AbstractID: 14596 Title: Radiation Necrosis and its Characterization Using Advanced MRI

Patients with malignant brain tumors are typically treated with a combination of surgery, chemotherapy, and radiotherapy. As no combination of treatments has yet proven curative, the majority of patients eventually experience a recurrence of their tumor. Significant subsets of patients develop MR imaging findings following these therapies that can be difficult to interpret. Radiation necrosis is the most common and most significant of these treatment-associated changes as its anatomic imaging characteristics are remarkably similar to those of recurrent tumor.

The development of non-invasive imaging markers of diagnostic specificity is an important goal for clinicians caring for patients with brain tumors. Recent advances in imaging, specifically exploiting PET imaging tracers that measure cell proliferation and advanced MR imaging techniques, including perfusion and diffusion-weighted imaging, as well as Magnetic Resonance Spectroscopy afford unique opportunities to monitor tumor biology *in vivo*. Despite these advances, no single imaging modality with sufficient diagnostic sensitivity and specificity to identify radiation necrosis versus tumor recurrence has been identified.

Until recently, few small-animal models of radiation necrosis in brain tissue have been reported. Previous models were developed primarily in rats and employed only a small number of radiation fractions. Recent models have evolved to describe the development of a radiation necrosis model in mice that employ focal, multi-fraction radiation to more accurately reflect the clinical situation encountered by patients treated for malignant brain tumors. The recent development of a conformal pre-clinical irradiation system has demonstrated that high dose, focal, fractionated brain irradiation in small animals is feasible and can generate relevant pre-clinical models of radiation necrosis. In addition, modification of the clinical gamma-knife irradiation system, used in humans for stereotactic radiosurgery, has also been used to develop a murine model for radiation necrosis.

The lecture will discuss the clinical importance of diagnosing radiation necrosis and distinguishing it from growing tumor, and will also address ongoing basic science research considering these questions of diagnostic specificity in two small animal models of radiation necrosis. In addition, the lecture will address translational clinical work considering advanced imaging applications for this clinical problem in human patients with malignant brain tumors.

Educational Objectives:

1. Understand the clinical problem of radiation necrosis in patients with neuro-oncology.
2. Understand the relevance of advanced MR imaging methods in diagnosing radiation necrosis in patients with malignant brain tumors.
3. Understand the murine models for radiation necrosis and their suitability for basic and translational research focusing on this clinical problem.