

Long-term Supratentorial Radiographic Effects of Surgery and Local Radiation in Children with Infratentorial Ependymoma

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Introduction

Current standard of care for children with an infratentorial ependymoma includes maximal safe resection with local radiation of 54-59gy. High-dose local radiation has been associated with decline in multiple cognitive domains. The anatomic correlates of this cognitive decline remain undefined and there have been no radiographic studies on the long-term effects of this treatment paradigm.

Methods

A comprehensive database of pediatric brain tumor patients treated at Stanford Children's from 2004-2016 was queried. 7 patients with posterior fossa ependymoma were identified who were treated with surgery and local radiation alone, who had no evidence of recurrent disease, and had imaging suitable for analysis. Diffusion-weighted MRI (DWI) datasets were used to calculate apparent diffusion coefficient (ADC) maps for each subject, while arterial spin labeling (ASL) datasets were used to calculate maps of cerebral blood flow (CBF). Using an atlas-based approach, the following brain structures were automatically segmented: cerebral white matter, cerebral cortex, thalamus, caudate, putamen, pallidum, hippocampus, amygdala, and accumbens. Furthermore, DWI and ASL datasets of 52 age-matched healthy children were available and analyzed in the same fashion to enable group comparisons. Binomial logistic regression models were developed for CBF and ADC measurements with disease status as a binary response variable and a significance threshold of $P < 0.05$.

Results

Several statistically significant differences were detected between the two groups. CBF was lower in the caudate (OR=.424 95%CI=.142-.838 $p=.05$) and pallidum (OR=.479 95%CI=.204-.808 $p=.029$) and higher in the accumbens (OR=1.917 95%CI=1.182-4.472 $p=.046$) in the ependymoma cohort compared to controls. ADC was increased in the thalamus (OR=1.168 95%CI=1.040-1.407 $p=.027$) and trended towards decreased in the amygdala (OR=.93 95%CI=.846-.996 $p=0.068$).

Conclusions

Surgery and local radiation for posterior fossa ependymoma are associated with supratentorial ADC and CBF alterations which may represent an anatomical and physiologic correlate to the previously published decline in neurocognitive outcomes in this population.