

AbstractID: 2765 Title: Geometric Parameter Analysis to Predetermine Optimal Radiosurgery Technique for the Treatment of Arteriovenous Malformation

Purpose: To develop a method of predicting the values of dose distribution parameters of different radiosurgery techniques for treatment of arteriovenous malformations (AVM) based on internal geometric parameters.

Method and Materials: For each of eighteen previously treated AVM patients, four treatment plans were created: circular collimator arcs, dynamic conformal arcs, fixed conformal fields and intensity modulated radiosurgery (IMRS). An algorithm was developed to characterize the target and critical structure shape complexity and the position of the critical structures with respect to the target. Multiple regression was employed to establish the correlation between the internal geometric parameters and the dose distributions for different treatment techniques. The results were used develop a statistical model which predicts the values of dose distribution parameters based on internal geometric parameters. The model was applied to predict the dosimetric outcomes of different radiosurgery techniques and select the optimal radiosurgery technique for a random AVM patient.

Results: Several internal geometric parameters showing statistically significant correlation ($p < 0.05$) with the treatment planning results for each technique were identified. The target volume and the average minimum distance between the target and the critical structures were the most effective predictors for normal tissue dose distribution. The structure overlap volume with the target and the mean distance between the target and the critical structure were the most effective predictors for critical structure dose distribution. When the model was applied to a random patient, the predicted treatment results were in close agreement with the original data.

Conclusion: A statistical model has been described which successfully predicts the values of dose distribution parameters of different radiosurgery techniques and may be used to determine the optimal technique on patient-to-patient basis.

Conflict of Interest (only if applicable):