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The long-term impact of irradiation on functional connectivity in brain circuits involved in memory processes after pediatric posterior fossa tumor

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Abstract

Purpose: Memory is one of the main specific cognitive domains impaired with attention and processing speed after a pediatric brain tumor. This work explored the long-term impact of radiotherapy in children with posterior fossa tumor (PFT) on brain connectivity in neural circuits involved in memory using resting-state functional magnetic resonance imaging (rs-fMRI).

Methods: A total of 20 irradiated and 15 non-irradiated PFT survivors, and 21 healthy controls, prospectively included in the IMPALA study ([NCT04324450](https://clinicaltrials.gov/ct2/show/study/NCT04324450)), performed memory tests assessing episodic, procedural, and working memories and were subjected to an rs-fMRI. We manually contoured main structures involved in memory to explore connectivity at rest in a seed-to-voxel analysis. The groups were compared and differences in connectivity were correlated with behavioral scores and irradiation doses.

Results: The performance of all mnesic tasks was lower in PFT survivors with a greater alteration in working and episodic memory in irradiated patients. Irradiated survivors had atypical connectivities in all memory circuits compared to controls and in cortico-caudate and cortico-cerebellar circuits compared to non-irradiated survivors. Non-irradiated survivors had only atypical connectivities in the cortico-cerebellar circuits compared to controls. In irradiated survivors, atypical connectivities in cortico-hippocampal circuits were linked with episodic memory scores and dose of irradiation to the left hippocampus and in cortico-striatal circuits with procedural memory scores and dose of irradiation to the striatum.

Conclusion: The results of this study highlight that irradiation has a long-term impact on brain connectivity in brain circuits involved in memory after pediatric PFT with a specific radiation-dose effect in supratentorial structures.

Keywords: Memory; Radiotherapy; children; infratentorial tumor; resting-state MRI.

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