QUALITY OUTCOMES: REDUCING RADIATION HEART DOSE WITH DEEP INSPIRATION BREATH HOLD

Outcomes of using Deep Inspiration Breath Hold technique during radiation treatment delivery on patients with left sided breast cancer

Sanford Cancer Center in Sioux Falls sees more than 300 patients with a new breast cancer diagnosis annually. As a leader in cancer care, we continue to develop and implement state-of-the-art techniques to ensure the best clinical outcomes. One of the goals of treatment for the patient is to have the lowest achievable dose of radiation delivered to healthy structures near the radiation treatment field. Deep Inspiration Breath Hold (DIBH) is a new technique initiated at Sanford Radiation Oncology to help achieve the goal of reducing dose to normal tissue. Our aim is to measure the radiation dose to the heart for patients being treated with radiation for left sided breast cancer and compare this to patients not treated with DIBH.

How it works

Patients will work closely with the radiation therapists. They coach patients on how to hold their breath, and will monitor their breathing during their treatment. Video cameras will be focused on the patient's breathing movement in the treatment room. There is no radiation associated with the monitoring system; it is comparable to a regular camera. The cameras are used by the radiation therapists to position patients on the treatment table, and also monitor their breathing during treatment.

Patients are positioned on the treatment table based on a series of marks on their skin that they receive at the time of the treatment planning CT scan. A series of lasers help guide proper patient position placement. The camera will shine a red light onto the patient's skin. The therapist will ask the patient to take a deep breath and they will move the table so the patient is positioned correctly. This process may be repeated for proper positioning.

When patients are ready for the radiation treatment, the radiation therapist will tell the patient over a speaker system to take in a deep breath and hold it. This may also take several tries before it's entirely correct. By holding their breath, their heart stays out of the radiation treatment field.

Since the implementation of DIBH there is a measurable reduction in the radiation heart dose for our left breast cancer patients. A quality study was completed and data following implementation of the DIBH technique quality improvement is as follows:

Study Topic: Performance measures radiation dose to critical structures before and after the introduction of DIBH technique in the Radiation Oncology treatment setting.

Purpose: The primary aim of the study was to measure the radiation dose outcome in critical structures for patients being treated in Radiation Oncology with left sided breast cancers. Current literature has shown that patients treated utilizing a DIBH technique receive the prescribed radiation dose to the treatment target, while decreasing dose to healthy tissues of the heart and left lung (Tang et al). Additionally, through patient selection, a robust patient education plan, and increased experience of the radiation oncology staff have also shown to decrease treatment time for some patients.

The goal of the study was to complete a retrospective comparison of left sided breast cancer patients treated under a conventional technique to the same patient population treated utilizing a DIBH technique. Measurement and reporting will include median dose and range to heart and left lung in all cases.

Scope of Issue: Comparison data was utilized from June 2016 through August 2017, inclusive of all physicians in the practice. A DIBH technique was initiated with the first patient being treated in March 2017. Evaluation included at least 30 cases within each group.

Reason why issue to be addressed: Sanford Cancer Center Radiation Oncology department developed and implemented the DIBH program in December 2016. Evaluation of the clinical impact to patients receiving their radiation through this technique was an important aspect of clinical decision making and assisted us in identifying any opportunities or successes, as well as, implement any departmental changes related to what we discovered.

SANFORD
CANCER CENTER

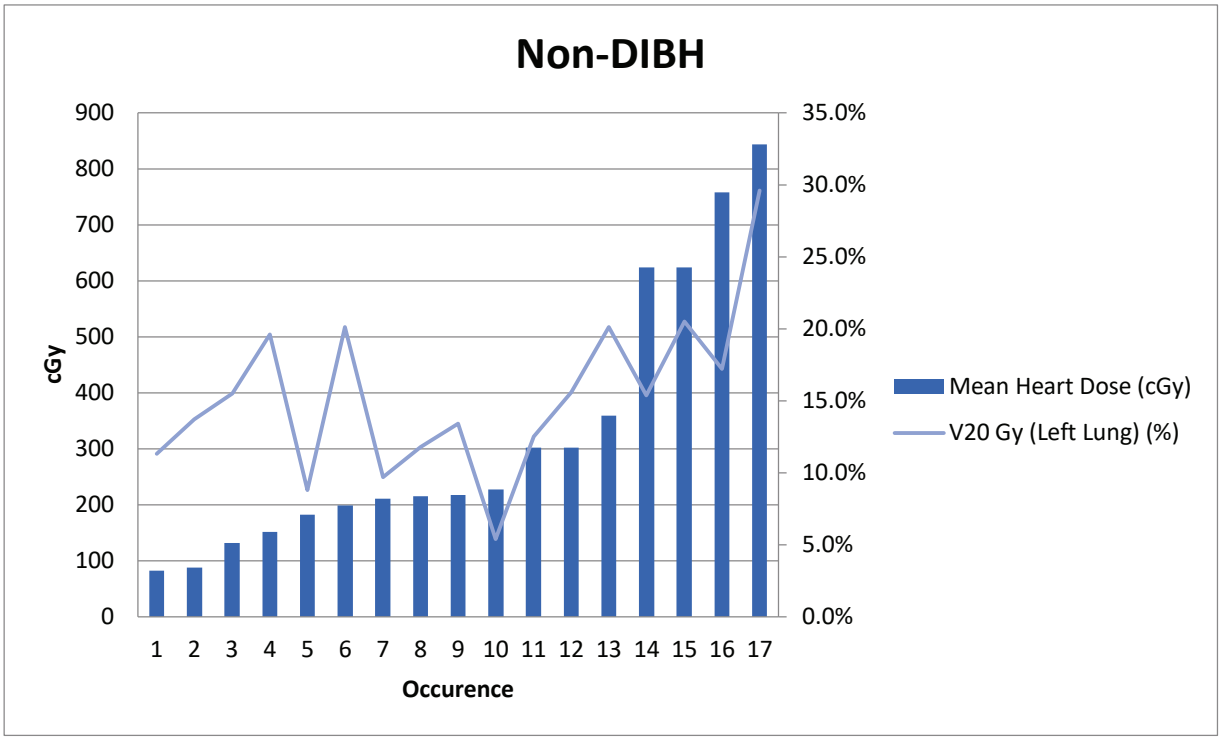
QUALITY OUTCOMES: REDUCING RADIATION HEART DOSE WITH DEEP INSPIRATION BREATH HOLD

Factors contributing to this issue: Sanford Cancer Center sees over 300 new breast cancer diagnoses annually. As a leader in healthcare, we want to continue to develop and use state-of-the-art techniques to ensure the best clinical outcomes for the patient with the lowest achievable dose of radiation delivered to healthy structures near the radiation field. DIBH is such a technique if implemented correctly. Developing clinical processes that support these principles should result in a clinically relevant decrease in radiation dose to adjacent structures for patients treated using the DIBH technique. Following implementation of DIBH in our clinic, we are measuring the impact on radiation dose for comparison, discussion and potential additional improvement to patient care.

Data Source: Data for this study was pulled from Sanford Radiation Oncology software Varian-Aria by the radiation oncology team. All cases were selected from the database by date of service until the specified number was achieved for both groups.

Project Population: To be considered for the DIBH technique patients must: be female; have a left breast cancer diagnosis that is pathologically staged as 0, 1, or 2; have undergone breast conserving surgery; and possess the ability to hold their breath for 20 or more seconds at a time in treatment position. Patients with a pacemaker and/or defibrillator are not eligible. Out of 21 eligible patients, only two were unable to select treatment using the DIBH technique as the department was in the final stages of completing physician and staff competency training. Some of the patients who would have been eligible had already completed simulation for their treatment, and offering treatment under DIBH may have resulted in extra preparation time for the patient's treatment planning and the potential for re-simulation at extra cost. For these reasons, DIBH was not offered to the two patients in this situation. Otherwise 100% of eligible patients elected to be treated with the DIBH technique.

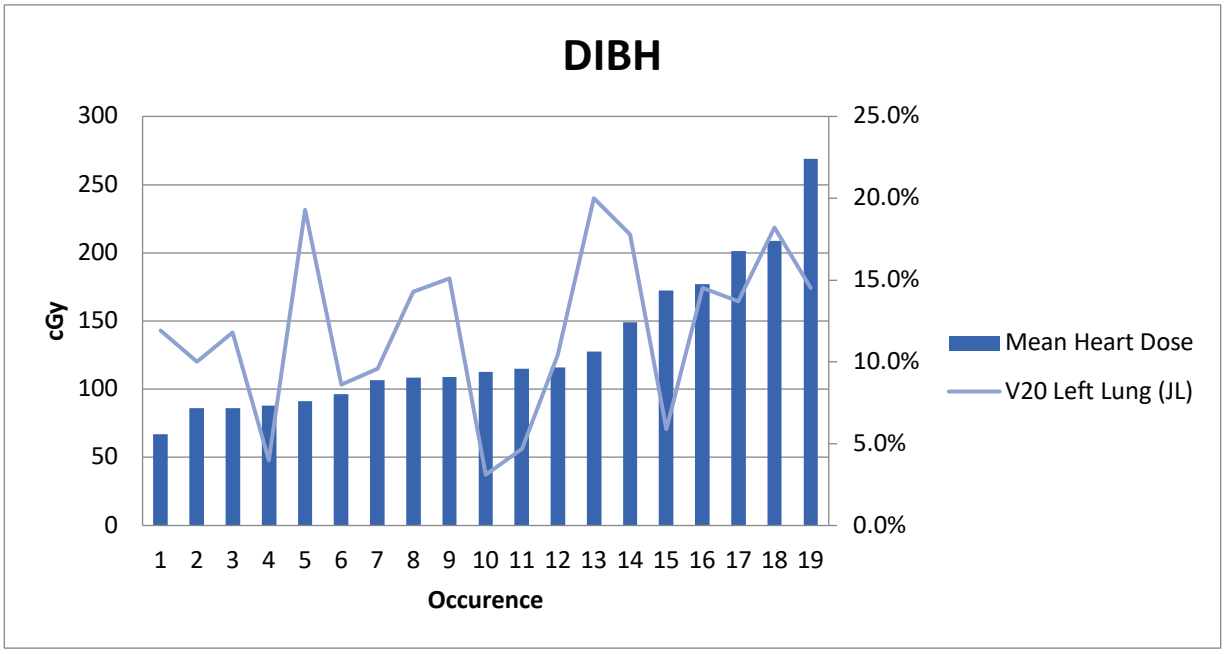
Summary of Data:



	Mean Heart Dose	V20 Gy (Left Lung) %
Mean	324.5	15.3%
Standard Deviation	237.4	5.7%

SANFORD CANCER CENTER

QUALITY OUTCOMES: REDUCING RADIATION HEART DOSE WITH DEEP INSPIRATION BREATH HOLD



	Mean Heart Dose	V20 Gy (Left Lung) %
Mean	130.9	12.0%
Standard Deviation	52.4	5.1%

Initial data for the first 19 patients for each category (Non-DIBH vs. DIBH) is graphed from lowest to highest mean heart dose in (cGy). Correlating V20 % for left lung is included for each case. A student's t-test was completed comparing the DIBH and non-DIBH groups, to see if the differences are statistically significant. At this time, findings show the mean Mean Heart Dose is 130.9 cGy with a SD of 52.4 in DIBH cases and the mean Mean Heart Dose is 324.5 cGy with a SD of 237.4 in in Non-DIBH cases. Mean V20 to Left Lung is 12.0% with a SD of 5.1 in DIBH cases and mean V20 to Left Lung is 15.3% with a SD of 5.7 in Non-DIBH cases.

Follow-up/ Action Plan: The initial findings above were shared with the radiation oncology physician group and section leadership for further input, comments and recommendations for changes in practice or process. We will continue to review data in this category until we have 30 cases for each treatment type, and then subsequent review and report will be generated. This study of quality was also reported to the Edith Sanford Breast Leadership Committee.

Quality workgroup: Ryan Nowak MD, Michael Ernster, Kelly Carlson, Lori Severson

References:

Tang X, Zagar T, Bair E, Jones E, et al. Clinical experience with 3-dimensional surface matching-based deep inspiration breath hold for left-sided breast cancer radiation therapy. Practical Radiation Oncology. 2014;4:e151-e158.

SANFORD CANCER CENTER