

Use of adjustable applicator system for MR image guided brachytherapy of cervical cancer

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Purpose: CT based 3D conformal external beam radiotherapy (EBRT) alone, or combined with chemotherapy, as well as image guided brachytherapy are the essential treatment of cervical cancer to date. The technique for EBRT is unquestionable and available in every radiation oncology center. Meanwhile the practice of recommendations based MR guided HDR replaces the use of conventional X-ray based therapy and gains its appropriate position.

Material and methods: Multichannel cylinder with a central opening and 8 circumferential channels parallel to the central axis has been methodically developed and introduced into practice with 0.35 Tesla high resolution open MRI examinations performed for the insertions. For a period of 6 years from total 248 patients, HDR BT has been performed on 92 patients. 65 patients (70.6%) with locally advanced uterine cervical cancer received as part of the complex irradiation HDR BT, accomplished with the MR assisted technique. The information of the pre-treatment sequential T2wMR images was used as recommended for the individually tailored delineation of the CTVs and the OARs on all planes, taking also into consideration the MRI-defined GTV at the time of the BT. After detailed analysis of the DVHs, HDR BT was carried out in three fractions within a period of one week.

Results: With the modification of the circumferential applicators positioning an advance in the dose distribution was obtained extending individually the treated volume. 61 accepted, individual MRbased treatment plans have been used for a total of 179 BT fractions. The treatment proved feasible and was tolerated well by all patients. Gastrointestinal, or urological adverse events were not detected in relation with the BT with average parameters for the 2 cc of bladder, rectum and sigmoid of 76.2; 72.3 and 68.7 Gy, respectively. Applying the linear-quadratic

model for sublethal damage repair the dose of the brachytherapy treatment was biologically normalized to the EBRT dose fractions. PTV, PTV-boost and (HR) CTV median coverage was 97.9%, 98.2% and 93.4%, respectively, while at retrospective analysis HR-CTV D100 dose was at mean value of 72.3 with HR CTV D90 at 79.9 Gy.

Conclusions: The routine employment of a multiple channel brachytherapy device with MR image based 3D treatment planning complements with the recommendations for defined target concept, and dose-volume constraints.