Phase Measurement of Cognitive Impairment Specific to Radiotherapy.

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Abstract

PURPOSE: Memory impairment is an early-delayed effect of radiotherapy (RT). The prospective longitudinal measurement of the cognitive phase effects from RT was conducted on treated and untreated brain tumor patients. The study design investigated semantic vs. perceptual and visual vs. verbal memory to determine the most disease-specific measure of RT-related changes and understanding of the neurotoxicity from RT to the brain.

METHODS AND MATERIALS: Tests of memory that had previously shown RT-related phasic changes were compared with experimental tests of memory to test hypotheses about cognition targeted to the neural toxicity of RT. The results from 41 irradiated and 29 nonirradiated patients with low-grade, supratentorial tumors were analyzed. The methods controlled for comorbid white matter risk, recurrence, interval after treatment, and age (18-69 years). The effects were examined before RT and at three points after RT to 1 year using a mixed effects model that included interval, group, surgical status, medication use, practice, and individual random effects. Four new tests of memory and other candidate cognitive tests were investigated, and a post hoc analysis of a comprehensive battery of tests was performed to identify the cognitive processes most specific to RT.

RESULTS: The RT effects on memory were identified in the treated group only; among the new tests of memory and the complete neurocognitive battery, the RT effects were significant only for delayed recall (p < 0.009) and interval to recognize (p < 0.002). Tumor location was not related to the treatment effect. Memory decline was specific to retrieval of semantic memories; a double dissociation of semantic from perceptual visual memory was demonstrated in the RT group.

CONCLUSIONS: These results implicate memory dependent on the semantic cortex and the hippocampal memory system. A cognitive measurement that is brief but specific to neural mechanisms is effective and feasible for studies of RT damage.

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