Abstract

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Dosimetric Predictors Of Toxicity In A Randomized Study Of Short-Course Vs. Conventional Radiotherapy For Glioblastoma.

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PURPOSE: There is no consensus on appropriate organ at risk (OAR) constraints for short-course radiotherapy for patients with glioblastoma. Using dosimetry and prospectively-collected toxicity data from a trial of short-course radiotherapy for glioblastoma, this study aims to empirically examine the OAR constraints, with particular attention to left hippocampus dosimetry and impact on neuro-cognitive decline.

METHODS AND MATERIALS: Data was taken from a randomized control trial of 133 adults (age 18-70 years; ECOG performance score 0-2) with newly diagnosed glioblastoma treated with 60 Gy in 30 (conventional arm) versus 20 (short-course arm) fractions of adjuvant chemoradiotherapy (ClinicalTrials.gov Identifier: NCT02206230). The delivered plan's dosimetry to the OARs was correlated to prospective-collected toxicity and Mini-Mental State Examination (MMSE) data.

RESULTS: Toxicity events were not significantly increased in the short-course arm versus the conventional arm. Across all OARs, delivered radiation doses within protocol-allowable maximum doses correlated with lack of grade ≥ 2 toxicities in both arms ($p < 0.001$), while patients with OAR doses at or above protocol limits correlated with increased grade ≥ 2 toxicities across all examined OARs in both arms (p-values 0.063-0.250). Mean left hippocampus dose was significantly associated with post-radiotherapy decline in MMSE scores ($p = 0.005$), while the right hippocampus mean dose did not reach statistical significance ($p = 0.277$). Compared to the original clinical plan, RapidPlan left hippocampus sparing model decreased left hippocampus mean dose by 43% ($p < 0.001$), without compromising planning target volume coverage.

CONCLUSIONS: In this trial, protocol OAR constraints were appropriate for limiting grade ≥ 2 toxicities in conventional and short-course adjuvant chemoradiotherapy for glioblastoma. Higher left hippocampal mean doses were predictive for neuro-cognitive decline post-radiotherapy. Routine contouring and use of dose constraints to limit hippocampal dose is recommended to minimize neuro-cognitive decline in patients with glioblastoma treated with chemoradiotherapy.

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