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Arc therapy versus 3D-CRT in accelerated partial breast irradiation

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Aim: Aim is to dosimetrically compare two techniques of Accelerated Partial Breast Irradiation (APBI): Arc therapy by RapidArc (RA) and 3D conformal external beam irradiation (3D-CRT) by two mini-tangents and an "en face" electron beam.

Method: A retrospective dosimetric comparison of RA and 3D-CRT was performed. 22 left-sided breast cancer patients treated by 3D-CRT APBI were included for a dosimetric comparison of the dose received to the ipsilateral breast, heart, Non-Target Breast Tissue Volume (NTBTV), ipsilateral lung. All patients were treated with 38.5 Gy in 10 fractions twice daily using two mini-tangents and an "en face" electron beam, the dosimetric constraints were respected. The lumpectomy cavities (CTV) were contoured based on surgical clips. The PVT was constructed as a uniform expansion of 1.8 cm for all patients and was limited to 5 mm below the skin. Normal structures including ipsilateral lung, breast and heart were delineated on each scan. The same contoured simulation CT was used for treatment planning and dosimetry with both techniques (RA and 3D-CRT) for each patient. To evaluate dose to the ipsilateral breast, heart, ipsilateral lung, NTBTV and PTV, Dose-Volume Histogram (DVH) analysis was performed.

Result: The average percentage of the breast volume receiving 30 and 20 Gy was higher in the 3D-CRT group (23.8% and 25.4 %, respectively) compared with RA (20.7% and 23.1%, respectively). Improved coverage of the PTV was noted in the 3D-CRT plans compared with RA plans. With 3D-CRT technique, 98.1% of the PTV received 36.5 Gy compared with 96.7% with RA technique. The average of the mean and maximal doses to PTV was higher by 2.1% and 5.9%, respectively in RA compared with 3D-CRT (p=0.001). Homogeneity index was lower with 3D-CRT (0.087) than RA (0.104). V5 Gy and mean dose to the heart were not significantly improved in RA (0.6 % and 0.58 Gy, respectively compared to 0.92 % and 0.82 Gy, respectively; p=0.78 for V5 Gy; p=0.95 for mean dose). V5 Gy and mean dose to the ipsilateral lung were not significantly higher in RA (5.7 % and 1.2 Gy, respectively compared to 5.2 %and 1.10 Gy, respectively; p=0.35 for V5 Gy; p=0.27 for mean dose). V10 Gy and mean dose to the NTBTV were not significantly improved in RA (35 % and 11.3 Gy, respectively compared to 38.1 % and 15.9 Gy, respectively; p=0.63 for V10 Gy; p=0.98 for mean dose).

Conclusion: In patients treated with 3D-CRT, coverage of the PTV was not significantly better and mean dose to ipsilateral lung was not significantly lower. As we did observe a trend in favor of RA, we think it would be useful to do the dosimetric comparison on a larger number of patients because a better PTV coverage with 3D-CRT might come at the cost of a higher integral dose to the remaining normal breast. RA might give a better sparing of the heart with lower doses to NTBTV but higher maximal dose to PTV.

Biography

George Farha has obtained General Medicine Diploma from St Joseph University. He has worked as Resident Radiation Oncologist at Hotel-Dieu de France-Beirut and Gustave Roussy Cancer Campus Paris, France. He had done his Fellowship in Head and Neck and CNS Radiation Oncology from University of Toronto. He has also served as an Assistant Professor of Radiation Oncology at University of Balamand, Beirut, Lebanon.

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