AbstractID: 3818 Title: A comparative dosimetric study of three-dimensional conformal, dynamic conformal arc, and intensity modulated radiation therapy for brain tumor treatment

Purpose: To investigate dosimetric differences among three-dimensional conformal (3D-CRT), dynamic conformal arc therapy (DCAT) and intensity modulated radiotherapy (IMRT) for brain tumor treatment for a broad range of brain tumor volumes and shapes in an effort to determine whether a preferred method can be identified based upon pre-treatment characteristics.

Methods and materials: Fifteen patients treated with Novalis were selected. We performed 3D-CRT, DCAT and IMRT plans for all the cases. The beam numbers in 3D-CRT or IMRT plans were the same as the arc numbers in the DCAT plans, and the gantry angle of each beam in 3D-CRT or IMRT plans was the middle angle of each arc in the DCAT plans. The PTV margin was re-chosen as 1mm, and the specific prescription dose was re-set to 90% for all the plans. The target coverage at prescription dose ($TV_{90\%}$), conformity index (CI) and heterogeneity index (HI) were used to compare the different plans. $V_{50\%}$ and $V_{80\%}$ of the organs at risk (OAR) were also calculated.

Results: For small brain tumors (PTV≤2cc), three dosimetric parameters had approximate values for both 3D-CRT and DCAT plans ($\overline{TV_{90\%}}$ ~93%, $\overline{CI}$ ~1.7, $\overline{HI}$ ~1.4). The CI for IMRT plans was high ($\overline{CI}$ =3). For medium brain tumors (2cc<PTV≤100cc), the three plans were competitive with each other. IMRT plans had higher CI and better $TV_{90\%}$ and HI. For large brain tumors (PTV≥100cc), IMRT plan had nearly perfect $TV_{90\%}$ and HI and the approximate CI values as those in both 3D-CRT and DCAT plans.

Conclusions: DCAT is suitable for most cases in the treatment of brain tumors. For a small target, 3D-CRT is still useful, and IMRT is not recommended. For larger brain tumors, IMRT is superior to 3D-CRT, and very competitive in sparing critical structures near the target, especially for the treatment of a big brain tumor.