DOSIMETRIC STUDY COMPARING HEART LUNG DOSES IN ADJUVANT LEFT BREAST RADIOTHERAPY USING DEEP INSIPRATION BREATH HOLD VERSUS FREE BREATHING TECHNIQUES

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Introduction

The management of breast cancer almost always includes adjuvant radiotherapy following surgery and chemotherapy for local control and survival benefits. Left sided breast cancer radiotherapy usually involves incidental exposure of the heart and increases the late cardiac toxicity and increased cardiac mortality. Several radiotherapy delivery techniques have been formulated to reduce cardiac morbidity due to treatment. One method used to reduce the dose to the heart and its substructures is deep inspiration breath hold technique (DIBH).

Aim of the work

The aim of this study was to compare the radiation doses received by the heart, left ventricle, left anterior descending coronary artery and the lung using deep inspiration breath-hold (DIBH) to those of free-breathing technique in adjuvant left breast cancer radiotherapy.

Subjects and Methods

A prospective study included 35 adult left sided breast cancer patients assigned to receive adjuvant radiotherapy in Alexandria Main University Hospital. Two CTs were taken, one during free breathing and the second one while the patient is in deep inspiration breath hold, during the simulation of the patients for radiotherapy .organ delineation was done for each CT and after treatment planning the doses to the left lung, heart, left ventricle and left anterior descending coronary artery were compared for the free breathing and DIBH technique. The mean dose differences were calculated and a p value

Results

- The mean heart dose was lower in DIBH technique(1.87Gy) than in FBT (2.38Gy) with a dose difference of 0.51Gy and a p value <0.01 and a moderate effect size of 0.6.
- The mean LADA dose was lower in DIBH technique (5.94Gy) than in FBT (8.50Gy) with a dose difference of 2.57Gy and a p value of <0.01 and a moderate effect size of 0.7.
- The left ventricle showed a mean dose difference of 0.90Gy with doses lower in the DIBH technique (2.73Gy) and (3.63Gy) in the FBT with a significant statistical difference of (*p*-value <0.01) and an effect size of 0.59.
- 20% of the left lung received less than 20Gy (V20Gy<20%) in both DIBH and FB techniques but the dose values were much lower in the DIBH technique with a dose difference of 2.19Gy.
- Doses to the target volumes were almost similar between the two techniques and the target dose coverage was not compromised in any of them. (p value 0.45).

Table : The Effect of difference between both techniques concerning the OARs.

Variables	FBT	DIBH	MD	CI 95%		t-test	Effect
	Mean (SD)	Mean (SD)	(SD)	Lower	Upper	p value	size
Heart							
• **Dmax**	33.4 (9.30)	31.78 (9.98)	1.62 (8.54)	-1.32	4.55	0.271	0.1897
• **Dmin**	0.43 (0.14)	0.40 (0.15)	0.04 (0.11)	-0.01	0.08	0.068	0.3636
• **Mean**	2.38(1.07)	1.87 (0.79)	0.51 (0.84)	0.22	0.79	0.001*	0.6071
• **V5<5%**	10.17(7.58)	7.08 (4.06)	3.09 (6.97)	0.695	5.49	0.013*	0.4433
Ipsilateral lung							
• **Dmax**	37.90 (7.06)	37.28 (8.68)	0.63 (5.48)	-1.25	2.52	0.499	0.1150
• **Dmin**	0.34 (0.12)	0.29 (0.13)	0.05 (0.10)	0.013	0.084	0.010*	0.5000
• **Mean**	7.09 (2.45)	6.30 (2.59)	0.79 (1.99)	0.104	1.477	0.025*	0.3970
• **V20<20%**	13.36 (7.29)	11.17 (6.63)	2.19 (6.63)	-0.087	4.47	0.059	0.3303
• **Mean Volume**	1215.59 (279.35)	1500.18 (416.71)	-284.559 (350.69)	-405.1	-164.12	<0.001*	-0.8115
Left ventricle							
• **Dmax**	32.10 (9.86)	29.56(10.80)	2.54 (9.70)	-0.782	5.87	0.129	0.2619
• **Dmin**	0.62 (0.19)	0.55 (0.18)	0.07 (0.14)	0.027	0.122	0.003*	0.5000
• **Mean**	3.63 (1.54)	2.73 (1.41)	0.90 (1.51)	0.382	1.42	0.001*	0.5960
• **V25<5%**	16.05 (8.55)	12.27 (6.91)	3.78 (8.39)	0.901	6.66	0.012*	0.4505
LADA							
• **Dmax**	29.37(10.89)	25.28(10.86)	4.09(10.11)	0.619	7.565	0.022*	0.4045
• **Dmin**	1.15 (0.43)	1.04 (0.45)	0.10 (0.33)	-0.009	0.217	0.072	0.3030
• **Mean**	8.50 (4.32)	5.94 (3.34)	2.57 (3.59)	1.34	3.81	<0.001*	0.7159

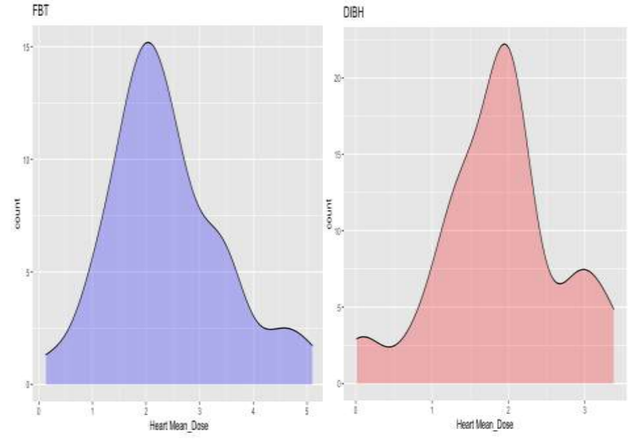

Figure: The distribution of the mean heart dose among the 35 patients shown between the FBT and the vDIBH technique

Conclusion

The DIBH technique shows great advantage in reducing the heart, left ventricle, LADA, and the lung doses in left breast cancer adjuvant radiotherapy. It is an effective and achievable technique and patients comply easily to it, hence making it a feasible technique to use for daily treatments to reduce the long-term cardiac morbidity.