Functional Connectivity Alterations in Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS): MRI Findings from a Hyperbaric Oxygen Therapy (HBOT) Observational Trial

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ME CFS Research Foundation

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Aim of the Study

Investigate structural and functional brain alterations using MRI in ME/CFS patients before and after HBOT treatment

- Breathing 100% oxygen within a hyperbaric chamber
- May enhance microcirculation, mitochondrial function and reduce neuroinflammation
- Potential therapeutic approach in ME/CFS

Methods

- 30 patients and 30 matched healthy controls
- HBOT therapy: 40 sessions
- Magnetic resonance imaging (MRI):
  - pre-treatment (<4 weeks before HBOT)
  - post-treatment (<4 weeks after HBOT)

  - **Structural**: Whole-brain volumetric analyses -> FreeSurfer
  - **Functional:** Seed-based resting state functional connectivity (FC) with bilateral thalamus as seed region -> CONN Toolbox

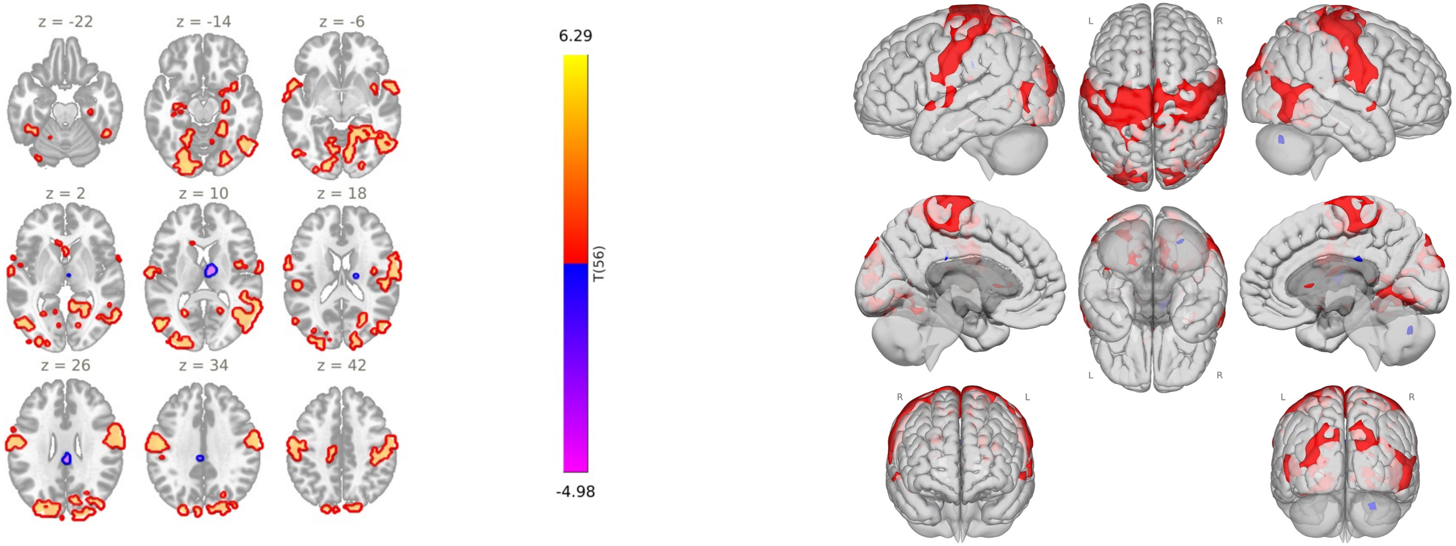
Results: functional analyses

a) Patients vs HC (pre-treatment)

Increased thalamic FC (patients pre-treatment > HC)

- Motor and somatosensory regions bilateral (t = 5.65, p < .001, FDR-corrected)
- Visuo-occipital regions right (t = 5.3, p < .001, FDR-corrected)
- Visuo-occipital regions left (t = 4.8, p < .001, FDR-corrected)

voxel threshold p < 0.001; cluster threshold p < 0.05, FDR-corrected



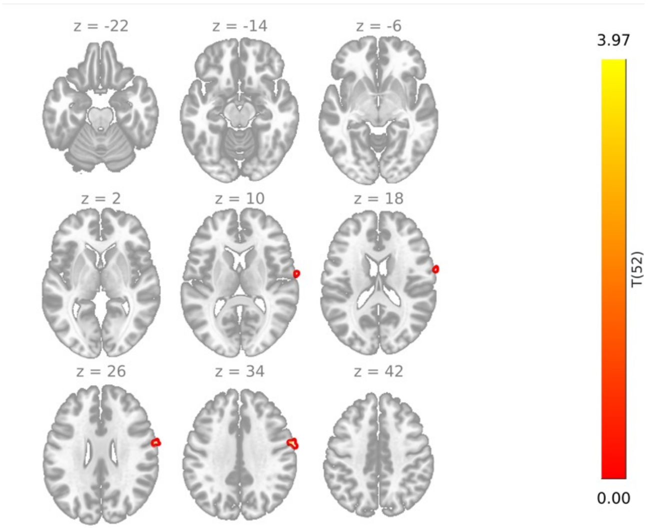
Results: functional analyses

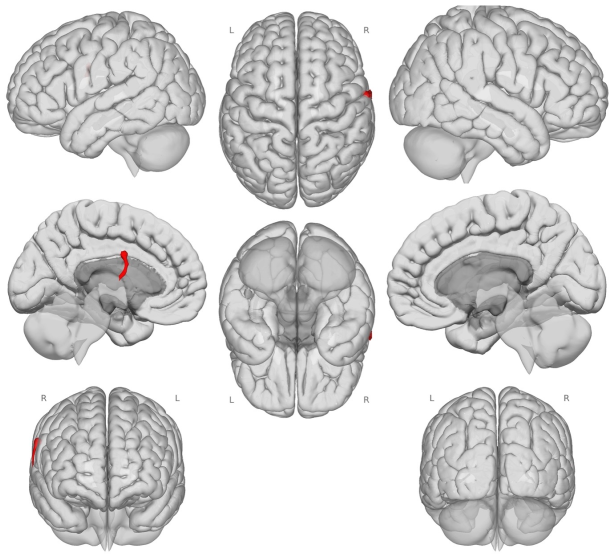
b) Patients vs HC (post-treatment)

Increased thalamic FC only in a small residual cluster (patients post-treatment > HC)

- Somatosensory regions right (t = 4.05, p < 0.001, FDR-corrected)

voxel threshold p < 0.001; cluster threshold p < 0.05, FDR-corrected





Results: functional analyses

c) Patients longitudinal (post- vs pre-treatment)

No significant FC differences (patients post-treatment > patients pre-treatment)

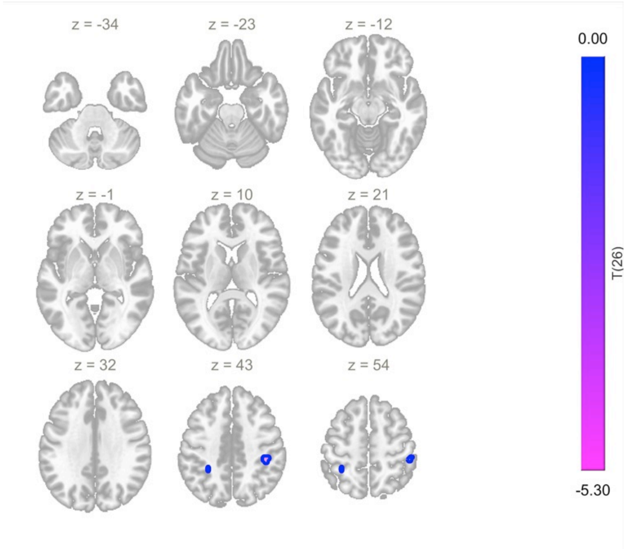
Thalamic clusters* as seed regions (Boeken et al. 2022)

Reduced thalamic FC

(patients post-treatment > patients pre-treatment)

- Somatosensory regions right (t = -5.54, p < .001, FDR-corrected)
- Somatosensory regions left (t = -5.08, p < .001, FDR-corrected)

voxel threshold p < 0.001; cluster threshold p < 0.05, FDR-corrected



*Sensorimotor-attentional integration

Results: structural analyses

No significant differences between groups **in any of the three comparisons** and across the different brain structures

Conclusions

- ME/CFS patients **pre-HBOT treatment: increased thalamic FC** with motor, somatosensory, and visual regions → Possibly altered sensory and motor processing

- **Post-HBOT treatment: trend of «normalization»**

- **Absence of volumetric changes** → ME/CFS symptoms may be more closely related to functional network changes than structural abnormalities

- Functional alterations must be put in relation to **ME/CFS symptomatology**

Thank you!

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Q & A