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Deep inspiration breath-hold technique in left-sided breast cancer radiation therapy: Evaluating cardiac contact distance as a predictor of cardiac exposure for patient selection.

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PURPOSE:

The purpose of this study was to evaluate the efficacy of voluntary deep inspiration breath-hold (DIBH) over a free-breathing (FB) technique to minimize cardiac radiation exposure in radiation therapy of left-sided breast cancer. Also, to better select patients for DIBH, the correlation between cardiac contact distance (CCD) and cardiac dose was assessed.

METHODS AND MATERIALS:

Thirty-five patients with left-sided breast cancer underwent DIBH and FB planning computed tomography scans, and the 2 plans were compared. Dose-volume histograms were analyzed for heart, left anterior descending coronary artery (LAD), left ventricle (LV), and left lung. Axial CCDs and parasagittal CCDs (FB-CCDps) were measured on FB planning computed tomography scans.

RESULTS:

Dose to heart, LAD, LV, and left lung was significantly lower in DIBH plans than in FB by all metrics. When DIBH was compared with FB, mean dose (Dmean) for heart was 0.9 versus 2.5 Gy; for LAD, 4.0 versus 14.9 Gy; and for LV, 1.1 versus 3.9 Gy ($P < .0001$), respectively. Seventy-five percent of the patients had a dose reduction of ≥ 0.9 Gy in Dmean to heart, ≥ 3 Gy in Dmean to LAD, and ≥ 1.7 Gy in Dmean to LV. FB-CCDps was associated with an equivalent uniform dose to heart, LAD, and LV for both the DIBH and FB plans ($P \leq .01$); FB axial CCD measures were not.

CONCLUSIONS:

DIBH is a simple and highly effective technique to reduce cardiac exposure without compromising target coverage. FB-CCDps is potentially a very good predictor for cardiac exposure: the longer the FB-CCDps, the higher the dose. Our findings suggest that at least 75% of patients with left-sided breast cancer might benefit from the DIBH technique in terms of potentially clinically relevant dose reduction to cardiac structures, and therefore, it should be instituted as routine clinical practice.