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ORIGINAL ARTICLE

COMPARISON IMPACT OF CONVENTIONAL VERSUS CONFORMAL RADIOTHERAPY TECHNIQUES ON THYROID IN BREAST CANCER IRRADIATION

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ABSTRACT

Introduction: Adjuvant radiotherapy is considered one of treatment options for treatment of locally advanced breast cancer. Thyroid gland is not considered an organ at risk in supraclavicular (SC) nodal radiation therapy (RT) for breast cancer. **Objectives**: Comparison the impact of 2 different RT techniques on thyroid gland; group (I) conventional two-dimensional radiotherapy of SC node and Group (II) three-dimensional conformal radiation therapy (3DCRT) planning of SC node. **Method:** Twenty (20) patients with breast cancer received SC RT, with evaluation of thyroid functions in both groups, including thyroid stimulating hormone and free thyroxine prior to RT and 3, 6, 9, 12, 18 and 24 months after RT. Based on each patient's dose volume histogram (DVH),total volume of thyroid and mean radiation dose of the thyroid which received radiation doses 10-50 Gy (V10-V50) were considered for statistical analysis. The median follow-up time was 20 months (range, 12-30 months). **Results:** of 20 patients, 5 (20%) were diagnosed with hypothyroidism (HT), 4 group (II) and 1 group (I). The median time to the development of HT was 9 months. SC node V50 in group I was lower than average in group II (Average: 2.06% versus 55.38% p<0.001).Thyroid V20 in group I was lower than average in group II (Average: 37.65% versus 50.47%, p<0.001) mean TSH in group I was lower than mean in group II (Average: 1.60 IU/L versus 3.08 IU/L, p=0.043). **Conclusion:** Conformal supraclavicular RT in patients with breast cancer appear to amplify the risk of HT more than conventional, however conformal radiotherapy is better than conventional radiotherapy in locoregional control

Kew words : Thyroid dysfunction, Breast Cancer, Radiotherapy

INTRODUCTION

Breast cancer is considered the commonest cancer in females worldwide, accounts for 23% of the total cancer and the most leading cause of cancer related death cases approximately 14% of the cancer deaths. **[1]**

Breast cancer is the commonest and leading cause of cancer death among females, in Egypt, accounting for 32.04% and. 29.1% respectively, confirmed by national cancer registry program of Egypt. **[2]**

Breast cancer management requires multidisciplinary team approach. Treatment modalities include surgery, chemotherapy, radiotherapy, hormonal therapy and targeted therapy. **[3]**

According to incidence of locally advanced breast cancer. It is considered very common. Common accepted treatment include mastectomy followed by adjuvant chemotherapy & radiotherapy. **[4]**

Adjuvant radiotherapy is considered mandatory part in the treatment of breast cancer as it provides approximately 70–75% decrease of risks of loco regional relapse after mastectomy. **[5]**

The American Society of Clinical Oncology (ASCO) recommends the use of Post-mastectomy radiotherapy (PMRT) for patients,

whose primary tumour is larger than 5 cm and/or patients who have four or more involved axillary lymph nodes (ALNs). **[6]**

Recent recommendation according to Saint gallen guidelines, post-mastectomy Radiation Therapy Reduces Loco-regional Recurrence in Breast Cancer Patients With 1-3 Positive Lymph Nodes: Eight-Year Results. **[7]**

As the axillary & supraclavicular lymph nodes are the major lymph nodes to be involved in the lymphatic drainage pathway of breast, part of PMRT includes the supraclavicular fossa (SCF) radiotherapy if four or more axillary nodes contain metastatic disease or if the extent of nodal disease is unknown (Nx) or uncertain because the axilla either has not been treated surgically or the surgery has been suboptimal. **[8]**

This is because Supraclavicular fossa recurrence is the second most common site of recurrence following mastectomy after chest wall recurrence provided that the axilla is treated surgically.**[8]**

Variations in practice have been documented in surveys done by the Radiation Oncology Expert Advisory Group of the National Breast Cancer Centre regarding the SCF field size and treatment parameters and depths. **[9]**

METHODS

The study was Prospective Randomized control study .

The work has been carried out in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. The study was approved by research ethical committee of Faculty of medicine, Zagazig University. Written consent has been obtained from all patients

The study was conducted in Clinical Oncology & Nuclear Medicine Department, Zagazig University Hospitals during the period from October 2015 to April 2018.

20 randomized Subjects were selected from patients attending to Clinical Oncology Department to receive their adjuvant radiotherapy, using linear accelerator machine dividing subjects into 2 arms, one group underwent conventional radiotherapy and other group underwent conformal radiotherapy

Inclusion criteria:

- Female patient >18 years old
- Involved L.N ≥ 4
- Histopathological confirmed invasive unilateral breast carcinoma
- Underwent modified radical mastectomy or breast conserving surgery
- No history of contralateral breast cancer
- No previous radiotherapy
- No serious non-malignant diseases (cardiovascular or pulmonary diseases)
- Normal hematological, liver and kidney function tests
- Normal baseline thyroid function tests.

Exclusion criteria:

- Previous thyroid surgical interference
- Patients with primary thyroid disease
- Previous radiotherapy included hypothalamic pituitary axis or lower neck nodes

All patients were subjected to

- **Pretreatment evaluation:**

1) Clinical evaluation: Medical history and complete physical examination

2) Laboratory evaluation:

- Complete blood count
- Liver and kidney functions tests
- Thyroid function tests
- Tumor markers

3) Radiological evaluation:

- Chest x-ray
- Pelvi-abdominal ultrasound
- Bone scan
- **Treatment:**

Planning CT scan for SC nodal irradiation

The patient in supine position; flat on back, with both arms extended above her head. Immobilization is done through breast board. The patient was scanned from the level of the

mandible to below the diaphragm. The scan was exported to the treatment planning system (Precise) for contouring and computer dosimetric planning.

SC nodal target volume determination The SC nodal target volume was determined in each technique as follows:

♦ *Technique 1*

- Clinical and radiologic landmarks were used to determine the field borders of the single anterior-oblique photon field:
- Superior border, 1-cm superior to skin profile
- Inferior border, lower border of the ipsilateral clavicular head
- Medial border, lateral aspect of the vertebral pedicles
- Lateral border, junction of medial 2/3 and lateral 1/3 of the clavicle

Technique 2

The target volume of SC lymph node, contoured according to anatomic guidelines as the clinical target volume (CTV). Due to the purpose of this study, our planning target volume (PTV) created using a 1-cm expansion from the CTV, with medial limitation at the lateral aspect of the vertebral pedicles and inferiorly at the junction of the breast or chest wall tangents.

SC nodal radiation therapy planning

A total dose of 50Gy in 25 fractions, administered in 2-Gy daily fractions at 5 fractions per week, was prescribed to the SC nodal target volumes. A monoisocentric technique was used; that means the isocenteris placed at the junction between the SC field and the breast or chest wall tangents.

Technique 1

A single 6-MV anterior-oblique field was used with the angle of the gantry 15 degrees away from the spinal cord. A half-beam block is used. The dose to the SC nodes is prescribed to a depth of 1.5 cm.

Technique 2

2 Opposed anterior and posterior-oblique fields were used, angled off-cord with adjustments of beam energies (6 and 15 MV) and weightings, through application of wedges or field-in field techniques if necessary. They were manually optimized to cover the PTV within 95%-107% of the prescribed dose as per International Commission on Radiation Units and Measurements 50 {ICRU 50} prescribing guidelines

Dosimetric parameters

For each SC nodal radiation therapy technique, the following thyroid gland dosimetric measures were evaluated: mean dose (Gy), maximum dose (Gy), and V5, V20, V30, V40, V50 (percentage of thyroid gland receiving ≥5 Gy, ≥20 Gy, ≥30 Gy, ≥ 40& 50 Gy respectively).

For the CT-contoured SC nodal target volume, the following PTV dosimetric measures were recorded for each technique: mean dose (Gy), maximum dose (Gy), homogeneity index (HI, percentage of the PTV receiving between 95% and 107% of the prescribed dose), V30, V40, and V50 (percentage of PTV receiving ≥30 Gy, ≥40 Gy, and 50 Gy

Treatment evaluation and follow up:

Patients were evaluated after finishing radiotherapy by assessment of thyroid function tests, including serum thyroid stimulating hormone (TSH), free triiodothyronine (fT3), free thyroxine (fT4).

Thyroid function tests were analyzed every 3 months in the first year, then at 18 months, and eventually at 24 months after finishing RT.

Hypothyroidism diagnosis is based on, fT3 and/or fT4 values were lower than the minimum value of its laboratory range in addition to TSH value was greater than the maximum value of its laboratory range, regardless any symptom may be present.

Statistical Analysis

Data analysis

All data were collected, tabulated and statistically analyzed using SPSS 22.0 for windows (SPSS Inc., Chicago, IL, USA) and MedCalc windows (MedCalc Software bvba 13, Ostend, Belgium). Continuous data are expressed as the mean ± SD & median (range),

and the categorical data are expressed as a number (percentage). Continuous variables were checked for normality by using Shapiro-Wilk test. Mann-Whitney U test was used to compare two groups of non-normally distributed data. Categorical data were compared using Chi-square test or Fisher's exact test when appropriate. All tests were two tailed. p-value < 0.05 was considered statistically significant (S), p-value < 0.001 was considered highly statistically significant (HS), and p-value > 0.05 was considered non statistically significant (NS)

RESULTS

Of the 20 eligible patients, 13 patients had a total mastectomy and 7 patients had breast-conserving surgery. Management comparison between 2 groups is summarized in table 1

Comparison between group I and group II regarding supraclavicular volume dose volume histogram parameters reveal a highly significant difference between the studied groups regarding mean dose where average of mean dose in group I was lower than average in group II (Average:41 Gy versus 50.05 Gy, p<0.001). A significant difference between the studied groups regarding maximum dose where average of maximum dose in group I was lower than average in group II (Average: 50.26 Gy versus 52.69 Gy, p=0.001). There was a significant increase in all supraclavicular dosimetric parameters using technique 2 compared with technique (P<0.001). This is shown in Table (2) and Figures (1)

Comparison between group I and group II regarding thyroid volume dose volume histogram parameters reveal insignificant difference between the studied groups regarding volume of delineated thyroid where average of volume in group I was 16.91cc versus 16.05cc in group II (p-value=0.880). A significant difference between the studied groups regarding mean dose where average of mean dose in group I was lower than average in group II (Average: 17.9 Gy versus 27.12 Gy, p=0.001). A significant difference between the studied groups regarding maximum dose where average of maximum dose in group I was lower than average in group II (Average: 47.13 Gy versus 51.55 Gy, p=0.002). A significant difference between the studied groups regarding percent of thyroid volume that received 5Gy, 20Gy, 30Gy , 40Gy and 50Gy in group I was lower than average in group II p<0.001). This is shown in table (3)

Comparison between group I and group II regarding T4 reveal insignificant difference between the studied groups regarding baseline T4 where mean T4 in group I was 122.70 nmol/L versus 131.40 nmol/L in group II (p-value=0.342). Insignificant difference between the studied groups regarding T4 at third, 6th, 9th, 12th. 18th and 24-month post-radiotherapy. This is shown in Table (4)

Comparison between group I and group II regarding T3 reveal insignificant difference between the studied groups regarding baseline T3 where mean T3 in 2.23 nmol/L versus 2.24 nmol/L in group II (p-value=0.939). Insignificant difference between the studied groups regarding T3 at third, 6th, 9th, 12th. 18th and 24-month post-radiotherapy. This is shown in Table (5)

Comparison between group I and group II regarding TSH reveal insignificant difference between the studied groups regarding baseline TSH where mean TSH in group I was 1.31 IU/L versus 1.79 IU/L in group II (p-value=0.286). A significant difference between the studied groups regarding mean TSH at third month post-radiotherapy where mean TSH in group I was lower than mean in group II (Average: 1.45 IU/L versus 2.83 IU/L, p=0.044). A significant difference between the studied groups regarding mean TSH at sixth month post-radiotherapy where mean TSH in group I was lower than mean in group II (Average: 1.60 IU/L versus 3.08 IU/L, p=0.043). Insignificant difference between the studied groups regarding TSH at twelfth month post-radiotherapy where mean TSH in group I was 1.94 IU/L versus 3.49 IU/L in group II (p-value=0.070). Insignificant difference between the studied groups

regarding TSH at fifteenth month post-radiotherapy where mean TSH in group I was 2.01 IU/L versus 3.61 IU/L in group II (p-value=0.061). Insignificant difference between the studied groups regarding TSH at eighteenth month post-radiotherapy where mean TSH in group I was 3.49 IU/L versus 6.38 IU/L in group II (p-value=0.100). Insignificant difference between the studied groups regarding TSH at twenty-fourth month post-radiotherapy where mean TSH in group I was 3.41 IU/L versus 6.51 IU/L in group II (p-value=0.078) this is shown in Table (6)

Table 1. Comparison between group I and group II regarding management.

Management	Group I (N=10)		Group II (N=10)		Test§	p-value	(Sig.)
	No.	%	No.	%			
Type of surgery							
BCS	4	40%	3	30%	0.220	1.000	(NS)
MRM	6	60%	7	70%			
Chemotherapy							
FEC	3	30%	3	30%	0.000	1.000	(NS)
AC-Taxol	7	70%	7	70%			
Hormonal treatment							
Not indicated	2	20%	1	10%	0.533	0.766	(NS)
Tamoxifen	2	20%	3	30%			
AI	6	60%	6	60%			
Trastuzumab							
Not indicated	8	80%	7	70%	2.067	0.356	(NS)
Indicated/Not given	1	10%	0	0%			
Given	1	10%	3	30%			

§ Chi-square test. p< 0.05 is significant. Sig.: significance.

Table 2. Comparison between group I and group II regarding supraclavicular DVH parameters.

Supraclavicular DVH parameters	Group I (N=10)	Group II (N=10)	Test?	p-value	(Sig.)
Mean dose (Gy)					
Mean ± SD	41.32 ± 1.75	50.05 ± 0.74	-3.784	<0.001	(HS)
Median (Range)	41.25 (38.70 – 44.10)	50.05 (48.90 – 51.20)			
Max. dose (Gy)					
Mean ± SD	50.26 ± 1.59	52.69 ± 0.92	-3.215	0.001	(S)
Median (Range)	50.70 (47.10 – 52.10)	52.70 (51.50 – 53.80)			
V30 (%)					
Mean ± SD	92.75 ± 2.94	99.96 ± 0.09	-3.908	<0.001	(HS)
Median (Range)	92.75 (87.90 – 97.60)	100 (99.70 – 100)			
V40 (%)					

Mean ± SD	71.70 ± 12.80	99.74 ± 0.52	-3.830	<0.001	(HS)
Median (Range)	70.80 (47 – 92.80)	100 (98.30 – 100)			
V50 (%)					
Mean ± SD	2.06 ± 2.06	55.38 ± 11.82	-3.782	<0.001	(HS)
Median (Range)	1.60 (0 – 6.90)	55.50 (38.50 – 72.50)			

? Mann Whitney U test. p< 0.05 is significant. Sig.: significance.

Table 3: Comparison between group I and group II regarding thyroid DVH parameters.

Thyroid DVH parameters	Group I (N=10)	Group II (N=10)	Test?	p-value	(Sig.)
Volume (cc)					
Mean ± SD	16.91 ± 11.36	16.05 ± 2.12	-0.151	0.880	(NS)
Median (Range)	15.75 (5 – 45)	16.10 (12.60 – 19.80)			
Mean dose (Gy)					
Mean ± SD	17.92 ± 5.74	27.12 ± 4.27	-3.175	0.001	(S)
Median (Range)	17.90 (9 – 26.80)	29.07 (19.90 – 31.90)			
Max. dose (Gy)					
Mean ± SD	47.13 ± 3.21	51.55 ± 1.25	-3.102	0.002	(S)
Median (Range)	47.30 (42.90 – 51.20)	51.20 (50 – 53.10)			
V5 (%)					
Mean ± SD	47.53 ± 2.99	65.28 ± 9.78	-3.479	0.001	(S)
Median (Range)	47.15 (42.80 – 51.20)	64.90 (49.70 – 82.90)			
V20 (%)					
Mean ± SD	37.65 ± 1.68	50.47 ± 5.99	-3.705	<0.001	(HS)
Median (Range)	37.30 (35 – 40.85)	50.65 (40.80 – 60.20)			
V30 (%)					
Mean ± SD	31.81 ± 6.92	48.14 ± 5.75	-3.704	<0.001	(HS)
Median (Range)	33.20 (19.90 – 41.15)	48.25 (38.90 – 57.10)			
V40 (%)					
Mean ± SD	24.54 ± 8.40	45.99 ± 5.82	-3.704	<0.001	(HS)
Median (Range)	25.10 (10 – 38.80)	46.20 (36.90 – 55.20)			
V50 (%)					
Mean ± SD	0.64 ± 0.67	26.63 ± 4.68	-3.782	<0.001	(HS)
Median (Range)	0.35 (0 – 1.90)	25.85 (21.40 – 35.20)			

? Mann Whitney U test. p< 0.05 is significant. Sig.: significance.

Table 4 Comparison between group I and group II regarding T4 (nmol/L).

T4 (nmol/L)	Group I (N=10)	Group II (N=10)	Test?	p-value	(Sig.)
Baseline					
Mean ± SD	122.70 ± 25.33	131.40 ± 2.22	-0.950	0.342	(NS)
Median (Range)	111.50 (91 – 169)	134.50 (103 – 169)			
3months					
Mean ± SD	102.95 ± 10.52	103.53 ± 11.26	-0.267	0.789	(NS)
Median (Range)	99.50 (89 – 125)	100 (89 – 125)			
6months					
Mean ± SD	97.78 ± 12.84	97.68 ± 13.02	0.000	1.000	(NS)
Median (Range)	95.20 (85 – 128)	95.20 (83 – 128)			
12months					
Mean ± SD	91.92 ± 12.77	93.62 ± 10.71	-0.154	0.878	(NS)
Median (Range)	89.50 (73 – 116)	89.50 (77 – 116)			
18months					
Mean ± SD	86.01 ± 22.77	86.01 ± 22.77	0.000	1.000	(NS)
Median (Range)	87.05 (45 – 135)	87.05 (45 – 135)			
24months					
Mean ± SD	84.34 ± 25.20	70.20 ± 21.19	-1.785	0.074	(NS)
Median (Range)	84 (40 – 139)	70.50 (35 – 110)			

? Mann Whitney U test. p< 0.05 is significant. Sig.: significance.

Table 5. Comparison between group I and group II regarding T3 (nmol/L).

T3 (nmol/L)	Group I (N=10)	Group II (N=10)	Test?	p-value	(Sig.)
Baseline					
Mean ± SD	2.23 ± 0.50	2.24 ± 0.50	-0.076	0.939	(NS)
Median (Range)	2.15 (1.60 – 3.10)	2.20 (1.60 – 3.10)			
3 months					
Mean ± SD	2.15 ± 0.42	2.17 ± 0.43	-0.152	0.879	(NS)
Median (Range)	2.10 (1.60 – 2.80)	2.15 (1.60 – 2.80)			
6 months					
Mean ± SD	2.10 ± 0.43	2.10 ± 0.43	-0.038	0.970	(NS)
Median (Range)	2 (1.66 – 2.88)	2.05 (1.66 – 2.88)			

12 months					
Mean ± SD	1.94 ± 0.40	1.94 ± 0.33	-0.155	0.877	(NS)
Median (Range)	1.80 (1.50 – 2.80)	1.80 (1.50 – 2.70)			
18 months					
Mean ± SD	1.90 ± 0.43	1.84 ± 0.37	-0.267	0.790	(NS)
Median (Range)	1.80 (1.30 – 2.60)	1.80 (1.30 – 2.40)			
24 months					
Mean ± SD	1.88 ± 0.42	1.64 ± 0.42	-1.064	0.287	(NS)
Median (Range)	1.74 (1.30 – 2.54)	1.66 (0.70 – 2.17)			

? Mann Whitney U test. p< 0.05 is significant. Sig.: significance.

Table 6. Comparison between group I and group II regarding TSH (IU/L).

TSH (IU/L)	Group I (N=10)	Group II (N=10)	Test?	p-value	(Sig.)
Baseline					
Mean ± SD	1.31 ± 0.31	1.79 ± 0.94	-1.066	0.286	(NS)
Median (Range)	1.37 (0.95 – 2)	1.42 (0.95 – 4)			
3 months					
Mean ± SD	1.45 ± 0.33	2.83 ± 2.64	-2.018	0.044	(S)
Median (Range)	1.45 (1.10 – 2.10)	1.80 (1.10 – 10)			
6 months					
Mean ± SD	1.60 ± 0.33	3.08 ± 2.69	-2.020	0.043	(S)
Median (Range)	1.60 (1.24 – 2.20)	1.93 (1.24 – 10.30)			
12 months					
Mean ± SD	1.94 ± 0.51	3.49 ± 2.71	-1.815	0.070	(NS)
Median (Range)	1.80 (1.30 – 3.20)	2.32 (1.77 – 10.30)			
18 months					
Mean ± SD	3.49 ± 5.08	6.38 ± 6.39	-1.643	0.100	(NS)
Median (Range)	1.90 (1.40 – 17.94)	2.85 (1.60 – 17.94)			
24 months					
Mean ± SD	3.41 ± 5.11	6.51 ± 6.57	-1.760	0.078	(NS)
Median (Range)	1.70 (1.53 – 17.94)	3.11 (1.54 – 17.94)			

? Mann Whitney U test. p< 0.05 is significant. Sig.: significance.

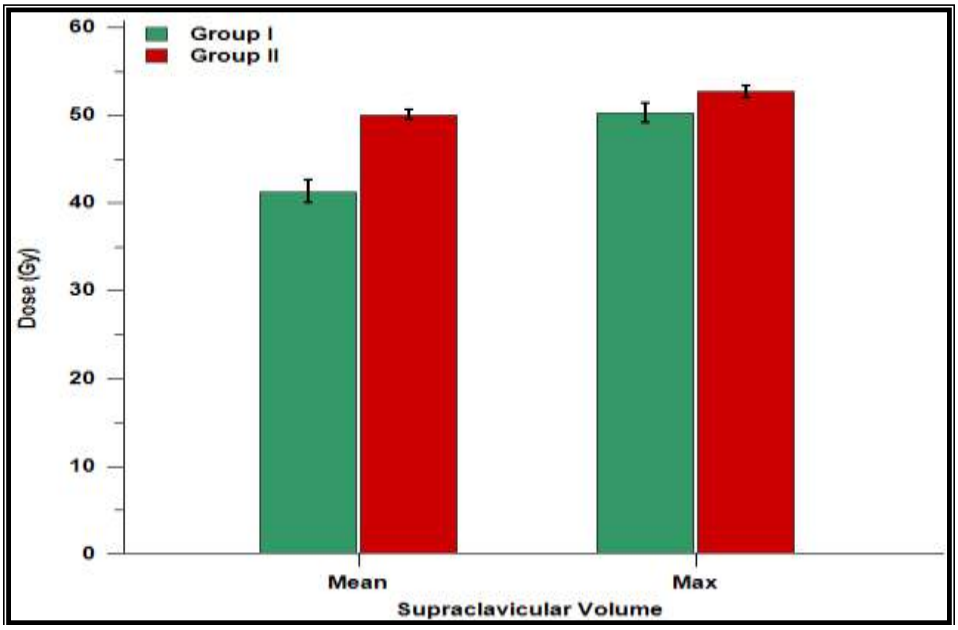

Figure 1. Comparison between group I and group II regarding mean and maximum dose to supraclavicular volume; bar represent mean, Y-error bar represent 95%confidence interval around mean.

DISCUSSION

Our study revealed a highly significant difference between the studied groups regarding mean dose of supraclavicular volume where average of mean dose in group I was lower than average in group II (Average:41 Gy versus 50.05 Gy, p<0.001) in agree with Kim Ann Ung et al. study (2013) where average of mean dose was 41.3Gy in conventional single-field technique (technique1) versus 50.1Gy in 3-dimensional conformal radiation therapy planning technique (technique2). [10]

In our study, there was a significant difference between the studied groups regarding maximum dose of supraclavicular volume where average of maximum dose in group I was lower than average in group II (Average: 50.26 Gy versus 52.69 Gy, p=0.001) in agree with Kim Ann Ung et al. study (2013) where average of maximum dose was 50.3Gy in technique1 versus 52.7Gy in technique2. [10]

Our study revealed a highly significant difference between the studied groups regarding percent of supraclavicular volume that received 30Gy where average of V30 in group I was lower than average in group II (Average: 92.75% versus 99.96%, p<0.001) in agree with Kim Ann Ung et al. study (2013) where average of V30 was 93.4% in technique1 versus 100% in technique2. [10]

There was a highly significant difference between the studied groups regarding percent of supraclavicular volume that received 40Gy where average of V40 in group I was lower than average in group II (Average: 71.70% versus 99.74%, p<0.001) in agree with Kim Ann Ung et al. study (2013) where average of V40 was 71.8% in technique1 versus 99.7% in technique2. [10]

In our study, there was A highly significant difference between the studied groups regarding percent of supraclavicular volume that received 50Gy where average of V50 in group I was lower than average in group II (Average: 2.06% versus 55.38%, p<0.001) in agree with Kim Ann Ung et al. study (2013) where average of V50 was 2% in technique1 versus 55.3% in technique2. [10]

Our study revealed insignificant difference between the studied groups regarding volume of delineated thyroid where average of volume in group I was 16.91cc versus 16.05cc in group II (p-value=0.880). A significant difference between the studied

groups regarding mean dose of thyroid volume where average of mean dose in group I was lower than average in group II (Average: 17.9 Gy versus 27.12 Gy, p=0.001) in agree with Kim Ann Ung et al. study (2013) where average of mean dose was 17.2Gy in technique1 versus 26.7Gy in technique2. [10]

In our study, there was a significant difference between the studied groups regarding maximum dose of thyroid volume where average of maximum dose in group I was lower than average in group II (Average: 47.13 Gy versus 51.55 Gy, p=0.002) in agree with Kim Ann Ung et al. study (2013) where average of maximum dose was 48.5Gy in technique1 versus 51.9Gy in technique2. [10]

In our study, there was a significant difference between the studied groups regarding percent of thyroid volume that received 5Gy where average of V5 in group I was lower than average in group II (Average: 47.53% versus 65.28%, p=0.001) in agree with Kim Ann Ung et al. study (2013) where average of V5 was 45.7% in technique1 versus 64.9% in technique2. [10]

In our study, there was a highly significant difference between the studied groups regarding percent of thyroid volume that received 20Gy where average of V20 in group I was lower than average in group II (Average: 37.65% versus 50.47%, p<0.001) in agree with Kim Ann Ung et al. study (2013) where average of V20 was 38.7% in technique1 versus 50.5% in technique2. [10]

In our study, there was A highly significant difference between the studied groups regarding percent of thyroid volume that received 30Gy where average of V30 in group I was lower than average in group II (Average: 31.81% versus 48.14%, p<0.001) in agree with Kim Ann Ung et al. study (2013) where average of V30 was 33.7% in technique1 versus 48% in technique2. Our study revealed , a highly significant difference between the studied groups regarding percent of thyroid volume that received 40Gy where average of V40 in group I was lower than average in group II (Average: 24.54% versus 45.99%, p<0.001) in agree with Kim Ann Ung et al. study (2013) where average of V40 was 24.4% in technique1 versus 46.1% in technique2. [10]

In our study, there was a highly significant difference between the studied groups regarding percent of thyroid volume that received 50Gy where average of V50 in group I was lower than average in group II (Average: 0.64% versus 26.63%, p<0.001) in agree with Kim Ann Ung et al. study (2013) where average of V50 was 0.6% in technique1 versus 26.7% in technique2[10]

According to our findings, we can conclude that there was no difference between both group regarding recovery of T4 level after radiotherapy, our data was in agree with Serap Akyurek et al. study (2014) where after 3 months of radiotherapy mean free T4 decrease from 10.82pmol/l to 9.91pmol/l then at 6 month recovery had occurred to mean free T4 of 10.30pmol/l then level decreased again at 9th month until 18th month then at 24th month raised again to mean free T4 of 9.58pmol/l. [11]

According to our findings, we can conclude that there was no difference between both group regarding recovery of T3 level after radiotherapy, our data was in agree with Serap Akyurek et al. study (2014) where after 3 months of radiotherapy mean free T3 decrease from 4.71pmol/l to 4.6pmol/l then at 6 month recovery had occurred to mean free T3 of 4.79pmol/l then level decreased again at 9th month until 18th month then at 24th month raised again to mean free T3 of 4.74pmol/l. [11]

According to our findings, we can conclude that there was no difference between both group regarding recovery of TSH level after radiotherapy, our data was in agree with Serap Akyurek et al. study (2014) where after 3 months of radiotherapy mean TSH increase from 1.8mIU/l to 2.01mIU/l then continue to increase until 24th month, at this time mean TSH had decrease to 4.23 mIU/l, indicate recovery of hypothyroidism but never TSH

come again to its pre-treatment value. Serap Akyurek et al. study (2014) [11]

CONCLUSION AND RECOMMENDATION

Our study justifies the 3D radiotherapy of supraclavicular lymph node in breast cancer patients is better in supraclavicular volume coverage than conventional 2D planning. However, the side effect on thyroid gland including permanent hypothyroidism is more with 3D planning than 2D planning.

So, it's strongly recommended that thyroid is considered to be one of important organ at risk during 3D planning of supraclavicular lymph node in breast cancer patients.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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