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## A Dosimetric Study of Reverse Semi-Decubitus Compared with Supine and Breath Hold Techniques for Left Chest Wall and Internal Mammary Chain Irradiation

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### Abstract

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Purpose: Incidental irradiation of the heart during adjuvant radiotherapy for breast cancer has been shown to increase the risk of ischemic heart disease. Various breath-hold techniques utilizing specialized equipment have demonstrated reductions in cardiac dose, but may not be clinically feasible for all patients. The reverse semi-decubitus (RSD) technique is an alternative method used at our centre in which the patient is rotated into the semi-lateral decubitus position, with the right side towards the treatment couch and left side elevated. This study was conducted in order to compare the dose to the heart, left anterior descending coronary artery (LAD) and lung in patients with left-sided breast cancer undergoing breast/chest wall radiotherapy using the supine, RSD and moderate deep inspiration breath-hold (mDIBH) techniques.

Materials and Methods: Twelve patients with left-sided breast cancer who had been simulated using supine, RSD and mDIBH techniques due to unfavourable cardiac anatomy were identified (36 scans in total). The heart, lungs, LAD, chest wall and breast were delineated using standardized anatomical boundaries. To ensure a consistent and clinically relevant medial target, the internal mammary chain (IMC) volume was delineated on each scan. Dose volume constraints for breast, chest wall and the IMC were defined a priori to ensure that all radiation plans delivered equivalent coverage. Two-field, wide tangent plans were developed retrospectively for each of the 36 scans. Data were analyzed using one-way analysis of variance and the Wilcoxon signed-rank test.

Results: Mean heart dose, heart V25Gy and mean LAD dose were found to be significantly lower for both RSD and mDIBH when compared to supine (p<0.001 to 0.006). Mean heart dose using the supine, RSD and mDIBH techniques was 10.1 Gy, 6 Gy and 3.0 Gy respectively. Mean LAD dose was 3.8 Gy, 2.9 Gy and 1.8 Gy respectively. Relative dose reductions normalized to supine dose were significantly different between mDIBH and RSD for mean heart dose (62.4% versus 40.0%, p=0.004), heart V25Gy (84.9% versus 50.4%, p=0.003) and mean LAD dose (53.4% versus 25.1%, p=0.003). No significant differences in lung dose statistics (V20Gy, V5Gy) were found.

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Distributed under Creative Commons CC-BY 3.0 Conclusions: For patients undergoing whole breast radiotherapy with unacceptable cardiac positioning on supine simulation, both the RSD and mDIBH techniques can significantly reduce the dose to the heart and LAD. These reductions are more pronounced using mDIBH. In patients who do not tolerate active breathing control, or who are not able to have treatment using mDIBH, the RSD technique is a suitable alternative to consider.