Evaluating a Novel Hybrid Planning Technique for Complex Cases in LINAC-based Stereotactic Radiosurgery

Hyunuk Jung*, Jihyung Yoon, Yuwei Zhou, Michael Milano, Kenneth Usuki, and Dandan Zheng

University of Rochester, Rochester, NY

the Radiosurgery Society

PURPOSE / OBJECTIVES

- SRS and fSRS are emerging treatment options for patients with multiple metastases. Elements® MME (DCA) and Varian RapidArc® (VMAT) are widely used in LINAC-based SRS planning with single-isocenter.
- Recently, BrainbLAB® introduced a novel Hybrid planning technique (Hybrid) in version 4.0 of Elements®, which combines the strengths of both VMAT and DCA in a single plan.
- This innovative approach aims to optimize the dosimetric outcomes, potentially enhancing the therapeutic ratio of SRS/fSRS. It may also address the challenges posed by large irregularly shaped cavities or a target near/inside the brainstem in the midst of multiple other metastases, thereby improving the overall plan quality.
- In this study, we aim to conduct a comprehensive dosimetric comparison between DCA, VMAT, and Hybrid for SRS/fSRS with multiple brain metastases including a large cavity or a target near/inside the brainstem

MATERIAL & METHODS

- Ten patients (a total of 73 PTVs, five patients with a large cavity, and five with a target near/inside the brainstem) treated with SRS/fSRS were retrospectively planned with DCA, VMAT, and Hybrid technique by an experienced planner following institutional planning standards.
- All plans used a 6MV flattening-filter-free beam on Varian Edge® equipped with HD-MLC.
- DCA used double-pass 5 non-coplanar arcs and VMAT used double-pass 4 non-coplanar arcs.
- Hybrid used double-pass 5 non-coplanar arcs with 3 additional VMAT arcs at existing couch angles for treating the cavity or a target near/inside the brainstem.
- 3 to 5-fraction prescriptions with 21 to 35Gy were used and plans were normalized to 95% of PTV receiving the prescription dose.
- Plans using the three techniques were compared in total MU and plan quality evaluated using the Paddick Conformity Index (PCI), gradient index (GI), normal brain volume receiving >X Gy (Vx), and organ-at-risk (OAR) maximum point (0.035cc) dose.

SUMMARY / CONCLUSION

- **This study suggests that the Hybrid planning technique is a viable option for multiple brain metastasis cases involving a large cavity or a target near/inside the brainstem, offering enhanced conformity for challenging targets compared to DCA alone and reducing normal brain exposure compared to DCA and VMAT, especially for lower a lower dose level (<12Gy)**

Contact Information

*Hyunuk Jung. PhD, DABR. Hyunuk_Jung@URMC.Rochester.edu

RESULTS

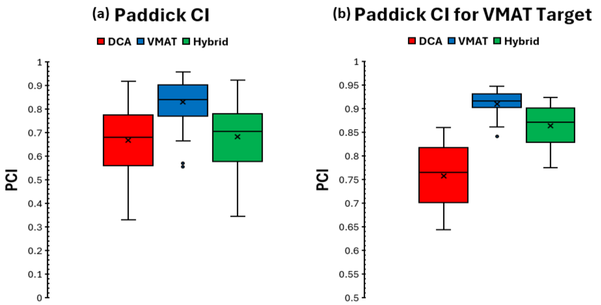

Figure 1. Comparisons of Paddick CI for the three different planning techniques

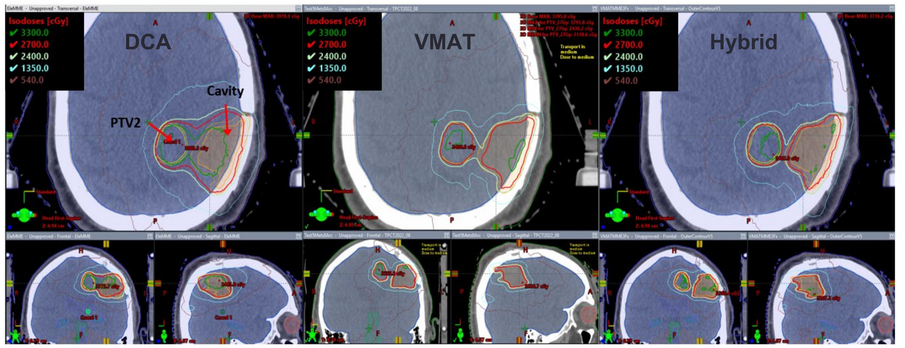

Figure 2. Comparisons of dose distribution for the three different planning techniques

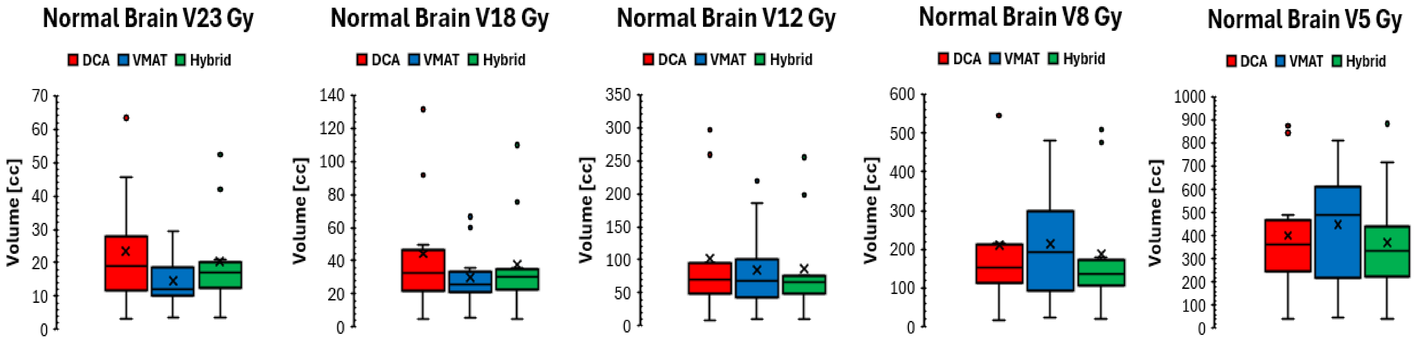

Figure 3. Comparisons of volume of normal brain receiving 23Gy, 18Gy, 12Gy, 8Gy, and 5Gy

- All plans were clinically acceptable and achieved the minimum target prescription dose coverage goal of 95%.
- Overall, VMAT plans demonstrated superior PCI (0.83) compared to DCA (0.67) and Hybrid (0.68) plans. Specifically, the Hybrid plans exhibited significantly improved conformity (0.86) for the VMAT applied targets compared to DCA plans (0.76).
- DCA and Hybrid plans demonstrated similar GIs (2.88 for DCA and 2.91 for Hybrid), which were better than the GI for VMAT plans (4.0).
- The Hybrid plan showed favorable normal brain parameters compared to DCA plans (for all dose ranges) and VMAT plans (for low dose ranges below 12Gy)
- Regarding the maximum dose to OARs, DCA plan performed slightly better than VMAT and Hybrid plans.
- As shown in the dose distribution in sagittal view, VMAT and Hybrid plans showed better coverage even for the adjacent targets.