INTRODUCTION

Whole breast radiation therapy carries a long-term risk of cardiac toxicity.

The probability of major coronary events increases linearly with the mean dose to the heart, with no minimal threshold for risk.

Alternative technique to tangential radiotherapy such as deep inspiration breath holding (DIBH) can be used in appropriately selected left-sided breast cancer patients.

PURPOSE

To determine if free breathing (FB) CT scan can be used before treatment planning to
1. Estimate in-field heart volume.
2. Predict mean heart dose.
3. Select patients with mean heart dose ≥ 3 Gy.

METHODS

Patients: Early-stage left-sided breast cancer patients treated with breast-conserving surgery + whole breast radiotherapy.

Treatment:. Hypofractionated doses of 42.5 Gy in 16 fx delivered with tangential irradiation.

Field placement and organ at risk delineation was performed by a radiation oncologist.

Definite in-field heart volume was measure with boolean operation.

Linear correlation between mean heart dose and in-field heart volume was obtained.

Heart dose estimates: Heart depth of field penetration and heart radius were measures by a medical physicist using FB CT and expected field placement.

Estimates of in-field heart volume was obtained from spherical cap volume equation (Fig 1) and corresponding mean heart dose was derived from linear correlation of group analysis.

Sensitivity and specificity in selecting patients with mean heart dose ≥ 3 Gy was measured.

RESULTS

Thirty-two tangential plans were analyzed.

Fig 2: Linear correlation between mean heart dose and irradiated heart volume

Mean heart dose of a tangential whole left breast irradiation can be estimated promptly using anatomical landmarks and expected field placement.

Patients who will most benefit from DIBH irradiation can be identified at the treatment scanning station and may undergo additional planning CT scan accordingly.

This can benefit the clinical workflow, as patients will no longer have to return on a later date for a second DIBH planning scan, further delaying their treatment.