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Brain insult from hypertension discovered in middle-aged adults

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Hypertension that leads to vascular dementia in older adults begins to impact the brain by middle age, reports a large new Northwestern Medicine study published in *PNAS*, the first to show the process begins so early. But in some middle-aged individuals with this damage, their brains reorganize to bypass the damage and enhance communication between brain cells, the study also found. And these people did better on tasks related to cognitive function.

"This tells us some people's brains appear to compensate by rerouting communication in the brain networks to improve messaging. It's like creating detours when one route is blocked or clogged," said senior author Farzaneh Sorond, MD, Ph.D., the Dean Richard H. Young and Ellen Stearns Young Professor, vice chair for faculty development and education in the Department of Neurology and a Northwestern Medicine neurologist. "If we can develop a treatment to produce this plasticity in an older person's brain, we might be able to improve their cognition and mobility."

Not everyone is affected equally by damage to their brain's white matter as they age, Sorond said.

"Why is that?" Sorond said. "We've been asking that for decades. Here we have an important clue. These people with white matter disease in their brain, why are they functioning OK? If we can figure it out, then we can help others."

In the multi-site study, scientists observed 600 individuals, average age

of 55.5 in an fMRI. All had vascular risk factors and were at risk for vascular dementia in late life but currently had normal cognitive function. Scientists looked at the executive function region of their brains, which is one of the first regions affected as people develop age-related white matter injury. This region of the brain is key to working memory and controls planning and decision making.

One form of brain injury from hypertension appears as white splotches, referred to as white matter hyperintensities, on brain fMRIs.

While participants were resting in the fMRI, scientists measured the level of oxygenation across the entire brain. As the brain works, it increases and decreases oxygen in a synchronized manner. The synchronization was enhanced in the people whose brains had redistributed paths to the brain's executive function region and were able to compensate for the white matter injury.

"The increased synchronization in the brain means communication is improved," said first author Lisanne Jenkins, Ph.D., research assistant professor of Psychiatry and Behavioral Sciences.

Next, the participants were given a series of tasks that tested their executive function. Those individuals whose brains had shown increased connectivity and rerouted brain networks performed better on the tasks than those whose brains did not.

The study adjusted for diabetes, cholesterol, BMI (Body Mass Index) and smoking, so scientists only were looking at the effect of blood pressure.

More information: Lisanne M. Jenkins et al, Blood pressure, executive function, and network connectivity in middle-aged adults at risk of dementia in late life, *Proceedings of the National Academy of*

Sciences (2021). DOI: 10.1073/pnas.2024265118

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