Dosimetric effect on variation of patient size in prostate volumetric modulated arc therapy

Innovation/Impact: This is the first time the dosimetric variation on the patient size reduction due to weight loss in prostate VMAT is investigated systematically.

Methods: Three prostate patients (small, medium and large prostate) were selected for prostate VMAT plans (6 MV). For each patient, the external body contour was contracted with reduced depths 0.5, 1, 1.5 and 2 cm all round the anterior and both lateral directions (Fig. 1). The dose distribution was then recalculated to determine the DVHs, Dose-volume points, maximum, minimum, and mean doses of the PTV, CTV and critical organs.

Results: We found that dose-volume points of target and critical organs increased with the patient size reduction. For the three patients with reduced depth ranged 0.5 – 2 cm:

- D99% of the PTV and CTV increased 2.65 ± 0.03% and 2.75 ± 0.15% per cm.
- D30% of the rectal wall and bladder increased 2.29 ± 0.12% and 2.31 ± 0.83% per cm.
- D5% of femoral head increased 3.30 ± 0.11% per cm.

Maximum, minimum and mean doses of the PTV, CTV, rectal wall, bladder and femoral head were found to increase by more than 5% when the reduced depth was equal to 2 cm.

Conclusions: The dosimetric data presented in this study are important for radiation oncology staff to justify whether a CT rescan is necessary when the patient’s weight loss occurs during treatment. Considering the minimum, maximum and mean doses of the PTV, CTV, rectum, bladder and femoral heads, all doses increased more than 5% when the reduced depth reached 2 cm, and variations of doses were linear to the increase of reduced depth.

Fig. 1: CT image of the contracted body contour (reduced depth = 2 cm).

Fig. 2: Change of D99% (PTV) vs. reduced depth.

Fig. 3: Change of D30% (rectal wall) vs. reduced depth.

Fig. 4: Change of D5% (right femoral head) vs. reduced depth.