Abstract: Comparison of RapidArc-Based Radiosurgery with Cone-Based Cyberknife Treatment for Multiple Intracranial Tumors

Purpose: To investigate the feasibility of RapidArc technique on intracranial radiosurgery for multiple lesions

Methods: Six patients who were previously treated using cone-based technique, Cyberknife were included in this study. These patients have multiple lesions (6-9, mostly metastasis). In our current clinical practice, each lesion was planned and treated individually. The prescription was 15-21 Gy at 80% with single fraction. These cases were replanned with RapidArc on the platform of Varian Truebeam STx equipped with high resolution MLC leaves of 2.5mm at center. The maximum dose rate is 1400 MU/min at 6 MV for flattening filter free mode. Because of long span of multiple lesions, the targets were divided into two groups with two isocenters. Each plan with one isocenter contains 4 non-coplanar arcs, and dose optimization was performed with the two plans combined. Critical organs, such as eyes, brainstem and brain were constrained. The individual Cyberknife plans were summed to compare with the RapidArc plan. Scenarios of setup error were simulated during RapidArc treatment.

Results: RapidArc plans can achieve comparable target coverage and normal tissue avoidance to Cyberknife plans. The brain dose volume histogram (DVH) curves of the two techniques are similar in spite of different appearance of their 3D dose distributions. MU is much higher for summed Cyberknife plan. Because RapidArc can treat several lesions together, the complete treatment time for all lesions is significantly reduced. However RapidArc treatment is susceptible to setup error, which may cause increase in normal tissue dose and decrease in target dose coverage. The level of discrepancy depends on the magnitude of setup error, location and dose distribution of the target.

Conclusion: Multiple brain lesions treatment with RapidArc radiosurgery is clinically feasible with setup error fully accounted. It can provide dose performance comparable to cone-based Cyberknife treatment.