DOSIMETRIC EVALUATION OF AN AUTOMATED PLANNING SOFTWARE FOR STEREOTACTIC RADIOSURGERY OF MULTIPLE BRAIN METASTASES USING SINGLE-ISOCENTER DYNAMIC CONFORMAL ARCHS

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PURPOSE
Historically, whole brain radiation therapy (WBRT) has been the routinely used radiation treatment option for multiple brain metastases. Today, stereotactic radiosurgery (SRS) has replaced WBRT as the standard of care due to a shortened course of treatment, while still maintaining equivalent overall survival (OSR) and minimizing normal brain exposure.

There are various established SRS techniques available that differ in efficiency and plan quality. These include SRS with multiple-isocenter dynamic conformal arcs (MIDCA), single-isocenter volumetric modulated arc therapy (SI-VMAT) and Gamma-Knife treatment (GK).

The purpose of this work is to report and analyze our early clinical results, concerning dosimetric parameters, of SRS of multiple brain metastases with single-isocenter dynamic conformal arcs (SIDCA) and compare these with the established SRS methods.

MATERIALS AND METHODS
The automated planning software Multiple Metastases Element (MME, Fig. 1) from Brainlab AG, that utilizes the SIDCA technique to treat up to fifteen brain metastases, has been used clinically in our institution since early 2017.

For sixty patients, with a total number of 236 brain metastases and an average planning target volume (PTV) of 1.2cc, the physician-approved MME plans were analyzed by means of Paddick conformity index (CI), Paddick gradient index (GI), and brain volume receiving 12 and 10 Gy (\(V_{12}\) and \(V_{10}\)).

The treatment unit used for this work is a Varian TrueBeam STx linear accelerator equipped with a high-definition MLC and an X-ray image guidance system with six degrees of freedom robotic couch (ExacTrac-system).

RESULTS
Tab. 1: MME achieves comparable plan quality with respect to the analyzed dosimetric criteria as MIDCA and GK, while significantly shortening delivery time (similar to SI-VMAT). SI-VMAT attains similar or slightly worse dose fall-off (in terms of increased GI) and shows the highest peripheral dose spread of the discussed techniques. MME and GK benefit from short planning time in comparison with SI-VMAT and MIDCA. [1, 2].

CONCLUSIONS
MME is highly efficient for treatment planning of multiple brain metastases. The plan quality, concerning the analyzed dosimetric parameters, is comparable or better than other SRS techniques. In addition, automation in the MME planning process drastically shortens planning time and minimizes inter-operator variation, resulting in consistent, individualized plans.

Furthermore, delivery time is short due to the use of single-isocenter treatment, which improves patient comfort and clinical throughput.

Finally, the dosimetric results help to anticipate and evaluate future treatment plans, which further educate planning time and is an important tool for the physician to determine treatment strategies.

REFERENCES