Does Breast Size Affect the Scatter Dose to the Ipsilateral Lung, Heart, or Contralateral Breast in Primary Breast Irradiation Using Intensity Modulated Radiation Therapy (IMRT)?
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Purpose/Objective: To evaluate the relationship between the volume of the primary breast and the dose received by the ipsilateral lung, heart (for patients with left breast cancer), and contralateral breast during primary breast irradiation using IMRT.

Materials/Methods: During March 2003 thru February 2004, sixty five patients with carcinoma of the breast were treated using 6 MV photons with IMRT technique using Varian’s Eclipse Planning System (Varian, Palo Alto, CA) following breast conserving surgery. Of these sixty five patients, thirty six had carcinoma of the left breast. All patients had a treatment planning CT scan at which time the primary breast was outlined with a wire. The primary breast, ipsilateral lung, and heart (for the thirty six patients only) were contoured on the axial CT slices. The primary breast volume was calculated using the Eclipse Planning system. The mean ipsilateral lung and mean heart doses were obtained from the dose volume histogram. The contralateral breast dose was measured using paired thermoluminescent dosimeters (TLDs) placed on the patient’s contralateral breast, four centimeters from the center of the medial border of the primary breast irradiation field. The TLDs were left on the patient during a single fraction of radiation and then measured 24 hours afterwards using a Harshaw model 5500 TLD reader (Bicron, Solon, Ohio). Using SPSS software, a correlation analysis was performed for breast volume, ipsilateral lung, heart, and contralateral breast dose.

Results: The mean dose delivered with photons to the primary breast for all patients was 4997 centiGray (cGy) (range 4680-5040 cGy). The mean volume of the primary irradiated breast was 1167.9 cubic centimeters (cc) (range 332.2-2982.6 cc). As a percentage of the prescribed dose to the primary breast, the mean ipsilateral lung, heart, and contralateral breast dose were 11.2 percent (range 2.8-31%), 6.1 percent (range 2.0-25.5%), and 7.2 percent (range 4.0-14.0%), respectively. The primary breast volume positively correlated to the contralateral breast dose with a Pearson Correlation value of 0.552 which was statistically significant (p<0.0005). There was no significant correlation between the breast volume and the ipsilateral lung dose or the heart dose (p=0.463 and 0.943, respectively).

Conclusions: This preliminary study suggests that the size of the primary breast significantly affects the scatter dose to the contralateral breast but not the ipsilateral lung or heart dose (for left breast carcinoma) when using IMRT for primary breast irradiation.