The correlation of infrared reflecting marker movement and lung expansion with deep inspiration breath-hold technique for left-sided breast cancer radiotherapy

**Purpose:**
This study was to quantify the correlation of the infrared reflecting marker movement and deep inspiration breath-hold (DIBH) lung expansions by setting the infrared reflecting marker below the xiphoid process on the abdominal wall.

**MATERIALS AND METHODS**
Ten patients with left breast cancer post operation underwent free-breathing (FB) and DIBH computed tomography (CT) using infrared reflecting marker on the abdominal wall. Therapists coached patient breathing maneuvers before CT scans. The breath-hold level (BHL) was recorded by infrared reflecting marker in the anteroposterior (AP) direction by Real-time Position Management system (RPM) system during CT procedure. Lung diameter in AP direction on both free-breathing (FB) and DIBH images were measured at 4 levels: half upper, upper border of heart, half lower and diaphragm levels of lung (Fig.1). The first CT slice with visible lung tissue and diaphragm level were identified for lung diameter in superioinferior (SI) direction corresponding Z values (slice position). Pearson correlation test was used to examine the correlation significance among BHL, lung AP diameter, lung SI diameter, heart dose, and left lung dose.

![Fig. 1 Example of measuring anterior-posterior (AP) diameter of chest wall at different levels including half upper chest wall, upper border of heart, lower chest wall, and diaphragm level.](image)

**RESULTS**
The BHL had strongly positive correlation with lung expansion in SI direction (Pearson correlation \( r = 0.770 \)). When BHL increased 1.0 cm, the lung expansion in SI direction increased 2.6 cm. Also, moderately positive correlation was revealed between BHL and total lung volume (Pearson correlation \( r = 0.596 \)). When BHL increased 1.0 cm, the total lung volume increased 414.1 c.c. Heart mean dose and maximum dose were strongly negative correlated to BHL according to inverse square law. Weak or no correlation was noted between BHL and lung expansion in AP direction at 4 levels (Pearson correlation \( r = 0.318, 0.009, -0.105 \) and -0.238). DIBH plans had lower heart dose (2.64 vs. 1.32 Gy; \( P = 0.005 \)) and ipsilateral lung V20 (%) relative volume (13.6 vs. 10.9 %; \( P = 0.007 \)) than FB plans as previous studies.

**CONCLUSION**
Setting infrared reflecting marker below the xiphoid process on the abdominal wall is sufficient for DIBH technique to detect lung expansion in SI direction and decrease the heart dose significantly. Patient coughing before CT scans is recommended.

**REFERENCE**