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Tomotherapy ultra-high dose escalation for radical malignant pleural mesothelioma patients: a feasibility study

A. Maggio1, C. Cutaia1, A. Di Dia1, S. Bresciani1, A. Miranti1, M. Poli1, E. Garibaldi2, P. Gabriele3, M. Stasi1

1Candiolo Cancer Center - IRCCS, Medical Physics, Candiolo (To), Italy
2Candiolo Cancer Center - IRCCS, Radiotherapy, Candiolo (To), Italy
3Candiolo Cancer Center - IRCCS, Medical Physics, Candiolo (To), Italy

Purpose/Objective: To investigate the doseimetric feasibility of a two-steps dose escalation strategy in patients affected by Malignant Pleural Mesothelioma (MPM) by using Helical Tomotherapy (HT).

Materials and Methods: Twelve patients with MPM, treated using HT, were selected. The prescribed median doses to the planning target volume (PTV) boost, outlined by the FDG-PET/CT and to the PTV (pleural cavity) were 61.6 Gy (range 60-66 Gy) and 54 Gy (range 50.4-54 Gy) in 28-30 fractions, respectively. PTVs and Organs At Risk (OAR) were contoured by physicians according to institutional protocols. Inverse planning optimization was performed using the following parameters: Field Width = 2.5 cm, pitch = 0.287, final Modulation Factor ranged between 1.8 and 2.3. For each patient two dose escalation plans were generated prescribing 62.5 Gy and 70 Gy (2.5 and 2.8 Gy/fraction respectively) to the PTV boost and 56 Gy (2.24 Gy/fraction) to the PTV pleural cavity in 25 fractions. For the three treatment planning strategies, for each patient, the average dose to the controlateral lung, lungs sum, liver, heart, esophagus, kidneys and small bowel were evaluated. QUANTEC Dose Volume Histograms (DVH) constraints were used for planning evaluation. The statistically difference among plans was tested by Mann-Whitney non parametric test (MedCalc statistics Software).

Results: For all plans, the 95% PTV Volumes received at least the 95% of the prescribed dose. For all the considered OARs, the dosimetric constraints investigated are reported in figure 1.

Figure 1. Mean 2 Gy Equivalent Doses and standard deviation of OARs (α/β = 3 Gy for all organs except for heart, α/β = 2 Gy).

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Conclusions: In the IMPT treatment plans calculated in this study, the CTV dose coverage was only slightly affected by setup errors and range errors. The OARs appeared to be more sensitive for the introduced uncertainties, with a potentially significant increase of dose to the OARs.
Purpose/Objective: Recent EORTC studies report an increase in survival in breast cancer patients treated with RT when the internal mammary node (IMN) is included. The aforementioned studies were based on conventional 3D irradiation with photons in breast and supraclavicular and axillary nodes and a direct electron field in the IMN. To our knowledge, the safety of including IMN in IMRT has not been studied to date. The objective of the study was to retrospectively evaluate the dosimetric impact on the usual OARs of our service (mainly based on QUANTEC), which are:

- Ipsilateral Lung: V20<30%
- Contralateral Lung: V5<60%; V20<30%
- Ipsilateral Breast: V5<2% (This is an orientation constraint)
- Contralateral Breast: V5<2% (This is an orientation constraint)

Materials and Methods: We selected all breast patients (n = 30) treated with IMRT (left breast, left chest wall, with/without nodes and with/without boost) in 2014. CT planning was performed in all patients with a Philips Big Bore CT. We defined the volumes to irradiate and the OAR. We performed a new IMRT planning to compare with the previous planning. We used our standard distribution of fields in each case. Treatment planning and volume definition were defined using the Eclipse V8.9 planning system from Varian. After optimizing dosimetry to obtain the best coverage and homogeneous distribution of PTVs, we compared the dose received in OAR for each of the 2 plans, considering the constraints of our service (mainly based in QUANTEC), which are:

- Heart: V30<30%; V25<15%; Dmean<10GY
- Lung: V5<60%; V20<30%
- Ipsilateral Lung: V20<30%
- Contralateral Lung: V5<40%
- Contralateral Breast: V5<2% (This is an orientation constraint because heart and lung area priority constraint).

We recorded the values of these indexes for IMRT with and without IMN.

Results: Table 1 shows the mean values recorded for IMRT with and without IMN, and the differences between the two plans. We found a slight increase in dose in OAR when IMN was included, but this increase did not exceed the limits established in our service.

Conclusions: IMN irradiation of the left breast can be safely performed with the new treatment techniques (IMRT) because it does not significantly increase the dose received by the OAR.