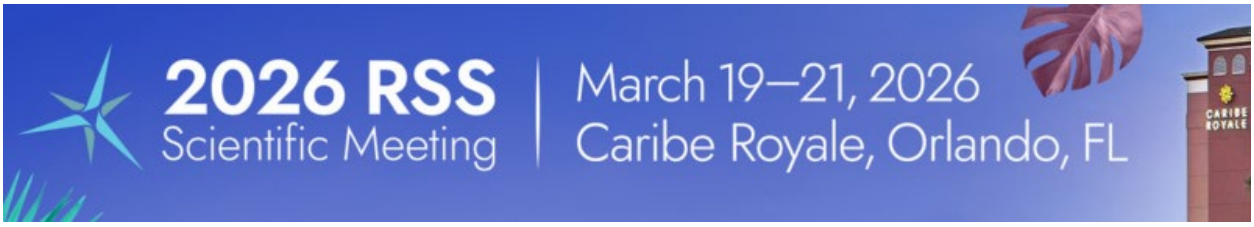


# Dosimetric Endpoints from a Randomized Trial of Differential Margins in Single Isocenter Multiple Target Radiosurgery in Patients with Brain Metastases

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**Objectives:** The treatment of multiple brain metastases in a single isocenter (SIMT) is highly efficient but carries an increased risk of rotational error causing increasing dosimetric error further from the isocenter. This risk is often cited as the primary rationale to add a PTV margin. UAB 2507 is a randomized phase II trial of 1-3 fraction radiosurgery using single isocenter VMAT and compares treatment with either 0 mm or 2 mm margin for patients with 1-20 brain metastases. The preliminary analysis of secondary dosimetric endpoints is presented here.

**Methods:** The first 23 patients have been enrolled and randomized with 0 mm and 2 mm plans created for each patient and approved prior to randomization. All plans were created with HyperArcTM and EclipseTM using the HD-120 multi-leaf collimator and 10MV FFF beam. The target hotspot was not constrained during plan optimization. Prescription doses for single fraction plans were 18-20 Gy and 8-9 Gy for 3 fractions covering at least 99% of each target. All prescriptions were the same for the margin and no margin plans for each tumor. Dosimetric measures were programmatically extracted using the Eclipse Scripting API. For V12 metrics the HyTEC equivalent of V19.6 was used for 3 fraction plans. V12 calculations included the target volume (GTV or PTV).

**Results:** Seventy targets were included in the 23 patients with a 0 mm and a 2 mm margin plan for each patient (46 plans total). The mean number of targets was 3 per patient (range 1-16). The 2 mm margin increased the mean target volume from 0.6 to 1.3 cc. A 2 mm PTV margin resulted in a higher V12 (or V19.6 for 3 fx) of 4.9cc vs 8.6cc ($p < 0.001$) and a higher mean brain dose of 4.1 vs 5.8% of prescription ($p < 0.001$). The mean V50 increased from a mean of 3.9 to 7.2 cc with a margin ( $< 0.001$). The use of a margin increased the dose received by the GTV (D99) by 24% and GTV mean dose by 14%.

**Conclusion(s):** Margin plans utilizing 2 mm vs no PTV margin increase the dose to the brain across low to high dose levels and result in an incidentally higher GTV dose. This dosimetry predicts higher rates of local control but worse toxicity with the 2 mm margin plans even if there is no rotational error. This randomized clinical trial will determine if uncomplicated tumor control and QOL are impacted by a 2 mm PTV margin in single isocenter multiple target radiosurgery.