AbstractID: 3003 Title: Biological analysis for hypofractionated lung cancer radiotherapy

Purpose: Hypofractionationated SRT for medically inoperable early stage primary lung cancers has gained great interest in radiotherapy society. This work analyzes the tumor control probabilities (TCP) and lung complication probability (LCP) for fractionated radiotherapy and SRT of lung cancer.

Method and Materials: Calculations were performed for hypofractionated scheme using 10 Gy/fraction for 4 fractions and for standard fractionation using 2 Gy/fraction in 30 fractions. A linear-quadratic (LQ) model was used in the TCP analysis. A quantal model was used for the LCP calculation. The dose inhomogeneity was assumed with a Gaussian distribution with a deviation of σ_{dose}. The variation of radio-sensitivity for a patient population was added assuming Gaussian distributions for LQ parameters α and β with σ_{α} and σ_{β}, respectively. The TCP and LCP were compared for the two fractionation schemes.

Results: As σ_{α}, σ_{β} and σ_{dose} increase, more doses are needed to keep the same 90% TCP. Because the equivalent dose EQD2 for hypofractionated SRT is much higher than the standard prescription dose of 60Gy, its corresponding TCP is always higher compared to standard radiotherapy, and in most cases, it is always greater than 90%. However, because of the higher EQD2, the LCP for hypofractionated lung SRT is also much higher. For the 4 cases studied here, the average LCP for SRT is increased by 100% compared to standard radiotherapy. Further studies are conducted using DVHs from standard radiotherapy with a 1cm MLC and DVHs from SRT with a 0.4cm mMLC to investigate the improvement in LCP and TCP.

Conclusion: Hypofractionated SRT provides better tumor control for lung cancer. However, it may lead to severe lung complications unless advanced target localization, treatment planning and beam delivery techniques are used to reduce the lung volume receiving significant radiation dose.