
Cardiac Sparing Radiotherapy for Standard Tangential Breast Radiotherapy

Standard Operating Procedure

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1 Purpose of the Document

This document provides LCA best practice principles and outlines the LCA standard operating procedure for the provision of cardiac sparing radiotherapy for standard tangential breast radiotherapy, using a Deep Inspiratory Breath Hold (DIBH) technique as identified and mandated by the LCA Radiotherapy Pathway Group.

2 Background

Cardiac irradiation increases the risk of coronary heart disease (CHD). There is no formalized safe limit of radiation, though various trials have recommended upper doses, assuming dose to breast of 40.05Gy in 15 fractions: V13Gy<10%, mean heart dose <3Gy (IMPORT HIGH, IMPORT LOW); V25Gy≤5%, V5Gy≤30% (FAST FORWARD, HEARTSPARE); HEARTSPARE plus (planned) V17Gy<10%, V35Gy<5%.

A recent study by Darby et al (1) showed a linear dose response relationship between radiation dose to the heart and CHD risk in breast cancer survivors for a relatively low range of mean heart dose (range, 0.03-27.7 Gy; average, 5 Gy) with the relative risk of major coronary events rising by 7.4 % per 1Gy increase in mean heart dose. A recent study in survivors of Hodgkin lymphoma (a different population demographic) reported a risk of CHD increased linearly with increasing mean heart dose (excess relative risk [ERR] per Gy, 7.4%) (2).

It is particularly important that dose is limited in patients with established cardiac problems or risk factors for future cardiac disease.

Treatment in deep inspiratory breath-hold (DIBH) reduces the dose delivered to the heart by around 50-60% in the majority of cases compared to delivery in free breathing (FB).

A maximum heart depth on a beams eye view of 1cm roughly correlates with a mean heart dose of 3Gy (3).

It is important to note that for most patients the impact of cardiac sparing radiotherapy will be slight. From Darby et al (2) the risk of a cardiac event and cardiac death between the ages of 40 and 80 with no cardiac risk factors is 4.7% and 2% respectively. Corresponding figures with one cardiac risk factor are 7.9% and 3.3%. Delivering a mean heart dose of 3Gy (a maximum heart depth of 1cm) at age 40 will increase these risks (see Figure 1).

Figure 1: Risk of cardiac event

	Risk of cardiac event between age of 40 and 80, no risk factor	Risk of cardiac death between age of 40 and 80, no risk factor	Risk of cardiac event between age of 40 and 80, 1 risk factor	Risk of cardiac death between age of 40 and 80, 1 risk factor
No cardiac irradiation	1.9%	0.5%	3.3%	0.9%
Mean heart dose of 3Gy delivered age 40	2.3%	0.61%	4.0%	1.1%

2.1 LCA audit of cardiac sparing radiotherapy

To understand the LCA baseline position regarding cardiac sparing radiotherapy, a retrospective audit of cardiac sparing radiotherapy for Standard Tangential Breast Radiotherapy was carried out for September 2015. The audit demonstrated that all four centres (The Royal Marsden NHS Foundation Trust, Mount Vernon Cancer Centre, Guy's and St Thomas' NHS Foundation Trust and Imperial College Healthcare NHS Trust) had implemented DIBH. It also highlighted that differing selection and exclusion criteria are applied.

3 Patient Selection

Treatment in DIBH requires respiratory coaching in the simulator and slightly longer treatment times such that some units choose to select only patients likely to exceed safe dose limits. The process of selection of these patients for DIBH can expend significant resources in terms of additional (free breathing) planning CT scans and radiotherapy planning in patients who will ultimately be treated in DIBH and, unless the CT-simulation workflow allows for immediate assessment and rescanning in DIBH, patient recall for a second (DIBH) planning scan.

3.1 Selection criteria

Patients most likely to benefit from a DIBH technique include:

1. Breast conservation cases with a tumour bed in the lower part of the left breast or post mastectomy cases in which cardiac shielding is inadvisable as it may shield the tumour bed.
2. Patients with established cardiac problems or risk factors for future cardiac disease and possibly patients < age 50
3. Patients with cardiac doses exceeding safe limits (mean heart dose 3Gy)
4. Patients with a maximum heart depth (in profile on a DRR) of 1cm

It is recommended that, as a minimum, units treat the above four categories of patient using a DIBH technique. Units may of course adopt their own additional local selection criteria and may, for example choose to treat all left-breast affected patients in DIBH or indeed treat all cases in DIBH if easier.

3.2 Exclusion criteria

It should be noted that a certain proportion of patients may not be able to comply with DIBH. The following exclusion criteria are applied across the four LCA centres.

- Unable to achieve reproducibility
- Patients unable to hold breath for >20 secs
- Hearing impaired patients
- Patients with breathing difficulties, e.g. COPD
- Patients unable to understand instructions
- Patients where there is <5mm of chest wall movement (using the ant PM)
- Patients who require a vac bag

4 Technique

Details of radiotherapy techniques will be different between centres and will be documented in each centre's ISO9000 RT QA system. Voluntary breath hold is practiced at all centres. Mount Vernon Cancer Centre uses Varian RPM system. All other centres monitor patient's position by light field or laser. ABC is used if light field cannot be visualised.

5 Monitoring Compliance

5.1 Implementation and monitoring compliance

All four centres have reported that they are implementing DIBH and the LCA Breast Cancer Clinical Guidelines have been updated to reflect this change in practice.

5.2 Pathway metrics and focus for data collection

It is estimated that if these guidelines are followed, at least 20% of left sided patients will be selected for treatment in DIBH. The Radiotherapy Pathway Group has therefore concluded the LCA baseline compliance target should be set at a minimum of 20%.

5.3 Monitoring compliance

The Radiotherapy Pathway Group will be monitoring compliance via regular reporting cycles which will form part of the quality metrics that underline the LCA Quality Assurance Framework. Provider Trusts that do not comply with the metric outlined above will be monitored via the pathway group's exception report and may be asked to provide an action plan ensuring implementation.

The LCA Radiotherapy Pathway Group can assist providers by supporting implementation where necessary and can escalate to gain traction if there are barriers which are prohibiting implementation.

6 References

1. Darby SC, Ewertz M, McGale P, Bennet AM et al. Risk of ischemic heart disease in women after radiotherapy for breast cancer. *N Engl J Med.* 368(11):987-98, 2013
2. Frederika A. van Nimwegen, Michael Schaapveld, David J. Cutter et al. Radiation Dose-Response Relationship for Risk of Coronary Heart Disease in Survivors of Hodgkin Lymphoma. *J Clin Oncol.* 2015 Nov 16. pii: JCO.2015.63.4444
3. Taylor CW, Povall JM, McGale P et al. Cardiac dose from tangential breast cancer radiotherapy in the year 2006. *Int J Radiat Oncol Biol Phys.* 72(2):501-7, 2008