Purpose: The purpose of this planning study was to evaluate the dosimetric effect of dose escalation for intracranial stereotactic radiotherapy by volumetric modulated arc therapy (RapidArc) with simultaneous integrated boost (SIB-VMAT).

Methods: Dynamic conformal arc therapy (DCA), VMAT, and SIB-VMAT plans using Novalis Tx (Varian/BrainLAB) were performed for twenty target volumes in patients with intracranial metastases with median PTV of 16.0 cm$^3$ (range 2.4-35.2 cm$^3$). PTV was created with 2 mm expansion from GTV. All plans were generated with a prescribed dose of 35 Gy in 5 fractions to the PTV (D95 = 95%), and dose escalation up to 40 Gy (SIB-VMAT40) and 45 Gy (SIB-VMAT45) was performed only to the PTV-boost (PTV shrunk by 5 mm) for SIB-VMAT. Each plan was compared using conformity parameters.

Results: The average Paddick conformity index (CI) was 0.78, 0.90, 0.91, and 0.89 for DCA, VMAT, SIB-VMAT40, and SIB-VMAT45, respectively. The average healthy tissue overdosage factor (HTOF), suggested by SALT was 0.118, 0.006, 0.007, and 0.011 for DCA, VMAT, SIB-VMAT40, and SIB-VMAT45, respectively. The average V30, V20, and V10 of normal brain for VMAT and SIB-VMAT decreased by 3.0 cm$^3$ (range 0.1-8.2 cm$^3$), 3.0 cm$^3$ (range 0.1-8.7 cm$^3$), and 7.5 cm$^3$ (range 0.3-26.2 cm$^3$), respectively, compared to DCA depending on the target volume.

Conclusions: SIB-VMAT improved dose conformity to the PTV for intracranial stereotactic radiotherapy, and decreased high and low dose volume of normal brain compared to DCA. SIB-VMAT offers the ability of dose escalation due to high conformity of high dose regions inside the target volume.