AbstractID: 5225 Title: 3-D Computed Rotational Angiography for radiotherapy planning for cerebral arteriovenous malformations: Comparison of Tomotherapy and non-coplanar dynamic arcs

Purpose:

Three-dimensional Computed Rotational Angiography (CRA) provides high quality images of the complex anatomical structure of cerebral arteriovenous malformations (AVMs). The objective of this research is to combine CRA, as an alternative to bi-plane angiography for target definition, with innovative radiotherapy techniques for stereotactic radiation therapy. This preliminary treatment planning study investigates the utility of Helical Tomotherapy, as compared to multiple non-coplanar dynamic arcs using a conventional linear accelerator (linac).

Materials and Methods:

A Siemens Axiom scanner was used to acquire CRA images for this treatment planning study. Non-coplanar dynamic arc treatments were planned using Theraplan Plus. These plans were designed for delivery on a conventional linac (Varian 2100 EX) equipped with a multileaf collimator (5 mm leaf width at isocentre). The same images and regions of interest were used to generate plans for helical tomotherapy delivery (TomoTherapy Inc., Hi-Art II). Tomotherapy is a dedicated intensity modulated radiation therapy system that delivers a narrow fan-beam, modulated by binary multileaf collimators (6.25 mm leaf width at isocentre).

Results:

The CRA images have an isotropic voxel spacing of less than 0.38 mm, with a signal-difference-to-noise-ratio greater than 20:1. These high quality images facilitated the delineation of the complex target volume for treatment planning. Each of the treatment planning techniques offered specific advantages. Multiple non-coplanar arc plans generated a lower integral dose to the surrounding healthy tissue (a 12 Gy isodose volume of 40 vs. 100 cm^3 for presented sample patient). Tomotherapy inverse-planning provided a more homogeneous dose distribution over the target volume (homogeneity index of 1.006 vs. 1.087), as well as better avoidance of critical structures (maximum brain stem dose of 8.2 vs. 13.2 Gy).

Conclusion:

Tomotherapy presents an alternative to forward planning with non-coplanar arcs. Moreover, the megavoltage CT imaging capabilities of Tomotherapy could provide frameless, stereotactic localization for AVM radiotherapy.