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Transition from Paris dosimetry system to 3D image-guided planning in interstitial breast brachytherapy

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Purpose/Objective: The purpose of this study is to evaluate our first experience with 3D image-guided breast brachytherapy (BT) and to compare dose distribution parameters between Paris dosimetry treatment plans and image-based treatment plans.

Materials and Methods: First, 49 consecutive breast cancer patients treated with high dose rate (HDR) interstitial brachytherapy were selected for the study. All patients received 10Gy boost dose after whole breast irradiation. Every patient underwent computed tomography and the planning target volume (PTV) and organs at risk (OAR) were outlined. Two treatment plans were created for every patient. First, based on a Paris dosimetry system (PDS), and the second one, imaged-based plan with graphical optimization (OPT). The reference isodose in PDS implants was 85%, whereas in OPT plans the isodose was chosen to obtain proper target coverage. Dose and volume parameters (D90, D100, V90, V100), dose at OARs, total reference air kerma (TRAK) and quality assurance parameters: dose nonuniformity ratio (DNR), dose homogeneity index (DHI), external volume index (EI) and conformal index (COIN) were used for a comparison of both plans.

Results: One-, two-, three-plane implants were used. The mean number of catheters was 7, but the mean for first 20 patients was 5 and almost 9 catheters for the next 29 patients. The volume of PTV ranged from 13,6 cm^3 to 163,4 cm^3 (mean: 58,2 cm^3). The mean value of isodose selected for prescribing the dose for OPT plans was 73%. The mean D90 was 88,2% and 105,8%, the D100 was 59,8% and 75,7%, the V90 was 88,6% and 98,1%, the V100 was 79,9% and 98,9% and the TRAK was 0,00375 Gym^{-1} and 0,00439 Gym^{-1} for the PDS and OPT plans respectively. The mean DNR was 0,29 and 0,42, the DHI was 0,71 and 0,58, the EI was 0,15 and 0,23 and the COIN was 0,68 and 0,76 respectively. All differences are statistically significant.

Conclusions: The target coverage in image-guided plans (OPT) was significantly higher than in plans based on Paris dosimetry system (PDS), but the dose homogeneity was worse. Also value of TRAK increased because of change of prescribing isodose. Our first experience proved, that more number of needles allows to obtain better dose distribution.

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Evaluation of toxicity in postoperative endometrial brachytherapy

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Purpose/Objective: The aim of our study is to describe the technique used in our center to plan and administer treatment with high dose rate (HDR) brachytherapy using CT simulation and 3D dosimetry to evaluate the dose in organs at risk by dose-volume histograms. Also describe the acute toxicity observed since the beginning of this modality of treatment in our center (6 years).

Materials and Methods: The unit used to administer the treatment is a Varian Gammamed Plus, and the applicator used in all cases is a vaginal cylinder with diameters of the segments between 20 mm and 35 mm. Planification and dosimetry was performed using Brachyvision software.

The planning and treatment protocol is as follows:

- Physical examination and determination of the applicator to be used.
- Bladder catheterisation.
- Vaginal cylinder placement.
- CT simulation.
- Determination of PTV (vaginal cylinder + 5 mm margin) and the volumes of organs at risk.
- Dosimetry.
- Administration of treatment.

We used 2 different schedules:

From September 2008 to September 2012:

- Treatment after external radiotherapy (46 Gy): 15 Gy in 3 sessions separated at least 48 hours.
- Treatment with exclusive brachytherapy: 30 Gy in 6 sessions separated at least 48 hours.

From October 2012 to November 2014:

- Treatment after external radiotherapy (46 Gy): 14 Gy in 2 sessions separated at least 48 hours.
- Treatment with exclusive brachytherapy: 28 Gy in 4 sessions separated at least 48 hours.

Toxicity was recorded according to RTOG criteria before every session.

Results: From September 2008 to November 2014 we treated 261 patients with this technique. All patients completed treatment with the planned dose. In no case was necessary to chamge the treatment schedule because of toxicity.

The average duration of the planning was 30 minutes.

All the treatments were complementary after surgery. The postoperative histology was adenocarcinoma in 210 patients (80.5%), papillary serous carcinoma in 19 patients (7.3%), sarcoma in 14 patients (5.3%) , carcinosarcoma in 10 patients (3.9%), and clear cell carcinoma in 8 patients (3%).

In 50.5% of the cases the treatment was performed as a boost after external radiotherapy and in the other 49.5% was exclusive brachytherapy.