allows greater heart and LAD sparing in left cases, when compared to RA with no gating. Of note beam-on time, in RA modality, is highly decreased.

**EP-1683**

**Left breast IMRT with SIB: a user improved technique to reduce heart and lung dose**

S. Naccarato¹, R. Ruggieri¹, G. Sicignano¹, F. Ricchetti¹, S. Fersino², A. Fiorentino³, N. Giaj Levra¹, R. Mazzola², A. Aloni³

¹Ospedale Sacro Cuore Don Calabria, Radiation Oncology, Negrar, Italy
²Radiation Oncology School, University of Palermo, Palermo, Italy

**Purpose or Objective:** Many strategies have been explored in attempt to reduce the cardiac dose and the lung dose during breast irradiation. Here we investigated the efficacy of user optimised collimator rotation and jaws setting, in static gantry IMRT with simultaneous integrated boost (SIB), on heart and lung dose sparing.

**Material and Methods:** From September 2010 to March 2014, 69 patients were treated for left breast (PTV-breast) cancer with SIB at surgical bed (PTV-boost) in 25 fractions: the prescribed doses (Dp) were 50 Gy and 60 Gy, respectively. All plans were generated with Varian EclipseTM v.10.0.28 TPS, using 5-7 IMRT sliding-window fields equally spaced along a 190° arc, with 6MV photon beams and a Varian Millennium120TM multileaf collimator. Dose computation were performed by AAA algorithm, with a 2.5 mm grid size. The first 41 patients were planned by fixing a null collimator rotation, and by leaving the optimizer Varian DVOTM v.10.0.28 free to search for the optimal setting of the jaws (IMRT-A). In the next 28 patients the arrangement of the two outermost tangential fields were set to maximally spare the heart and the left lung. In details, the collimator was rotated so as to align the medial jaw with the projection of the chest wall (IMRT-B). Further, for the most lateral field the jaws were collimated to the lateral and central portions only of the PTV-breast. The remaining 3-5 fields covered entire target according the BEV projection of the target. By selecting the Fixed Jaws Parameter of the two outermost fields into DVO the same jaws aperture defined in BEV were assured during optimization process. Plans aimed to cover at least 95% of the PTVs volume with a dose of 95% of the Dp (V95% ≥95%), with V107%≤2%, for PTV-boost. Hearth volume receiving more then 20 Gy (V20)>10%. Left lung V20<20%. Right breast mean dose (Dmean)-2Gy and right lung Dmean-3Gy. By hypothesis testing, several dose-volume metrics were then compared across the two groups of plans.

**Results:** As detailed in Table 1, although a slightly reduced V95% to PTV-breast was associated with IMRT(B), both techniques assured to any patient the required target dose coverage. In terms of dose sparing to the OARs, IMRT(B) was associated with a 25.6% reduction in the median of Dmean to the heart, while the heart V5, V10 and V20 were respectively reduced by 21.1%, 49.8%, and 52.1% (all p<0.002). Further, the median of Dmean to the left lung decreased by 21.2%, while V5, V10 and V20 to this organ decreased by 5.4%, 36.8% and 28.6%, respectively (all p<0.003). No significant differences resulted for Dmean to the right breast and lung.

**Conclusion:** Similar PTVs coverage were obtained with both IMRT techniques, the selection from an experienced user of collimator rotation and fixed jaws settings for the two outermost tangential fields in a 5-7 fields sliding-window IMRT (IMRT-B) resulted in a significant reduction of the dose to the heart and the ipsilateral lung.

**Material and Methods:** A retrospective planning study was conducted on a sample of 10 patients with HN cancer previously treated with IMRT. PTVs were delineated for 3 different dose levels (70, 63 and 56 Gy in 35 fractions) with a SIB technique. All plans were generated with 6 MV x-rays for a Varian Clinac IX linac. Optimization and calculations were done in the Varian Eclipse system (v. 10.0.28). IMRT plans included 7 equally placed beams using sliding window technique. Three TAV plans were generated for each patient: triple full-arc plan, 3F (collimator angles (CA): 0°, 20°, 340°); double full + partial arc plan, ZFP0 (CA: 20°, 340°; 0° for partial arc); double full + partial arc plan, ZFP90 (CA: 20°, 340°; 90° for partial arc). Dose normalization was set as D(95%) -70 Gy for the primary tumour and involved nodes (PTV70), while planning objectives were D(95%) - 95% of prescription dose for the high- and low-risk target volumes (PTV63 and PTV 56). OARs taken into account into optimization included the brainstem, spinal cord, parotids, oral mucosa, larynx, mandible, vertebrae, thyroid. The healthy tissue was defined as the body volume excluding the PTVs. Planning objectives are shown in Table 1. The parameters used for plan comparison include PTV coverage, dose homogeneity (HI) and conformity (CI), OAR sparing, healthy tissue integral dose (HTID) and number of MUs.

**Results:** Table 1 shows the results of PTV coverage, homogeneity, conformity, and doses to OARs for the 4 planning techniques. Similar coverage of all PTV’s is obtained in all the techniques. TAV plans show better homogeneity and conformity in PTV70 compared to IMRT, though the difference is significant only for HI of the ZFP90 technique. For spinal cord and vertebrae the ZFP90 plans show significant reductions of maximum dose. No significant
changes are observed in terms of mean dose to parotids or maximum dose to mandible, while oral mucosa and thyroid result better spared with TAV techniques. Though smallest for IMRT, the mean HTID is not significantly different from the test plans. Finally, MUs for all TAV techniques are significantly lower than for IMRT; no reduction is observed when using one partial arc instead of 3 full arcs.

Table 1. Planning objectives and dose comparison among 7 field IMRT and TAV plans. Results are averaged over the 10 studies of the phantom. Statistical significance of Wilcoxon signed-rank test is expressed in the last column.

<table>
<thead>
<tr>
<th>Objective</th>
<th>IMRT</th>
<th>TAV 3F</th>
<th>TAV 7F</th>
<th>TAV PFDO</th>
</tr>
</thead>
<tbody>
<tr>
<td>D50%</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>D95%</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>Max Dose</td>
<td>17</td>
<td>17</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Mean Dose</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Homogeneity (HI)</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Gradient Score Index (GSI)</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Figure 1 represents total seven (one reference arm and six test arms) plans for an evaluated patient. Maximum dose and mean dose of PTV/GTV V105%, V100%, V95%, D1%, D2%, D3% showed a maximum inter MLC-beam model variation of 1.5% and 2% for PTV and GTV respectively. Average PTV heterogeneity index and conformity index shows a variation in the range 1.08-1.11 and 0.56-0.63 respectively. Mean dose difference (excluding reference arm) for all organs varied between 1.7cGy - 194.5cGy (mean dose 16.1 cGy SD=57.2 cGy) and 1.1cGy-74.8cGy (Mean dose 6.1 cGy SD=26.9 cGy) for multiple and single fraction respectively.

Conclusion: The dosimetry of VMAT based stereotactic treatment plan yield minimal dependency on beam characteristic (model) and MLC width. All tested MLC and beam model could fulfill the desired PTV coverage respecting OAR dose constraints. The only notable difference was the halving of the MU for FFF beam as compared to plane beam. This has the potential to reduce the total patient on couch time by 15% (approximately 2 minutes).

EP-1686
Frameless radiosurgery in brain metastasis with Tomotherapy: a comparison toward dosimetric index A. Cliamtori1, 2, G. Guidi1, 3, A. Bruni1, N. Maffei1, C. Vecchi1, M.G. Mistretta1, P. Ceroni1, S. Gaito1, P. Giacobazzi1, T. Costi1
1Azienda Ospedaliero Universitaria “Policlinico” di Modena, Medical Physics Department, Modena, Italy
2Alma Mater Studiorum University, Post Graduate School in Medical Physics, Bologna, Italy
3Azienda Ospedaliero Universitaria “Policlinico” di Modena, Radiation Oncology Department, Modena, Italy

Purpose or Objective: Effectiveness of stereotactic radiosurgery (SRS) in treatment of brain metastasis have been demonstrated. In this work we have, retrospectively investigated dosimetric features of frameless SRS delivered with Tomotherapy and compared with reported result in literature in term of Paddick Conformity Index (CI), Homogeneity Index (HI) and Gradient Score Index (GSI).

Material and Methods: 68 patient treated between 2008 and 2013 in our institution with frame less set up (only thermoplastic mask) have been enrolled. 89 Lesions have been stratified for dimension (lower or greater than 5 cc) and for prescription strategies. ICRU 62 (D95%>95%, D110%>10%) guidelines were utilized for 40 patients while ICRU83 (D50%=Prescription, D98%5%, D107%5%) recommendations were utilized in the remaining 28. Dosimetric index for describing Target Coverage, Target Homogeneity and Organ at Risk (OAR) sparing were selected among the most used in similar studies (Pubmed Line, keyword: “Dosimetric Index”, “Radosurgery”, “Tomotherapy”, “Brain”).

Results: CI, HI and GSI are the most cited feature for describing respectively Target Coverage (21 studies), Target Homogeneity (12 studies) and OARs sparing (5 studies). Mean and standard deviation of CI, HI and GSI in the cohort were, respectively, 1.59 ± 0.38, 1.06 ± 0.04 and 51 ± 16. A multivariate logistic regression analysis of the PTV volume showed significant influence (p<0.05) on CI while prescription strategies influenced GSI. ICRU83 recommendations seems to