Medical Xpress

Differential brain network changes in Alzheimer's patients with and without CeVD

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A new study of those with Alzheimer's disease (AD) with and without cerebrovascular disease (CeVD) has found that there are likely differential brain network changes suggesting differences in the underlying pathology for each of these seemingly similar brain disorders.

Given that dementia is one of the biggest public health and social care challenges facing the world today, this finding may greatly improve the ways in which doctors diagnose, treat, manage and anticipate the outcomes of treatments in patients with neurodegenerative disorders. Alzheimer's disease is the most common form of dementia accounting for up to 60% of all cases, while Alzheimer's with CeVD accounts for nearly 20% of all dementia cases in Asia . Alzheimer's disease frequently co-occurs with CeVD, which has emerged as the leading cause of age-related cognitive impairment especially in Asia.

The burden of dementia is increasing exponentially worldwide, especially in Asia-Pacific, with an estimation that dementia sufferers in the region will triple between now and 2050. It is projected that the region will have almost 71 million people with dementia by 2050. Similar to other parts of Asia, the prevalence of dementia in Singapore is also projected to rise rapidly, with projected dementia patients of 53,000 in 2020 more than tripling to 187,000 by 2050 .

A new study by researchers at Duke-NUS Medical School (Duke-NUS) and the National University of Singapore Yong Loo Lin School of Medicine (NUS Medicine), on a local cohort of 235 Singapore residents

with prodromal and clinical Alzheimer's disease showed differential functional connectivity and structural network changes in the brains of patients with and without CeVD.

The human brain is made up of many regions with different functions, all of which need to communicate with each other to execute specific tasks. This collaborative process within the brain is known as functional connectivity, which exists when persons are at rest or performing tasks. Using state-of-the-art functional and structural Magnetic Resonance Imaging (fMRI) methods, both low-level sensorimotor and high-level cognitive networks in the human brain such as the default mode and executive control networks can be mapped non-invasively in vivo.

With an innovative network-sensitive neuroimaging method, the researchers were able to observe divergent brain functional connectivity and structural differences of these two high-level cognitive networks in both prodromal and clinical stages of AD patients with and without CeVD.

Specifically, only Alzheimer's disease without CeVD patients exhibited reduced posterior default mode network functional connectivity. In contrast, patients with the double burden of Alzheimer's disease and CeVD showed much greater reduction of frontal executive control network functional connectivity. Importantly, patients at the prodromal stages exhibited similar patterns and such network changes relate to hippocampal atrophy (marker of neurodegeneration) and white matter hyperintensity (marker of CeVD).

These different presentations of brain dysfunction, as detected by neuroimaging, for Alzheimer's patients with and without CeVD, suggests that there may need to be different clinical approaches in treating patients who only have Alzheimer's disease, and those who either only have CeVD or have CeVD as well as Alzheimer's disease.

Stressing the relevance of this finding, Assistant Professor Juan Helen Zhou of Duke-NUS, who is the senior author of this study, said: "Given that growing prevalence of Alzheimer's disease and CeVD in Asia and particularly in Singapore, our findings could potentially provide basis for better patient management, disease monitoring and long term treatment planning for patients with both Alzheimer's disease, and those with or without CeVD. This is the first time that the study demonstrated neural network structural and functional changes differ in AD patients with CeVD and without it."

The study's co-author, Associate Professor Christopher Chen of NUS Medicine, added: "Although there is a growing awareness of Alzheimer's disease and CeVD, however, due to lack of well-defined criteria and treatment guidelines, Alzheimer's disease with CeVD is largely underdiagnosed. With this study, we demonstrated the combined effects of Alzheimer's disease and CeVD on brain network degeneration, and further studies could shed more light into the clinical characteristics of these two important brain pathologies."

More information: Joanna Su Xian Chong et al, Influence of cerebrovascular disease on brain networks in prodromal and clinical Alzheimer's disease, *Brain* (2017). DOI: 10.1093/brain/awx224

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