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To Assess the Effect of BMI on Patient Setup Reproducibility in Hypofractionation of Breast Cancer to Establish an Imaging Protocol

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ABSTRACT

Objectives: *To analyze the setup accuracy among patients treated for breast cancer with hypofractionation radiation therapy (HFRT) regimen (five fractions instead of 15-16 fractions in standard regimen) and predict the necessity of performing the setup imaging in the 4th and 5th fractions as a function of setup accuracy in the first three fractions.*

Methods: *This retrospective study reviewed setup displacements in each direction (lateral, longitudinal, and vertical) for 51 women with breast cancer treated with HFRT at the Radiation Therapy Unit between September 2020 and May 2022. Besides the five fractions (#1– # 5), the mean setup error was computed for the first three fractions (AVG-III) for each direction. Setup accuracy rates were computed for each direction and fraction as the percentage of fractions with setup error ≤ 0.5 cm. The correlations of #1, #2, #3, and AVG-III setup errors and their value in indicating #4 and #5 setup error and accuracy were analyzed using Pearson's coefficient and Receiver Operating Characteristics (ROC) curve, respectively. Furthermore, the effect of body mass index (BMI) on setup reproducibility was analyzed using logistic regression*

Result: *The mean (SD) age of the participants was 54.41 (11.46) years. There was a high percentage of overweight (25.5%) and obese (53.0%). The mean setup error was <0.5cm for all five fractions and three directions, and accuracy rates were remarkably high ranging between 80.4%–90.2%, 84.3%–94.1%, and 94.1%–100.0% in the lateral, longitudinal, and vertical directions, respectively. The bivariate correlations analysis showed no significant correlations of fraction #4 (Pearson's coefficient r = -0.057–0.269; p>0.05) and #5 (r = -0.128–0.254; p>0.05) within any of the first three fractions or AVG-III, in any of the directions. In the ROC curve, only #5 accuracy was indicated by #3 in the longitudinal direction (AUC=0.89, p=0.025). BMI was only associated with inaccurate setup for fraction #3 in the lateral direction, in a positive relationship (OR=1.15, 95% CI = 1.01–1.30; p=0.031).*

Conclusion: *Setup accuracy in the first fractions of HFRT does not predict accuracy in the two last fractions nor is predicted by the patient's BMI. Consequently, women with breast cancer treated with HFRT require daily imaging for optimal setup before each radiotherapy fraction.*

Keywords

Setup Accuracy, Breast cancer, Hypofractionation, Reproducibility.

List of abbreviations

ASTRO: American Society for Radiation Oncology, AUC: The area under the curve, AVG: Average, HFRT: Hypofractionation radiation therapy, BMI: Body mass index, CBCT: Cone beam computed tomography, CI: Confidence interval, COVID-19: Corona Virus Disease 2019, CTV: Clinical target volume, EPI: Electronic portal image, OR: Odds ratio, PTV: Planning tumor

volume, ROC: Receiver Operating Characteristics, SD: Standard deviation, SE: Standard error, TNM: Tumour Node Metastasis, VMAT: Volumetric-modulated arc therapy.

Introduction

Globally, breast cancers continue to be the most common malignancies in women, accounting for more than 25% of all female cancers causing high mortality rates ranging between 7.7 – 32.4 per 100,000 that are increasing in the majority of the world's regions [1,2]. In 2018, the GLOBOCAN study provided an estimate of 2.1 million new cases and approximately 626,680 deaths [3]. In Saudi Arabia, breast cancer represents a major public health concern with more than 5,300 new cases diagnosed in 2010 and a constantly rising incidence over the two past decades and an increasing proportion of younger patients [4,5].

Besides histopathology, breast cancer is characterized by its recently discovered biological heterogeneity, resulting in a paradigm shift in the classification and management of these tumors. Advances in molecular methods and the introduction of biological therapies have revolutionized the treatment and prognosis of patients, notably in early disease where cure rates reach up to 80% [6]. Nevertheless, radiation therapy continues to be an important component of the curative arsenal in many breast cancer cases, notably in reducing the risk of ipsilateral recurrence and improving the cosmetic outcome in patients treated with breast-conserving surgery [7]. Although the conventional protocol consists of fractionated breast radiation, evidence and evidence-based guidelines from the American Society for Radiation Oncology (ASTRO) support the use of hypofractionation radiation therapy (HFRT), such as 40 Gy in 15 fractions or 26 Gy in five fractions, enabling a comparable efficacy, lower acute toxicity, and better psychosocial well-being compared with conventionally fractionated protocol [8-11].

On the other hand, the outbreak of the Corona Virus Disease 2019 (COVID-19) pandemic has imposed restrictive measures to mitigate the spread of the virus by limiting human-to-human transmission both in community and hospital-based settings. To maximize the efficacy of these preventive measures, radiation therapy departments were urged to revise their workflow, both quantitatively and qualitatively, to limit patient-to-patient and patient-to-staff contact [12,13]. Among these measures, the adoption of hypofractionated regimens has been an ideal and safe compromise to ensure continuity of care to breast cancer patients while reducing hospital visits by 10-20 visits per patient [14,15].

In our department, the standard protocol consists of 40, 05 Gy in 15 fractions for both node-negative and node-positive breast cancer, as supported by evidence from clinical trials and international guidelines [16-18]. Since the ongoing COVID-19 pandemic, and given the publication of the five-year results of the FAST-Forward trial [11], the researchers considered implementing the 5-fraction regimen in an early disease setting, consisting of 26 Gy in five fractions, following the international guidelines on "radiation therapy for breast cancer during the COVID-19 pandemic" [19].

However, in a view to further reduce patient exposure and interactions within radiation therapy departments, the present study explored the possibility of reducing the number of setup imaging sessions, notably the 4th and 5th fractions in an HFRT regimen, based on the prediction of setup reproducibility. The researchers hypothesized that the level of setup accuracy in the first three fractions can predict setup reproducibility in the 4th and 5th fractions, thus avoiding further setup imaging sessions. Additionally, the researchers analyzed the impact of body mass index (BMI) in setup reproducibility, as previous studies showed greater total error among obese patients [20,21].

Methods

Design and Setting

This retrospective study was conducted at the radiation therapy unit between September 2020 and May 2022.

Ethical Approval and Patient Consent

The study protocol (IRB 2021-70) was reviewed and ethically approved by the institutional review board. This study did not require patient consent.

Population

The study included 51consecutive women with histologically proven breast cancer who were treated with a 5-fraction HFRT regimen, consisting of 26 Gy in five fractions, using either 3-D conformal therapy or volumetric-modulated arc therapy (VMAT). Since the 5-fraction regimen was applied for early-stage disease during the COVID-19 pandemic, patients with lymph node involvement or metastasis were excluded. Furthermore, patients who were treated using moderate hypofractionated regimens were excluded.

Procedures

Patient Position

The patient was positioned supine using a breast board, with arms up and supported on the wing board. The breast board was immobilized to the couch using an indexer, with the knees supported under an indexed cushion, to minimize setup errors. An anterior tattoo was marked on the patient's breast bone and 2 lateral tattoos were placed at the same level, on the patient thorax, using a 3-point laser for patient setup reproducibility. Computed Tomography simulation was performed on Siemens Sensation Open with 3 mm slice thickness. The same position was maintained for treatment.

Radiotherapy Planning

Treatment planning was performed on either Eclipse or Monaco depending on the treatment machine. A tangential pair beam arrangement was used to encompass the whole breast planning tumor volume (PTV), minimizing the ipsilateral lung and heart in the field. A clinical target volume (CTV) to PTV of 10 mm was applied to allow for breathing, breast swelling, and setup error. Beam energies for treatment, usually 6 MV, but a mixture of energies e.g. 6 MV and 10 MV or 6 MV and 18 MV were used for larger patients.

Dose Constraints

Dose constraints for the 5-fraction schedules were as follows: 15% volume of ipsilateral lung receiving 8 Gy or less, 30% of heart volume receiving 1,5 Gy or less, and 5% of heart volume receiving 7 Gy or less.

Imaging

To verify patients' setup accuracy, an electronic portal image (EPI) or Cone beam computed tomography (CBCT) was taken 5 days before the treatment, and registered to the planning reference image to determine the corresponding translational shift. EPI using KV of the treatment area is done on Siemens ARTISTE linear accelerator while CBCT, using KV, was used on Elekta VERSA. Initial alignment was to bone followed by soft tissue match. Imaging is required for every fraction as per international guidelines, with shifts of no more than 5 mm tolerance. However, best practice is to correct all measured displacements. Subsequently, in this study, all shifts were implemented using an automatic couch displacement.

Data Collection

The following data have been collected for all participants:

1. Baseline demographic and clinical data, including age, height, and weight with the calculation of BMI, treated breast (right or left), pathological stage using Tumour, Node, Metastasis (TNM) classification, and the total number of fractions;
2. Translational shifts, or setup errors, including the three directions lateral, longitudinal, and vertical, for all five fractions (#1– # 5).

Statistical Methods

Data were coded and analyzed using the Statistical Package for Social Sciences version 21.0 for Windows (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to present categorical variables as frequency and percentage and continuous variables are presented as mean ± standard deviation (SD). Accuracy rates were computed for each direction and fraction as the percentage of fractions with setup error ≤ 0.5 cm.

The mean setup error for the first three fractions (AVG-III) was computed for each direction. Pearson's coefficient was used to analyze the correlations of #4 and #5 setup errors with those of fractions #1, #2, #3, and AVG-III; results are presented as Pearson's coefficient (R) with the level of statistical significance.

Additionally, the values of #1, #2, #3, and AVG-III setup errors in indicating inaccurate setups in #4 and #5 were analyzed using Receiver Operating Characteristics (ROC) curve, respectively; results are presented as the area under the curve (AUC) with 95% confidence interval (95% CI), standard error (SE), and the level of statistical significance.

Finally, the effect of BMI on setup reproducibility was analyzed using two methods:

- Method 1 used logistic regression to analyze the level of accuracy (inaccurate setup: error>0.5cm) in the given direction and fraction, as a function of BMI; results are presented as odds ratio (OR) with 95% CI.
- Method 2 used pooled data by translational direction (i.e., pooling all patients' and all fractions' setup errors under the given direction: lateral, longitudinal, and vertical) and analyzed the association of the level of accuracy rates (≤ 0.5 vs > 0.5 cm) with BMI (< 30 vs ≥ 30 kg/m^2) using chi-square test, as well as the difference in the mean shift between the two BMI categories using independent t-test.

A *p*-value of <0.05 was considered to reject the null hypothesis.

Results

Participants' Characteristics

The mean (SD) age of the participants was 54.41 (11.46) years. There was a high percentage of overweight (25.5%) and obese (53.0%), and the mean (SD) BMI was 29.92 (6.04) kg/m^2. Clinically, the sample was characterized by low pathological stage, notably the absence of lymph node involvement (N0, 100%) or metastasis (M0, 98%), and a minority had stage 3 (5.9%) (Table 1).

Table 1: Participants' characteristics (N=51).

Parameter	Level	Mean	SD	Frequency	Percentage
Age	(years)	54.41	11.46		
Height	(cm)	155.76	6.23		
Weight	(Kg)	72.45	14.38		
BMI	(Kg/m^2)	29.92	6.04		
BMI category	Normal (18.54-24.9)			11	21.6
	Overweight (25-29.5)			13	25.5
	Class I Obesity (30-34.9)			19	37.3
	Class II Obesity (35-39.9)			5	9.8
	Class III Obesity (40+)			3	5.9
Treated breast	Right			29	56.9
	Left			22	43.1
Pathological stage	T1N0M0			19	37.3
	T2N0M0			29	56.9
	T3N0M0			3	5.9
Total fractions	5			51	100.0
Dose per fraction	5,2 Gy			51	100.0

Setup Errors in the Five Fractions

The mean, and SD of all setup errors in the five fractions, by direction, are depicted in Table 2, as well as the accuracy rate corresponding to the percentage of fractions with setup error ≤ 0.5 cm. The mean setup error was < 0.5cm for all fractions and directions, and accuracy rates were remarkably high ranging between 80.4%–90.2%, 84.3%–94.1%, and 94.1%–100.0% in the lateral, longitudinal, and vertical directions, respectively.

Table 2: Setup errors in the five fractions.

Direction	Fraction	Mean	SD	Accuracy rate*
Lateral	#1	0.32	0.28	82.4
	#2	0.30	0.26	84.3
	#3	0.34	0.27	80.4
	AVG-III	**0.32**	**0.17**	-
	#4	0.23	0.26	90.2
	#5	0.33	0.31	80.4

Longitudinal	#1	0.34	0.29	84.3
	#2	0.30	0.41	90.2
	#3	0.33	0.32	86.3
	AVG-III	**0.32**	**0.27**	-
	#4	0.31	0.37	86.3
	#5	0.24	0.20	94.1
Vertical	#1	0.37	0.39	96.1
	#2	0.19	0.22	100.0
	#3	0.10	0.12	98.0
	AVG-III	**0.22**	**0.16**	
	#4	0.12	0.15	96.1
	#5	0.19	0.24	94.1

* Percentage of fractions with setup error≤0.5 cm

AVG-III: average setup error for the first three fractions

Correlations between Setup Errors within Each Direction

The bivariate correlations analysis showed no significant correlations of fraction #4 (Pearson's coefficient r = -0.057–0.269; p >0.05) and #5 (r = -0.128–0.254; p>0.05) within any of the first three fractions or AVG-III, in any of the directions (Table 3).

Accuracy of the First Three Fractions in Indicating Setup Error in Fractions #4 And #5

The ROC curve analysis showed no significance for setup errors in fractions #1, #2, #3, or AVG-III in indicating inaccurate setup in fraction #4, in any of the directions, with AUCs ≤ 0.64 (p > 0.05). Regarding fraction #5, setup inaccuracy was significantly indicated by fraction #3 in both the longitudinal

Table 3: Bivariate correlations between setup errors of the different fractions in each direction.

Direction	Fraction	#1	#2	#3	AVG-III	#4	#5
Lateral	#1	1	0.041	0.063	0.604**	0.112	0.053
	#2		1	0.173	0.626**	0.138	0.234
	#3			1	0.654**	-0.057	0.199
	AVG-III				1	0.102	0.254
	#4					1	0.151
	#5						1
Longitudinal	#1	1	0.392**	0.279*	0.663**	0.064	-0.014
	#2		1	0.606**	0.885**	0.202	0.096
	#3			1	0.801**	0.269	0.246
	AVG-III				1	0.231	0.141
	#4					1	0.575**
	#5						1
Vertical	#1	1	-0.026	0.063	0.845**	0.124	-0.031
	#2		1	0.065	0.455**	0.182	-0.128
	#3			1	0.324*	0.068	0.037
	AVG-III				1	0.201	-0.077
	#4					1	0.243
	#5						1

Results are Pearson's coefficient R;

AVG-III: Average setup error for the first three fractions.

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 4: Accuracy of the first three fractions in indicating setup error in fractions #4 and #5.

Direction	Indicator	Predicting inaccurate setup #4					Predicting inaccurate setup #5				
		AUC	95% CI		SE	p-value	AUC	95% CI		SE	p-value
Lateral	#1	0.51	0.26	0.76	0.13	0.924	0.55	0.33	0.77	0.11	0.644
	#2	0.64	0.40	0.88	0.12	0.296	0.57	0.35	0.79	0.11	0.514
	#3	0.24	0.10	0.38	0.07	0.059	0.58	0.36	0.80	0.11	0.448
	AVG-III	**0.48**	**0.21**	**0.74**	**0.14**	**0.862**	**0.61**	**0.41**	**0.81**	**0.10**	**0.280**
Longitudinal	#1	0.44	0.15	0.72	0.14	0.594	0.62	0.25	0.99	0.19	0.496
	#2	0.46	0.21	0.72	0.13	0.753	0.77	0.43	1.00	0.17	0.114
	#3	0.48	0.23	0.73	0.13	0.859	0.89	0.74	1.00	0.08	0.025*
	AVG-III	**0.51**	**0.27**	**0.75**	**0.12**	**0.913**	**0.78**	**0.46**	**1.00**	**0.16**	**0.105**
Vertical	#1	0.20	0.03	0.37	0.09	0.308	0.51	0.33	0.68	0.09	0.981
	#2	0.15	0.00	0.35	0.10	0.234	0.14	0.00	0.29	0.07	0.089
	#3	0.21	0.00	0.47	0.13	0.325	0.38	0.09	0.68	0.15	0.577
	AVG-III	**0.05**	**0.00**	**0.11**	**0.03**	**0.126**	**0.12**	**0.03**	**0.22**	**0.05**	**0.073**
Pooled	#1	0.45	0.27	0.63	0.09	0.556	0.55	0.38	0.71	0.08	0.566
	#2	0.53	0.35	0.72	0.09	0.687	0.58	0.39	0.76	0.09	0.334
	#3	0.47	0.32	0.61	0.08	0.680	0.66	0.49	0.83	0.09	0.046*
	AVG-III	**0.50**	**0.33**	**0.68**	**0.09**	**0.974**	**0.63**	**0.47**	**0.79**	**0.08**	**0.099**

AUC: Area under the curve; SE: Standard error;

* statistically significant association (p<0.05)

AVG-III: Average setup error for the first three fractions

direction (AUC=0.89, p=0.025) and pooled directions (AUC=0.66, p=0.046) (Table 4).

Effect of Body Mass Index on Setup Reproducibility

BMI was incidentally associated with inaccurate setup for fraction #3 in the lateral direction, in a positive relationship (OR=1.15, 95% CI = 1.01 – 1.30; p=0.031). No other significant association was found between BMI and setup inaccuracy in any of the other fractions and directions (Table 5).

Table 5: Effect of body mass index on setup reproducibility.

Direction	Fraction	OR	95% CI		p-value
Lateral	#1	1.06	0.94	1.19	0.367
	#2	0.91	0.78	1.05	0.188
	#3	1.15	1.01	1.30	0.031*
	AVG-III	**1.03**	**0.89**	**1.20**	**0.686**
	#4	0.87	0.71	1.05	0.154
	#5	1.00	0.89	1.12	0.943
Longitudinal	#1	1.00	0.88	1.14	0.988
	#2	1.01	0.87	1.18	0.855
	#3	1.04	0.91	1.18	0.549
	AVG-III	**1.07**	**0.94**	**1.21**	**0.325**
	#4	0.96	0.84	1.11	0.612
	#5	1.20	0.99	1.44	0.062
Vertical	#1	1.07	0.95	1.19	0.264
	#2	0.96	0.75	1.24	0.754
	#3	-	-	-	-
	AVG-III	**1.01**	**0.83**	**1.22**	**0.913**
	#4	1.20	0.89	1.60	0.231
	#5	1.06	0.85	1.31	0.623

Logistic regression: dependent variable = the level of accuracy (inaccurate, setup error >0.5cm) in the given direction and fraction; independent variable = BMI

OR: Odds ratio; 95% CI = 95% confidence interval;

* statistically significant association (p<0.05).

By pooling the five fractions setup errors for each direction, no difference was observed between BMI categories <30 versus ≥30 kg/m^2 in the mean setup error or accuracy rates (setup error ≤0.5) in any of the 3 directions (Table 6).

Table 6: Association of BMI with setup accuracy in the three directions by pooling the 5 fractions.

Variable	All setups	BMI<30	BMI≥30	p-value
Lateral shift				
≤0.5 cm	213 (83.5)	100 (83.3)	113 (83.7)	
>0.5 cm	42 (16.5)	20 (16.7)	22 (16.3)	0.937
Mean (SD)	**0.30 (0.28)**	**0.30 (0.30)**	**0.31 (0.26)**	**0.744**
Longitudinal shift				
≤0.5 cm	228 (88.2)	109 (90.8)	116 (85.9)	
>0.5 cm	30 (11.8)	11 (9.2)	19 (14.1)	0.225
Mean (SD)	**0.31 (0.32)**	**0.29 (0.29)**	**0.32 (0.35)**	**0.352**
Vertical shift				
≤0.5 cm	240 (94.1)	116 (96.7)	124 (91.9)	
>0.5 cm	15 (5.9)	4 (3.3)	11 (8.1)	0.103
Mean (SD)	**0.19 (0.26)**	**0.17 (0.25)**	**0.21 (0.26)**	**0.182**

Discussion

Summary of Context and Findings

Following the implementation of hypofractionation regimens among early-stage breast cancer patients to mitigate the risk of transmission during the COVID-19 pandemic, a central question remained regarding the possibility of reducing the number of daily imaging sessions to further reduce patient exposure and workflow. The present study analyzed the level of setup reproducibility in #4 and #5 fractions as a function of setup accuracy in the first three fractions and the effect of BMI on this association. Findings showed that all mean setup errors were within 5 mm for over 80% of setups in all fractions and translational directions. Furthermore, all setup errors (including those beyond 5mm) were corrected by implementing automatic couch displacement. Association analysis and predictive models failed to establish any clinically significant relationship between setup error or accuracy levels in the first three fractions with the last two fractions. Furthermore, the impact of BMI was negligible in predicting setup accuracy in any of the fractions and directions. The explanations of these findings and their clinical implications are discussed below:

Is High Overall Setup Accuracy – An Advantage of Hypofractionation?

The researchers found consistently low levels of setup errors in all directions and fractions in the present cohort. The high accuracy rates maymay argue against the need for daily image-guided radiotherapy. However, at least 20% of patient setups were not within the 0.5 mm setup tolerance in at least one direction, although all errors were corrected before treatment. The high dose per fraction is a concern. Evidence and clinical practice indicate that close image-guided monitoring of setup errors, including daily imaging in the case of a hypofractionated regimen, is more particularly required in patients with extensive errors in initial treatment sessions [22]. On the other hand, failure of setup accuracy in the initial fractions to predict accuracy in the last fractions argues in favor of daily imaging. Furthermore, because of the particular risk of cardiac and lung toxicity associated with breast cancer radiotherapy, especially left-sided tumors [23], the high fraction doses in hypofractionated regimens may justify additional caution towards the risk of translational shift. Consequently, findings from the present study do not provide sufficient evidence regarding the possibility of avoiding imaging in the last two sessions; hence, the precautionary principle should apply.

The Impact of Body Mass Index on Setup Accuracy

The researchers observed no significant association between patients' BMI and setup error or accuracy level in any of the fractions or directions, using both the original and pooled databases. That is, obese and non-obese patients showed comparable mean setup error values and accuracy rates, with high type I error values (p-values 0.10 – 0.94). This is inconsistent with data from the literature demonstrating the impact of BMI on setup reproducibility in breast cancer radiation therapy and thoracic tumors in general. A cohort by Batumalai et al. involving 25 patients, who underwent postoperative radiotherapy for breast cancer, showed highly positive correlations between patients' BMI and setup error values. Pearson's correlation

coefficient values in the three directions were left-right (Pearson's coefficient, r = 0.62), superior-inferior (r=0.77), and anterior-posterior (r=0.70) [21]. Likewise, Zhao et al. divided a cohort of sixty male and female patients who underwent IMRT for thoracic tumors into four BMI categories including <18.5, 18.5-24, 24.0-28.0, and ≥28.0 kg/m^2. Assessments of setup errors in the three translational directions showed significantly greater shifts in BMI ≥ 28.0 group (mean values 5.4 – 8.8 mm), depending on the direction, compared with other BMI categories (up to 3.9 mm) [20]. However, the effect of BMI is not consistent throughout the literature. A study by Yang et al. showed no difference in setup accuracy between the three BMI categories including <25, 25 – 30, and >30 kg/m^2 [22]. Considering findings from this study, the absence of a correlation between BMI and setup error may be explained by the high prevalence of obesity and overweight in the cohort, resulting in an underestimated comparison.

The Impact of Breast Size on Setup Reproducibility

The present study failed to analyze the association of setup errors with breast size, which may constitute one of the major factors confounding setup reproducibility and its association with BMI. Thus, this represents the study limitations preventing the generalizability of the findings. Evidence from the literature showed the great significance of breast volume in predicting setup errors. A study by Chung et al. showed that large breast size, indicated by bust size minus under bustsize ≥10 cm, was independently associated with a 2.8 odds ratio of extensive setup error among women with breast-conserving surgery [24]. Another study by Batumalai et al. showed that breast size was significantly correlated with setup error in the three translational directions, with a Pearson's correlation coefficient of 0.61 – 0.66 [25]. Conversely, a study by Offerman et al. showed no significant correlation between daily setup errors with breast size, indicating that setup reproducibility cannot be predicted by breast size in a view to reducing imaging setup [26].

Limitations

The major limitation of this study is the overrepresentation of overweight and obese individuals, which impacted the BMI effect. Furthermore, breast size and other eventual factors and confounders that impact setup reproducibility were not assessed.

Conclusion

Setup accuracy in initial fractions among early-stage breast cancer patients, did not provide any significant value in predicting setup accuracy in the last fractions, which advocates in favor of daily imaging for better safety regarding the high risk of cardiotoxicity. Likewise, the effect of BMI on setup accuracy was not significant in a cohort characterized by a high prevalence of overweight and obesity. In such terms, it appears safer to implement a daily imaging setup in patients treated with hypofractionated regimens.

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