INTRODUCTION AND OBJECTIVES

Topic: Treatment planning: applications  
Keywords: Dynamic WaveArc, noncoplanar beam, VMAT

Although hip fracture is a rare complication in radiation therapy for prostate cancer (PCa), it is a major cause of morbidity and mortality in elderly patients [1]. Therefore, the femoral heads are the major organs at risk (OARs) in treatment planning of PCa and reduction of doses to the femoral heads could be important.

Vero4DRT (Mitsubishi Heavy Industries Ltd. and BrainLAB AG) has an X-ray head on an O-ring gantry (Figure 1). This allows combining simultaneous rotation of the gantry and O-ring, resulting in sequential noncoplanar intensity-modulated beam delivery in a short treatment time, without a couch rotation. This new irradiation technique was termed volumetric-modulated Dynamic WaveArc (DWA). Figure 2 shows the trajectory of DWA beam. Since the bilateral femoral heads were located on the same level as the planning target volume (PTV), DWA would reduce the doses to the bilateral femoral heads. We performed a planning study using coplanar volumetric-modulated arc therapy (coVMAT) and DWA to compare the dose distribution of PTV and OARs, beam-on-time, and monitor units (MU).

RESULTS

The mean dose and D1cc of the bilateral femoral heads in DWA plans were lower than in coVMAT plans (9.1 vs 11.8 Gy (p < 0.001) and 18.5 vs 21.8 Gy (p < 0.001), respectively).

The mean V70 of rectal wall were significantly smaller in DWA plans (8.04 vs 9.22% (p < 0.001)). The CI and HI were similar in both plans. The mean beam-on time and MU were larger in DWA plans than in coVMAT plans (73.5 vs 70.6 seconds (p = 0.045), and 454 vs 427 MU (p = 0.041), respectively).

CONCLUSIONS

DWA significantly reduced the mean doses and D1cc of the bilateral femoral heads in compensation for slight increases in the beam-on time, and MU. DWA also significantly reduced the V70 of rectal wall.

DWA seems to be a promising irradiation technique for prostate cancer.

REFERENCES

[2]: van’t Riet A, Mak AC, Moerland M a., et al. (1997) A conformation number to quantify the degree of conformality in brachytherapy and external beam irradiation: application to the prostate. Int J Radiat Oncol Biol Phys 37:731-736