AbstractID: 4972 Title: Using Quality of Life Information to Rationally Incorporate

Normal Tissue Effects into Treatment Plan Evaluation and Scoring

Purpose: Modern radiotherapy treatment planning systems provide an increasing number of competing plans. The decision to select a particular plan for treatment is generally made by a radiation oncologist based on training and clinical experience. The criteria applied are often poorly-defined, qualitative, and largely based on tradition and familiarity. A “realistic” approach utilizing decision analysis tools to evaluate/rank treatment plans based on quality adjusted life years (QALY) expectancy was developed.

Method and Materials: The decision analysis methods were applied to the concept of uncomplicated tumor control probability (UTCP). The expected outcome for an anticipated course of radiation was described as a series of probabilities: alive, free of disease without complication; alive with disease; alive with complication, etc. For each of these states of health, a utility can be assigned based on published work or empirical estimates. The total QALY's for a particular treatment plan represent the product of duration-weighted states of health. The formalism for UTCP was generalized to incorporate the total QALY ($UTCP_{QALY}$) for a particular treatment.

Results: This approach was applied to compare the clinical treatment plans of 200 patients who received high-dose external-beam for unresectable non-small cell lung cancer. Thirty nine out of the 200 patients developed radiation-induced pneumonitis with the grade distribution of 8.7%, 69.6%, and 21.7% for grades 1, 2, and 3, respectively. The plan ranking based on the traditional UTCP and pneumonitis QALY-weighted UTCP ($UTCP_{QALY}$) values were different. The UTCP varied significantly, reaching values of 0.5. Using $UTCP_{QALY}$ scoring, the mild complications importance is downplayed compared to the severe complications, with all $UTCP_{QALY}$ values above 0.85. The QALY-weighted UTCP’s appear to provide better clinical realistic differentiator between plans.

Conclusion: The construct presented represents a potential improvement in the current methods used to compare plans. Formulas presented can be readily incorporated into planning systems.