# Predicting late lung complications following lung tumor radiosurgery with cyber knife using biologically effective doses and normalized dose-surface histograms

**Purpose:**
To evaluate prospectively the acute and late morbidities (toxicity) of hypofractionated stereotactic radiosurgery with cyberknife with stage I/II lung cancer: predictors for radiation pneumonitis and fibrosis.
End Point is to determine the radiation induced lung toxicity (pneumonitis and fibrosis) and tumor response using biological-effective dose histogram.

**Methods and Materials:**
The model evaluates the biological consequences of inhomogenities in the physical dose to the surface of the lung for a given fractionation scheme. A method of normalizing the surface area of the lung is employed so that the predicted NTCP is independent of the differing cross-sectional size of the lung. The surface area of the lung is normalized to ensure that all sections of the lung contribute equally to the NTCP.

**Results**
The model has been used to assess late lung complications and the milder RTOG grade 2 and 3 reactions. This model was found to predict late lung toxicity levels of $1.5 \pm 0.6$ % for an accelerated treatment of 60 Gy in 3 fractions commonly employed at our center. The model predicts that the average NTCP for late effects for four lung patients becomes greater than 5 % with a fractionation scheme of 60 Gy in 3 fractions.

**Conclusion:**
The relative seriality model will be extended to incorporate dose-surface histograms and BED. The model assesses the biological effects of inhomogeneities in the dose delivered to the lung. Dose-surface histograms provide a convenient means of studying the differences in the biologically effective dose to the lung.