Evaluation of Three Dimensional Conformal versus Field in Field Forward IMRT Planning for Intact Breast Irradiation

Prasana Sarathy Nariyangadu[1],
[1] Division of Radiotherapy Physics, Department of Radiation Oncology, CCWH & RI, Kolkata
mail: sarathy_prasana@rediffmail.com

Introduction

Conditions that make 3D breast planning complex are: Lung inhomogeneity, irregular body contour and concavity of target. Three Dimensional Conformal Radiotherapy (3DCRT) for intact breast involves standard tangential beam arrangement. The persisting problems are increased dose in the corners of the posterior edges of the tangential field, and in cranio-caudal direction, where the breast tissue thins. The objective of this work is to evaluate and compare 3DCRT and Field in Field IMRT planning technique for intact breast irradiation.

Material and Methods

For our present study, two categories of plans are produced for each of five patients. **Plan 1** is a Wedge based 3DCRT 6MV plan, having Medial tangential (MT) beam angles 55°±2° and 305°±2° for Right and Left Breast respectively. Lateral Tangential (LT) beam angle varies from 230°-233° and 127°-130° for Right and Left Breast respectively. Lateral Tangential beam angle is chosen to avoid beam divergence at the posterior edge of the tangential beam. **Plan 2** is a Field in Field (FIF) tangential beam arrangement identical to Plan 1, but with wedges removed. Here, fields are added to MT or LT beams or to both and the fields are shaped according to the requirement. The requirement here is to improve the dose homogeneity within the target, while also ensuring adequate dose coverage for it, and limiting dose maximum to treated volume to below 110% of the prescription dose. Four Evaluation Criteria are used for comparison of the plans: (1) The Planning Target Volume (PTV) receiving 95% of the prescription dose, (2) Homogeneity Index (HI) $D_{2\%}/D_{98\%}$ where $D_{2\%}$ and $D_{98\%}$ are dose received by 2% and 98% of PTV respectively, (3) Average Ipsilateral Lung Dose, and Ipsilateral Lung volume receiving 90% of the prescription dose (4) Dose Maximum and Treated Volume receiving greater than 110% of the prescription dose.

Results

Our findings are presented here for the 3DCRT and FIF plans, in that order.The mean PTV for the two plan categories is 554.65cc ± 143.30(1σ). Mean PTV receiving 95% of the prescription dose is 514.36cc± 159.17(1σ) and 520cc± 135(1σ). The Mean HI is 1.1819± 0.036(1σ) and 1.149± 0.0064(1σ). Mean value of dose maximum is 115.24% ±2.82(1σ) and 109.78%± 0.23(1σ). On the average, dose greater than 110% of the prescription dose is received by 69.86cc± 63(1σ) of the treated volume for 3DCRT technique, as opposed to 0cc in FIF technique. There is no significant difference among the two categories of plans, for average Ipsilateral Lung dose, and Ipsilateral Lung volume receiving 90% of the prescription dose.

Discussion

FIF technique showed improved target coverage (criterion 1) and dose homogeneity (criterion 2) when compared to 3DCRT. On the average, Homogeneity for FIF technique improved by 4%, PTV coverage by 1% and Dose Maximum is reduced by 6% in the FIF plans. According to our departmental protocol, dose maximum up to 110% of the prescription dose is accepted. The FIF plan yielded a relatively increased ipsilateral lung dose in some of the cases. This can be attributed to the adequate dose coverage of the target. In conclusion FIF technique may be said to be superior to 3DCRT plans, for intact breast.

References

[1] Clifford Chao, K.S.: Practical Essentials of Intensity Modulated Radiation Therapy. Lippincott Williams and Wilkins. 2005.