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Cognitive deficits and altered functional brain network organization in pediatric brain tumor patients

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Abstract

Survivors of pediatric brain tumors experience significant cognitive deficits from their diagnosis and treatment. The exact mechanisms of cognitive injury are poorly understood, and validated predictors of long-term cognitive outcome are lacking. Resting state functional magnetic resonance imaging allows for the study of the spontaneous fluctuations in bulk neural activity, providing insight into brain organization and function. Here, we evaluated cognitive performance and functional network architecture in pediatric brain tumor patients. Forty-nine patients (7–18 years old) with a primary brain tumor diagnosis underwent resting state imaging during regularly scheduled clinical visits. All patients were tested with a battery of cognitive assessments. Extant data from 139 typically developing children were used as controls. We found that obtaining high-quality imaging data during routine clinical scanning was feasible. Functional network organization was significantly altered in patients, with the largest disruptions observed in patients who received propofol sedation. Awake patients demonstrated significant decreases in association network segregation compared to controls. Interestingly, there was no difference in the segregation of sensorimotor networks. With a median follow-up of 3.1 years, patients demonstrated cognitive deficits in multiple domains of executive function. Finally, there was a weak correlation between decreased default mode network segregation and poor picture vocabulary score. Future work with longer follow-up, longitudinal analyses, and a larger cohort will provide further insight into this potential predictor.

Keywords: Brain networks; Cognition; Pediatric brain tumor.

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