

A Novel Radiosurgery Software for Treating Multiple Brain Metastases Simultaneously in a Single Fraction -- First Clinical Experience

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Abstract

Objectives: To evaluate a new, automated brain metastases planning software designed to treat up to ten brain metastases simultaneously.

Methods: Between August 2014 and November 2015 we treated 61 patients with multiple brain metastases using the novel Elements software by BrainLab (Munich, Germany). Patients had a minimum of 2 and a maximum of 10 metastases (median 5) ranging from 0.01 cc to 8.64 cc in volume. Dose prescription was 18-24 Gy depending on histology, size, and location of the metastasis. In this software dose is prescribed to the tumor margin. Plans are normalized to give between 95% and 99% of the dose prescription to 100% of the tumor volume. Plans are delivered with a maximum of 5 non-coplanar arcs using a single isocenter at the center of mass of all metastases. The number of arcs and their lengths are optimization parameters. The high degree of automation shortens the planning time to 15-20 minutes per patient. For comparison we planned 21 of the patients using RapidArc (Varian, Palo Alto CA) (RA). We used two coplanar arcs so as to keep planning times as short as possible, and comparable to the Elements planning times. We compared the Paddick conformity index (CI), volume of brain receiving over 12 Gy (V12) and mean brain dose (MBD) between Elements and RA. The Mann-Whitney Rank-Sum test was used to determine statistical significance of differences between systems.

Results: All plans were judged clinically acceptable. There were no statistically significant differences in V12 or MBD between the planning systems. CI was also similar between Elements and RA plans. RA plans took a minimum of twice as long to plan. Delivery times for Elements plans were approximately 30 minutes (including imaging between couch rotations), and 10 minutes for RA.

Conclusions: Due to the high level of automation, planning times for Elements were much shorter than for RA. While treatment times for Elements plans were on average threefold longer than RA plans, 30 minutes is a significant improvement over conventional radiosurgery techniques where each metastasis is treated individually and delivery times to 10 metastases are typically close to 300 minutes. BrainLab Elements is a novel software allowing fast, automated planning and efficient radiosurgical irradiation of multiple brain metastases with minimal dose to the healthy brain.

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Abstract

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