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Background Electroconvulsive therapy (ECT) is associated with volumetric enlargements of cortico-limbic brain regions. However, the pattern of whole-brain structural alterations following ECT remains unresolved. Here, we examined the longitudinal effects of ECT on global and local variations in gray matter, white matter and ventricle volumes in major depression as well as predictors of ECT-related clinical response. Methods Longitudinal MRI and clinical data from the Global ECT-MRI Research Collaboration (GEMRIC) were used to investigate changes in white matter, gray matter and ventricle volumes before and after ECT in 328 patients experiencing a major depressive episode. In addition, 95 non-depressed control subjects were scanned twice. We performed a mega-analysis of single subject data from 14 independent GEMRIC sites. Results Volumetric increases occurred in 79 of 84 gray matter regions of interests. In total, the cortical volume increased by (mean ± SD) 1.04 ± 1.03 % (Cohen's d=1.01, p<0.001) and the subcortical gray matter volume increased by 1.47 ± 1.05 % (d=1.40, p<0.001) in patients. The subcortical gray matter increase was negatively associated with total ventricle volume (Spearman's rank correlation rho=-0.44, p<0.001), while total white matter volume remained unchanged (d=-0.05, p=0.41). The changes were modulated by number of ECTs and mode of electrode placements. However, the gray matter volumetric enlargements were not associated with clinical outcome. Conclusions The findings suggest that ECT induces gray matter volumetric increases that are broadly distributed. However, gross volumetric increases of specific anatomically defined regions may not serve as feasible biomarkers of clinical response.

**General information**

Publication status: Accepted/In press
Organisations: Magnetic Resonance, Department of Health Technology, Center for Hyperpolarization in Magnetic Resonance, Haukeland University Hospital, Feinstein Institute for Medical Research, University of California, University of New Mexico, KU Leuven, University of Barcelona, University of Duisburg-Essen, Keio University, Vrije Universiteit Amsterdam, Autonomous University of Barcelona, University of Münster, University of Copenhagen, Linköping University, Psychiatric Center Copenhagen, Rigshospitalet, Radboud University Medical Centre, Cleveland Clinic Ohio, University of Bergen

Number of pages: 32
Publication date: 2019
Peer-reviewed: Yes

**Publication information**

Journal: Biological Psychiatry
ISSN (Print): 0006-3223
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
Original language: English
Keywords: Depression, ECT, MRI, Neuroimaging, Antidepressant, Biomarker, Brain
Electronic versions:
1_s2.0_S0006322319315434_main.pdf
DOIs: 10.1016/j.biopsych.2019.07.010
Source: PublicationPreSubmission
Source ID: 187662414
Research output: Contribution to journal > Journal article – Annual report year: 2019 > Research > peer-review