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Abstract

Can a jawless ring gantry delivery system provide value based high quality intracranial stereotactic radiotherapy (SRT)?

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Purpose: To develop a simplified, robust and standardized workflow for intracranial stereotactic radiotherapy (SRT) using a ring gantry linear accelerator equipped with a dual layer multi leaf collimator (MLC). Methods: 10 recent clinical SRT cases treated with non coplanar volumetric modulated arc therapy to delivering 30Gy in 5 fractions on a stereotactic radiotherapy linear accelerator (linac) equipped with high definition MLCs were used to create a new planning workflow using a ring gantry delivery systems that is optimized for value based care. These re-planed cases were assessed on plan quality and deliverability, and then compared to their clinical counter parts. Each plan was created using 4 full arcs with optimized collimator rotations. A 5mm ring structure away from the planning target volume (PTV) and the normal tissue optimization were used during optimization besides the normal organ-at-risk (OAR) constraints to achieve clinical acceptable plan while maintaining a simple and standardize workflow. All plans were calculated with a 1mm dose grid and were normalized to match the clinical plan PTV coverage. For each plan, the OAR tolerances were mandatory. Conformity Index (CI), Gradient Index (GI), and Gradient Measure (GM) were then collected for all cases and compared with a matched Wilcoxon signed-rank test. All plans also underwent current clinical plan review and quality assurance protocols. Results: With the standardized workflow, all plans were able to meet OAR constraints while matching the clinical PTV coverage. CI, GI, and GM were found to have median values vs the clinical standard of 1.1 vs 1.09 (p=0.06), 3.3 vs 2.8 (p=0.06), and 8.1 mm vs 7.1 mm (p=0.04) respectively. The interquartile range (IQR 75%-25%) were 0.1 vs clinical 0.09 for CI; 0.33 vs clinical 0.79 for GI; 2.8mm vs clinical 3.6mm for GM. Conclusions: The simplified and standardized workflow described is useful for centers seeking to deliver intracranial SRT using a ring gantry linear accelerator in a resource thin environment.

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