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Longitudinal Changes in Regional Brain Volumes in Type A Alcohol Dependent Patients: A 7 Year MRI Follow-Up Study

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Description

Although there are numerous reports of neuropsychological and neuroimaging investigations in alcohol dependence, longitudinal studies are scarce. This work investigated the evolution of magnetic resonance imaging in brain volumes over a long follow-up period 7 years, in Type A alcohol-dependent patients i.e., without psychiatric or somatic comorbidity and whose addiction had started late. In line with the literature, we hypothesized that long-term abstinence would lead to an at least partial recovery of the prefrontal cortex, cingulate cortex, and of White Matter (WM) volume reductions. We investigated the long-term changes in Grey Matter (GM) and WM regional volumes by comparing longitudinally the followed-up subgroups of abstainers, relapsers, and controls.

26 patients and 24 healthy controls were assessed at baseline using structural MRI and voxel-based morphometry, among which 17 patients and 6 controls were re-evaluated 7 years later. At follow-up, three groups were compared: abstainers (n=11, more than 2 years of abstinence), relapsers (n=6, less than 2 years of abstinence) and controls (n=6).

MRI data was acquired at BL and at FU on the same signa 1.5 Tesla Whole Body system from General Electrics (Milwaukee, Wisconsin) with a standard 3D T1. All neuroimaging analyses were performed with SPM12 in whole brain.

Longitudinal analyses were conducted using a flexible factorial design; one-way ANOVA for repeated measures) with time (BL and FU) as within-subject factor and group (relapsers, abstainers, controls) as between-subject factor.

Cross-sectional analyses differences between subgroups were conducted with voxel-wise two sample t-tests.

The longitudinal analysis of neuroimages in which relapsers were compared to abstainers, demonstrated the recovery of initial GM volumes in the bilateral middle and inferior frontal cortex, as well as the bilateral middle cingulate cortex, whereas no recovery was found in sub-cortical regions. Moreover, we found a WM recovery in the corpus callosum and in anterior and superior regions between the frontal cortex and the striatum.

No longitudinal significant difference in GM and WM volume was detected between controls and abstainers. In the cross-sectional analyses, both at BL and at FU, relapsers had larger heads of Caudate Nuclei (CN) than abstainers bilaterally. The results of brain volumes analyses in abstainers confirm previous findings in the literature that examined shorter time-periods generally up to 2 years [1,2].

The pre-existing CN volume difference at baseline might be associated with a risk of relapse and thus could be a candidate vulnerability factor. It founded higher GM volume in bilateral CN at age 14, as a structural brain predictor of a larger increase in alcohol use scores over 5 years, between age 14 and 19 [3]. Caudate volume in males with type A alcoholism could be associated with BDNF genotype [4]. The longitudinal analysis did not detect any significant change in this region, confirming the stability over time of the larger CN volumes in relapsers.

Speculatively, we provide evidence of volume recovery with abstinence in cortical regions and WM, while volumes in appetitive (Sub-Cortical CN) regions did not vary. Imbalance between the "Appetitive" network including the CN, and the "Executive" network including the cingulate and pre-frontal cortex leads to a failure to optimize the regulation of relevant functions and increases the vulnerability to relapse [5,6].

These results support the crucial role of abstinence in fronto-limbic GM and WM volumes recovery in alcohol-dependent type A patients.

Conflict of Interest

The authors declare a potential conflict of interest and state it below: CM, EA, and JLM have no conflict of interest to report. AB has given talks for Lundbeck, Mylan, Merck-Serono, Ethypharm and Bristol-Myers Squibb and is a member of the Indivior board.

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