



Breast Radiotherapy : Heart position reproducibility with spirometric DIBH



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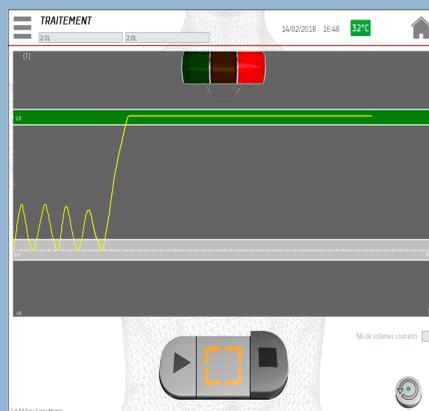
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Purpose and Objective

Deep Inspiration Breath Hold (DIBH) is currently a standard practice to protect the heart during left breast radiotherapy. The increased lung volume pushes the heart in the opposite direction of the breast. This mechanical effect drives the heart away from the irradiate volume. Different systems are used to manage this breathing maneuver which are based on surrogates. The spirometric method offers a guaranty of inspired air volume reproducibility. However, a question remains about the heart position reproducibility.

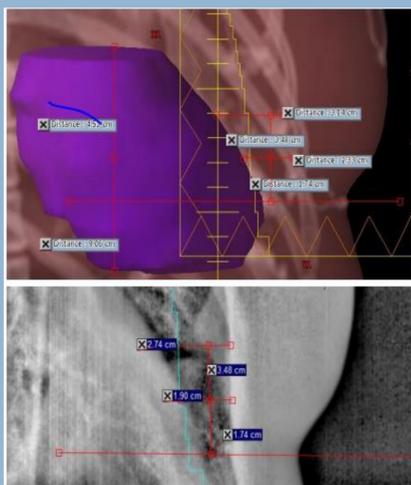
Material and Methods

The breast radiotherapy is driven with the help of the **SDX/DYN'R** spirometer and video feed back assisting the patient to provide a deep inspiration breath hold during each imaging and delivery phase.



Patient in treatment position and breath hold BH management with the SDX spirometer

The heart position was measured on the portal images compared to the DRR. The study contained 98 portal images of 15 patients having each three successive and weekly imaging controls. We defined three measurements with the heart image, the ribs and the inferior breast gland limit.



One measurement was defined in the middle head-feet heart distance.

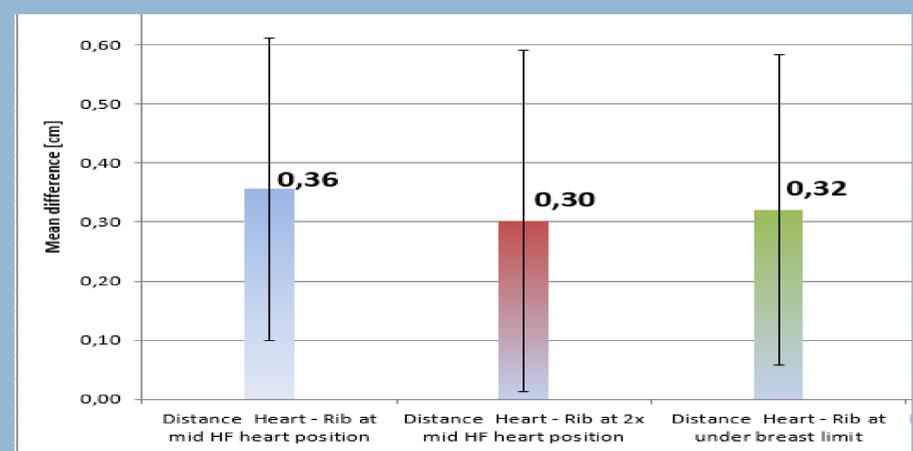
The second measurement was at the inferior breast gland limit and a third position was feet direction with the same gap of the two first positions.

Results

The measurements were obtained with the graphic rule on a stretched image area over the entire screen. The manual use of the graphic rule was evaluated with a potential error of less than 2mm due to the mouse tool and the blurred edge of each anatomy image

The mean / maximum heart position variation in the middle heart head-feet image was 0,36 / 0,51 cm. At the inferior breast gland limit we measured 0,32 / 0,52 cm and on the third position feet direction 0,30 / 0,58 cm.

	Distance Heart - Rib at mid HF heart position	Distance Heart - Rib at 2x mid HF heart position	Distance Heart - Rib at under breast limit
Mean (cm)	0,36	0,30	0,32
STd Deviation	0,26	0,29	0,26
2σ	0,51	0,58	0,52



Heart position measured between MV et DRR for 15 patients

Some cine images were acquired with the objective to evaluate the intra-Breath-Hold movement but we could not highlight credible results inside 2 mm as read in some articles.

CONCLUSION

The heart position reproducibility during spirometric DIBH radiotherapy is fully acceptable. These results can be used to take into account the dosimetric effect in the dose gradient area on the heart edge. However, only the maximum dose can be evaluated as the mean dose would need a CB-CT and a deformable heart image process.

