AbstractID: 13402 Title: Analysis of biological effective doses for 4D-SBRT using a model based simulation

Purpose:
Four-dimensional radiotherapy(4DRT) using respiratory gating system and other techniques to control patient breathing are useful for stereotactic body radiotherapy. However, treatment time in 4DRT also will be elongated by the degree of synchronization. In such a situation, the synchronization, internal margin and the target localization might have effects on the target as to tumor control probability. The purpose of this study was to investigate the relationship of biological effective dose(BED) between respiratory motion patterns, gate parameters and target positioning accuracies using a model based simulation.

Method and Materials:
A virtual square of dimension 512X512 matrices of interest FOVs were used in this simulation. The pseudo tumor was set on the virtual matrices. The motion of the sphere was modeled by a simple cosine curve, and a sinusoidal breathing curve simulated by mathematical equation. A minimal time interval and various motion parameters such as amplitudes, target volumes, and gate parameters were set in this simulation. Then the probability densities of the target in each parameters ware calculated. Using calculated data sets, BEDs for the target were determined by changing two modeled curves of motion, margins, and gate parameters, respectively.

Results:
Various patterns such as tumor size, motion function, amplitude, gate parameters and size of margins of BEDs for the target were calculated. The result showed that it depended upon target volume and gate parameter. The approximate equation of optimal internal margins for target volume of 99% BED coverage was also determined.

Conclusion:
In this study, we have calculated BED based optimal internal margins of the moving target. This study also showed a method of 4DRT taking into account BED. Further research is in progress to evaluate the effect of elongation of patient irradiation and shape of the target by gate parameter settings.

Conflict of Interest (only if applicable):