Exploring regional CSF volume differences in patients from the Sunnybrook Dementia Study

Emmanuel Edward Ntiri[1, 2], Joel Ramirez[1, 2], Maged Goubran[1, 2], Fuqiang Gao[1, 2], Mario Masellis[1-3], Sandra E. Black[1-3]

[1]L.C. Campbell Cognitive Neurology Research Unit, Toronto, Canada; [2]Hurvitz Brain Sciences Research Program, Sunnybrook Research Institute, Toronto, Canada; [3] Department of Medicine, Division of Neurology, University of Toronto, Toronto, Canada

BACKGROUND

- Atrophy, marked by increases in cerebrospinal fluid (CSF), is associated with deficits in cognitive domains [1]
- Alzheimer's disease (AD), Frontotemporal dementia (FTD), and Lewy-body dementia (LBD) can exhibit regional atrophy that are both unique and overlapping between these diseases [2-3]
- Regional differences in ventricular (vCSF) and sulcal cerebrospinal fluid (sCSF) volumes measured on structural MRI may be useful imaging markers to establish differences between these complex dementias

PURPOSE & HYPOTHESIS

Purpose: To investigate whether or not regional CSF volumes can distinguish between different disease types.

Hypothesis:
1. All groups will have larger CSF volumes than the normal control group (NC), as characterized in neuroimaging
2. Patients with FTD will have a significantly larger interhemispheric fissure than other patient groups
3. Regional differences will be found between AD and FTD groups

METHODS

MRI imaging was acquired on 1.5T GE Signa scanner
- T1-weighted (AX 3D SPGR, 1.2-1.4mm slice thickness)

DIAGNOSTIC GROUPS

Table 1 – Demographic summaries for study patients

Demographics[a]	AD	FTD	LBD	NC
N	347	121	52	112
Age, y	72.2 (9.2)	66.5 (9.1)	70.1 (10.5)	68.8 (8.6)
Gender, n (%) male	154 (44.4)	58 (47.9)	52 (65.4)	46 (41.1)
Education, y	13.7 (3.8)	14.2 (3.9)	14.1 (3.0)	15.6 (3.3)
MMSE/30, y	23.0 (4.7)	23.1 (6.2)	22.0 (5.7)	28.8 (1.2)

[a]Values reported are mean (SD) unless otherwise stated.

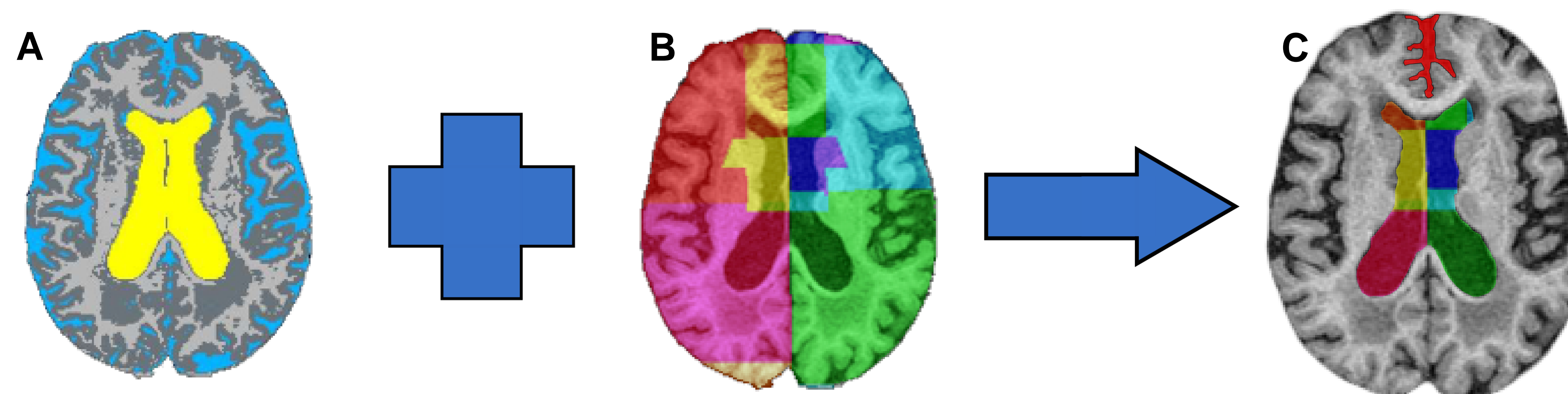## IMAGE PROCESSING & ANALYSIS

Fig. 1: Flowchart depicting image processing pipeline. (A) T1s segmented by tissue class through an in-house segmentation tool [4] were intersected with (B) individual regional parcellations delineated using the SABRE pipeline [5] to calculate volumes for the anterior interhemispheric fissure, as well as the anterior and posterior lateral ventricles
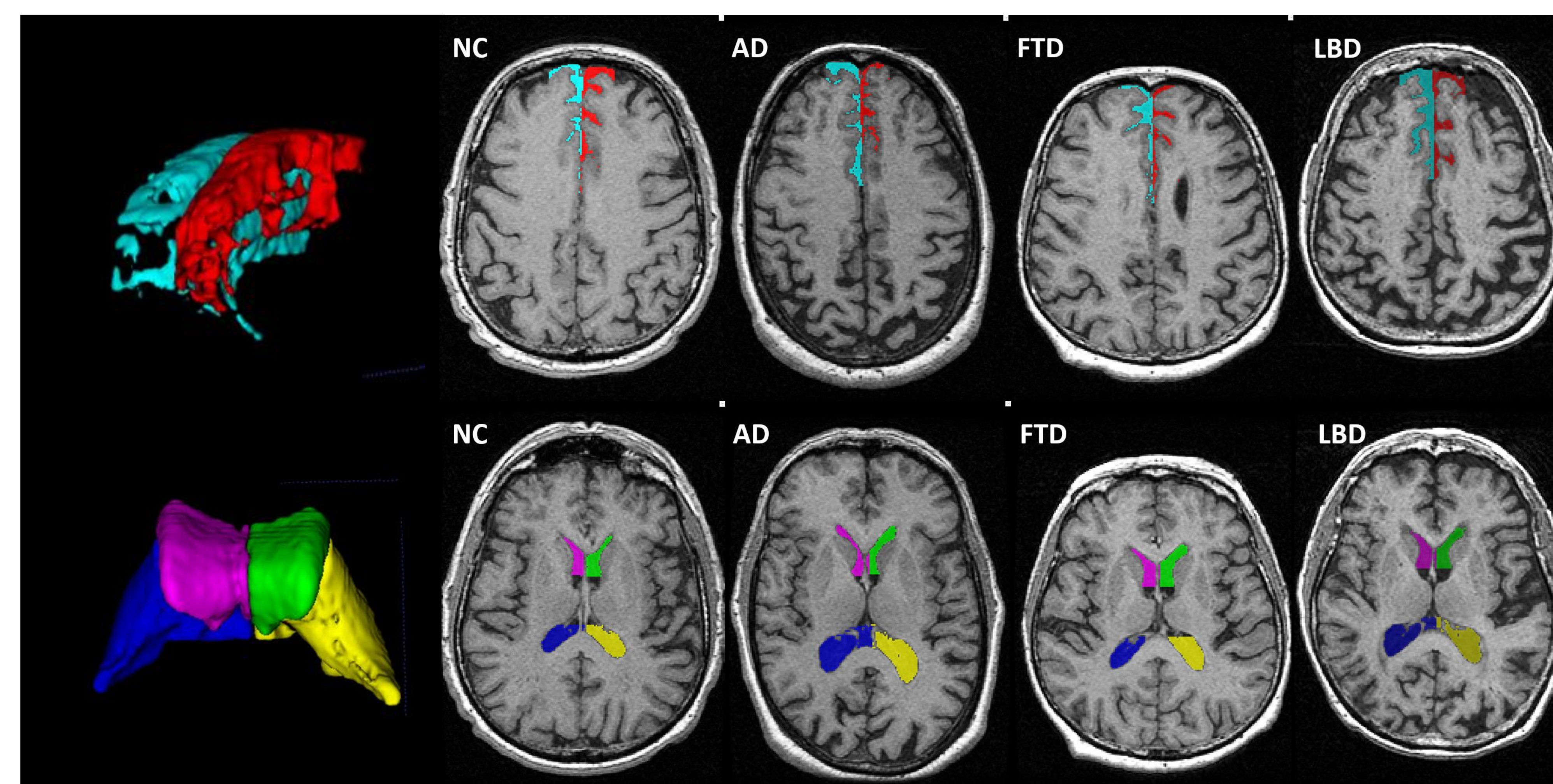
RESULTS

Fig. 2: (Top) Visualization of segmented left and right anterior interhemispheric fissure (red and light blue, respectively) for NC, AD, FTD, and LBD. (Bottom) Visualization of segmented left and right anterior and posterior ventricles for NC, AD, FTD, and LBD
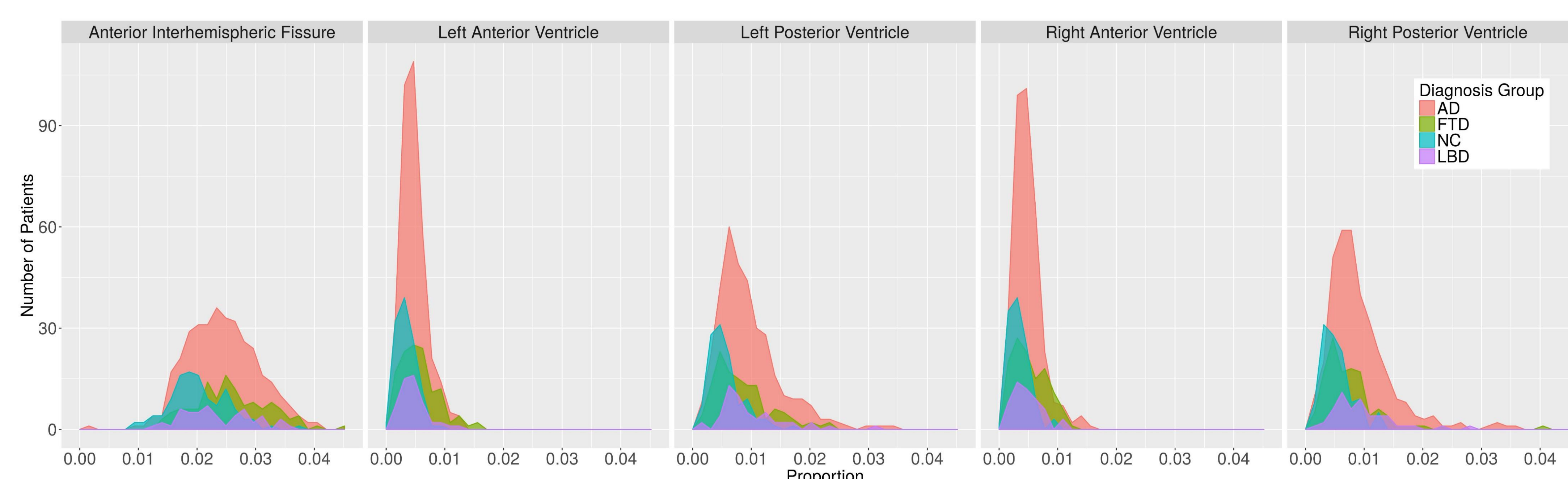

Fig. 3: Distribution of volume proportions between groups for each region. Proportions were calculated by dividing each ROI volume by the total intracranial volume (TIV)

RESULTS (CONT'D)

Table 2 - Volumetric summaries for patient groups across all regions of interest

Volumetrics[a]	AD	FTD	DLB	NC
Interhemispheric fissure	29.5 (8.7)	31.1 (8.8)	29.4 (8.5)	24.6 (6.7)
Left anterior ventricle	5.8 (3.0)	6.8 (4.1)	6.0 (3.3)	4.2 (2.2)
Left posterior ventricle	11.7 (7.4)	10.2 (5.9)	12.2 (6.8)	6.8 (3.8)
Right anterior ventricle	5.8 (3.3)	6.3 (3.4)	5.9 (3.2)	4.2 (2.3)

[a]Values reported are in mean (SD) cc

- All groups had significantly larger volumes than the normal control group (Table 2)
- No significant differences were found between the interhemispheric fissure volumes of all patient groups
- The FTD group had significantly larger left anterior ventricles than the AD group, while AD group had significantly larger right posterior ventricles

DISCUSSION

- Future studies will measure the progression of regional atrophy to explore rates of cognitive decline
- Regional definitions for the anterior and posterior ventricles do not account for the medial portion of the lateral ventricles
- A future method will include segmentation with a regional subdivision at the medial lateral ventricles

ACKNOWLEDGEMENTS

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