Contribution ID: **9** Type: **Oral presentation**

MC-IMPT: A multi-collimator intensity-modulated PVDR-optimized treatment planning method for proton minibeam radiotherapy

Thursday 21 March 2024 11:50 (20 minutes)

Purpose: The clinical translation of proton minibeam radiation therapy (pMBRT) is non-trivial, for which the proper treatment planning technique remains an open question: on one hand, the uniform target dose is desirable for anti-tumor efficacy and the easy acceptance of pMBRT as a standalone treatment modality; on the other hand, high peak-to-valley dose ratio (PVDR) is also desirable in organs-at-risk (OAR) for normal tissue sparing, which however can be challenging for these OAR distal to beam entrance or require patient-specific collimators. This work proposes a novel pMBRT treatment planning method that can achieve uniform dose at target and high PVDR at OAR simultaneously, via multi-collimator intensity-modulated PVDR-optimized inverse optimization method called MC-IMPT.

Methods: MC-IMPT utilizes a set of generic and premade multi-slit collimators with different center-to-center distances, and does not need patient-specific collimators. The collimator selection per field is OAR-specific and tailed to maximize PVDR in OAR. Then the inverse optimization method with intensity modulation and PVDR optimization is utilized to jointly optimize target dose uniformity, PVDR, and other dose objectives, which is solved by iterative convex relaxation optimization algorithm.

Results: The efficacy of MC-IMPT is demonstrated using clinical abdomen, lung, and head-and-neck cases. Compared to CONV, MC-IMPT had similar target dose uniformity and plan quality, while providing unique PVDR in OAR. It was also shown that the use of PVDR optimization further improved PVDR for MC-IMPT.

Conclusions: A novel pMBRT treatment planning method called MC-IMPT is proposed that utilizes a set of generic and premade collimators and PVDR optimization algorithm to optimize OAR-specific PVDR and target dose uniformity simultaneously.

Primary authors: ZHANG, Weijie (University of Kansas Medical Center); WANG, Chao (University of Kansas Medical Center); JOHNSON, Daniel (University of Kansas Medical Center); AKHAVAN, David (University of Kansas Medical Center); GAN, Gregory (University of Kansas Medical Center); WANG, Fen (University of Kansas Medical Center); LIN, Yuting (University of Kansas Medical Center); GAO, Hao (University of Kansas Medical Center)

Presenter: GAO, Hao (University of Kansas Medical Center)

Session Classification: Treatment planning and simulations

Track Classification: Treatment planning and simulations