

## ORIGINAL ARTICLE

**Regional Lymph Node Radiotherapy in Breast Cancer: Single Anterior Supraclavicular Field vs. Two Anterior and Posterior Opposed Supraclavicular Fields**

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**ABSTRACT**

**Objective:** To compare different alternatives for the two regional Auxiliary lymph node (AXLN) and Supraclavicular lymph node (SCLNs) treatment programs by providing a perfect balance of homogeneity and by arranging target volume coverage.

**Study Design:** Cross sectional.

**Place and Duration of Study:** The study was conducted from 11<sup>th</sup> March 2020 to 11<sup>th</sup> September 2020 at the oncology ward of the Tertiary Care Hospital, Multan.

**Materials and Methods:** Forty breast cancer patients were included in the study. A three-dimensional (3D) planning system and a 6MV Compact machine technique were planned for the patients with breast cancer treated with post-surgery radiation that included the SC field.

**Results:** The minimum weight of these patients was 40kg, maximum 110kg. The minimum height was 148cm, the highest 175cm. Measurements averaged 63.5kg and 163.5cm respectively. The depth of the SC was 3-7 cm whereas the diameter of the chest wall was 12-21 cm. Body mass index has a relation with the mean of both the diameter of the chest wall and SC depth.

**Conclusion:** Two anterior and posterior opposed supraclavicular field is a better choice for the treatment as compared to single anterior supraclavicular fields. Several hot spots were produced at the two anterior and posterior opposed supraclavicular fields due to the use of single-photon.

**Key Words:** AXLN, Body Mass Index, Radiotherapy Supraclavicular, SCLNs.

**How to cite this:** Anwer A, Ijaz A, Arshad M. Regional Lymph Node Radiotherapy in Breast Cancer: Single Anterior Supraclavicular Field vs. Two Anterior and Posterior Opposed Supraclavicular Fields. *Life and Science*. 2022; 3(2): 70-75. doi: <http://doi.org/10.37185/LnS.1.1.202>

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**Introduction**

The uncontrolled division and multiplication of cells in the breast leads to breast cancer. Breast cancer is the most familiar cancer after lung cancer, especially in women. In the year 2018, 20.9 million cases of breast cancer were diagnosed. 1 out of 7, that means 14% of the population of women suffers from the disease. Most of the women with breast cancer are of more than 50 years of age<sup>1</sup> and only 5% of them are below 40 years. Lobules, the milk-producing

glands, and ducts, the passage through which milk reaches the nipple, are the most common breast cancer points where usually cancer develops. Also, it can develop in the fatty or fibrous connective tissue of the body.<sup>2,3</sup>

Other than these, the cancerous cells can travel to the lymph nodes that are present under the arms.<sup>4</sup> Lymph nodes are the primary medium for transferring cancer from one part to other body parts of the body.<sup>5</sup> At the early stages, the tumor is sometimes not visible, but the first sign is a lump development in the breast. Other symptoms include swelling or lumps under your arm, breast pain, reddish skin of the breast, fluid discharge from the nipple, scaling of breast skin, change in the nipple shape, and many more.<sup>6</sup> Surgeries, radiation therapy, chemotherapy, hormone therapy, and medications are ways to treat breast cancer. After removing early-

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*Funding Source: NIL; Conflict of Interest: NIL*

*Received: Apr 20, 2021; Revised: Dec 10, 2021*

*Accepted: Feb 14, 2022*

stage breast cancer, it is recommended that there be a radiation therapy of breast.<sup>7,8</sup> As a result of radiation therapy, the risk of developing cancer again is reduced. Also, radiation therapy is done at the lymph nodes of nearby breast areas where the tumor was occurred and removed. This therapy is known as regional lymph node radiation. Two techniques that have been approved for use in radiation therapy in breast cancer patients are Axial computed tomography (CT) simulation and three-dimensional conformal radiation therapy (3DCRT).<sup>9</sup>

Previous studies have shown that post-operative regional radiotherapy is beneficial for the women who suffered breast cancer and reduced the chance of its coming back; hence, increasing the survival rate. All the patients require adjuvant radiotherapy after the breast-conserving surgery.<sup>10</sup> In addition radiation therapy of Auxiliary lymph node (AXLN) and Supraclavicular lymph node (SCLNs) is also needed if these are involved in the patients' clinical results. Suppose the T4 tumor is present in the patient's report, and the size of the tumor is 5cm.<sup>11</sup> In that case, adjuvant radiotherapy at AXLNs and SCLNs is a must after the modified radical mastectomy. Particularly for these purposes, the images of CT scan stimulation are required by the oncologists. Several years before, the use of single-photon with a low energy source of Cobalt 60 or 6MV was the most frequently applied technique for the radiation therapy of AXLNs.<sup>3,12</sup>

The depth of maximum dose of the method, also known as Dmax, is D=3 cm. Simultaneously, some recent studies in developed countries show that as a result of using single AP in SCLN by oncologists, 66% of radiation therapy had a certain depth (not D = 3) in 67.5 midplanes in 17% of patients. So, the prescribed center may not correctly incorporate the nodal target into all patients who showed significant differences in the location and depth of SC and AXLNs previously.<sup>13,14</sup> For the improvement of dose homogeneity and dose compliance, appropriate CT techniques are required. It is a challenging task for the radio-oncologists to improve the treatment strategies for treating AXLNs and SCLNs. The study's primary aim was to make a comparison of multiple techniques for the treatment of AX II / III and SC.<sup>15</sup> The use of different alternatives for the two regional AXLN and SCLNs treatment programs by providing a

perfect balance of homogeneity and by arranging target volume coverage will be studied in this research.<sup>16</sup>

## Materials and Methods

A cross sectional study was conducted from 11<sup>th</sup> March 2020 to 11<sup>th</sup> September 2020 at the oncology ward of the Tertiary Care Hospital, Multan among the patients having breast cancer. Forty breast cancer patients were involved in the study. The patients under the study already had undergone radiation therapy at their regional lymph nodes so that any technique used in the study could not affect their cure rate.

The two techniques; three-dimensional (3D) planning system and a 6MV Compact machine technique are used to treat breast cancer patients with post-surgery radiations that involve the SC field. Only female patients diagnosed from breast cancer and age more than 19 years were included in the study. All the male patients or females below 18 years were excluded. At first, CT stimulation of each patient was done before further treatment. A breast board was provided to immobilize the patients, and the patients were set at the supine position. Also, we made sure 90 degrees abduction of the ipsilateral arm of the patients. A slice of 3mm thickness was taken for CT simulation purposes. The radio-oncologists contoured the treatment target volume AX II / III and SC lymph nodes concerning the radiation therapy oncology group 8. These two techniques were direct anterior-posterior field alone and an anterior-posterior parallel pair (AP/PA). To overcome the unneeded radiation at the spinal cord, 10-degree external gantry rotation was used. Iso gray treatment planning software (V4.1.3.23L) was used in the data collection method. In the first technique with a single field, the calculation of SC depth from skin to the LII / III and SC lymph nodes was measured vertically. Also, the measurement of the diameter of the chest wall was done vertically. The oncologists evaluated 121 plans, out of which two plans were for the AP/PA fields patient, and one plan was for every single AP field. BMI is one of the factors on which the precision of CT stimulation and 3DCRT depends. To avoid false results, the patients were divided into four groups according to their BMI: underweight, overweight, normal, or obese. Ethical statements from all the patients were recorded. All the

procedures were explained as the patients were made sure that the procedure will not affect their already done therapy. Also, the data collected from all the patients have been performed anonymously.<sup>17,18</sup>

According to the BMI of the patients, the SC depth and diameter of the wall were analyzed. A simple linear regression analysis was performed. The Data Analysis procedure was done using the Statistical software package for social sciences (SPSS) version 2.<sup>19</sup>

**Results**

A total of 40 patients was included in the study which was categorized into 4 groups based on their BMI. The minimum weight among these patients was 40kg and the maximum was 110kg. The minimum height was 148cm and the maximum was 175cm. the average of both measurements was 63.5kg and 163.5cm respectively. Among the 4 groups 10 patients were included in the underweight group, which means body mass index 18.5-22.5, 10 in the normal weight group with BMI 22.6-24.9, 10 in the overweight group with BMI 25-29.9, and the last 10 were included in the group of obese patients with body mass index more than 30. The minimum age of the patients included in the study was 22 whereas 70 was the maximum. So, the mean age was 46. Out of 40, modified radical mastectomy was done on 26 patients whereas the other 15 were undergone BCT. The size of all the tumors was in between 1.0-8.6 cm.

● **Chest Wall Diameter and SCLNs Depth**

The following table 1 shows the mean diameter of the chest wall and mean depth of SCLNs according to the BMI classification of the patients.

**Table 1: Chest Wall Diameter and SCLNs Depth**

BMI	Mean Diameter of the chest wall	Standard Deviation	Mean Depth	Standard Deviation
18-21.5	12.09	0.30	3.27	0.26
22.6-24.9	13.50	0.40	4.5	0.41
25-22.9	15.17	0.53	5.43	0.41
≥30	18.02	2.04	6.60	0.54
Total	14.2	2.36	4	1.3

● **BMI Depending Dosimetry Results**

This table ii shows the results of all the study including AX level 2 and 3, and SC lymph nodes in

V95, V105 and V110. Also, the significant p-values according to the BMI.

**Discussion**

SC and AX lymph nodes depth were found different in the study. Also, a direct relationship was determined BMI and SC depth and chest diameter. So, the higher the BMI, the deeper the nodal beds. Bentel and Colleagues performed a study and the SC depth found were 19-64cm, being a comparable study. In the study, there was a negligible difference in both the fields of V95. Whereas in V105 a significant difference was found in both the fields at levels 2, 3 and SC.<sup>20</sup> It was concluded that the AP/PA method for the treatment is more significant for obese patients. The reason behind it is that in this method they don't have to face hot spots scans. A study conducted by Liengsawangwong and colleagues shows that the level 3 axillary lymph nodes and SC depth are in between 14-67mm.<sup>21</sup> A clear difference was found in the lymph dose of the Axillary Lymph nodes according to Goodman's study. We can also compare these results with our study making all the patients falling in the four categories of BMI with both fields appropriate with V95 in LN 2 and 3. Jephcott and his fellows were performing a CT study in the year 2004 in which, 4 radiotherapy techniques including an anterior field with a posterior axillary boost with compensator, an anterior field with posterior axillary boost, single AP field, and AP/PA fields were compared.<sup>22</sup> So, among all the patients 60% of the patients undergoing a single AP field did not show significant results. The AP/PA field showed good results but some excessive dose was given to the medial of the neck and chest region. The posterior axillary boost method was better than the second one as the adequate dose reached PTV and the dose between the neck and chest region was decreased. But 90% of the patients had more hot spots in this case. Everything including the dosages to medial neck and chest as well as PTV was optimized but the hot-spots were 120% less in the patients. It is all due to better coverage of PTV that AP/PA is considered better than a single performance appraisal method. So, some of these points were consistent with our studies and some were not.

In Pakistan, 12,000 of the population suffers from Cancer according to WHO, but there is no Cancer Registry. All three types of radiotherapy are done for

**Table 2: BMI depending dosimetry results**

BMI Range kg/m <sup>2</sup>	18.5-22.5			22.6-24.9			25-29.9		
	AP	AP/PA	P-value	AP	AP/PA	P-value	AP	AP/PA	P-value
Level II	V95 95.81±0.7	98.63±1.2	0.09	96.00±0.8	97.00±2.3	0.08	99.12±1.1	98.37±2.1	0.09
	V105 3.25±1.4	0.00±0	0.07	16.50±3.1	0.00±0	<0.001	28.12±5.7	0.62±0.7	<0.001
	V110 0.00±0	0.00±0	0.1	14.25±3.5	0.00±0	<0.001	29.87±6.4	0.25±0.7	<0.001
Level III	V95 98.90±0.3	100.00±0	0.1	96.50±1	98.75±1.9	0.09	96.75±1	99.62±0.5	0.09
	V105 2.22±0.8	0.00±0	0.2	5.37±0.5	0.00±0	0.06	15.37±5	0.00±0	<0.001
	V110 0.00±0	0.00±0	0.1	1.50±1	0.00±0	0.07	7.00±3.8	0.00±0	<0.001
Supraclavicular	V95 98.63±1.2	96.81±0.6	0.08	98.25±1	97.50±0.6	0.091	99.75±0.5	98.62±1.7	0.09
	V105 63.63±1.3	0.00±0	<0.001	76.00±0.8	0.00±0	<0.001	85.25±5	0.00±0	<0.001
	V110 31.08±7	0.00±0	<0.001	38.75±1	0.00±0	<0.001	47.75±0.8	0.00±0	<0.001

the treatment of breast cancer including tele therapy, brachytherapy, and other sources. The production of radiotherapeutics is done at a local level whereas the Cobalt-60 resources are imported to the country. International Atomic Energy Agency is trying to improve the stability and infrastructure of radiotherapy. Pakistan Institute of Nuclear Science and Technology collaboration is the only way to introduce the radio therapeutics. There is a dire need to increase its clinical applications as well.<sup>23,24</sup>

Some of the limitations of the research method include that the planning for treatment relay on the person's design practice. Different radiation oncologists have different treatment planning, so made different results and calculations.<sup>25</sup> The procedure is managed by the radiation physicist and oncologist. We used the standard defined field, so there is not much difference. Moreover, the average or maximum dosage by skin, lungs, and heart were not considered by us. This may increase to a great level in the AP/PA technique than in the AP technique.<sup>26,27</sup>

## Conclusion

Two anterior and posterior opposed supraclavicular field is a better choice for the treatment as compared to single anterior supraclavicular fields, specifically for overweight patients. Several hot spots were produced in two anterior and posterior opposed supraclavicular fields due to the use of single-photon. Further researches are required to study the dose to lungs and heart. In case the dose is excessive, it needs to be controlled.

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