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Understanding the Complexity of the Migraine Brain

Brain regions showing consistent alterations in migraineurs converge to a common brain network, which includes areas with a pivotal role in migraine pathophysiology.

Neuroimaging studies have shown functional and structural alterations of different brain areas in migraine patients, raising new questions. How do these regions interact with each other? Does a unique network enclose all these brain areas? Are these neuroimaging findings migraine specific?

To address these questions, researchers used resting-state functional MRI data from 1000 healthy controls and looked at functional connectivity of brain areas that previously showed consistent volumetric alterations in migraine patients with and without aura: brain regions involving the right cerebellum, left cingulate, and bilateral frontal gyrus. They also looked at connectivity of brain areas involved in chronic pain conditions and Alzheimer disease as control groups.

In migraine patients, all brain regions of interest were connected to the V3/V3A subregion of the left extrastriate visual cortex, an area where aura and photophobia in migraine might originate. Most selected regions were also connected with the hypothalamus and bilateral insula. The hypothalamus is involved in the premonitory and pain phase of the migraine attack. The insula has a critical role in pain processing. Only functional connections to the V3/V3A region were specific for migraine compared with other chronic pain conditions and Alzheimer disease. Connectivity to the hypothalamus and insula discriminated migraine from Alzheimer disease but not from other chronic pain disorders.

COMMENT

This study supports the idea of migraine as a brain network disorder. The migraine brain follows a hierarchical organization where key brain regions modulate the activity of other areas. The current findings confirm a pivotal role of the visual cortex in migraine pathophysiology, regardless of aura presence. In previous research, transcranial magnetic stimulation used to treat migraine seems to modulate the activity of this visual area. The findings provide new starting points for the understanding of the different subtypes of migraine. While some brain hubs are migraine-specific, other regions are also commonly involved in other chronic pain disorders. Identification of brain regions specifically involved in migraine is fundamental for the development of novel and precise treatments. The same approach used in this study should be applied in the future in a large sample of migraineurs.

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