Purpose: To investigate the treatment of multiple brain metastases using stereotactic radiosurgery with single-isocenter volumetric modulated arc therapy (VMAT) compared with conventional multi-isocenter dynamic conformal arc therapy (DCAT) and three-dimensional conformal radiation therapy (3D-CRT).

Methods: Seventeen patients with 2 to 5 brain metastatic lesions were studied. The number of patients with 5, 4, 3, and 2 lesions were 4, 5, 4, and 4, respectively. For patients treated with DCAT/3D-CRT plans, VMAT plans were retrospectively generated, and vice versa. Single-isocenter set up was employed in VMAT plans while the number of isocenters was proportional to the number of lesions in DCAT/3D-CRT plans. The DCAT/3D-CRT and VMAT plans were generated using iPlan® RT Dose Version 4.1.1 (BrainLAB, Germany) and Eclipse™ Version 8.6 (Varian, USA) treatment planning system, respectively. All plans were designed to be delivered on Novalis Tx™ system (Varian, USA and BrainLAB, Germany), in which the accelerator equipped with a high definition multileaf collimator (HDMLC).

Results: Conformity index for VMAT plans were equivalent to or better than that for DCAT/3D-CRT plans. While VMAT and DCAT/3D-CRT plans were similar in target coverage, quality of coverage for VMAT plans was better. However, the volume receiving 5Gy was 46% larger for VMAT plans. In addition, the distance from individual lesion to the VMAT isocenter has no impact on VMAT plans. Compared with DCAT/3D-CRT plans, the mean monitor units (MU) decreased by 42% and the estimated treatment time decreased by 49% for VMAT plans.

Conclusions: This work suggests that single-isocenter VMAT is promising for stereotactic radiosurgery in the treatment of multiple brain metastases. Single-isocenter VMAT is able to achieve comparable conformity, target coverage and quality of coverage with significantly superior delivery efficiency.