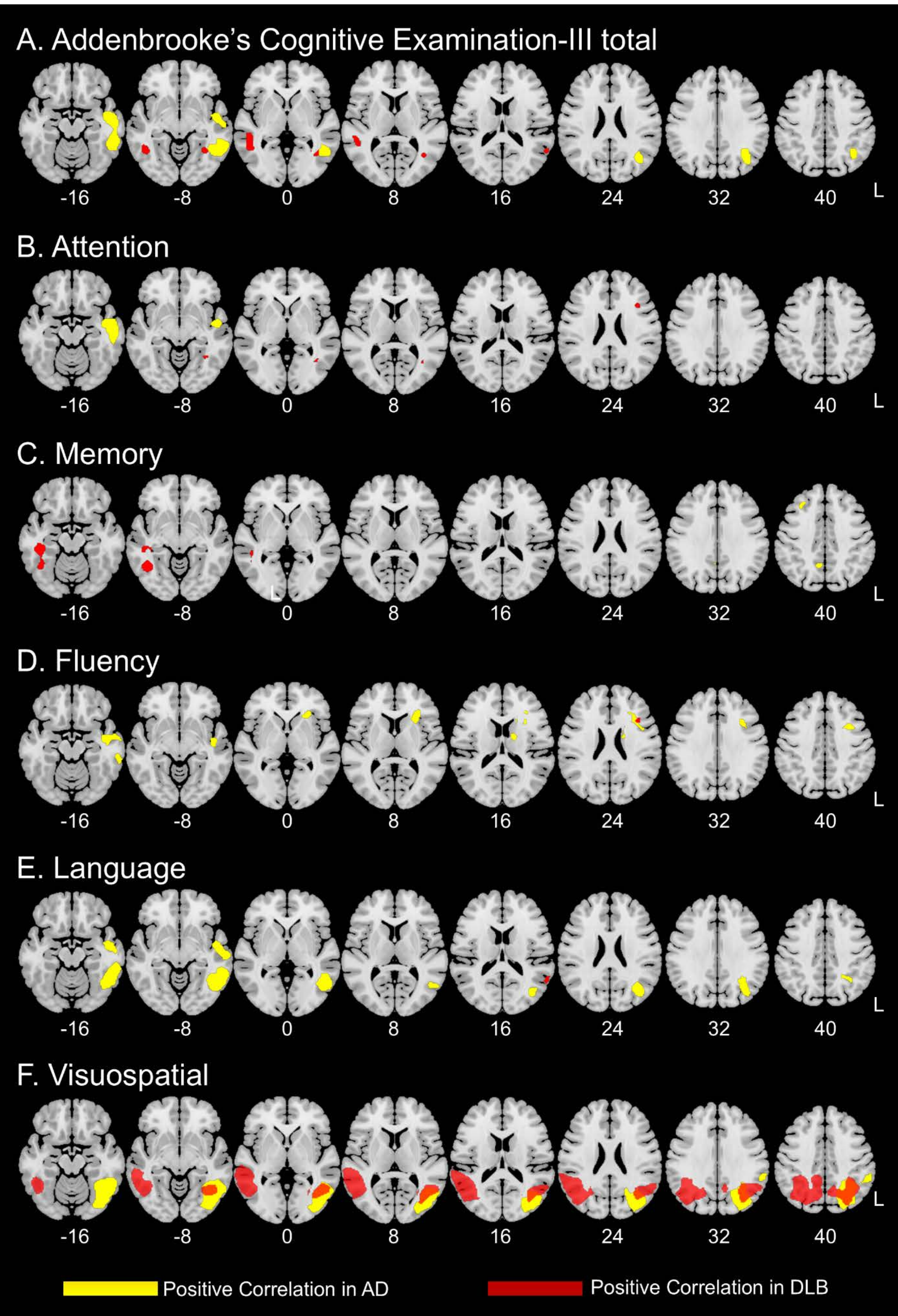


Figure 2. Associations between ACE-III domain scores and regional CBF in AD and DLB. Positive correlations are shown, indicating regions where lower CBF was associated with lower ACE-III scores. Covariates: age, sex, and scanner type. Threshold: uncorrected p < 0.001, cluster >30 voxels. Yellow = AD; red = DLB. Numbers indicate MNI z-coordinates. L = left.

Additional finding: In AD, cognitive decline was associated with relative cerebellar and sensorimotor hyperperfusion; this pattern was less evident in DLB.