Material and Methods: We modeled the CBCT system which is built-in in Varian Clinac iX with full-fan and half-fan filter by using the Monte Carlo code (MCNPX 2.7.d). By acquiring the measured data with EBT3 films for PDD (percent-depth dose) and beam profile for open, full-fan and half-fan filter in static mode, we verified that simulated data was coincided with measured data for spectrum. The assessment of absorbed dose of each organ during the CBCT scanning was performed with ORNL (Oak Ridge National Laboratory)-male-MIRD (Medical Internal Radiation Dose) phantom. In this study, we set the scan range adapted for the CBCT scan conditions and then the absorbed dose of each organ was evaluated applying a half-fan filter. In that time, the CBCT scan range was changed by modulating the Y jaw from 16 cm to 8 cm at intervals of 2 cm and we verified the difference of absorbed dose of each organ according to CBCT scan range.

Results: For CBCT scan in thorax, the absorbed dose of heart and lung were reduced for 46.6–32.1 mGy and 75–47.4 mGy, respectively, and the other side lung was reduced for 31.7–19.1 mGy. As the scan range was decreased at intervals of 2 cm, the absorbed dose in lung was reduced up to 10 %. In the case of heart, the absorbed dose was reduced drastically. For prostate, absorbed dose of bladder, sigmoid colon and testes showed dose reduction for 61.4–41.7 mGy, 50.4–38.8 mGy and 81.1–45.4 mGy, respectively. In the case of penis, the absorbed dose was reduced from 81.1 to 45.4 mGy.

Conclusion: We evaluated the change of organ dose according to CBCT scan range with Monte Carlo code MCNPX and male-MIRD phantom. In the result, we verified the organ dose can be different about 30–40 % according to changes of CBCT scan range. We thought this study can be used in optimization for radiation exposure to patients, usefully.

EP-1612
Optimizing breast imaging dose in CBCT using patient specific acquisition parameter
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Purpose or Objective: Defining patient specific Cone beam computed tomography (CBCT) acquisition parameter to optimize breast imaging dose

Material and Methods: Since last few years, in-room volumetric imaging systems which include MV computed tomography (CT) and MV or kV cone-beam computed tomography (CBCT) are being used for greater soft tissue definition and improved target localization. This technology helps in escalating target dose while decreasing normal tissue doses. This improves the therapeutic ratio of radiotherapy. Intense IGRT protocols are adopted to reduce the PTV margin and to understand changes happening during course of treatment. Additional imaging dose due to intense IGRT protocol is concern for deterministic and non-deterministic radiobiology effect. In this study we measure imaging dose to breast in thorax region from Varian on board imaging CBCT. Three OSL dosimeters were placed on the contra lateral breast. One dosimeter was placed at centre and other two dosimeters were placed 5 cm apart from centrally placed dosimeter. Low dose thorax imaging protocol was used for all measurements. All CBCT acquisitions were performed with fixed geometry for all measurements. CBCT images were acquired with half-fan cone with bow tie filtration, source-detector distance of 150 cm, 0.25 cm slice thickness, transversal field-of view (FOV) of 25 cm, and a scan length of 18 cm giving a longitudinal FOV of approximately 17.5 cm. Scans were performed with 200 degree rotation of gantry. To get a reasonable signal, dosimeters were irradiated during five consecutive treatment fractions for the CBCT imaging protocols. For some patients CBCT images were acquired using modified low dose thorax protocol also. In modified Low dose thorax protocol tube current was reduced from 20mA to 10 mA. Dose to contra lateral breast was measured in same three positions.

Results: The absorbed dose per fraction using the CBCT for standard low-dose thorax protocol was 9 ± 0.30 mSv; for the “Modified Low dose thorax” protocol it was 4.8 ± 0.21 mSv; it can be seen that the “Modified Low dose thorax” protocol results in a reduction of 51 % in absorbed dose compared to the standard low-dose thorax protocol. It was also noticed that, by changing acquisition parameters quality of both scans were comparable.

Conclusion: It is important to have patient specific acquisition protocol rather than vendor supplied protocol so that imaging dose can be optimized.

EP-1613
Comparison of peripheral doses associated to SBRT, VMAT, IMRT, FFF and 3D-CRT plans for lung cancer
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Purpose or Objective: Out-of-field doses during radiotherapy treatments (RT) are associated with an increased risk of second malignant neoplasms in cancer survivors. The purpose of this work is to evaluate the impact, in terms of peripheral dose (PD), that new techniques for lung cancer such as stereotactic body radiotherapy (SBRT), modulated beams (IMRT and VMAT) and FFF would have in comparison to more traditional plans (3DCRT).

Material and Methods: Self-developed models [1,2] were used for neutron and photon peripheral dose (NPD and PPD, respectively) estimation to 12 organs, associated to lung treatments delivered using 3 linacs: Siemens Primus (6&15 MV), Elekta Synergy (6 MV) and Varian TrueBeam (6, 10&15 MV; FFF mode available for the first two). Facilities were previously characterized in terms of neutron production [3] and photon leakage.

17 plans were generated for a lung cancer case (60 cGy to 100%). Different PTVs were used for conventional and stereotactic treatments (factor of 20 between both volumes). Results were compared to values from the literature [4] where PD studies were done but by terms of direct measurements of only photon component for few external points.

Results: Figure (a) shows estimated NPD and PPD to some selected organs for SBRT treatments in 6 and 10 MV, including FF and FFF modes. Figure (b) shows average PPD to the same representative out-of-field organs (mSv) for 4 studied techniques, considering all the linacs and plans.