

Dosimetric study comparing photon and electron Beams for boosting the tumor bed in early-stage breast cancer

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Abstract

Purpose: To assess and compare the potential dosimetric advantages and drawbacks of photon beams and electron beams as a boost for the tumor bed in superficial and deep seated early-stage breast cancer.

Materials and methods: planning CTs of 10 women with early breast cancer underwent breast conservative surgery were selected. Tumor bed was defined as superficial and deep with a cut of point 4 cm, those with less than 4 cm were defined as superficial tumors representing 4 patients and those with depth of 4 cm or more were classified as deep tumors representing 6 patients. The clinical target volume (CTV) was defined as the area of architectural distortion surrounded by surgical clips. The planning target volume (PTV) was the CTV plus margin 1 cm. a dose of 10 Gy in 2 Gy fractions was given concurrently at the last week of treatment. Organs at risk (OARs) were heart, lungs, contra-lateral breast and a 5-mm thick skin segment of the breast surface. Dose volume histograms were defined to quantify the quality of concurrent treatment plans assessing target coverage and sparing OARs. The following treatment techniques were assessed: photon beam with 3D-conformal technique and a single electron beam.

Results: for superficial tumors better coverage for CTV and PTV with good homogeneity with better CI was found for the 3DCRT but with no significant planning objectives over electron beam. For deep tumors, the 3DCRT met the planning objectives for CTV, PTV with better coverage and fewer hot spots with better homogeneity and CI. For superficial tumors, OARs were spared by both techniques with better sparing for the electron beam whereas for deep tumors also OARs were well spared by both techniques.

Conclusion: boosting the tumor bed in early-stage breast cancer with optimized photon may be preferred to electron beam for both superficial and deep tumors. The OARs dose sparing effect may allow for a potential long-term toxicity risk reduction and better cosmesis