New radiotherapy approach for simultaneous breast-nodes cancer treatment: Comparison with 3D and IMRT techniques

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Purpose

Usual radiotherapy treatments of simultaneous breast-nodes cancer are 3-dimensional static fields (3D) and intensity modulated radiotherapy (IMRT). IMRT improves 3D regarding conformity and maximum doses to organs at risk (OR). However, IMRT implies longer treatment times due to an increment of Monitor Units (MU). In this study a new hybrid radiotherapy technique (HYB) is presented and its differences with 3D and IMRT analyzed.

Methods

Three dosimetric plans were performed for 15 patients with breast-nodes cancer in Eclipse (Varian Medical System).

1. 3D: 2 tangencial half beams for the breast matching the isocenter plus 2 more half-beams for the nodes using 6 and 18MV photon energy.

2. IMRT: 7 coplanar mono-isocentric, different angled 6MV fields covering the breast-nodes volume simultaneously.

3. HYB: 3 IMRT 6MV fields (2 tangencials and 1 confronting the PTV) delivering 70% of the prescribed dose to the breast-nodes plus 2 co-planar 6MV half-arcs with the same isocenter delivering the 30% left (figure 1).

Fig 1: Beams arrangement for the hybrid technique

The distributions of Dmax, Dmean, D98-2%, CI and Homogeneity Index (HI) for the PTV; D2%, Dmean, V5Gy for the contralateral breast; V2%, Dmean, V10Gy for the contralateral lung; D2%, Dmean, V5-10-20-30Gy for the ipsilateral lung and D3%, Dmean,V5-25Gy for the heart, were compared for the three techniques with Kruskal-Wallis and Wilcoxon tests. The dependence of MU versus PTV volume was also analyzed.

Results

All the PTV dose distributions are statistically equivalent for 3D, IMRT and HYB. CI is inferior and HI superior for 3D, while equivalent for IMRT and HYB.

All the aforementioned OR variable distributions for HYB and IMRT are statistically equivalent, but different with respect to 3D for some of them, accordingly with literature.

The MU distributions are statistically different: IMRT has more MU, followed by HYB and finally 3D.

Fig 2: Behaviour of MU vs PTV volume for IMRT, hybrid and 3D technique.

Fig 3: Total MUs mean for each technique

Conclusions

Regarding dosimetry, IMRT and HYB techniques are equivalent. However HYB implies fewer MU than IMRT, regardless of the PTV volume. Moreover, the higher the volume of the PTV, the more benefit seems to have the HYB technique with respect to the MU, since this implies less treatment times, inconvenience for the patient, and better treatment reproducibility.