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Abstract
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Target Delineation of the Amygdala, Corpus Callosum, and Fornix in Stereotactic Radiosurgery and Whole Brain Radiotherapy: A Contouring Atlas and Examples for Practical Use

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Abstract

Objectives:

Brain metastases are the most common brain tumor in adult patients. As survival outcomes improve for patients with brain metastases, improving cognitive preservation through sparing of organs at risk (OARs) has gained importance. Both RTOG 0933 and NRG CC001 show how hippocampal avoidance can be utilized for patients with extensive brain metastases treated with whole brain radiation therapy. As our understanding of the cognitive architecture of the brain grows, identifying additional memory avoidance structures is needed to further preserve cognition. Herein, we present an atlas and practical guide for designation of a broadened matrix of cognitive OARs.

Methods:

The fornix, amygdala, and corpus callosum are key cognitive structures with a low propensity for brain metastases. Previous data have shown these structures to be crucial with manual dexterity, attention, working memory, and processing emotions. There have been recently published contouring atlases that accurately delineate borders for these structures; however, there are no known modern studies that treat them as avoidance structures for patients with brain metastases. In a prospective trial at our institution, we are treating patients who have >15 brain metastases with whole brain radiation therapy utilizing fornix, amygdala, corpus callosum, and hippocampus avoidance applying NRG CC001 dose constraints (D100% ⩽ 9Gy, Dmax ⩽ 16Gy for memory sparing OARs).

Results:

Through utilization of Brainlab auto-segmentation, cross-referencing fornix, amygdala, and corpus callosum contours with published guidelines, and peer review with both neuroradiology and radiation oncology principal investigators, we have created an effective workflow for OAR delineation that can be applied for stereotactic radiotherapy or whole brain treatments. Herein, we have contouring examples for practical use.

Conclusion(s):

Advanced memory sparing approaches for patients receiving radiation for brain metastases is warranted as patients live longer due to advances in systemic therapy. These data and examples show how contouring the fornix, amygdala, and corpus callosum can be standardized and reproducible. Prospective quality of life and cognitive data is pending, and further prospective investigation is warranted.