Additional evidence that ionizing radiation causes Alzheimer's

By Caroline Rodgers*

In 2011, *Medical Hypotheses* published my paper proposing that Alzheimer's disease (AD) is a long-term consequence of ionizing radiation (IR) due to dental X-rays. [1] Since then, three more articles have been published in scientific journals raising concerns that ionizing radiation may be a cause of Alzheimer's disease.

1) In 2012, a review in the *Journal of Radiation Research* by Begum et al posed the question, "Does ionizing radiation influence Alzheimer's disease risk?" The authors declared "significant evidence suggests that exposure to ionizing radiation can lead to the development of AD," noting that "even relatively low dose exposures" were of concern. In their conclusion, although they note "the absence of conclusive epidemiological or molecular data proving unequivocally that exposure to IR increases the risk of developing AD … there is consistent evidence that IR might trigger mechanisms that could ultimately favor AD." [2]

2) A few months later, a review by Kempf et al was epublished by *Radiation and Environmental Biophysics* titled, "Long-term effects of ionising (sic) radiation on the brain: cause for concern?" The authors concluded that beyond the fact that ionizing radiation can cause cancer, the "…latest evidence from epidemiological data as well as animal and cellular studies suggests an additional role in increasing the risk of non-cancerous diseases, including neurodegeneration." They suggested that ionizing radiation may be causally linked with both Alzheimer's and Parkinson's disease. [3]

3) Later that year in *PLoS One*, a study by Cherry et al designed to find out whether astronauts on long flights would experience cognitive deficits made national headlines. The environmental factor being tested was cosmic radiation, which is an umbrella term for a number of different types of radiation, including X-rays. In the experiment, mice exposed to ionizing radiation in the form of highly charged iron particles developed brain pathology and cognitive deficits that were consistent with Alzheimer's. [4]

All four papers propose different pathways to neurodegeneration via ionizing radiation, with some overlap, yet with all of the scientific literature on the subject – each review has well over 100 citations, many of which relate specifically to radiation-induced effects – why has the possibility that ionizing radiation may be a major cause of dementia not been properly addressed?

Traditionally, radiation experts, doctors and dentists have compared low levels of medical radiation to a single airplane flight or an extra day of environmental exposure. They point out that we are naturally exposed to low levels of ionizing radiation arising from the ground and descending from the sky, called "background radiation," without apparent ill effect. However, it is only within the last 100 years that frequent, lifelong head exposure to X-rays from dental visits has become "normal."

Before proceeding further, it is important to note that the three latest papers only suggest that ionizing radiation could be causing dementia and do not venture that dental X-rays are the source. Begum et al clarify that by "relatively low doses," they are referring to computed tomography (CT) scans (versus

oncological doses); Kempf et al do not address dental X-ray exposure beyond noting that together, diagnostic medical and dental radiation exposures have increased significantly in recent years. Cherry et al only consider the possible consequences of space travel, not oral health as it is practiced today.

Dental X-rays, unlike comparable levels of background radiation that occurs over several hours or days, can involve multiple head exposures in quick succession, which could overwhelm cellular recovery mechanisms. Consider that a full mouth series usually involves between 14 and 21 individual X-ray images; a panoramic X-ray systematically scans the jaws, jaw joints, nasal area, sinuses and teeth; bitewings expose upper and lower back teeth at the same time and usually are done in pairs; and occlusal X-rays aim at the floor or roof of the mouth. Can we really state with confidence that this increase in head exposure to ionizing radiation, which starts in early childhood and continues throughout adulthood, is unrelated to the increase in dementia? Alzheimer's is distinct from age-related cognitive loss both in terms of brain pathology and symptoms and has become a major killer within the same 100 years that has brought us this array of common dental X-ray procedures.

If the answer to stopping the Alzheimer's epidemic is not drug or therapy development but simply taking many fewer X-rays with head involvement, the kind of market-driven research that America is good at and has yielded results in cancer treatment will not work. That is why we need government and/or academic leadership to form and fund research teams that will properly investigate the effects of ionizing radiation on the brain.

References

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* *Caroline Rodgers is the author of "Dental X-ray exposure and Alzheimer's disease: a potential etiological association," which was published in Medical Hypotheses in 2011. She gave a poster presentation of her peer-reviewed hypothesis at the Alzheimer's Association International Conference in Paris (ICAD 2011) and has presented her work as a member of the public at meetings of the Advisory Council on Alzheimer's Research, Care and Services in Washington, DC. In 2012 she made a presentation as a member of the public at the FDA Guidance and Workshop on Pediatric X-Ray Imaging Devices. She also attended a 2012 Institute of Medicine workshop exploring commonalities across four neurodegenerative diseases. She can be reached at: caroline.rodgers@rocketmail.com*