AbstractID: 10531 Title: An evaluation study of treatment planning of brain tumor using implanted neutron brachytherapy and compared with photon IMRT

Purpose: The objective of this study is to perform a plan evaluation using Californium-252 neutron brachytherapy for the treatment of malignant gliomas and compare the neutron brachytherapy planning with photon IMRT planning.
Materials/Methods: After a phase I trial of neutron brachytherapy (Cf-252 implant) for the treatment of malignant gliomas, there is renewed interest to evaluate the effectiveness of radiation therapy using neutron brachytherapy compared with photon IMRT. Here we performed a dosimetric comparison of two treatment plans based on the same patient using equivalent prescribed dose. Isodose lines and dose volume histogram of brain tumor and adjacent critical structures were used for plan evaluation. Dose of neutron brachytherapy was calculated using CT-converted Monte Carlo model and simulated by Monte Carlo code MCNPX. The tissue component of Monte Carlo model was adapted from the sectioned images of human cadavers of the Visible Human Project of NLM. Dose of IMRT plan was calculated using Pinnacle3 TPS. A relative biological effectiveness of 6 was used to determine the neutron equivalent dose (ncGy) for central nervous system (CNS) tissues. An equivalent dose of 6000 cGy was prescribed for both the IMRT plan and the neutron brachytherapy plan.
Results: The targets were well covered by the 95% isodose line in both IMRT and neutron brachytherapy plans. Comparing the IMRT and Cf-252 neutron brachytherapy, the mean dose was 6102 cGy and 6708 ncGy for target, 403 cGy and 177 ncGy for brainstem, 1022 cGy and 311 cGy for chiasm, 311 cGy and 275 ncGy for pituitary, and 705 cGy and 420 ncGy for brain, respectively.
Conclusions: Cf-252 Brachytherapy provided conformal dose distribution to the brain tumor and reduced the dose to the surrounding critical organs compared to IMRT. The implanted Cf-252 source provides high dose to brain tumor and reduces the radiation exposure of normal brain.