

AbstractID: 10879 Title: Lung Injury from Stereotactic Radiosurgery and Efficacy of Amifostine: a Small Animal Study on Helical TomoTherapy

**Purpose:** To evaluate a Helical TomoTherapy-based rodent radiosurgery platform that reproduces human image guided radiosurgery treatment and to study radiobiologic effects of stereotactic radiosurgery on lung tissues, with or without Amifostine, a radioprotector.

**Methods and Materials:** Hypofractionated radiosurgery with varying radiation dose from 21 Gy to 60 Gy was delivered to the right lung of 16 anesthetized New Zealand rabbits using Helical TomoTherapy in three fractions with MVCT image guidance. Contrast enhanced MR perfusion, hyperpolarized helium-3 MR ventilation, and CT were obtained before radiation and monthly for 4 months after radiation. The radiological findings were verified by subsequent histopathology studies. Amifostine was given to a subgroup of rabbits received 33 Gy before each fraction of radiation.

**Results:** Precise dose delivery to a 1.6 cc of the lower right lung was achieved without additional immobilization. No deficits were detected at baseline with respect to perfusion and ventilation. Lung perfusion deficits in the irradiated lung regions began at 2 months post radiation and worsen with time for rabbits received 27 Gy and higher. No ventilation defects were observed after radiation. Decrease of lung CT density in irradiated regions was observed after radiation, but the changes were less significant than those in MR perfusion. Compared with rabbits received 33 Gy radiation only, rabbits received Amifostine treatments were significantly better protected from lung injury indicated by a 31% higher perfusion level.

**Conclusions:** We demonstrated that highly conformal radiation can be reproducibly delivered to a small volume of rodent lung on a widely available clinical unit. The radiation-induced lung injury can be detected as early as 2 months after radiation with perfusion MRI. The primary pattern of injury agrees with previously reported endothelial damage to radiosurgical radiation doses. The injury can be effectively reduced by Amifostine, a free radical scavenger.