Comparison of dosimetric variation between prostate IMRT and VMAT due to patient's weight loss: Patient and phantom study

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Abstract

Aim

This study compared the dosimetric impact between prostate IMRT and VMAT due to patient's weight loss.

Background

Dosimetric variation due to change of patient's body contour is difficult to predict in prostate IMRT and VMAT, since a large number of small and irregular segmental fields is used in the delivery.

Materials and methods

Five patients with prostate volumes ranging from 32.0 to 86.5 cm³ and a heterogeneous pelvis phantom were used for prostate IMRT and VMAT plans using the same set of dose–volume constraints. Doses in IMRT and VMAT plans were recalculated with the patient's and phantom's body contour reduced by 0.5–2 cm to mimic size reduction. Dose coverage/criteria of the PTV and CTV and critical organs (rectum, bladder and femoral heads) were compared between IMRT and VMAT.

Results

In IMRT plans, increases of the D99% for the PTV and CTV were equal to 4.0 ± 0.1% per cm of reduced depth, which were higher than those in VMAT plans (2.7 ± 0.24% per cm). Moreover, increases of the D30% of the rectum and bladder per reduced depth in IMRT plans (4.0 ± 0.2% per cm and 3.5 ± 0.5% per cm) were higher than those of VMAT (2.2 ± 0.2% per cm and 2.0 ± 0.6% per cm). This was also true for the increase of the D5% for the right femoral head in a patient or phantom with size reduction due to weight loss.

Conclusions

VMAT would be preferred to IMRT in prostate radiotherapy, when a patient has potential to suffer from weight loss during the treatment.

Keywords

Prostate IMRT; Prostate VMAT; Patient's weight loss; Treatment planning evaluation and dose–volume points