Optimal VMAT techniques for adjuvant breast radiotherapy: initial results of cooperative study from two institutes


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Purpose/Objective: Radiation technique is a key component in the multimodal treatment of women with locally advanced breast cancer. Targets include the chest wall (CW) and very often axillary (AX) and supraclavicular (SL) nodal region. Due to uneven surfaces and varying depths achieving uniform dose distribution within the targets while sparing the healthy tissue (lungs, heart and breast) is an enormous challenge even for VMAT techniques. We aim to compare the different VMAT techniques which are routinely used in two institutions where the same TPS (MONACO) and accelerators (Acesse, Elekta Synergy), with the same equipment (Agility Multi Leaf Collimator) are available.

Materials and Methods: Five patients (pt) with left sided cancer were selected and a CTV was drawn including CW, AX (I-III level) and SL to RTOG contouring atlas. PTV was added according to local protocol. Plans were created in two radiation departments on – one (RD 1) was able to use 6 MV and 10 MV photon while the other (RD2) only 6 MV. Prescribed dose was 50 Gy in 25 fractions. In RD1 VMAT was realized with the use of 3 arcs (TA), in RD2 VMAT technique uses 1 single arc (SA). Dose Volume Histograms (DVH) were generated to compare the plans from RD1 and RD2. For PTV, the parameters Dmin, Dmax, Dmean, D95% and D107% were reported. Various dosimetric parameters were recorded for organs at risk (OARs): ipsilateral and contralateral lung, heart, contralateral breast, spinal cord and external.

Results: For PTV all planning objectives were largely met with the comparable Dmax, Dmin and Dmean. D95 were higher in the range of 0,49-1,74 % in the SA technique. Total MU were slightly lower in TA (597.96- 718.73) than in SA (655.53-829.89). The results for healthy tissues (heart V33, ipsilateral and contralateral lung, heart, contralateral breast, spinal cord and external) are presented in Tab. 1.

Conclusions: Both techniques of VMAT results in acceptable cover of PTV as well as sparing OAR. However, more homogenous cover of PTV in TA VMAT leads to more dose to contralateral lung and breast. The SA VMAT results with higher dose to ipsilateral lung and more MU. Clinical conditions have to be taken under considerations while choosing the SA or TA techniques. It is our first experiences to compare different technique used in routine practice in two radiation departments. A further study is needed to prepare a protocols for cooperative institutions.

Optimization of high-dose rate photon needle parameters for topical applications, based on Monte Carlo simulation

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Purpose/Objective: A prototype High-Dose Rate (HDR) Photon Needle exists, but its developers at our institute sought to optimize its treatment parameters, particularly for irradiating skin cancers. The purpose of this investigation was therefore to develop a model HDR Photon Needle equipped with PMMA corrective filters of different shapes to assure surface isotropy (x,y) of the X-ray radiation from the X-ray source.

Materials and Methods: The upgraded model HDR Photon Needle was developed using Monte Carlo code MCNP5. The proposed device with the corrective filters is shown in Fig. 1. The anode of the HDR Photon Needle lamp is placed within a specially-designed collimator with corrective filters. The design of the collimator assures full absorption of the X-ray from the HDR Photon Needle. The choice of appropriate filters should assure isotropic radiation on the circular surface of the diameter equal to that of the collimator (2R)