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Neural oscillations modulation during working memory in premanifest and early Huntington's disease

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Objective: To identify neuronal oscillations in specific frequency bands in patients with Huntington's disease (HD), pre-symptomatic and early symptomatic, and in a control group, during a working memory (WM) task with high-density electroencephalography (hdEEG) coupled to source localization.

Background: We recently [1] demonstrated specific spectral signatures associated with updating of memory information, working memory maintenance and readout, with relatively high spatial resolution by means of hdEEG. WM is the ability to keep in mind information and retrieve them after a short period of time, and is one of the first cognitive functions to decline in early-HD and also in pre-HD [2].

Methods: Participants had to respond to an n-back WM task (with n = 2, 3), with a button press when the currently presented letter (stimulus) corresponded to the letter presented n trials earlier (probe). We examined modulation of neural oscillations during the task by event-related desynchronization and synchronization (ERD/ERS) of θ, β, gamma low, γLOW and γHIGH EEG bands in a-priori selected large fronto-parietal network, including the insula and the cerebellum. Results: (i) Reduced θ oscillations in HD with respect to controls in almost all the areas of the WM network during the update and readout phases; (ii) Reduced β oscillations in HD with respect to controls in DLPFC-L and InsCl-L; (iii) For γHIGH oscillations, HD showed decreased oscillation compared to controls during maintenance in the PFC-R in both 2-back and 3-back tasks and decreased γHIGH oscillation in PM L and PPC L during the 3-back task, in the maintenance phase. Finally, in HD patients, brain oscillations during WM task correlated with CAG repeat length.

Conclusions: HD patients showed reduced phase-specific modulation of oscillations, even in the presence of preserved dynamic of modulation. Correlations between phase-specific modulations of neural oscillations and CAG repeat lengths suggest that decreased EEG oscillations are linked to HD pathology.

References:

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