Mobility Grant Report

Clinical implementation of deep inspiration breath-hold technique (DIBH) for breast radiotherapy

Host Institute : *Imperial College Health Care National Health Service (NHS) Trust, London, United Kingdom*
Date Of Visit : *7-20 October 2019*

Aim:

The purpose of my visit was to learn all aspects of the clinical implementation of the deep inspiration breath-hold technique (DIBH) for breast radiotherapy, from simulation through mould-room procedure, contouring and treatment planning to quality assurance (QA) and delivery. In addition, verification of the images used for patient set-up during delivery of the treatment was observed.

During my visit, I was amazed to discover that Imperial College Health Care NHS Trust provides acute and specialist health care for a population of nearly two million people in North West London. The radiotherapy department also operates across Hammersmith and Charing Cross hospitals. The scanning, with a CT Brilliance machine, and treatment planning are performed at Charing Cross Hospital, but treatment delivery takes place at both hospitals. The radiotherapy departments have Varian-based linear accelerators (linacs) for patient treatment, which combine advanced 3D-imaging with precise radiotherapy delivery, and a unique CT scanner that provides exceptional image quality with the lowest possible radiation exposure. These departments have been at the forefront of implementing new radiotherapy treatment techniques. Charing Cross Hospital has performed a lot of pioneering work on DIBH for various clinical sites, especially breast radiotherapy.

Use of DIBH reduces investment costs and offers an easily understood technique that is simple to implement in a radiotherapy department. The advantage of this technique for patients is that it provides heart-sparing radiotherapy for patients with left-sided breast cancer. In our institute, we have treated many breast-cancer patients with external beam radiotherapy (EBRT). Therefore, the focus of my visit was to learn this technique and establish the same in my home institute.

Scientific details of the visit:

Firstly, selection of patients for DIBH breast radiotherapy is considered an important factor. The patients who are able to perform consistent breath holding during simulation and delivery are chosen for this technique. I spent a few days in CT simulation with radiographers, where I observed that during the simulation procedure the patients were trained to hold their breath and the DIBH technique was explained to them in detail. The patient set-up was performed on the CT couch. The patient was placed in a supine position with both arms elevated and supported, and a breast board was used. . The standard patient positioning was carried out using skin markers, room laser alignment, and breast board scale positioning. All the measured data related to patient set-up was noted down in the patient set-up sheet. The patient was trained to take a deep breath in and hold it for different intervals of five, 10, 15 and 20 seconds. In order to maintain consistency of the breath hold, patients were instructed by radiographers to breathe in and out twice before asking them to hold their breath for 20 seconds. During the CT scan they communicated with the patient through an intercom system in order to instruct the patient when they should hold their breath and when they should release it. During this procedure the patient was continuously monitored. For treatment planning, a CT slice of 3 mm thickness was produced.

Holding the breath during treatment inflates the lungs and pushes the heart away from the chest wall and away from the area being treated. Many studies have confirmed that this technique can significantly reduce the radiation dose to the heart during left-breast irradiation. The prescription dose to target volume was 40.05Gy in 15 fractions. A three-dimensional conformal radiation therapy (3D-CRT) technique was used to generate the treatment plan, which consisted of two opposing tangential beams and additional beam segments (Field- Field in technique).

For treatment delivery, the patient was positioned on the treatment couch in the same position as that used for the CT simulation. A pre-treatment 2D image verification was performed to verify the patient set-up. Once the patient was correctly positioned, the radiographers asked the patient to hold the breath and release it several times until they were satisfied with the position. The

patient was then asked to hold the breath when the radiographers were ready to switch on the radiation beam. The patient was asked to release the breath when the radiation beam was completed. This was repeated several times until the treatment was finished. During treatment delivery, while one radiographer monitored the patient position, another switched on the radiation beam. If the patient released the breath without being told to do so, the monitoring radiographer would alert the other who would then switch the radiation off. After various discussions with the radiotherapy team, I was able to understand that the DIBH technique was able to provide better results and significant reduction in dose to the heart compared with radiotherapy without DIBH, and was comfortable for the patient with no risk factors.

This two-week period was sufficient for me to understand the complete process of the incorporation of the DIBH technique to breast radiotherapy. I was also given an opportunity to present a talk on this technique in a seminar organised on the last day of my fellowship. The participants found the session interesting and knowledgeable.

Results:

Through this fellowship, I gained in-depth practical experience and knowledge of the clinical implementation of the DIBH technique. After the completion of my fellowship, I have shared the technical and clinical knowledge I gained with my team members (radiation oncologist, medical physicist and technologist) at my home institute. As a team, we plan to start use of this advanced technique as soon as possible in our department.

I would like to convey my sincere thanks to Camarie Welgemoed, breast specialist and superintendent at the Imperial College Health Care NHS Trust, who invited me to learn this technology and supported me as a host supervisor during my fellowship. Also, I thank her for her wonderful organisation and clinical support to make my fellowship successful. I thank Jackarias Doraisamy, Patti McNaught, Susan Cleator, Sindhy Singh and the other radiographers for supporting me to learn the different planning methods used in the treatment planning system (Eclipse™ and Oncentra™) and treatment delivery.

I would like to convey my thanks to Peter Dunn, Ruth McLauchlan and Mark Elsworthy for various discussions on treatment protocols, QA methods and research work. I especially thank Claire Hardiman, head of radiation physics, for various discussions on treatment planning, different QA protocols and research work. Also, I thank Dr Narendra Kumar Bhalla (head radiation oncologist) at my home institute for his continuous encouragement and clinical support.

Finally my sincere thanks go to the ESTRO team for the ESTRO mobility grant award to enable me to learn from a reputable institute and enhance my knowledge and skills in DIBH breast radiotherapy. Moreover, I especially thank Viviane Van Egten (education manager, ESTRO) for her support and organisation, which helped to make this fellowship successful.

References:

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- Smyth LM, Knight KA, Aarons YK, Wasiak J. The cardiac dose sparing benefits of deep inspiration breath-hold in left breast irradiation: a systematic review. J Med Radiat Sci 2015; 62: 66–73.
- Zurl B, Stranzl H, Winkler P, Kapp KS. Quantitative assessment of irradiated lung volume and lung mass in breast cancer patients treated with tangential fields in combination with deep inspiration breath hold (DIBH). Strahlenther Onkol 2010; 186: 157–62.

With Host Supervisor

At Hammersmith Hospital

During treatment planning with Eclipse™ & Oncentra™ TPS

Preparation of mould

Seminar on DIBH breast radiotherapy – training-experience and knowledge-sharing session

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