Hippocampal avoidance with rapid arc and helical tomotherapy for base of skull tumors

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Introduction

The presence of radiosensitive neurogenic stem cells in the hippocampal area suggests identification and avoidance of the hippocampi may reduce the potential risks of radiation related cognitive and memory impairment.

Material and Methods

Six patients treated for base of skull tumors (4 pituitary adenoma, 2 meningioma) were re-planned with specific hippocampus sparing using co-planar helical tomotherapy (HT) as well as co-planar and non-coplanar volumetric arc techniques: Rapid Arc (RA). Two options (10 and 2 mm) of PTV margins were considered to evaluate the impact of on-board image guidance/stereotaxis enabling tighter margins. The PTV dose was set for all plans to 50 Gy. The hippocampal areas were identified and contoured as avoidance structures with the specific goal of minimizing the planned dose to the hippocampus while respecting other organ at risk dose limits.

Results

Comparison of the hippocampus avoidance plans with HT and different number of arcs in RA approach demonstrated the importance of non-coplanar delivery when larger GTV to PTV margins were used (10mm). With smaller PTV margins (2mm) both co-planar and non-coplanar delivery provided similar degrees of hippocampal sparing although a benefit for brainstem and optic nerve sparing was still noted with non-coplanar delivery (although PTV and OAR constraints were met by all techniques). A similar benefit was noted with 2 versus 3 non-coplanar arc plans.

Discussion

Our comparisons suggest interventions to minimize GTV to PTV margins (accurate tumor volume delineation and image guidance) have a profound influence on the ability to spare intracranial OAR. Non coplanar techniques could be advisable when larger margins are used.

References

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