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Use of volumetric arc therapy for nodal boosting in cervical cancer radiotherapy.

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Background. Cervical cancer is the second most common malignancy affecting females in Azerbaijan and one of the main mortality causes in the female population in developing countries. In addition to its high morbidity rate in the developing world, cervical cancer is usually diagnosed at late, locally advanced stages: 74% of new cases are IIB –IVA stage and this determines a higher risk of pelvic and para-aortic lymph node metastasis. Radiotherapy remains an integral component of the standard treatment for locally advanced cervical cancer and a combination of megavoltage external beam radiotherapy (EBRT) and intracavitary brachytherapy (ICBT) with concurrent cisplatin-based chemotherapy is the accepted definitive modality of treatment. Brachytherapy allows increasing the dose delivered to the primary tumor while for metastatic lymph nodes it is possible only by external beam boosting up to a total dose of 60 Gy (by 2Gy fractionation equivalent dose, EQD2). But the main limitation for EBRT nodal boost is the proximity of surrounding normal tissues and organs like rectum, femoral heads, small and large intestine, bladder and pelvic bones. Recent advances in radiotherapy techniques like volumetric modulated arc therapy (VMAT) make it possible to deliver higher radiation doses to targets while sparing organs at risk. On the other hand it is well known that prolongation of the overall treatment time could adversely affect radiation therapy results. Taking into account the above, we decided to use a VMAT-based integrated boost method for the treatment of node positive cervical cancer patients.

Objective. The aim of this research was to document the treatment results of metastatic lymph node cervical cancer patients treated by VMAT-based integrated EBRT boost.

Material and methods. We analyzed radiotherapy results of 52 patients treated in the Department of Radiotherapy of the National Center of Oncology, Baku, Azerbaijan from 2014 to 2016. Planning was done in automatic regimen and the dose distribution was improved (more conformal) if two dynamic arcs with 6 MV photon beams were used. The total number of fractions was 25. The fraction dose prescribed to the pelvis (primary tumor and regional zone up to the aortic bifurcation or L1-L2 interspace) was 2.0 Gy while the fraction dose prescribed to the metastatic lymph nodes was 2.3 Gy during the same treatment, thus reaching a total dose of 50 Gy and 59 Gy respectively (EQD2 by $\alpha/\beta = 10$). From the first day of treatment patients received concurrent weekly cisplatin at the dose of 40 mg/m² (max. 70 mg), 5 infusions. After 46 Gy of EBRT we started high dose rate (HDR) 3D image guided brachytherapy which consisted of four weekly 7.0 Gy fractions to the high risk clinical target volume (HR-CTV).

Results. Implementation of a VMAT-based integrated boost technique allowed reducing the total treatment time by one week in comparison with the sequential boost approach. Also, arc therapy having shorter irradiation time in comparison with traditional static field 3D conformal radiotherapy and IMRT procured an improved patient set up. We analyzed close results of the treatment which were assessed one month after the course was completed. Complete regression, partial regression and stabilization of the tumor occurred in 88.5% (n=46), 9.6% (n=5), and 1.9% (n=1) cases respectively.

Conclusion: VMAT EBRT with integrated boost, HDR brachytherapy and concurrent cisplatin appears to be a safe and effective treatment modality for pelvic lymph node metastatic uterine cervical carcinoma providing high rate local tumor control and acceptable toxicity. It also could provide improved radiobiological conditions such as a shorter overall treatment time and higher fraction sizes. These may be especially important for radiotherapy of relatively hypoxic tumor cells in metastatic lymph nodes. But to reach final conclusions we need a longer follow up

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