AbstractID: 7101 Title: Study of total positioning accuracy of a newly developed image-guided radiotherapy system

Purpose:
The aim of this study was to evaluate system accuracy of our newly developed image-guided radiotherapy (IGRT) system.

Method and Materials:
The system has the following structural characteristics; (1) C-band compact linear accelerator (LINAC), (2) O-ring shaped gantry, (3) Gimbals mechanism at X-ray head, and (4) Imaging subsystem. The whole X-ray head with the LINAC and a MLC is equipped on gimbals mechanism to correct beam direction to isocenter. The imaging subsystem mounted on the O-ring gantry consists of two sets of a kV X-ray tube with an image detector, and can obtain either X-ray images or cone-beam CT (CBCT) images. By using Electronic Portal Imaging Device, the IGRT system also provides an automatic daily QA tool for total positioning accuracy, which means beam accuracy towards isocenter combined with image-guiding accuracy. The daily QA requires only 3 minutes.
Firstly in this study, to evaluate the image-guiding accuracy, a spherical metal ball with a diameter of 10 mm was set at given positions within 20 mm from isocenter. X-ray images or CBCT images were obtained to measure the ball position, and the difference between true and measured position was calculated. Secondly, Mechanical accuracy of beam direction to isocenter was measured in various gantry angles with CCD camera attached to MLC frame. Finally, the combined accuracy was verified by using the daily QA tool.

Results:
The difference between true and measured position was 0.34 mm in SD and 0.9 mm at the maximum for X-ray image, then 0.17mm in SD and 0.4 mm at the maximum for CBCT, respectively. Mechanical beam accuracy was within 0.1mm. The combined accuracy was better than 0.5 mm.

Conclusion:
The IGRT system has suitable accuracy for image-guided stereotactic irradiation.

Conflict of Interest (only if applicable):
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