Contribution ID: **170** Type: **Poster**

Multiple brain metastases treatment, dosimetric comparison of IMRT vs VMAT, is there any gain?

Wednesday, June 21, 2017 3:35 PM (5 minutes)

INTRODUCTION:
Volumetric Arc Therapy (VMAT) and Intensity Modulated Radiation Therapy (IMRT) have been used in brain radiosurgery in terms of non coplanar rotational arc beams with the aid of circular cones to provide beam collimation. The goal of this study is to evaluate two treatment techniques VMAT and IMRT in the treatment of intracranial metastases and to compare results between them. The issues discussed in this study with regard to not only the beam characteristics but also the dosimetry features. Both the pros and cons of both techniques are presented. 37 Lesions in 10 patients treated with VMAT were re-calculated in IMRT, for its comparison in parameters of dosimetric homogeneity, target conformation, organs at risk (OAR) protection, monitor units used, treatment time per fraction used in the 2 described techniques, PTV volumes >14 cc and target dose 40 Gy in 10 Fractions.

MATERIALS AND METHODS:
We evaluate the mean dose to normal brain tissue, maximum dose to OARs. Patients were simulated in Computed tomography (CT) simulation General Electric (GE) Optima model, slides acquisition 1.25 mm; Magnetic Resonance was also done in a Siemens de 1.5T with 1 mm slices in contrast enhanced T1 MPR, T2 Flair, T2 Ciss, Diffusion, Perfusion, DTI Tractography; image fusion for PTV and OAR contouring; calculation were done in Monaco® planning system version 5.10.02 with Monte Carlo algorithms; treatment delivery were make in a LINAC Elekta Infinity™ with Agility™ head with 160 interdigitating leaves with 0.5 cm width at isocenter; positioning verification XVI versión 4.5.1 b141. Dosimetric analysis were made in regard to conformity Index RTOG (CI-RTOG), homogeneity index (HI-RTOG), Paddick inverse conformity Index (PCI), Dmean. OARs were analyzed in terms of Dmax and Dmean.

RESULTS:
Treatments were assessed regarding to the on beam time. Dosimetric conformity, homogeneity and OAR were comparable between IMRT and VMAT single Arc, Treatment Delivery time 16 +/- 1.30 minutes for IMRT and 2 +/- 0.20 minutes for VMAT 1 arc. Mean MU were 1130 and 903 for IMRT, and VMAT 1 arc plans, respectively.

CONCLUSIONS:
Data found in this study suggest that VMAT and IMRT plans are clinically comparable in terms of CI, HI, and OAR restrictions. However there is a substantial difference on beam time and fewer MU for VMAT compared to IMRT. This MU reduction is important due to limits in the exposition time to the resultant leakage radiation even though it is minimum due to Agility™ head used for the treatment. Fewer on beam time limits the inter-fraction potential uncertainties due to OAR and PTV movements, what could lead considerable dosimetric variations. This important clinical advantage makes VMAT a safe and efficient treatment technique for multiple brain metastases more than 14 cc volume with controlled extracranial disease.

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Session Classification: Wednesday afternoon - Poster Presentations - Screen2