AbstractID: 10812 Title: Investigating the benefits of stereotactic light ion radiation therapy for treating large intracranial AVMs

Purpose
The majority of complications occur in patients with large AVM volumes being treated with high doses. For large intracranial arteriovenous malformations, the special characteristics of high ionization density light ion beams offer several advantages over photon and proton beams for high dose stereotactic radiation therapy. These include a better depth dose-distribution in tissue, negligible lateral scattering, a sharper penumbra, a steep dose fall-off beyond the Bragg peak and a higher probability of vascular response.

Material and Methods
Peripheral doses and dose volume histograms (DVHs) of large AVMs were collected from different centers. Based on these data and using a maximum likelihood fitting, dose-response parameters were derived for the Binomial model. A comparison was performed for different radiation modalities taking also into account their radiobiological differences.

Results
Light ion Bragg peak dose delivery has the precision required for treating very large AVMs, as well as for delivering extremely sharp focused beams to irregular lesions. For stereotactic radiosurgery with light ions, a better angiographic obliteration rate was observed. Furthermore, a lower complication rate and lower white matter necrosis was simultaneously achieved, which composed a more favorable overall clinical outcome. In patients treated by helium ion beams, a sharper dose-response gradient was observed, which is probably related to a more homogenous radiosensitivity of the AVM nidus to ion beam radiation.

Conclusion
Based on this study of linear energy transfer of different therapeutic ion beams[19] (H, He, Li, C), Helium or Lithium ions may be most suitable for AVM's up to 10 cm^3 and for larger AVMs Lithium to carbon ions may be more appropriate. The unique physical characteristics of light ion beams are of considerable advantage for the treatment of AVMs located in front of or adjacent to sensitive and functionally important brain structures.