



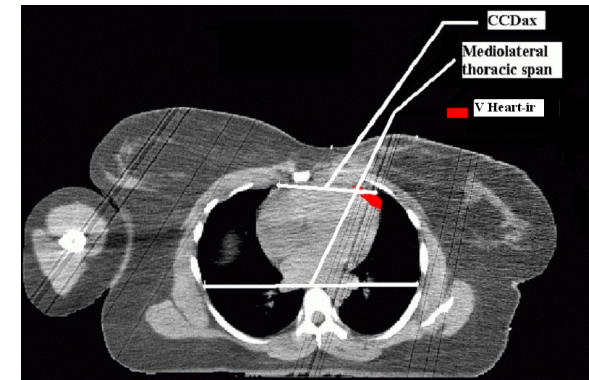
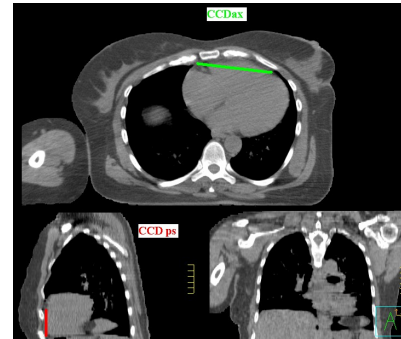
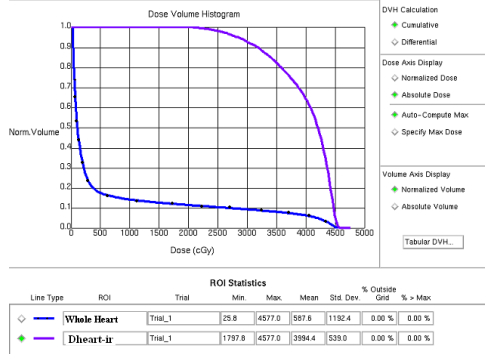
Unfavorable cardiac anatomy for left-sided tangential breast irradiation: Incidence and predictive factors

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Background: There is considerable patient-to-patient variation in the volume of heart that can be included within a left breast tangential field. This fact is largely ignored in studies of cardiac morbidity after breast irradiation. In some cases, the anatomic relationship of the heart to the left anterior chest wall can be so unfavorable as to raise serious doubt as to the safety of conventional whole-breast radiotherapy in the context of long-term cardiovascular risk.

Purpose: To quantify the prevalence of unfavorable cardiac anatomy and to identify specifically associated anatomic and clinical factors.



Methods and Materials: The study consisted of 73 patients planned for left-sided whole breast irradiation with tangentially opposed fields to a dose of 46 Gy. Unfavorable cardiac anatomy was defined as those cases where $\geq 6\%$ of the cardiac volume received at least 27.6 Gy (V27.6) (Geynes G et al. Radiother Oncol 1998;48:185-190). Cases were evaluated for the volume of breast (Vbreast), volume of heart (Vheart), volume of heart included in the tangential field (Vheart-ir) as well as the minimum dose delivered to the heart volume included in the tangential field (Dheart-ir). Clinical factors recorded included age, documented coronary artery disease (CAD), presence of diabetes, history of congestive heart failure (CHF), history of hypertension, and weight. Additional anatomic factors evaluated included medio-lateral thoracic width (measured anterior to the vertebral body at the level of the right hemidiaphragm), and cardiac contact distance in the axial (CCDax) and parasagittal planes (CCDps) as determined by computed tomography. Cardiac contact distance was measured as the shortest linear distance from the points of contact of the cardiac silhouette with the chest wall.

Results: The mean age for the entire cohort was 57 years (SD 10.9). The mean VHeart was 477.1 cc (SD 98.7), mean Vheart-ir was 24.0 cc (SD 20.9), and the mean Dheart-ir was 32.9 Gy (SD 7.9). The mean VBreast was 1625.7 cc (SD 865.8). The mean CCDax was 7.5 cm (SD 3.0) and the mean CCDps was 3.9 cm (SD 1.8). Unfavorable cardiac anatomy was identified in 21.9% of cases. The CCDax and CCDps were significantly correlated with the Vheart with a Pearson correlation coefficient (PCC) of 0.43 ($p < 0.01$) and 0.34 ($p < 0.04$), respectively. The CCDax and Vheart were significantly correlated with the Vheart-ir with a PCC of 0.27 ($p = 0.02$) and 0.41 ($p < 0.01$), respectively. The CCDax alone was most predictive for unfavorable cardiac anatomy with an odds ratio of 1.228 (95% CI 0.99-1.52, $p = 0.06$). Patient age, weight, hypertension, history of CAD or CHF, V Breast, and medio-lateral thoracic width were not statistically significant in their association with unfavorable cardiac anatomy.

Conclusions: Unfavorable cardiac anatomy for left-sided tangential breast irradiation is seen in approximately one-fifth cases. The CCDax was the only factor that approached statistical significance in predicting for unfavorable cardiac anatomy.