

## Impact of meningioma and glioma on whole-brain dynamics

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Introduction: Brain tumors, such as meningiomas and gliomas, can significantly impair neural function. However, their specific effects on brain dynamics remain poorly understood. Understanding these impacts is crucial for advancing knowledge of tumor-related pathophysiological mechanisms and developing effective biomarkers.

Objective: This study aims to investigate alterations in brain dynamics caused by meningiomas and gliomas. Specifically, it seeks to assess these changes using the Intrinsic Ignition Framework, which quantifies dynamical complexity through metrics such as intrinsic ignition and metastability.

Methods: The study analyzed resting-state fMRI data from 34 participants, including both meningioma and glioma patients, as well as controls. Brain dynamics were quantified using intrinsic ignition and metastability metrics. Additionally, resting-state network analysis was performed to examine correlations between brain regions.

Results: Distinct patterns of disruption were observed between the two tumor types. Glioma patients exhibited significant reductions in intrinsic ignition and metastability metrics compared to controls, indicating widespread network disturbances. Meningioma patients showed significant changes primarily in regions directly affected by the tumor. Resting-state network analysis revealed strong

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metastability and metastability/ignition correlations in controls. These correlations were slightly weakened in meningioma patients and severely disrupted in glioma patients.

Discussion: These findings demonstrate the differential impacts of gliomas and meningiomas on brain function, reflecting their distinct pathophysiological mechanisms. Gliomas are associated with more widespread disruptions in brain dynamics, while meningiomas primarily affect tumor-involved regions. Additionally, the study underscores the potential of brain dynamics metrics as biomarkers for identifying disruptions in brain information transmission caused by tumors.

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