University College London Hospitals NHS
NHS Foundation Trust

uclh

Reproducibility of Lung Volume with the Varian RPM for Deep Inspiration Breath Hold (DIBH)

Sairanne Wickers[1], Laura Allington[1], Helen Grimes[2], Naina Hindocha[2]
1. Radiotherapy Department 2. Radiotherapy Physics
sairanne.wickers@uclh.nhs.uk

INTRODUCTION & OBJECTIVES

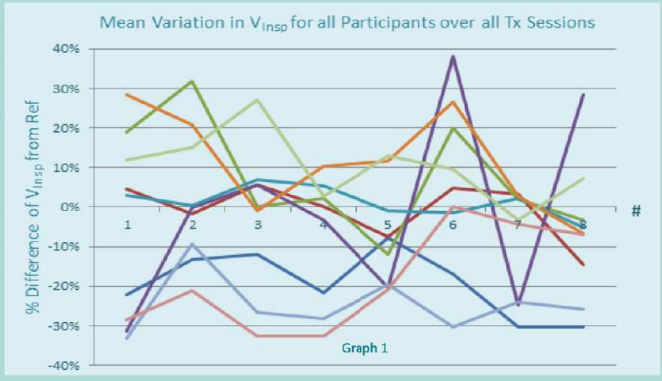
DIBH can reduce heart dose when planning breast radiotherapy versus free breathing (FB)[1-3]. Whilst reducing heart dose is an important clinical objective[4], DIBH must support accurate and reproducible treatment. Inspired lung volume (V_{Insp}) variation may be an important variable in terms of the impact on set-up accuracy in the DIBH setting with regard to lung, heart and tumour bed dose[1]. The Varian Real Time Position Management system (RPM) uses a reflective marker block that when positioned on the patient acts as a respiratory surrogate. The aim of this study was to measure the inter and intra-fraction variation of V_{Insp} when performing DIBH with the Varian RPM.

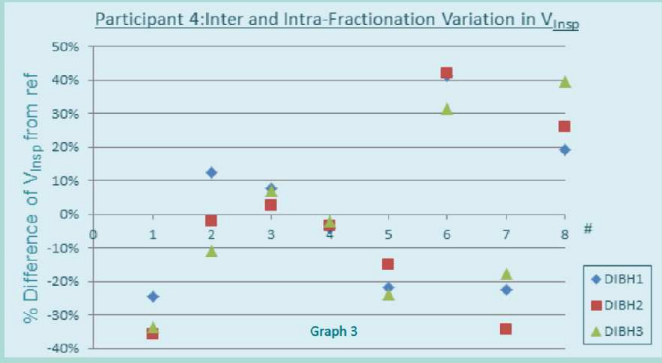
METHODS

Staff volunteers were positioned supine on a 15 degree inclined breast board with both arms raised. The RPM marker block was localised to midline where vertical movement was observed during DIBH. All volunteers were visually coached to an individualised DIBH RPM amplitude, and a reference (planning) session was acquired. Each participant attended 8 subsequent (treatment) sessions where they were visually coached to perform 3 DIBH's to the reference amplitude (5mm threshold). For all sessions, V_{Insp} was measured with the SDX® DynR spirometer. Variation was measured as a percentage difference from the reference V_{Insp}.

RESULTS

- 10 reference and 240 treatment DIBH's were acquired, with all 10 participants meeting their RPM amplitude for all sessions
- Mean reference RPM amplitude & V_{Insp} was 21.8mm (12.2-32.2mm) & 1.94 litres (1.41-3.44 litres)
- Treatment V_{Insp} was found to vary from the reference session with a mean deviation of 15.5% (range 0-49%)
- Graph 1 displays the mean variation of V_{Insp} from the reference for each participant over 8 fractions
- Graph 2 and 3 show the differences in intra and inter-fraction variation between two volunteers. Both volunteers met the planned amplitude threshold.





CONCLUSION

DIBH is widely reported as reducing heart dose for left-sided breast RT in a series of FB versus DIBH plan comparison studies. However, the impact of DIBH on set-up accuracy in terms of organ reproducibility over a treatment course has not been widely investigated.

The Varian RPM respiratory gating system delivers DIBH treatment based on the assumption that the marker-block motion is an accurate surrogate for lung inflation throughout a treatment course, compared to that acquired during the planning CT.

This study highlighted wide variations in V_{insp} between planning and treatment sessions. This may influence the position of, and therefore dose to the adjacent organs; the heart and the breast. Differences in planned and delivered dose to these structures could have clinical implications in terms of predicted toxicity and tumour control.

FUTURE WORK

A patient cohort study to evaluate the impact of V_{insp} when performing DIBH with the Varian RPM on dose to the heart, lung and PTV is currently in trial set-up. Treatment plans will be recalculated on CT data acquired at specific fractions during a course of breast RT. Variation in dose will be correlated against variation in V_{insp} measured with the SDX® DynR spirometer.

REFERENCES

1. Giraud et al, 2010. Contribution of respiratory gating technique for optimization of breast cancer radiotherapy. *Cancer Investigation 30 pp.323-330.*
2. Bartlett et al, 2013. The UK Heartspare Study: Randomised evaluation of voluntary deep-inspiration breath-hold in women undergoing breast radiotherapy. *Radiotherapy Onc 108 pp. 242-247.*
3. Eldridge-Hindy et al, 2015. Active breasthing co-ordinator reduces radiation dose to the heart and preserves local control in patients with left breast cancer: Report of a prospective trial. *Practical Radiation Oncology 5 pp. 4-10.*
4. Darby et al 2013. Risk of ischemic heart disease in women after radiotherapy for breast cancer. *N Engl J Med 368(110) pp.987-998.*

1118--PO
RTT track: Image guided radiotherapy, adaptive radiotherapy, geometric uncertainties and margins
Sairanne WICKERS
DOI: 10.3252/pso.eu.estro2015.2015
Poster presented at: 3rd ESTRO FORUM
PosterSessionOnline.com