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TREATMENT OF MULTIPLE BRAIN METASTASES USING SINGLE ISOCENTRIC TECHNIQUE WITH FORWARD PLANNED DYNAMIC ARCS

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PURPOSE

Single isocenter image guided radiosurgery (IGRS) using forward planned dynamic arcs without intensity modulation is an attractive option for multiple brain metastases. We recently commissioned the BrainLab Elements system at our institution to treat up to 15 brain metastases.

We examined the safety and efficacy of patients treated with this new planning system.

MATERIALS AND METHODS

Forty patients underwent IGRS with BrainLab Elements at our institution from 05/2017 to 12/2017.

Treatment plans were made and optimized using either 5 or 6 couch positions with up to 12 dynamic conformal arcs. Treatment plans using 6X and 6X flattening filter free mode were compared for each patient and the better dosimetric plan was used for treatment. IGRS was delivered using a 6D robotic couch with stereoscopic imaging to position the patient. Corrections were made at each couch position using 0.5 mm and 0.5 degrees correction tolerances.

Dose was prescribed by treated lesion volume, as in figure 1.A total of 283 lesions were treated. Median age was 57 (24 to 87) years. A median number of 5 lesions (2 to 15) were treated per session, with a median total treated volume of 3.049 cm^3 (range 0.038 cm^3 to 105.809 cm^3). Median integral whole brain dose was 135.5 cGy and median hippocampal dose was 153 cGy.

Median treatment time was 21 minutes.

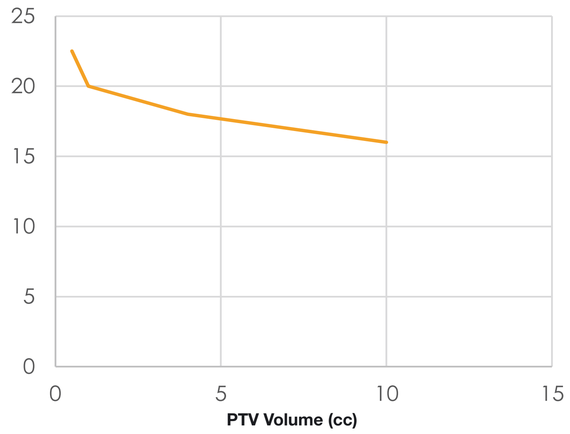
RESULTS

Follow up imaging at time of analysis was available for 65 % (30) of treatment plans. At a median follow up time of 2.2 months, 85 % (34) of patients showed control of disease in the treated lesions. Six patients (15 %) showed radiographic enlargement of treated lesions, of these 4 were asymptomatic. At time of analysis, 70 % (28) of patients were alive. Of the 12 deaths, 50 % (6) were due to neurological causes. Death was only significantly associated with the number of lesions treated ($p = 0.004$). No cases of radiation necrosis were reported. Three patients developed seizures more than 10 days after IGRS date. Three patients developed transient fatigue or confusion (grade 2-3). Two patients developed weakness (grade 2) that improved with steroids. On univariate analyses, toxicity was significantly associated with the total treated volume ($p = 0.010$) but not the number of treated lesions ($p = 0.370$). Toxicities were greater for patients with treatment volume $> 5\ cm^3$ ($p = 0.032$).

CONCLUSIONS

For patients with multiple brain metastases, utilizing IGRS with single isocentric technique using forward planned dynamic arcs reduced the planning and on-table treatment time. Lower monitor units allow for lower integral whole brain dose than would be expected with a similar volumetric arc radiotherapy (VMAT) plan. At analysis, there was an acceptable level of lesion control. Observed toxicities were transient, and possibly unrelated to the IGRS treatment in all cases. There were no instances of radiation necrosis to date.

Figure 1: Prescribed Dose (Gy) vs PTV Volume for Single Fraction SRS



Left: pre-treatment MRI. Right: post-treatment MRI.
Three lesions had responded to SRS, with the appearance of a new lesion (arrow) that was treated in a subsequent session.