

## **A comparative study of Voluntary deep inspiration breath hold versus Free breathing techniques in adjuvant left breast hypofractionated radiotherapy.**

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### **Background and purpose:**

Left-sided breast cancer radiation therapy has been associated with an increased risk of major coronary events. There is evidence demonstrating that the increase is proportional to mean heart dose. Deep Inspiration Breath Hold (DIBH) is a radiation therapy technique that has shown significant dose reduction to the heart and lung in hypofractionated radiotherapy of adjuvant left-sided breast cancers. This study explores the potential benefit of utilizing a DIBH technique to reduce heart and ipsilateral lung doses.

### **Materials and Methods:**

A cross-sectional study was done on 65 patients with adjuvant left breast cancer. Patients are coached and asked to voluntarily hold their breath. For each patient, using Computed Tomography (CT) simulator machine (Siemens, SOMATOM), two CT scans corresponding to free breathing (FB) and vDIBH were acquired during simulation. Using Monaco treatment planning system (version 5.1), FB and vDIBH plans were generated for each patient. All patients were treated on Synergy ELEKTA linear accelerator (Agility platform) utilizing a vDIBH technique. 40.05 Gy in 15 fractions was prescribed. The evaluating parameters are target coverage; the volume of ipsilateral lung received 20 Gy ( $V_{20}$ ); mean heart dose (MHD) and volume of heart received 25 Gy ( $V_{25}$ ). All patients followed an offline portal imaging protocol, where the patients were imaged on day 1-3 and then weekly. Inter-fraction reproducibility was determined by measuring change in chest wall position over all treatment fractions for portal images were obtained. Comparison in chest wall position on the planning digital reconstructed radiograph (DRR) and portal images was used to determine reproducibility of vDIBH at simulation and treatment.

### **Results:**

The mean age for the patients was 45years (SD+<sub>-2</sub>), 45% with stage I, 35% with stage II and 20% with stage III breast cancer. Ninety percent of the patients underwent modified radical mastectomy and received post-mastectomy chest wall radiotherapy and 10% underwent conservative breast surgery and received whole breast radiotherapy. The comparing result shows there is a significant reduction in ipsilateral lung and heart dose statistics for vDIBH compared to FB plans without compromising the target coverage. For ipsilateral lung, the  $V_{20}$  was reduced by 15% with vDIBH comparing with FB. The volume of the heart receiving >25 Gy was reduced 20% and MHD was reduced by 18%. These reductions are considered to be statistically significant. The vDIBH mean reproducibility was 2mm (range 1- 4 mm) in antro-posterior direction.

### **Conclusion:**

Voluntary DIBH technique is successfully implemented and is an important tool for cardiac sparing and has been reproducibly associated with a reduction of mean heart dose. This is a benefit for those patients with left-sided breast irradiation and also has been shown to decrease dose to the lungs.

**Keywords:** breast cancer; reproducibility; radiation therapy; voluntary deep inspiration breath-hold.