BRAIN STRUCTURAL CONNECTIVITY NETWORK ALTERATIONS IN INSOMNIA DISORDER REVEAL A CENTRAL ROLE OF THE RIGHT ANGULAR GYRUS

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Background: Insomnia Disorder (ID) is a prevalent and persistent condition, yet its neural substrate is not well understood. The cognitive, emotional, and behavioral characteristics of ID suggest that vulnerability involves distributed brain networks rather than a single brain area or connection.

Aims: The present study utilized tractography to compare the whole-brain structural connectivity networks of people with ID and those of matched controls without sleep complaints.

Method: Diffusion-weighted images and T1-weighed images were acquired in 51 people diagnosed with ID (21–69 years of age, 37 female) and 48 matched controls without sleep complaints (22–70 years of age, 31 female). Probabilistic tractography was used to construct the whole-brain structural connectivity network of each participant. Case–control differences in connectivity strength and graph efficiency were evaluated with permutation tests.

Results: People with ID showed structural hyperconnectivity within a subnetwork that spread over frontal, parietal, temporal, and subcortical regions and was anchored at the right angular gyrus. The result was robust across different edge-weighting strategies. Moreover, converging support was given by the finding of heightened right angular gyrus nodal efficiency (harmonic centrality) across varying graph density in people with ID. Follow-up correlation analyses revealed that subnetwork connectivity was associated with self-reported reactive hyperarousal.

Conclusions: The findings demonstrate that the right angular gyrus is a hub of stronger structural connectivity in ID. Hyperconnectivity within the identified subnetwork may contribute to increased reactivity to stimuli and may signify vulnerability to ID.

Keywords: Insomnia, Sleep, Tractography, Brain structural connectivity, White matter, Connectome, Network, Hub, Hyperarousal

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