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PRIMARY eyecare

Retinal Changes that Correspond to Brain Changes in Early Stage Alzheimer's Disease May Lead to Earlier Diagnosis

Every three seconds, someone in the world develops dementia. However, The early signs and symptoms of dementia can be subtle and hard to recognise but that may be about to change. Just this year Cedars-Sinai investigators have produced the most extensive analysis to date of changes in the retina-and how those retinal changes correspond to brain and cognitive changes in Alzheimer's disease patients.

Their analysis, published in the peer-reviewed journal Acta Neuropathologica, is an important step toward understanding the complex effects of Alzheimer's disease on the retina, especially at the earliest stages of cognitive impairment. Experts believe this understanding is key for the development of more effective treatments that could prevent progression of the disease.

Almost 70,000 Kiwis are living with dementia today. Dementia impacts more women than men - around 30% higher

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There were over 50 million people worldwide living with dementia by 2020.The disease progressively destroys memory and cognitive ability. Currently, there is no single diagnostic test that can definitively diagnose a patient with Alzheimer's disease, and the newest treatments only slow progression but do not stop progression. Alzheimer's New Zealand predicts that almost 170,000 New Zealanders are likely to be living with dementia by 2050.

"Our study is the first to provide in-depth analyses of the protein profiles and the molecular, cellular, and structural effects of Alzheimer's disease in the human retina and how they correspond with changes in the brain and cognitive function," said Maya Koronyo-Hamaoui, PhD, professor of Neurosurgery, Neurology, and Biomedical Sciences at Cedars-Sinai and senior author of the study.

"These findings may eventually lead to the development of imaging techniques that allow us to diagnose Alzheimer's disease earlier and more accurately and monitor its progression noninvasively by looking through the eye."

"The retina, as a developmental extension of the brain, offers an unparalleled opportunity for access to affordable, non invasive monitoring of the central nervous system," said Yosef Koronyo, MSc, research associate in the Cedars-Sinai Department of Neurosurgery and first author of the study. "With the help of our collaborators, we discovered the accumulation of highly toxic proteins in the retinas of patients with Alzheimer's disease and mild cognitive impairment, causing severe degeneration of cells."

Investigators looked at retinal and brain tissue samples collected over 14 years from 86 human donors-the largest group of retinal samples from human patients with Alzheimer's disease and mild cognitive impairment thus far studied. They compared samples from donors with normal cognitive function to those with mild cognitive impairment at the earliest stages of Alzheimer's disease, and those with later- stage Alzheimer's disease dementia.

The investigators explored the physical features of the retinas of these patients, measuring and mapping markers of inflammation and functional cell loss, and analyzed the proteins present in retinal and brain tissues.

"We found changes in the retina which correlated with changes in parts of the brain called the entorhinal and temporal cortices, a hub for memory, navigation and the perception of time," said Koronyo.

Here is what investigators found in the retinas of patients with mild cognitive impairment and Alzheimer's disease:

- An overabundance of a protein called amyloid beta 42, which in the brains of Alzheimer's disease patients clumps together to form plaques that disrupt brain function

- Accumulation of amyloid beta protein in ganglion cells, the cells that bridge visual input from the retina to the optic nerve

- Higher numbers of astrocytes and immune cells, called microglia, tightly surrounding amyloid beta plaques

- As many as 80% fewer microglial cells clearing amyloid beta proteins from the retina and brain

- Specific molecules and biological pathways responsible for inflammation, and cell and tissue death

Retinal changes also correlated with the pathological stage of Alzheimer's disease (called Braak stage) and patients' cognitive status. And they were found even in patients who appeared cognitively normal or very mildly impaired, marking them as a possible early predictor of later cognitive decline.

Key Alzheimer's facts

From Alzheimer's New Zealand

Almost 70,000 New Zealanders are living with dementia today.

It is predicted that 170,000 Kiwis are likely to be living with dementia by 2050

Four out of five New Zealanders know or have known someone living with dementia.

Dementia impacts more women than men - around 30% higher

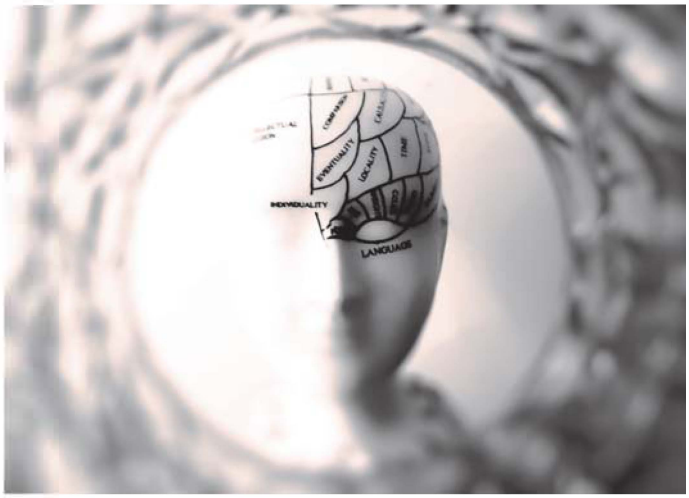
Dementia numbers are increasing at a faster rate among Maori, Pasifika and Asian populations than those of European New Zealanders.

And from Alzheimer's Disease International

There were over 50 million people worldwide living with dementia by 2020.

This number will almost double every 20 years, reaching 82 million in 2030 and 152 million in 2050.

Much of the increase will be in developing countries. Already 60% of people with dementia live in low and middle income countries, but by 2050 this will rise to 71%.



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Alzheimer's New Zealand have a great deal of information about the condition on their website www.alzheimers.org.nz

The website includes advice about getting a diagnosis; making it clear to anyone who thinks they, or someone they care about, may have dementia that it is important to see a GP for an assessment as soon as possible.

The Alzheimer's New Zealand website also lists modifiable risk factors for dementia outlined in The Lancet Commission report:

less education
hypertension
hearing impairment
smoking
obesity
depression
physical inactivity
diabetes
infrequent social contact
excessive alcohol intake
head injury in mid-life
exposure to air pollution in later life.

Dementia prevention, intervention, and care: 2020 report of the Lancet Commission, The Lancet Commissions/ Volume 396, ISSUE 10248, P413-446, August 08, 2020

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