ABSTRACT

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Neurocognitive and radiological changes after cranial radiation therapy in humans and rodents: A systematic review.

Perez WD(1), Perez-Torres CJ(1)(2)(3)(4).

Author information:
(1)School of Health Sciences, Purdue University, West Lafayette, Indiana, US.
(2)Purdue University Center for Cancer Research, Purdue University, West Lafayette, Indiana, US.
(3)Academy of Integrated Science, Virginia Polytechnic Institute and State University, Blacksburg Virginia, US.
(4)School of Neuroscience, Virginia Polytechnic Institute and State University, Blacksburg Virginia, US.

BACKGROUND: Radiation-induced brain injury is a common long-term side effect for brain cancer survivors, leading to a reduced quality of life. Although there is growing research pertaining to this topic, the relationship between cognitive and radiologically detected lesions of radiation-induced brain injury in humans remains unclear. Furthermore, clinically translatable similarities between rodent models and human findings are also undefined. The objective of this review is to then identify the current evidence of radiation-induced brain injury in humans and to compare these findings to current rodent models of radiation-induced brain injury.

METHODS: This review includes an examination of the current literature on cognitive and radiological characteristics of radiation-induced brain injury in humans and rodents. A thorough search was conducted on PubMed, Web of Science, and Scopus to identify studies that performed cognitive assessments and magnetic resonance imaging techniques on either humans or rodents after cranial radiation therapy. A qualitative synthesis of the data is herein reported.

RESULTS: A total of 153 studies pertaining to cognitively or radiologically detected radiation injury of the brain are included in this systematic review; 106 studies provided data on humans while 47 studies provided data on rodents. Cognitive deficits in humans manifest across multiple domains after brain irradiation. Radiological evidence in humans highlight various neuroimaging-detectable changes post-irradiation. It is unclear, however, whether these findings reflect ground truth or research interests. Additionally, rodent models do not comprehensively reproduce characteristics of cognitive and radiological injury currently identified in humans.

CONCLUSION: This systematic review demonstrates that associations between and within cognitive and radiological radiation-induced brain injuries often rely on the type of assessment. Well-designed studies that evaluate the spectrum of potential injury are required for a precise understanding of not only the clinical significance of radiation-induced brain injury in humans, but also how to replicate injury development in pre-clinical models.

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