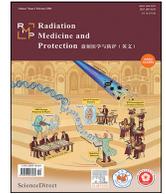




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Original article

# Comparison of dose sparing between visual feedback guided- and active breathing coordinator-assisted- deep inspiration breath hold for left whole breast radiotherapy

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## ARTICLE INFO

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## ABSTRACT

**Objective:** To compare the benefits of dosimetry between different deep inspiration breath hold (DIBH) techniques.

**Methods:** A total of sixty patients eligible for adjuvant left whole-breast radiotherapy were enrolled, with equal allocation ( $n = 30$  per group) to either vDIBH or active breathing coordinator (ABC)-DIBH techniques. All patients received computed tomography (CT) scans in both free breathing (FB) and DIBH states. The target and crucial organs at risks (OARs) were precisely delineated on both breathing states of CT scans. The primary endpoints focused on assessing the irradiation exposure to OARs, including the heart, left anterior descending coronary (LAD) artery, left lung and stomach.

**Results:** The dose sparing advantage was more pronounced with vDIBH compared to ABC-DIBH, correlating with its enhanced lung expansion capacity. The relative dose reduction of heart's mean dose ( $32\% \pm 18\%$  vs.  $22\% \pm 15\%$ ,  $P = 0.018$ ) and LAD artery's mean dose ( $43\% \pm 25\%$  vs.  $30\% \pm 16\%$ ,  $P = 0.023$ ) were improved with vDIBH comparing with ABC-DIBH. However, regardless of whether vDIBH or ABC-DIBH was employed, our study did not demonstrate the protective effect of DIBH on the left lung.

**Conclusion:** The vDIBH group demonstrated a remarkable dose reduction for OARs mentioned above compared to the ABC-DIBH group, attributed to greater lung inflation during vDIBH.

## 1. Introduction

Whole-breast radiotherapy after breast conservative surgery can remove microscopic disease as radiotherapy halves the breast cancer recurrence rate, which reduced the 10-year recurrence risk from 35.0% to 19.3%.<sup>1</sup> Compared to conventional fractionated radiotherapy, which involves higher costs in terms of both time and economy, hypofractionated radiotherapy provides a more efficient alternative that substantially reduces both treatment duration and expense. The several randomized trials have demonstrated noninferiority between hypofractionated and conventional fractionated radiotherapy after breast-conserving surgery.<sup>2–4</sup> However, none of these approaches can

mitigate the cardiovascular radiation risk by altering fraction regimens. Radiation exposure of the heart and coronary arteries increases the incidence of ischemic heart disease, which is linearly with the mean ionizing radiation dose.<sup>5,6</sup>

Furthermore, during the inspiratory and expiratory phases of breathing, the amplitude of organ motion within the thorax can exceed the centimetric range. To guarantee comprehensive coverage throughout the respiratory cycle, planning target volumes (PTV) are often expanded accordingly. Researchers had explored methods to mitigate the detrimental effects of cardiopulmonary radiotherapy and demonstrated DIBH can efficiently address and resolve these deficiencies. Previous researches have validated that DIBH enhances lung

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