Comparison of FinF and VMAT Plans Prepared Using Breath-Hold Technique in Early Stage Left Breast Irradiation

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Purpose

Breath control radiotherapy is a technique that allows the treatment of cancer patients with respiratory movement to be performed synchronously with the tumor movements. In breast cancer patients, respiratory movement management systems are of great benefit in terms of critical organ doses. A number of techniques (Respiratory gating RT-RGRT, Tumor-tracking RT-TTRT, Breath-hold radiation therapy and Abdominal compress) have been developed to provide follow-up of organ movements through breathing.

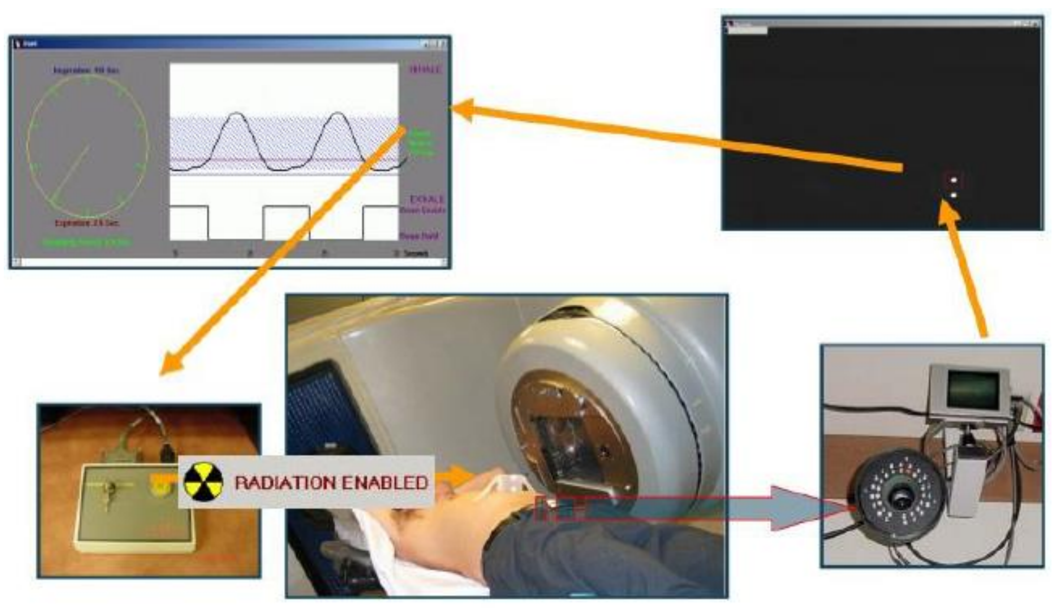
Breath-hold RT (BHRT), in which organ movements can be controlled, is one of the recommended methods for treating left breast cancer. Studies have shown that patients with left breast cancer increase late cardiac morbidity and mortality risk due to radiotherapy compared to patients with right breast cancer[51,52].

In radiotherapy planning of left breast cancer, the risky organs in the radiation field make it difficult to obtain a homogeneous dose distribution. The aim of this study was to compare the volumetric arc therapy (VMAT) plans with the Field-in-Field (FinF) plans prepared for the early stage left breast cancer patients using BHRT. Treatment plans were compared in terms of plan quality and doses received by organs at risk.

Methods

In the study, 10 tomography images of the patients were taken using breath-hold technique. Patients were scanned by Philips Brillance Big Bore 4D computed tomography machine. VMAT and FinF plans were prepared in Eclipse Treatment Planning System (TPS). The suitable gantry angles were selected for FinF RT plans which can cover CTV breast volume entirely and does not see the contralateral breast. A double arc design was used in VMAT plans. The dose was defined as 50 Gy / 25 fractions. For all plans, 95% of the CTV breast volume was targeted to receive 46 Gy. In both techniques, target volume homogeneity index (HI) and conformity index (CI), critical organ doses (ipsilateral lung, heart, contralateral lung and breast) and MUs were compared.

Figure 1

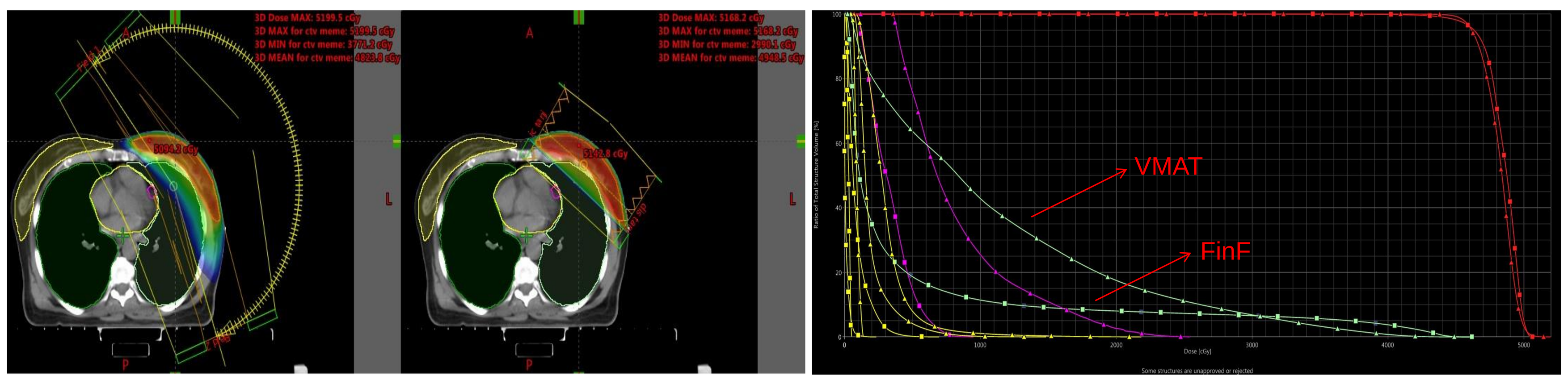


Process of RPM system during treatment procedure

Results

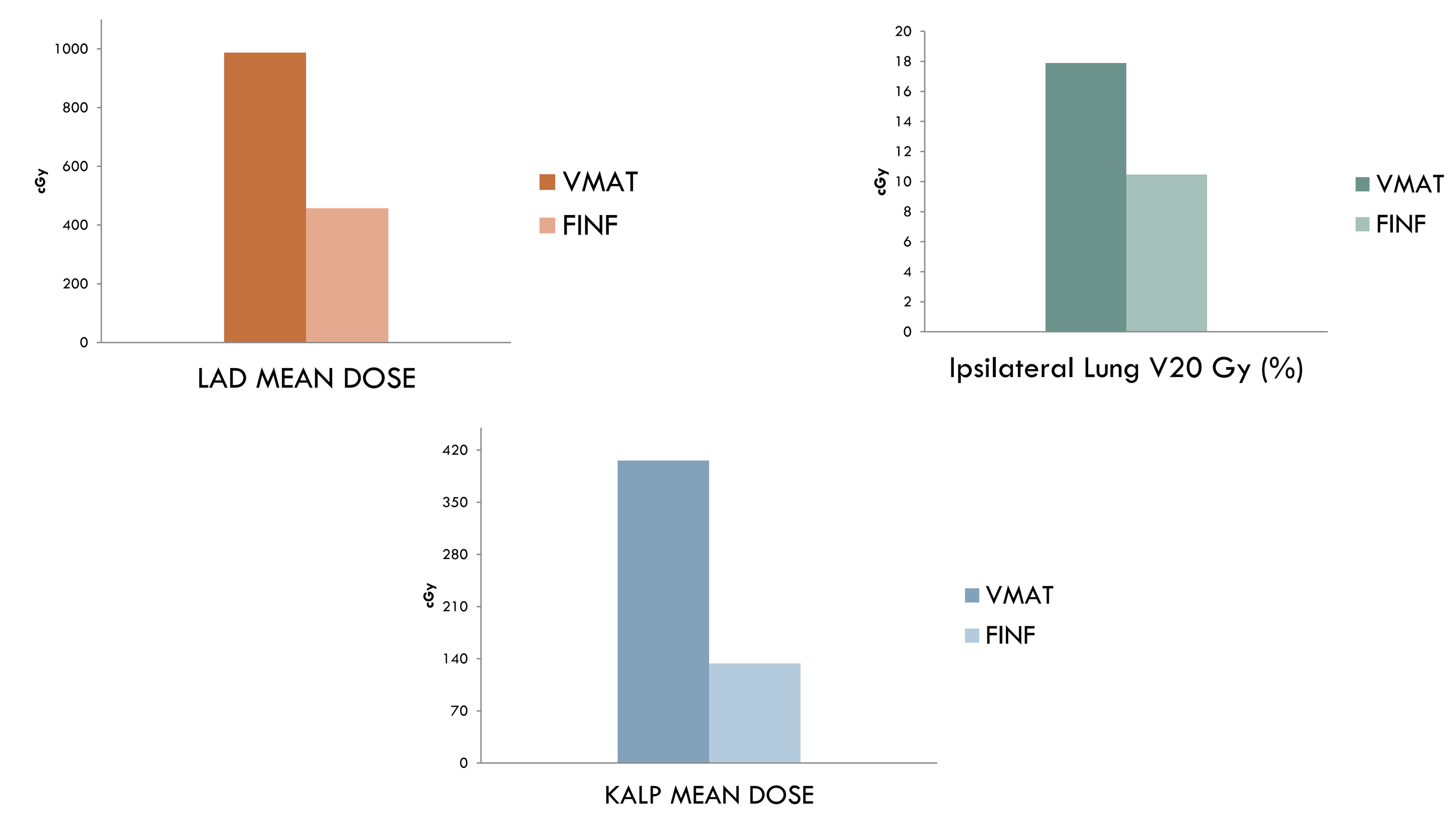
For the VMAT and FinF techniques, CI was found as 1.02±0.04 and 1.341±0.08; HI was found as 0.101±0.02 and 0.147±0.03, respectively.The differences between the treatment techniques are statistically significant for CI and HI values.The CTV breast maximum and mean doses were found to be lower in the VMAT technique ($p<0.05$).The LAD mean doses were lower in the FinF technique compared to the VMAT technique ($p<0.05$). The volume of the ipsilateral lung receiving 5,10,20 and 30Gy; the volume of the heart receiving 5 and 10 Gy and mean dose of the heart;the maximum doses of contralateral lung and breast were found lower in FinF technique ($p<0.05$).MU differences are also statistically significant in favor of FinF.

Figure 2



VMAT and FinF plan isodoses and their Dose-Volume Histograms

Figure 3



VMAT and FinF plan isodoses and their Dose-Volume Histograms

Conclusions

In patients with early stage left breast cancer, better CI and HI values were obtained with VMAT than with FinF in the case of irradiation using BHRT technique**.** But on the other hand, critical organ doses were found to be higher with VMAT technique. This result should not be overlooked in young patients who are thought to have longlife expectancy.

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