Purpose: Stereotactic radiosurgery (SRS) is a treatment of choice for Arteriovenous Malformations (AVMs) in anatomical locations associated with a risk of surgical complication. The aim of this study was: 1) to determine which AVM patients benefit from IMRT treatment over 3D-Conformal Treatment (3DCRT) based on PTV size, shape and normal tissue (NT) dose constraints imposed upon IMRT plans; 2) to assess optimized dose distributions against prospectively collected data for symptomatic radiation injury following SRS.

Methods: 31 patients previously treated for AVMs with 3DCRT were replanned with static gantry IMRT. PTV volumes, defined as AVM+1mm margin, ranged from <1cc to >25cc. IMRT plans were generated for BrainLab microMLC using the iPlan treatment planning system. First, PTV constraints were used. The conformity of the dose prescribed to the PTV margin was compared between the two plan types for all patients. Second, NT constraints were introduced into each IMRT plan at 7Gy and 12Gy. Finally, these dose constraints were manipulated to achieve maximum NT sparing while maintaining the desired dose coverage of the PTV.

Results: Examination of the conformity index for an increase of >0.03 showed a separation of patients into those who did and did not benefit from IMRT. Some patients who did not have a significant benefit from conformity alone showed a reduction in max PTV dose by as much as 9%. Moreover, with NT dose constraints, the volume of NT irradiated decreased by a considerable amount for a subset of patients by 10-21.8% and 9-16.9% for the 7Gy and 12Gy constraints, respectively.

Conclusions: This work indicates the potential for significant dose reduction to NT surrounding AVMs and provides rules to determine which patients are likely to benefit from IMRT. By utilizing IMRT plans, with and without dose constraints, NT sparing can be improved and risk of symptomatic injury reduced.