Cureus

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Abstract

Dosimetric Evaluation of Lung Optimized Treatment in Robotic Radiosurgery

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Categories: Medical Physics, Radiation Oncology
Keywords: srs, sbrt, stereotactic body radiotherapy, lung

How to cite this abstract
Kucukmorkoc E, Caglar H B, Kucuk N, et al. (November 02, 2017) Dosimetric Evaluation of Lung Optimized Treatment in Robotic Radiosurgery. Cureus 9(11): a283

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Objectives: Lung optimized treatment (LOT) allows tracking lung tumor without using fiducial markers even if it is not visible one of the live images. The aim of this study is to verify the dosimetric accuracy of the LOT method in tumors that are not seen in X-ray images during treatment using robotic radiosurgery system.

Methods: A special phantom was designed with animal spine, 25 mm water-filled spherical hole and ionization chamber was located at the center. Phantom was placed on a moving platform and scanned three different phases. Exhale and inhale CT dataset were used to cover all target movement and mid-ventilation was used for planning. 0- and 2-view treatment plans were generated by using MLC and fix collimator system (12.5 and 25 mm). Dose fraction scheme was 54 Gy at 3 times. Both 0- and 2-view plans were irradiated with CyberKnife M6 system. For checking the reproducibility between fractions at the center of the target volume, each fraction was irradiated. Measured and calculated point doses were compared to understand if LOT was capable of applying both 0-view and 2-view treatment plans in the machine.

Results: The dose reproducibility between fractions was better in conformal shaped MLC plans compared to 25 mm and 12.5 mm fixed collimator for 0-view plans (0.5%, 6%, and 3% respectively). Good agreement was observed in MLC and 25 mm fix collimator (0.75 and 0.08%) but 2% difference was seen in 12.5 mm fix collimator in 2-view plans. Also calculated and measured dose in all fractions was compared in this study. MLC and 25 mm fix collimator measured and calculated doses are within 2% but 12.5 fix collimator had large differences (>20%) both in 0-view and 2-view treatment plans.

Conclusions: LOT algorithm could be used both in 0-view and 2-view with using nearly same size collimator with the tumor or conformal shaped MLC plans. If large tumors are treated with small size collimators, dosimetric inaccuracy could occur in both 0-view and 2-view.

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Published 11/02/2017