Abstract

Forty percent of HIV/AIDS patients experience minor to severe cognitive impairments, but the brain changes underlying this cognitive decline are still poorly understood. We mapped and analyzed 3D patterns of brain atrophy in a large cohort of 210 patients with HIV infection, using tensor-based morphometry (TBM). Women patients showed greater frontal lobe atrophy compared to men, and non-Caucasian patients showed greater brain atrophy than Caucasian. Lower nadir CD4+ count was associated with greater atrophy, in a broad region encompassing the frontal/parietal white matter bilaterally; for each 25-point reduction in nadir CD4+, there was a 1-2% greater deficit in white matter volumes.

Materials and methods

TI-weighted brain MRI scans were acquired from 210 AIDS patients scanned by the HIV Neuroimaging Consortium (mean age: 48.6±8.4 years; 175 men/35 women). A high-resolution average brain template was created to illustrate regions of volume deficit or excess relative to the brain template, reflecting, in part, profiles of neurodegeneration. At each voxel within the brain, linear correlations were assessed between demographic factors and clinical measures of HIV disease progression (the statistical effects did not pass FDR correction for multiple comparisons), suggesting one possible basis for impaired executive function in patients. These modulators of brain atrophy may be of interest for clinical trial design.

Results

Hypothesis and objectives

We hypothesized that brain atrophy is associated with nadir CD4+ counts; we also assessed associations with age, sex, race, education, viral load, and clinical measures of disease burden.

Materials and methods

Results

After controlling for age, female patients (coded as “0”) showed greater frontal lobe atrophy than men (“1”), by 5-15% (FDR q=0.05, critical P=0.01 in the whole brain, critical P=0.02 in the frontal lobes).

After controlling for both age and sex, non-Caucasian patients (“0”) showed greater brain atrophy than Caucasian participants (“1”), by 5-15% (FDR q=0.05, critical P=0.03 in the whole brain). The study, at the current stage, has more Caucasian participants (N=148) than non-Caucasian (N=62). The average AIDS dementia complex (ADC) scores for Caucasian and non-Caucasian subjects are 0.24 and 0.36 respectively.

Demographic factors and clinical measures of HIV disease progression

Not associated with brain atrophy

- Education
- AIDS dementia complex (ADC) stage
- Current CD4+ count

CONCLUSION

TBM analysis of brain MRI provides a noninvasive measure of HIV-associated brain atrophy. Brain atrophy was associated with immunosuppression, suggesting one possible basis for impaired executive function in patients. These modulators of brain atrophy may be of interest for clinical trial design.

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