Radiation Medicine and Protection 7 (2026) 43–47

Contents lists available at ScienceDirect

Radiation Medicine and Protection

journal homepage: www.radmp.org

Original article

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

Rencui Quan[a,b,c], Dong Yang[b,c], Hongtao Chen[b,*], Xianming Li[b,**], Zihuang Li[b], Jingwen Liu[b], Yucong Zhang[b], Jianfeng Liu[b]

[a] Jinan University, 510632 Guangzhou, China
[b] Department of Radiation Oncology, Shenzhen People's Hospital, Second Clinical Medical College, Jinan University, First Affiliated Hospital, Southern University of Science and Technology, Shenzhen 518000, China

ARTICLE INFO

Keywords:
Adjuvant radiotherapy
Left-sided breast cancer
Deep inspiration breath hold (DIBH) technique
Benefits of dosimetry
Visual feedback DIBH

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 % ± 18 % *vs.* 22 % ± 15 %, $P = 0.018$) and LAD artery's mean dose (43 % ± 25 % *vs.* 30 % ± 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 %.[1] 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.[2–4] 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.[5,6]

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

* Corresponding author.
** Corresponding author.
E-mail addresses: taohongchen@hotmail.com (H. Chen), lxm1828@hotmail.com (X. Li).
[c] They contributed equally to this work.

https://doi.org/10.1016/j.radmp.2026.01.004
Received 11 June 2025; Received in revised form 18 January 2026; Accepted 21 January 2026
Available online 22 January 2026