Alzheimer's imaging study identifies changes in brain's white matter

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Scientists at the University of Kentucky's College of Medicine have identified changes in the brains of normal individuals at high risk for Alzheimer's disease that could prove important for early detection of the disease.

The research, led by Brian Gold, associate professor of anatomy and neurobiology, focused on the brain's white matter, which forms the majority of deep parts of the brain and consists primarily of myelinated nerve cell processes, or axons. These myelinated axons serve to connect the brain's gray matter regions, which contain nerve cell bodies.

"The brain's white matter can be thought of as a set of telephone wires which enable communication between gray matter 'thinking regions'," Gold said.

Previous studies have demonstrated decline in both gray and white matter tissue types in individuals with Alzheimer's. In the present study, the authors sought to determine which of these changes are present in normal seniors at high risk for Alzheimer's disease, a likely target group for emerging interventions.

The high-risk group consisted of individuals whom have both genetic and family risk factors for Alzheimer's disease but do not yet show cognitive changes. The low-risk control group consisted of individuals who had neither risk factor but were similar to the high-risk group in terms of age, education level and cognitive functioning.

The study used several magnetic resonance imaging (MRI) techniques to assess the integrity of gray matter and white matter brain tissue in the high and low risk groups. In particular, a recently developed form of MRI called diffusion tensor imaging (DTI) was used to assess the integrity of the brain's white matter. This technique allows for assessment of the microstructural integrity of axons and their surrounding myelin.

Results indicated that the two groups did not differ in the tissue volumes of several gray matter regions know to contribute to memory function. However, the high-risk group showed decreased integrity in white matter tracts that inter-connect gray matter regions involved in memory function. Both the axonal and myelin integrity of these white matter tracts were reduced.

These data suggest that changes in white matter connections may be among the earliest brain changes in Alzheimer's disease, which may prove important for early detection by non-invasive imaging. In addition, the findings may have implications for the development of new preventative treatment interventions in Alzheimer's disease, which could attempt to protect axon and myelin integrity in seniors at risk for this neurological disorder.

More information: The findings were published in an article in the journal Neuroimage.

Provided by University of Kentucky