Breath hold techniques during volumetric modulated arc therapy in breast cancer patients

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Interestingly, treatment machines used to deliver radiotherapy can be configured to receive feedback from special sensors placed on the patient that tell the machine if the patient is not breathing enough that would help separate critical organs from the treatment area. This would automatically terminate the radiation beam, turning it back on only if the patient is able to breathe in adequately as expected. This arrangement manages to spare the critical organs and avoid excessive dose to normal tissue.

**DEEP BREATH HOLDS REDUCE RADIATION EXPOSURE**

The main findings of Dr Dumane’s study were that DIBH during VMAT did reduce the volume of the heart, lungs and contralateral breast or implant exposed to low doses of radiation while also reducing the average radiation exposed to the heart. Given that there is a significant link between radiation dose that the heart is exposed to, and cardiac implications for patients with breast cancer undergoing radiotherapy.

In addition to reducing exposure to the heart, DIBH also decreased the level of radiation to the lungs, reducing the risk of radiation-induced inflammation within them.

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Finally, the team were also able to show that DIBH reduced the amount of the contralateral breast exposed to radiation, reducing the risk of future incidence of secondary cancer to the contralateral breast.

Although DIBH as a technique is not novel and has already been implemented across many treatment centres, Dr Dumane’s research shows its application in patients receiving VMAT for complex anatomies due to the presence of tissue expanders or permanent implants requiring regional nodal irradiation, furthering knowledge and understanding to the ways in which patients with breast cancer undergo treatment. DIBH when utilised with VMAT has a significant dosimetric impact with respect to reducing low-dose which is of immense overall benefit – especially since the consequences concerning low dose exposure in this cohort of patients is relatively understudied and unknown.

Dr Dumane concludes that DIBH should be considered when breast cancer patients with implant reconstructions also requiring regional nodal radiation are being treated with VMAT due to complex anatomies. Using a combination of VMAT and DIBH reduced radiation to the heart and lungs by 30% and 11%, respectively, and to the contralateral breast/implant by 18%. This suggests that using a breath hold is beneficial and should be factored into treatment planning for this patient group, especially as there is limited to no risk associated with it, and for a treatment centre with machines configured to use this technology should require no additional specialised training or resources.

Dr Dumane investigates the development of treatment planning approaches that are designed to cover the target volumes while minimising dose to critical organs, developing knowledge-based models for automated treatment planning for various treatment sites including mastectomy, multiple cranial lesion stereotactic radiosurgery (SRS) and prostate cancer.

### References


### Personal Response

**What other techniques can be used to limit the exposure of surrounding tissues and organs to high doses of radiation?**

Techniques to limit high doses of radiation to the surrounding tissue are field-in-field intensity modulated radiation therapy (FIF-IMRT) where subfields are added to reduce volumes of high doses throughout the target; however these are typically restricted to 2 radiation beams. Multibeam intensity-modulated radiation therapy (MB-IMRT) can further reduce high dose regions to surrounding tissue since it uses many radiation beams from different angles/approaches. Helical tomotherapy (HT) is another way of delivering MB-IMRT where the machine resembles a CT scanner continuously rotating around the patient while the patient is translated through the beam delivery plane. Remember that all these techniques mentioned use photons for treatment. The other option is to use proton therapy.