

ASSESSMENT OF SETUP ERROR AFFECTING DOSE COVERAGE OF TARGET VOLUME BY USING IMAGE-GUIDED RADIATION THERAPY TECHNOLOGY

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Introduction : By using image-guided correction, we analyzed the dose coverage of planning target volume (PTV) and surrounding normal tissues impacted by radiation dose retrospectively. This was done on head and neck (H&N) cancer patients who were not guided by imaging based on the effective treatment results of intensity modulated radiation therapy (IMRT).

Material and Methods : 20 patients underwent image-guided radiotherapy (IGRT) resulted in a total of 386 paired images which were analyzed by software to acquire the correction shifts in three axis, followed by recalculation of a treatment plan system. The effect of PTV and normal tissue irradiation volume were evaluated by plan summation.

Results : The average correction shift of anterior-posterior (AP), medial-lateral (RL) and cranio-caudal (CC) directions were -0.4 ± 0.9 mm, -0.4 ± 1.2 mm and -0.1 ± 0.7 mm, respectively. The systematic and random errors in AP direction were 0.9 mm and 0.9 mm, in RL direction were 0.7 mm and 0.9 mm, in SI direction were 1.2 mm and 1.1 mm. The average vector shift was 2.1 ± 0.3 mm with 88% probability of being less than 3 mm.

In brain and H&N tumor groups, the PTV missing probability of V90 (the volume covered by 90% isodose curve), V95 (the volume covered by 95% isodose curve) and V107 (the volume covered by 107% isodose curve) were 0.15% and 0.17%, 0.37% and 0.39%, 0.03% and 0.31%, respectively. On the other hand, in brain and H&N tumor groups, the probabilities of normal tissue being irradiated were as follows: $0.25 \pm 1.36\%$ of left eye, $1.18 \pm 0.81\%$ of brain stem, $-0.22 \pm 0.63\%$ of spinal cord, left $0.15 \pm 0.77\%$ of parotid gland, $-0.09 \pm 1.16\%$ of right eye and $-0.21 \pm 0.8\%$ of right parotid gland.

Conclusion: The dose coverage of PTV and normal tissue risk can be kept within the acceptable range by adding the safety margin recommended by Marcel van Herk ($2.5\sigma \pm 0.7\sigma$) mm along with the control of the setup error of less than 3 mm and the space vector shift of less than 5.2 mm.

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Key words: IGRT, setup error, PTV, OAR