EVENT ABSTRACT « Back to Event

Neural correlates of modified subjective state of consciousness induced by hypnosis using EEG-connectivity approach

Rajanikant Panda[1], Olivia Gosseries[1*], Audrey Vanhaudenhuyse[2], Athena Demertzi[1], Andrea Piarulli[1], Marie-Elisabeth Faymonville[2] and Steven Laureys[1*]

[1] Coma Science Group, GIGA-Consciousness, and Neurology Department, University and University Hospital of Liege, Belgium
[2] Sensation & Perception Research Group, GIGA-Consciousness, and Algology & Palliative Care Department, University and University Hospital of Liege, Belgium

Introduction: Hypnotic state has been shown to be of clinical utility, however its neural mechanisms still remain unclear [1]. This study investigates the neural basis of hypnosis using resting state EEG connectivity measurements.

Methods: Ten healthy subjects (7 females, mean age 24±3years) underwent high density EEG recordings in both eye close awake resting state and hypnosis state. The hypnotic state instruction involved a 3-min induction procedure with muscle relaxation and eye fixation. After preprocessing EEG data, both hypothesis and data driven analysis were conducted using connectivity approach. Classical power spectral analysis was performed for delta (1-4Hz), theta (4.1-8Hz), alpha (8.1-12Hz), beta1 (12.1-20Hz) and beta2 (20.1-30Hz) frequency bands. Connectivity between every pair of electrodes was assessed using weighted Phase Lag Index. Hypothesis-based connectivity was computed for frontal, parietal and midline regions [2]. Data-driven graph theory connectivity was carried out to measure brain connectivity network properties and altered hub regions [3].

Results and Discussion: During hypnosis, increased spectral power was observed in delta and decreases were noted in the alpha and beta bands. From hypothesis based connectivity analysis, we observed an increased frontal interhemispheric connectivity in delta and left frontal to right parietal in theta band. Decreased connectivity was found both for alpha and beta bands in midline (upper central with lower central), right frontal with 'right parietal and upper central'. Graph theory measures showed differences between hypnotic state and resting state both at the global and local level. Through integrated nodal clustering coefficient, we found increased frontoparietal connectivity in delta and theta bands and decreased bilateral frontal and parietal connectivity in alpha and beta-2 frequency bands.
During hypnosis, we found increased connectivity in the lower frequency range (i.e., delta) and decreases at higher frequencies (i.e., beta) when considering frontal and parietal regions. These oscillations seems to characterise modified subjective state of consciousness induced by hypnosis, possibly reflecting states of efficient cognitive-processing and positive-emotional experiences.

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*** Correspondence:**
Dr. Olivia Gosseries, Coma Science Group, GIGA-Consciousness, and Neurology Department, University and University Hospital of Liege, Liege, Belgium, ogosseries@uliege.be
Prof. Steven Laureys, Coma Science Group, GIGA-Consciousness, and Neurology Department, University and University Hospital of Liege, Liege, Belgium, stevenlaureys01@gmail.com