

Analysis of standard loading patterns for cervix brachytherapy using MRI-based dosimetry

Lettmayer Anna, Trnkova Petra, Berger Daniel, Dimopoulos Johannes, Benesch Thomas, Pötter Richard, Kirisits Christian

Medical University of Vienna, Vienna, Austria

Purpose: Analysis and comparison of dose distributions resulting from different standard loading patterns (SLPs) in intracavitary high-dose-rate-brachytherapy (HDR-BT) using MRI-based contours.

Material and methods: According to severity of tumour extension and stage 30 cervical cancer patients (treated with tandem-ring applicator) were assigned to either group A "limited tumour", group B "medium-sized tumour" or group C "extensive tumour". For each patient MRI-based treatment plans were generated implementing four SLPs (SLP-1: Fletcher-Typ; SLP-2: reduced loading in tandem; SLP-3: dose-point-optimized; SLP-4: loading tandem only). Treatment planning and dose reporting was performed using OncentraGYN v0.9.15 from Nucletron. DVH parameters (prescribed dose 7 Gy/fraction) D90 and V100 were calculated for HR-CTV and GTV, D2cc for bladder, rectum, sigmoid and D0,1cc for vagina. Statistical significance of results was evaluated using paired Student's t-test.

Results: Evaluation of SLP-4 showed sufficient dose coverage to HR-CTV in 9 of 10 patients in group A (Vmean100 96%), in 5 out of 10 patients in Group B (Vmean100 86%) and in 1 patient in group C (Vmean100 83%). Comparing SLP-4 to SLP-1 D2cc turned out to be significantly lower for rectum in group A and B as well as for bladder in group B. By activating more dwell positions in ring the Dmean90 increased from 6,6 Gy to 7,4 Gy in group B and from 5,2 Gy to 5,9 Gy in group C. In all groups

dose delivered to target- and risk-structures was highest for loading SLP-1, lower for SLP-2, -3 and lowest for SLP-4. In all groups vagina observed significant lower dose using SLP-4 (Dmean 0.1cc 6.6 Gy).

Conclusions: The simulation of standard-loading-plans offered the possibility to analyse and compare different dose distributions concerning target coverage and dose exposure to OAR related to the impact of individual tumour growth pattern and pelvic anatomy. The results could provide an opportunity to reconsider current SLPs used as starting points for individualised optimization and for cases where no 3-D treatment planning is possible.