

AbstractID: 11404 Title: Effects of Peripheral Dose Fall-off on Biologically Equivalent Dose to Normal Brain for Intracranial Stereotactic Radiosurgery and Radiotherapy

**Purpose:** The peripheral dose volume such as 10-Gy or 12-Gy volume has been reported to correlate with incidence of radionecrosis for stereotactic radiosurgery (SRS) or radiotherapy (SRT). In this study, we investigated whether variations in peripheral dose fall-off of individual treatments would significantly affect normal tissue sparing for SRS or SRT.

**Method and Materials:** A power relationship for measuring general dose fall-off near the target was developed for both isocentric and non-isocentric intracranial radiosurgery modalities. For the study, we sampled the ranges of variations in the peripheral dose distributions from patients treated with Gamma Knife Perfexion, Cyberknife, or linac-based delivery system. Equivalent uniform biological effective dose (EUBED) for the normal brain tissue was formulated to study the effect of dose-fall variations on treatments of different targets of varying  $\alpha/\beta$  values. Functional relationship of normal brain EUBED with increasing number of fractions was derived for treating either fast growing tumors with  $\alpha/\beta$  of 10-20) or abnormal tissues such as AVM with possible  $\alpha/\beta$  of 2-5.

**Results:** The average  $\gamma$ -index from the derived power formula was found to be  $-1.49 \pm 0.25$  with a range of -1.19 to -1.79. Based on such range, EUBED of the normal brain was calculated and found to decrease with increasing number of fractions for targets with  $\alpha/\beta$  of 10-20. This decrease was most pronounced for fractions fewer than 10. However, the EUBED was found to slightly increase with increasing number of fractions for targets with  $\alpha/\beta$  of 2-5.

**Conclusion:** In delivering SRS or SRT, normal tissue EUBED was found to favor hypofractionated treatments for fast growing tumors with  $\alpha/\beta$  of 10-20, but single fraction treatments for abnormal tissues with  $\alpha/\beta$  of 2-5. The result was found to be insensitive to variations in dose fall-off from individual cases regardless being treated with Gamma Knife, Cyberknife or Linac-based modality.