

Analysis of Lung Dose Variation in Post-Mastectomy Radiotherapy and Whole Breast Radiotherapy

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Breast cancer is the most common cancer in women worldwide; Radiotherapy reduces the recurrence following surgery and chemotherapy. Post Mastectomy Radiation Therapy (PMRT) and Whole Breast Radiation Therapy (WBRT) pose a risk of lung injuries due to proximity, necessitating an analysis of lung dose variation between these two techniques. This study focused on comparing lung radiation dose variation between PMRT and WBRT, evaluating the influence of lung dose distribution with anatomy and radiotherapy treatment strategies and identifying optimization methods to reduce lung toxicities due to radiation. A retrospective study involved extracting lung dose metrics (V20, V5, mean lung dose) from Dose Volume Histogram (DVH) along with anatomical parameters such as Central Lung Distance (CLD), Midplane Lung Width (MLW), Maximum Heart Distance (MHD) as well as treatment strategies details including wedge type and Field arrangement in breast cancer patients treated with PMRT and WBRT at the National Cancer Institute Maharagama, Sri Lanka, using the Varian Eclipse treatment planning system. The impact of differences in radiation therapy techniques on lung dose variation was analysed using SPSS 25.0. PMRT resulted in higher lung doses compared with WBRT, with mean lung dose values of 6.68 ± 2.19 Gy and 6.34 ± 2.16 Gy ($p < 0.05$), respectively. The percentage of V20 was $14.67 \pm 6.32\%$ for PMRT and $12.77 \pm 6.88\%$ for WBRT. CLD in PMRT is higher as compared to WBRT: 2.84 ± 1.24 cm versus 2.33 ± 0.91 cm ($p < 0.05$). Field in Field technique and 30° wedges significantly reduced mean lung doses, WBRT achieved 5.46 ± 1.78 Gy with 30° wedges compared to 6.60 ± 1.57 Gy with 15° wedges ($p < 0.05$). This study highlights that WBRT reduces low-dose lung radiation than PMRT, with lower V5 values. CLD is a major parameter for lung dose difference, especially for PMRT. The 30° wedge optimise lung dose sparing in WBRT. However, the combination of FIF and wedges effectively reduces lung doses in both treatment approaches.

Keywords: Post mastectomy radiation therapy, whole breast radiation therapy, lung dose, central lung distance, field in field technique