



Electroconvulsive therapy changes functional brain connectivity in depressed patients

Name: Nadia Falhani, Caroline Nothdurfter, Jens Schwarzbach

Affiliation: Dept. of Psychiatry and Psychotherapy, University of Regensburg

Country: Germany

Email ID: nadia.falhani@ukr.de

ABSTRACT

Depression is characterized by a range of symptoms including persistent low mood, anhedonia, and fatigue. Notably, 30% of cases are resistant to treatment. For such cases, a chance of relief is provided by electroconvulsive therapy (ECT). ECT consists of an electrical stimulation of the brain which triggers a generalized seizure. Although beneficial, the precise antidepressant mechanism of ECT remains to be determined. We expect that ECT induces changes in brain network communication. Eight depressed patients underwent three ECT sessions per week for a total of 16 sessions in average. Functional magnetic resonance imaging (fMRI) was performed before starting the therapy and then once a week for four weeks to investigate functional graph theoretical measures of brain connectivity. The complex structure and function of the brain can be described as a graph which is defined as a set of nodes (brain regions) linked by edges (connections). Here we show that several regions included in default mode (DMN), cognitive control (CC) and somatomotor (SM) networks change the number of connections (degree) during four weeks of therapy. In particular, SM regions (PreCG) and CC regions (IFG, ITG) increase their degree; whereas the degree of DMN regions (MTG, MFG) decreases. Interestingly, these changes mostly occur between the first and second week, suggesting that the main effect of ECT on brain connectivity is taking place at very early stages of the therapy, although the first

effects on the clinical outcome emerge only around week four. Moreover, exactly these DMN regions belonging to the temporal lobe have been associated with autobiographical recollection and past-oriented thoughts. Altogether these results might suggest a weaker recruitment of DMN regions associated with depression symptoms and a higher involvement of cognitive control as a potential mechanism of ECT.

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PreCG = Precentral Gyrus; IFG = Inferior Frontal Gyrus; ITG = Inferior Temporal Gyrus; MTG = Medial Temporal Gyrus; MFG = Medial Frontal Gyrus

BIOGRAPHY

I achieved my Master's degree in Pharmacy at the University of Milan, Italy. During my undergraduate studies, the neuroscience field strongly aroused my curiosity. I was particularly intrigued by learning more about psychiatric diseases. After completing my Master's program, I attended a six months internship on social fear in animal models at the Faculty of Biology & Preclinical Medicine at the University of Regensburg, Germany. I am now investigating ECT mechanisms in depressed patients as a PhD student at the department of Psychiatry and Psychotherapy, University of Regensburg, Germany.

Presenter Name: Nadia Falhani.

Mode of Presentation: Poster.

Contact number: +39 3519367375

