Planning Stereotactic Radiosurgery for Cerebral Arteriovenous Malformation

AVM obliteration depends principally on the minimum dose to the Planning Target Volume (PTV), typically greater than 18Gy [1) 2) 3)].

Stereotactic radiosurgery planning for cerebral arteriovenous malformations (AVM) is complicated by the variability in the appearance of an arteriovenous malformation nidus across different imaging modalities. Simon et al. from the University of California San Diego, developed a deep learning approach to automatically segment cerebrovascular-anatomical maps from multiple high-resolution magnetic resonance imaging/angiography (MRI/MRA) sequences in AVM patients, with the goal of facilitating target delineation. Twenty-three AVM patients who were evaluated for radiosurgery and underwent multi-parametric MRI/MRA were included. A hybrid semi-automated and manual approach was used to label MRI/MRAs with arteries, veins, brain parenchyma, cerebral spinal fluid (CSF), and embolized vessels. Next, these labels were used to train a convolutional neural network to perform this task. Imaging from 17 patients (6362 image slices) was used for training and 6 patients (1224 slices) for validation. Performance was evaluated by Dice Similarity Coefficient (DSC). Classification performance was good for arteries, veins, brain parenchyma, and CSF, with DSCs of 0.86, 0.91, 0.98, and 0.91, respectively in the validation image set. Performance was lower for embolized vessels, with a DSC of 0.75. This demonstrates the proof of principle that accurate, high-resolution cerebrovascular-anatomical maps can be generated from multiparametric MRI/MRA. Clinical validation of their utility in radiosurgery planning is warranted [4)]

Flow rate seems to be associated in predicting outcome after GKSR conferring high-flow AVM a lower occlusion rate. Its role should be considered when planning radiosurgical treatment of AVM, and it could be added to other parameters used in GKRS outcome predicting scales [5)].

1)
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