**Purpose**
This study compared the dose blurring of three types of radiation therapy plans due to the setup error for the left-sided breast cancer: 3D conformal radiotherapy (3D-CRT), forward intensity-modulated radiotherapy (FIMRT), and volumetric modulated arc therapy (VMAT).

**Methods and Materials**

**10 Patients**
For each patient, there are three types of radiation therapy plans
1. 3D plan with two opposing open fields using enhanced dynamic wedges (15°~30°)
2. FIMRT plans with the same gantry angle with that of 3D plan (control points: 4~5 per beam)
3. VMAT plans with the similar gantry angle covering 190 degree

**Radiation Treatment Planning System (RTPS): Eclipse V.13 (Varian)**
Prescription Dose: 5040 cGy (28 fractions, 180 cGy/fraction)
Target Volume (the only region with 5cm and more to the distance to skin and lung tissue)
\[ 533.0 \pm 219.6 \text{ cm}^3 \] (from 239.5 cm³ (Patient 06) to 916.7 cm³ (Patient 04))

**Generating the setup error**
Five plans for each technique with iso-center shift in the beam’s eye view (BEV)
Origin (No-shift), X±3mm (±3mm shift in the x-direction), Y±3mm (±3mm shift in the y-direction)

**Evaluation Parameter**

- **CI**: conformity index
- **HI**: homogeneity index
- **TV**: Target Volume
- **PIV**: Prescription Isodose Volume

\[ CI = \left( \frac{TV_{PIV}}{TV} \right)^2 / (TV \times PIV) \]  
\[ HI = 100 \times \left( \frac{D_{98}}{D_{2\%}} \right) / D_{2\%} \]

**Mean Dose**: Lung Lt (Ipsilateral lung), Lung Rt (contralateral lung), heart, coronary artery (CA)

**Results**

**MU Comparison**

<table>
<thead>
<tr>
<th>MU (medial direction)</th>
<th>MU (lateral direction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D</td>
<td>FIMRT</td>
</tr>
<tr>
<td>average</td>
<td>stdev</td>
</tr>
<tr>
<td>114.40</td>
<td>3.60</td>
</tr>
</tbody>
</table>

**Plan Quality**
VMAT is the best plan on the target coverage point Relative value in comparison with VMAT

**Conclusion**
For radiotherapy plans for the left-sided breast cancer, VMAT is the most useful technique for the target coverage and saving for the coronary artery if only the setup error can be minimized using CBCT and so on.

**Email**: thwang91@hallym.or.kr