

Concern that radiation may contribute to development of Alzheimer's

October 27 2016, by Birgitte Svennevig

More humans than ever are exposed to higher levels of ionizing radiation from medical equipment, airplanes, etc. A new study suggests that this kind of radiation may be a confounding factor in the neurodegenerative disease Alzheimer's.

Alzheimer's disease is the leading cause for dementia in the elderly, and its global prevalence is supposed to increase dramatically in the following decade - up to 80 million patients by 2040.

"It is crucial that we investigate the potential factors behind this disease," says postdoc Stefan J. Kempf, University of Southern Denmark. His research focuses on possible connections between [radiation](#) and cognitive impairments.

In a new study, he and an international consortia involving colleagues from Italy, Japan, Germany and Denmark show that low doses of ionising radiation induce molecular changes in the brain that resemble the pathologies of Alzheimer's.

The study has been published in *Oncotarget*. Co-authors are from Institute of Radiation Biology/Institute of Pathology, Helmholtz Zentrum München, German Research Center for Environmental Health and Institute for Environmental Sciences in Japan.

Large numbers of people of all age groups are increasingly exposed to ionizing radiation from various sources. Many receive chronic

occupational exposure from nuclear technologies or airline travel. The use of medical diagnostics and therapeutic radiology has increased rapidly - for example more than 62 million CT scans per year are currently carried out in USA.

Approximately one third of all diagnostic CT examinations are scans of the head region.

"All these kinds of exposures are low dose and as long as we talk about one or a few exposures in a lifetime I do not see cause for concern. What concerns me is that modern people may be exposed several times in their lifetime and that we don't know enough about the consequences of accumulated doses," says Stefan J. Kempf.

Recent data suggest that even relatively low radiation doses, similar to those received from a few CT scans, could trigger molecular changes associated with cognitive dysfunction.

In their new study, the researchers have elucidated molecular alterations in the hippocampus of mice. The hippocampus is an important brain region responsible for learning and memory formation and it is known to be negatively affected in Alzheimer's.

The authors induced changes in the hippocampus by two kinds of chronic low-dose-rate ionizing radiation treatments. The mice were exposed to cumulative doses of 0.3 Gy or 6.0 Gy given at low dose rates of 1 mGy over 24 hours or 20 mGy over 24 hours for 300 days.

"Both dose rates are capable of inducing molecular features that are reminiscent of those found in the Alzheimer's disease neuropathology," says Stefan J. Kempf.

When a patient gets a head scan, the doses varies between 20 and 100

mGy and lasts for around one minute. When a person flies, he or she gets exposure to ionising radiation coming from space but the rates are by far smaller than a CT scan.

"When you compare these figures you will find that we exposed the mice to a more than 1000 times smaller cumulative dose than what a patient gets from a single CT scan in the same time interval. And even then we could see changes in the synapses within the hippocampus that resemble Alzheimer's pathology."

According to Stefan J. Kempf, the data indicate that chronic low-dose-rate radiation targets the integration of newborn neurons in existing synaptic wires.

Provided by University of Southern Denmark

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