Critical appraisal of the potential role of IMPT for advanced breast cancer

D. Franceschini1, L. Cozzi1,2, F. De Rose1, I. Meattini3, A. Fogliata1, S. Cozzi1, C. Becherini3, S. Tomatis1, L. Livi3, M. Scorsetti1,2.

1Humanitas Research Hospital and Cancer Center, Radiotherapy and Radiosurgery, Milan, Italy.
2Humanitas University, Biomedical Sciences, Milan, Italy.
3Azienda Ospedaliero-Universitaria Careggi- University of Florence, Radiation Oncology Unit- Oncology Department, Florence, Italy.

PURPOSE

To investigate the role of intensity modulated proton therapy (IMPT) for advanced breast carcinoma in comparison with volumetric modulated arc therapy (VMAT).

METHODS

Methods: A cohort of 20 patients (10 breast-conserving and 10 post-mastectomy patients, the latter with tissue expander implants) was retrospectively planned for locoregional treatment using VMAT and IMPT. Proton plans were computed with or without robust optimization methods. Plan quality was assessed by means of quantitative analysis of the dose volume histograms and scored with conventional metrics. In addition, estimates of the risk of secondary cancer induction (excess absolute risk, EAR) were performed according to a model inclusive of fractionation, repopulation and repair.

RESULTS

Concerning target coverage, the data proved a substantial equivalence of VMAT and IMPT. Organs’ at risk planning aims were achieved for all structures for both techniques but IMPT plans presented the best results. Robust optimization impacted on the near-to-maximum dose values for contralateral lung and breast, on the mean dose for the heart and ipsilateral lung. The numerical values of EAR per 10’000 patients-year resulted about one order of magnitude higher for VMAT then for IMPT for contralateral structures (~11-14 vs ~0.9-1.4 for VMAT and IMPT respectively) and about a factor two for the ipsilateral lung (~35 vs 19). The robust optimization methods induced a deterioration in the EAR estimates.

CONCLUSIONS

Conclusion: This study suggests that IMPT is a potentially promising approach for the radiation treatment of advanced breast cancer when nodal volumes should be irradiated. Clinical trials should be performed to demonstrate the anticipated dosimetric benefit.

Corresponding Author: davide.franceschini@humanitas.it