Cureus

Single-Isocenter Multiple-Metastases Stereotactic Radiosurgery Treatment Planning: An Evaluation of Two Systems and Planning Techniques

Gage Redler [1], Jasmine A. Graham [2], William Johansson [1], Chris Tichacek [1], Daniel Opp [3], Bruce Libby [4], Geoffrey Zhang [1], Daniel Oliver [1], Hsiang-Hsuan Michael Yu [5]

1. Radiation Oncology, Moffitt Cancer Center, Tampa, USA 2. Radiation Oncology/Physics, Moffitt Cancer Center, Tampa, USA 3. Radiation Oncologist, Moffitt Cancer Center, Tampa, USA 4. Radiation Oncology, H. Lee Moffitt Cancer Center, Tampa, USA 5. Department of Radiation Oncology, Moffitt Cancer Center, Tampa, USA

Corresponding author: Gage Redler, gage.redler@moffitt.org

Abstract

Objectives:

The various commercially available treatment planning systems (TPSs) may have differing capabilities in the context of single-isocenter multiple-metastases treatments. Plan quality was compared between a dynamic conformal arcs (DCA) technique and a volumetrically modulated arc therapy (VMAT) technique, both with couch kicks.

Methods:

Twenty patients, prescribed to 18-24Gy and originally planned for treatment with DCA, were selected for analysis with 49 total lesions (1-5 per patient, mean 2.6 lesions). Organs-at-risk were auto-contoured and reviewed by physicist/physician prior to treatment planning. Gross tumor volumes (GTVs) were contoured by physician and planning target volumes (PTVs) were developed by expanding 1mm symmetrically. Plan quality metrics included PTV coverage (D98%), D5%, conformity index (CI), normal brain V12Gy and V4Gy.

Results:

PTV VRx (volume receiving prescription dose) coverage was comparable between DCA and VMAT plans, demonstrated an average of 1.19% (±4.90%, p< 0.01) difference (with VMAT having higher average VRx). VMAT plans were on average cooler with D5% difference of 0.45 Gy (±0.89 Gy, p< 0.01). The greatest difference between DCA and VMAT was the dose to the normal brain: average V12Gy was 3.72cc (±2.54cc) vs. 4.85cc (±2.84cc, p< 0.01) and average V4 was 27.77cc (±18.13cc) vs. 38.67cc (±26.88cc, p< 0.01) for DCA vs. VMAT, respectively. The conformity indices were also better in DCA vs. VMAT (1.24 vs 1.52 average, p< 0.01).

Conclusion(s):

While PTV coverage, determined by the VRx is similar between the two planning systems/techniques, the plans developed with DCA are superior due to lower CI's and normal brain tissue doses for SRS planning of 1-5 lesions. These superior parameters are important if the patient would need to be retreated.