

AB015. OA02.06: A dosimetric comparison of VMAT and IMPT with and without aperture for thymic cancer

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Background: Due to the location of thymic cancer, proton therapy will save more normal organ dose in distal direction than conventional photon radiotherapy. But the lateral penumbra of intensity modulated proton therapy (IMPT) is usually larger than photon. One option is to use aperture for IMPT to reduce lateral penumbra. We compared volumetric modulated arc therapy (VMAT) and IMPT with aperture (IMPTa) and without aperture (IMPT) to evaluate the effect of normal organ saving for thymic cancer.

Methods: We evaluated treatment plans for 7 patients who received IMPT from May 2016 till October 2017. They are treated with curative aim with 52.8 Cobalt Gy equivalent (CGE) for 5 patients, 60 CGE and 66 CGE for each one patient. IMPT treatment plans were optimized using one or two fields, analogous VMAT plans were optimized by using 2 or 3 partial arcs. The treatment doses were prescribed to the volume of CTV with robust optimization (including both setup and range uncertainties) for IMPT and PTV for VMAT. The aperture margin was set to the prescription

isodose volume to guarantee the target robustness. Dosimetric indices were maximum dose, average dose for normal organs and their statistical analysis were done with SPSS 21 (IBM), Wilcoxon signed-rank test with Bonferroni correction. Treatment plans were done by Raystation v6.2 (Raysearch, Sweden).

Results: The average normal organ doses of 7 patients were significantly lower for IMPT than VMAT: 4.3 CGE *vs.* 6.7 CGE for right lung, 6.8 CGE *vs.* 11.1 CGE for left lung. And it was same for esophagus, 5.4 CGE *vs.* 9.3 CGE, spinal cord, 0.6 CGE *vs.* 3.7 CGE, left ventricle (LV) 0.1 CGE *vs.* 1.1 CGE, left anterior descending artery (LAD), 10.3 CGE *vs.* 17.9 CGE and superior vena cava (SVC) 24.8 CGE *vs.* 29.7 CGE. The maximum doses were reduced by using IMPT for esophagus 23.8 CGE *vs.* 35.8 CGE and spinal cord, 3.7 CGE *vs.* 13.3 CGE. There was small difference between IMPTa and IMPT for average dose for SVC 22.5 CGE *vs.* 24.7 CGE. And the maximum dose difference between IMPTa and IMPT were 46.4 CGE *vs.* 51.6 CGE for SVC, and 0.7 CGE *vs.* 8.0 CGE for LV.

Conclusions: The result showed normal organ doses for lung, spinal cord and heart were significantly reduced by using IMPT. And penumbra reduction by using aperture gave more organs saving for organs at risk of small volume. These would reduce the chance of secondary malignancy for organs at risk. And it is expected the occurrence of radiation-induced chronic heart disease would be reduced.

Keywords: Thymic cancer; volumetric modulated arc therapy (VMAT); intensity modulated proton therapy (IMPT) with aperture

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