

VMAT vs. IMRT for Treatment of Neoplasms of the Brain: Dosimetric Quality and Delivery

We performed a retrospective study of patients treated for neoplasms of the brain using modulated radiotherapy techniques. A total of eighteen patients were included in the study and their primary treatment volumes ranged 15.4 cm³ to 374.9 cm³ (Figure 1). Prescriptions ranged from 5320 to 6000 cGy depending on disease type and concern. Representative IMRT and VMAT patient dose distributions for are presented in Figure 2 and Figure 3, respectively.

Dosimetric Parameters: Skin dose parameters were based on a 0.5 cm margin from the exterior body contour. Brain minus CTV contour included a 0.5 cm margin from the CTV. Homogeneity¹ and conformity² indices are as follows:

$$\text{Homogeneity Index} = \frac{D_{5\%} - D_{95\%}}{D_{Rx}} \quad , \quad \text{Conformity Number} = \left(\frac{PTV_{95\%}}{Vol_{PTV}} \right) * \left(\frac{PTV_{95\%}}{ISO_{95\%}} \right)$$

where $D_{5\%}$, $D_{95\%}$, D_{Rx} = dose value at 5%, 95%, and prescription of target volume, respectively. Vol_{PTV} , $ISO_{95\%}$, $PTV_{95\%}$ = total target contour volume, 95% isodose volume, and volume of target within 95% isodose, respectively.

Delivery Time: Measurements of time required to deliver fields and change between fields were measured at the machine during treatment delivery: average beam on time for delivery of two arcs is 2.5 minutes, average time between arcs is 0.33 minutes, average beam on time for 720 MU delivery of 6 IMRT fields is 1.83 minutes, average time between IMRT fields is 0.33 minutes. Thus, the total average delivery time is 2.83 minutes for a two arc VMAT delivery (one field change), and the total average delivery time is 3.47 minutes for six field IMRT delivery (five field changes).

Significance: This study indicates clinical viability for the use of VMAT to replace IMRT delivery for patients undergoing radiotherapy for treatment of brain neoplasms. The decreased delivery time of VMAT increases clinical efficiency and may lead to diminished intrafraction motion uncertainties.

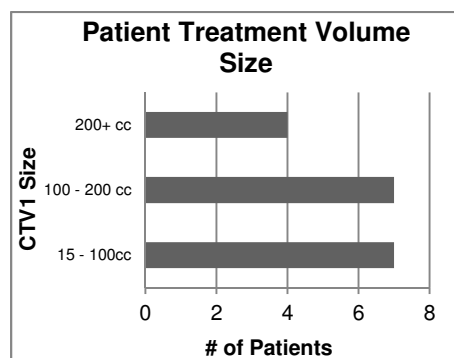


Fig 1. Patient distribution showing diversity of treatment volume sizes.

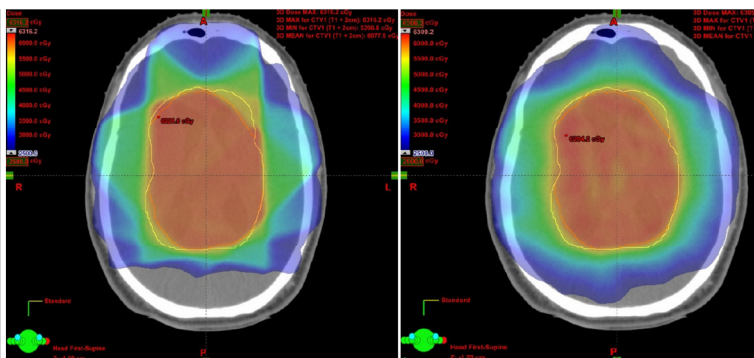


Fig2. IMRT axial dose distribution (2000-6300 cGy dose color wash).

Fig 3. VMAT axial dose distribution (2000-6300 cGy dose color wash).

References:

- ¹M. Yoon, Journal of Applied Clinical Med. Phys., **8**(2), 2007.
- ²L. Feuvret, Int. J. Radiation Oncology Biol. Phys., **64**(2), 333-342, 2006.