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Mini Beam Radiation Treatment - Preliminary Report of a Randomized Study of Treating Dog Brain Tumors

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Abstract

OBJECTIVES: The challenge in treating malignant brain neoplasms lies in eradicating tumor while minimizing treatment-related damage to normal adjacent brain. These tumors are currently treated with conventional radiation therapy techniques which control the tumor but are associated with considerable side effects. Synchrotron generated micro-beam radiation therapy (SMBRT) has shown promising results in preserving brain architecture while killing tumor cells, however physical characteristics of SMBRT limit its use. We have successfully prepared a new device which produces fine beams of radiation called mini-beams (MBRT) of 1000micron size using 6 MV photons. The objective of this study is to test if MBRT can emulate the SMBRT biological effects using spontaneous brain tumors in dogs.

METHODS: Pet dogs with de-novo brain tumors were accrued for treatment across the country. Dogs were randomized between standard Stereotactic (9 Gy x 3 fractions) radiation treatment (SRS) Vs single fraction MBRT (30Gy to Dmax). Dogs were followed for clinical assessment and MRI. Whenever dogs were euthanized, the radiation changes/tumor response were assessed by one veterinary pathologist through autopsy.

RESULTS: Between 2013 and 2017 we accrued 16 dogs (8 in each arm). There were definite treatment-related changes seen in both arms of treatment, however hemorrhagic changes to correlate to the cause of clinical progressive symptoms resulting in euthanasia was clearly documented in the one dog treated with SRS for whom we received the post mortem report. Similarly treatment-related toxicity in the form of seizure was also noted in SRS treated dogs. The SRS treated dogs images and where available post mortem report showed residual tumor in all of them except one who had a good response. Among, dogs treated with MBRT, only one showed treatment-related changes on post mortem study. In contrast the mini beam treated dogs have almost complete response as noted on the images. For 2 dogs where post mortem report is available there was hardly any residual tumor remaining following the treatment.

CONCLUSIONS: Preliminary results show MBRT resulted in impressive tumor control and fewer long term pathologically correlated toxicities.

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