Enhanced synchronizability of structural connectomes in female chronic migraine is related to increased connectivity

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OBJECTIVES

With a final sample of **57 female patients with episodic migraine (EM), 61 female patients with chronic migraine (CM) and 34 female healthy controls (HC)**, our objective was:

1. **To characterize the role of synchronizability of structural connectomes in CM and EM**.

2. **Find the most important features of the connectomes** responsible for the differences between patients with migraine.

BACKGROUND

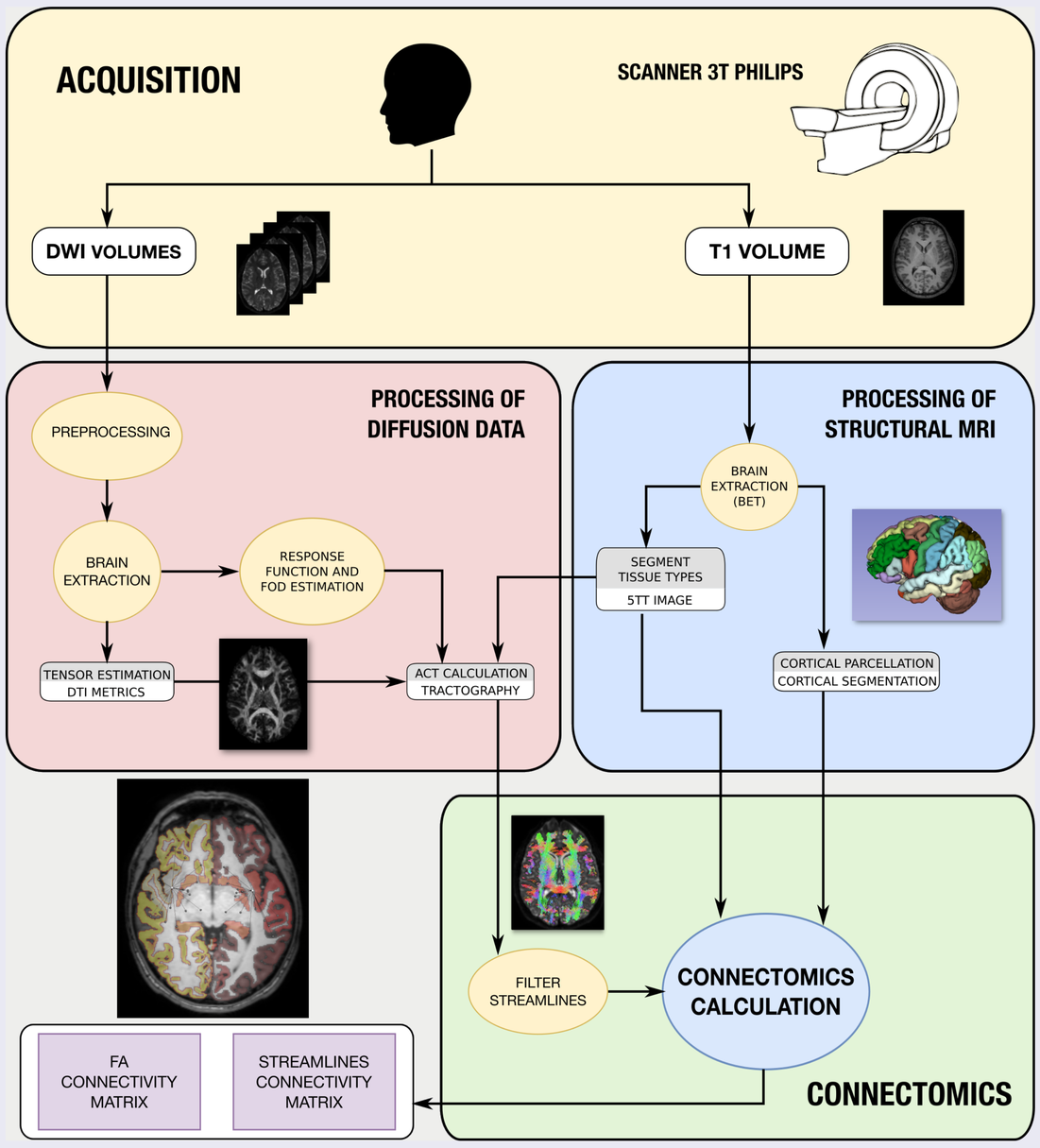
Connectome → Representation of a brain network → Nodes (**gray matter regions**) **connected by white matter fibers** (diffusion MRI and **tractography** reconstruction) or signal correlated in time (functional MRI).

Structural connectivity in migraine → Enhanced in regions involved in pain processing and debilitated in other regions.

Synchronizability → Capability of a brain to sustain processes that involve the synchronization of several brain regions. **Master Stability Function** (MSF).

METHODS

- High-resolution 3D brain T1-weighted and diffusion MRI (b = 1000 s/mm^2).
- Anatomically-constrained tractography → An **84 x 84 structural connectivity matrix** per subject (gray matter regions) with the number of streamlines.
- Two MSF synchronizability measures: λ_2 and **R**. Higher values of both parameters are associated with higher synchronizability of the network.



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CONCLUSIONS

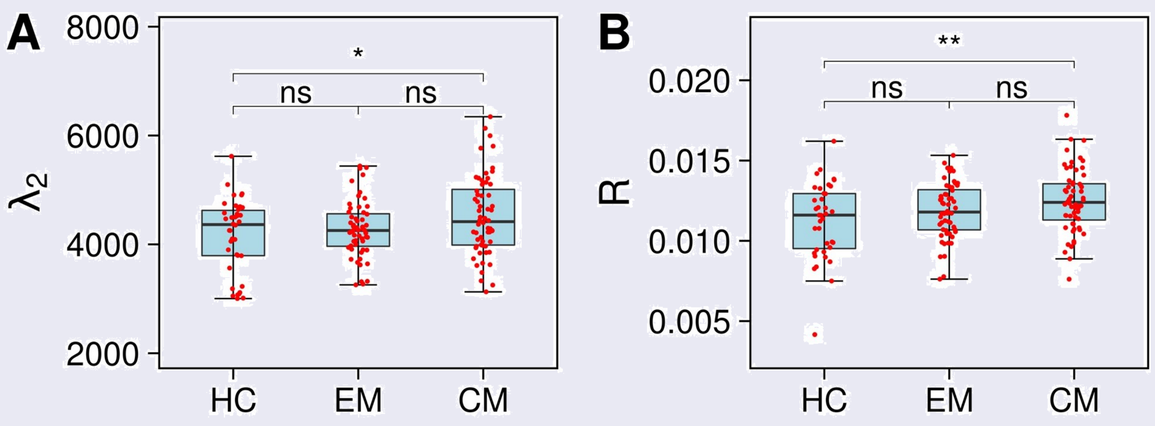
The **structural connectome of CM is more synchronizable that the one of HC.** This result was observed for the whole brain and smaller subnetworks with diverse regions from both hemispheres.

1. **Higher synchronizability in CM → Increase in structural interhemispheric connectivity**.

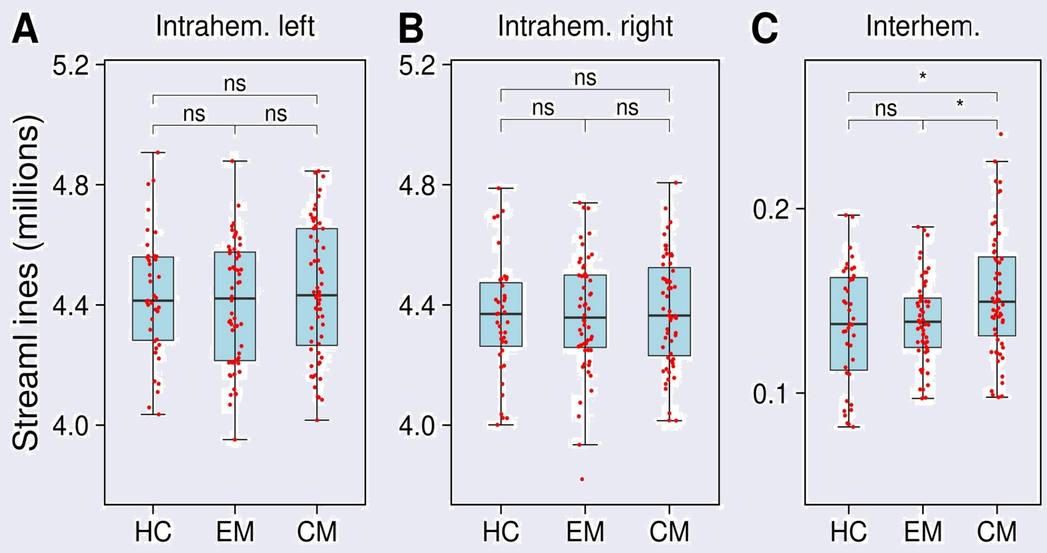
2. Key regions:**superior frontal gyrus, precentral gyrus, and caudate nucleus**.

RESULTS

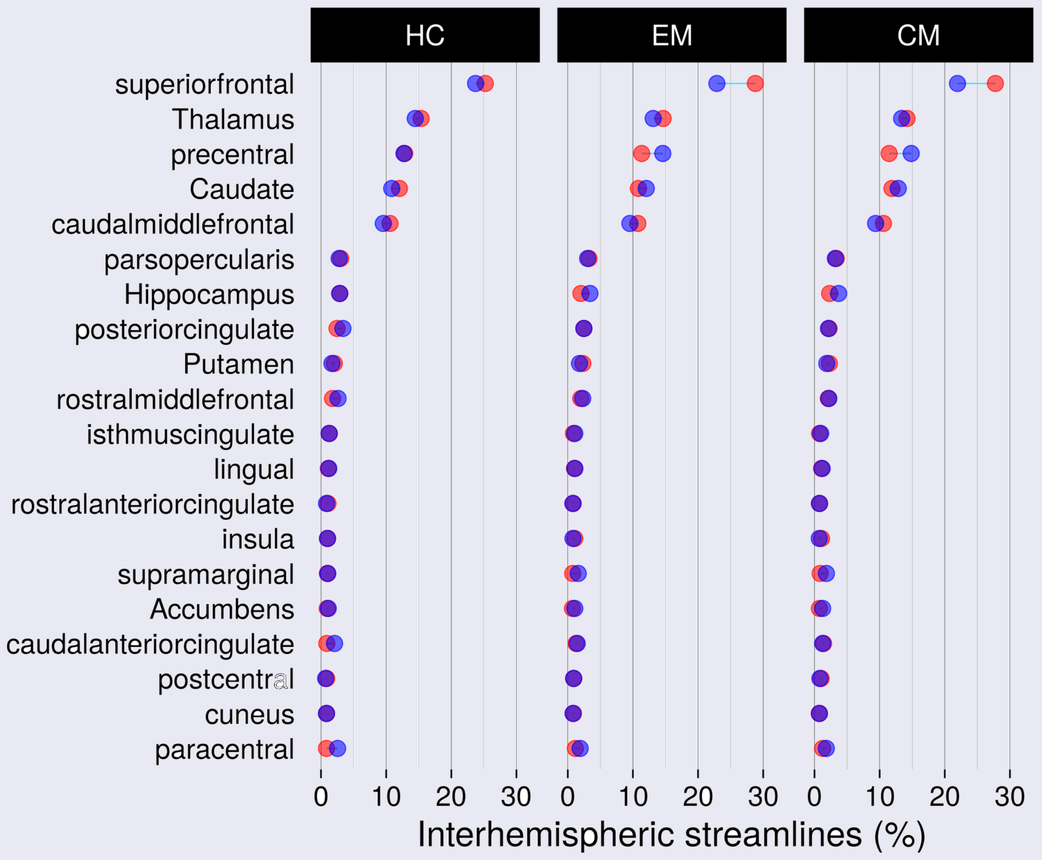
Higher values of λ_2 and R in CM compared to HC (no differences with EM).



Higher interhemispheric connectivity R in CM compared to HC and EM (no intrahemispheric differences).



The regions that mostly contributed to the interhemispheric connectivity were the superior frontal gyrus, thalamus, precentral gyrus, caudate nucleus, and caudal middle frontal gyrus:



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