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Thema: Prostata

Titel: Volumetric Modulated Arc Therapy (VMAT) Treatment Planning for Prostate - A Comparison of Flatness Filter Free (FFF) and Flat Beam Plans

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Text: **Fragestellung:** Linear accelerators (Linacs) with Flatness Filter Free (FFF) mode obtain a much higher dose rate by omitting the flatness filter. The resulting inhomogeneous dose distribution is compensated by fluence modulating techniques like IMRT or VMAT. This planning study compares VMAT plans for patients with prostate carcinoma. Optimizations were performed using both modes: flattened beam (FB) and FFF. The aim of this study is to evaluate the plan quality and the number of monitor units (MU).

Methodik: Data sets of 10 patients with localized prostate cancer and reliable dose volume objectives were used for this retrospective planning study. A simultaneous integrated boost radiation therapy aims at a minimum dose of 71.0Gy and maximum of 74.2Gy in the CTV and a minimum dose of 59.4Gy in the PTV in 33 fractions. The posterior rectum wall is limited to 50.0Gy. The median values of rectum and urinary bladder are set to 50.0Gy. Additionally the maximum dose to the rectum is set to 74.2Gy. The VMAT parameters in the treatment planning system (TPS) Oncentra® External Beam v4.5 are set to: Single Arc rotation (182°-178°), collimator 45°, maximum delivery time 110s, gantry spacing 4°, and collapsed cone algorithm. The linac Synergy Agility offers a dose rate of 550MU/min (FB) and 1700MU/min (FFF). The leaves have a width of 5mm projected to the isocenter.

The following parameters are evaluated: average dose D_{AV} and homogeneity $H = (D5-D95)/D_{AV}$ in the CTV, minimum dose in the PTV represented by the $D98_{PTV-CTV}$ of the difference volume of PTV and CTV, maximum dose in the posterior rectum wall represented by the $D2_{Rpost}$, median dose to rectum $D50_R$ and urinary bladder $D50_B$, and the number of MU.

Ergebnis: Generally the dose volume statistics are very close for both modes. Taking the average dose in the CTV as normalization value, the maximum does not exceed 107%. The minimum dose in the PTV has been reached in one plan of each group only. The objectives for the median values in rectum and urinary bladder as well as maximum dose to the posterior rectum wall have been achieved in all cases. The only statistically significant difference for both groups is the number of MU which is about 10% lower for the FB plans.

Schlussfolgerung: The plans for both modes show a good homogeneity in the CTV. The minimum dose to the PTV and the maximum dose to the posterior rectum wall are counterworking objectives which resulted in favour for the rectum for the given weights of the objectives. The high dose rate of the FFF mode aims at shorter treatment times which would reduce intrafractional organ motion. Measurements of the delivery times will be performed and discussed in the presentation.

Konferenz: 22. Jahrestagung der Deutschen Gesellschaft für Radioonkologie · Abstract: A-788-0002-00075 · Status: in Arbeit

Drucken

Zurück