

Comparison of two stereotactic body radiotherapy techniques for the treatment of prostate cancer

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Purpose

One of the primary treatment modalities for patients with localized prostate cancer is external radiotherapy. In Stereotactic Radiosurgery, the extremely high radiation dose is delivered to the target in a single or few fractions while minimizing the dose to surrounding critical organs. Many trials emphasize that SBRT provides high local control with reduced toxicity and shorter treatment times in low or intermediate risk prostate cancer patients. In this study, it has been compared the Planning Target Volume (PTV) and critical organs dose in Stereotactic Body Radiotherapy (SBRT) plans created by CyberKnife (CK) and volumetric arc radiotherapy (VMAT) techniques for patients with prostate cancer.

Methods

The computed tomography images of 8 patients with low or intermediate risk prostate cancer were acquired in 1 mm thickness and transferred to the MultiPlan v4.5.3 treatment planning system (TPS). The PTV and critical structures were contoured. The Clinical Target Volume (CTV) was generated by encompassing the prostate plus the 1 cm proximal part of seminal vesicles. To create the PTV, a margin of 3 mm was added in the posterior direction and 5 mm in the other directions to the CTV. The treatment plans were created with CK technique. To create the SBRT plans with the VMAT technique, the volumes were transferred to the Aria v15.1 system. The double arc VMAT plans were prepared. The prescribed dose for PTV was 33.50 Gy/5fr in both techniques. Conformity Index (CI), Homogeneity Index (HI) of PTV, critical organs doses, the integral dose (ID) to the patient body and monitor unit (MU) values were assessed using the Wilcoxon test.

Results

For plans created with CK and VMAT technique, CI was 1.11 ± 0.06 and 1.04 ± 0.01 , HI was 1.20 ± 0.04 and 1.08 ± 0.01 , respectively; there was a statistically significant difference between them. The differences between all critical organ doses except D1cc of the rectum were significant statistically in favor of VMAT. The mean of the difference of the mean right testicular dose was 137.1 cGy. It was 113.8 cGy for left testicular. MU value and the ID were found significantly to be higher in the CK technique.

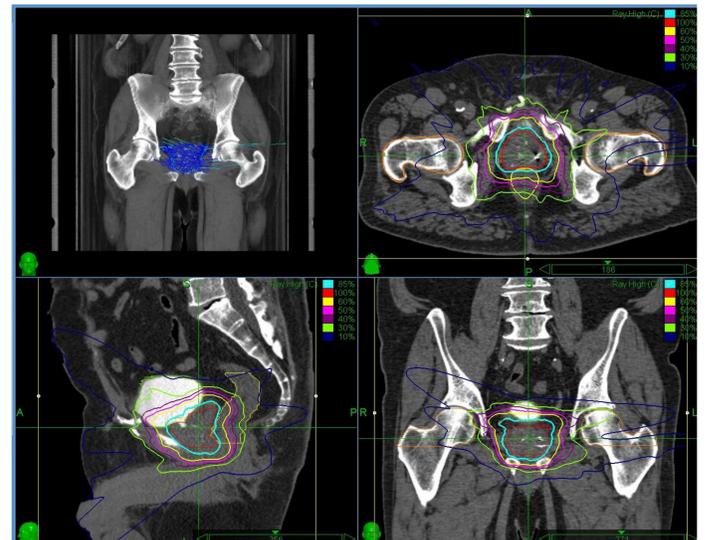
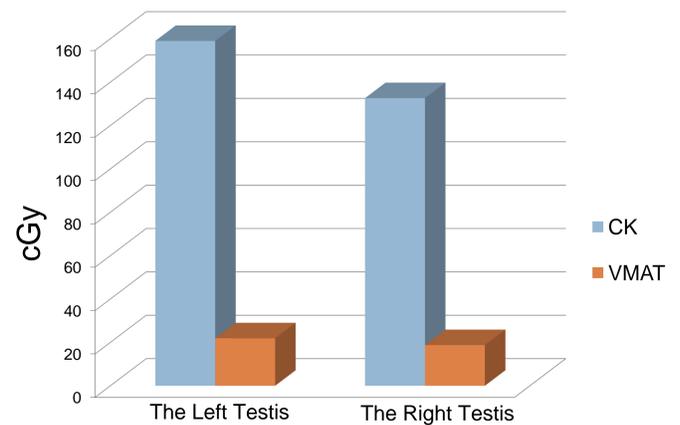


Figure 1. Isodose distribution of CK plan



Figure 2. Isodose distribution of VMAT plan

Conclusions

The VMAT technique compared with the CK technique provides better sparing of the critical structures, and the irradiation time is shorter as the MU value is less. The less irradiation time is to be advantageous in minimizing uncertainties due to patient movement. In conclusion, the VMAT technique may be preferred, especially in young patients.

