
# A Cumulative-Dose Optimization Approach of Volumetric Modulated Arc Therapy for Volume-Staged Stereotactic Radiosurgery to Treat Large Cerebral Arteriovenous Malformation

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**Objectives:** Large-volume, arteriovenous malformation (AVM) has conventionally been treated using gamma knife surgery (GKS) due to its high conformity and low dose-spillage values. Here we describe a cumulative-dose, volumetric modulated arc therapy (VMAT) optimization technique for such treatments.

**Methods:** 10 cases with large AVM (>10cc) were planned on a linear accelerator equipped with high-definition multi-leaf collimators and an external image-guided radiotherapy verification system. The AVMs were contoured and divided into 2-3 sub-targets to be treated sequentially in a volume-staged approach at two-week intervals. The prescription dose ranged from 18 Gy to 20 Gy for each stage, depending on the sub-target number, volume, and location. The first stage was optimized to minimize the dose to the adjacent sub-target. For every subsequent stage, the dose distribution from the previous stage was used as a base dose in the optimization process. Cumulative plans were evaluated in terms of target coverage (V100%), conformity index (CI100%), gradient index (GI), homogeneity index (HI), and normal brain V12Gy(%).

**Results:** The VMAT plans resulted in an average planning target volume coverage of 96.7% ±1.2. The resulting CI100%, GI, HI, and V12Gy values were 1.19±0.2, 3.25±0.4, 1.27±0.1 and 2.52%±1.13, respectively.

**Conclusion(s):** The linac-based plan optimization described can deliver multi-staged conformal doses to treat large AVMs. The results indicate similar conformity, gradient, and normal brain V12Gy to well-established GKS treatments.