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Original Research Article

Frequency of Breast Cancer Metastasis and Extent on Computed Tomography

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Abstract: ***Background:*** Computed Tomography is a significant imaging modality in cancer staging, the extent of disease evaluation, and cure management for breast cancer women. The purpose of the current study was to determine the prognostic value of metastasis in breast cancer patients on computed tomography. ***Objective:*** The present study explores the frequency of breast cancer Metastasis and the extent on computed tomography in Gujranwala, Pakistan. ***Material and Method:*** A cross-sectional study was organized at the diagnostic department of radiology (DHQ/Teaching Hospital, Gujranwala). The duration of the study was 3 months i.e. 23rd January 2022 to 23rd April 2022. The total number of participants was 50 with primary breast cancer. Between 23rd January 2022 and 23rd April 2022, 50 breast cancer patients who underwent computed tomography for verification of breast cancer metastasis were analyzed. Volume acquisition in axial sections with multi-slice CT of the abdomen from chest to the pubic symphysis was done for the assessment. ***Results:*** At the time of diagnosis, 29 patients (58%) did not have while 21 patients (42%) had metastasis. Information on histological types was available for 50 primary breast cancer patients. These were (22%) Ductal carcinoma, (4%) inflammatory, and (74%) other subtypes. On patient-based analysis, computed tomography identified distant metastasis in axillary lymph nodes (44%), pulmonary (8%), hepatic (2%), and bone (4%) and 3 patients (6%) had metastasis extended to ALN, pulmonary, hepatic and bone. ***Conclusion:*** Breast CT with contrast upgrade lesion visualization could be advantageous for the determining extent of metastasis The breast CT radiation dose is complementary to and is within the dimension of conventional mammography imaging. Given all the possible aspects, imaging of breast techniques in addition to biopsies guidance, adjunctive screening, and evaluation of diagnosis, the extent of disease evaluation, and examining feedback to neoadjuvant therapy, CT breast could become a vital modality for metastasis evaluation in breast tumor patients.
Keywords: Metastasis Extent, Breast Cancer, Ductal Carcinoma, Computed tomography.

INTRODUCTION

Aside from skin cancer, cancer of the breast is the most frequent type of cancer in women, accounting for approximately 30% of all new cancers diagnosed in females. It is evaluated that out of every 8 women in the US one will develop breast cancer at some stage in their lives (Glick, 2007). Breast cancer incidences and mortality rates differ by race and ethnicity. Breast cancer is a disease in which the breast cells proliferate wildly. Breast cancer is of different types and its type is determined by which breast cells develop into cancer. Mostly, breast cancers start in the lobules or in the ducts. Cancer can be metastasized outside the breast through blood and lymph vessels (Peart, 2017). Invasive ductal carcinoma is the commonest type of breast cancer, in which cancer cells begin in the ducts and metastasized to various parts of the breast tissue (Wang, Khosla, Gargeya, Irshad, & Beck, 2016).

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Breast cancer incidence and mortality rates differ by race and ethnicity. Because there is no known cure for breast cancer at present, early detection, and better treatment plans have proven to be the more convincing means of reducing mortality rates (Pesapane, Downey, Rotili, Cassano, & Koh, 2020). Admitting mammography has been shown to be convincing in lowering breast cancer mortality, a current imaging technology known as breast computed tomography is being studied in the hopes of even earlier detection of breast cancer. Breast computed tomography is a breast modality that gathers projection data with complete angular sampling (James *et al.*, 2019). When breast computed tomography is correlated to magnetic resonance imaging, the acquisition time in CT imaging is significantly lesser; 10sec for a whole scan in comparison to 4 to 8 mint per sequence in MRI, resulting in approximately 40 minutes for an entire MRI scan (Kutomi *et al.,* 2014) diagnostic setup, Breast CT may not be able to take over breast MRI, but it may be fruitful as a substitute to MRI for a contraindicated patient, such as pregnancy (Wienbeck *et al.*, 2017).

CT breast imaging has been a promising modality in diagnostic setting in evaluating the extent or distribution of a malignant cancer (O'Connell, Karellas, & Vedantham, 2014). An authentic preoperative breast cancer evaluation is difficult for successful conservation surgery of breast. CT imaging of breast would, in the best-case scenario, take over screening mammography imaging for breast cancer in all females (Kutomi *et al.*, 2014). The extent, existence and location finding of distant metastases are vital prognostic factors in cancer of breast and are important in treatment planning. In few cases, primary breast tumors surgical removal may be worthless, while metastases of breast tumor may amend systemic or adjuvant therapy. As a result, it is habitual to look for distant diseases before beginning a treatment procedure with therapeutic intent. Different imaging methods at present are being used for this purpose, including bone scintigraphy scan, ultrasound of liver, X-ray of chest, and computed tomography scan (Bitencourt *et al.*, 2017). However, it may be concluded that breast CT imaging outperforms screening mammography only for certain groups of patients, similarly those with dense breasts, sensitive to breast compression used in mammography technique, or those at high chances for developing breast cancer (Chen *et al.*, 2019).

MATERIAL AND METHOD

A cross-sectional study was aimed using purposive sampling technique with a sample size of 50 primary breast cancer patients. The respondents were the patients registered at the department of diagnostic radiology (DHQ/Teaching Hospital, Gujranwala) from 23rd january 2022 to 23rd april 2022. All the cases were females that had been diagnosed pathologically with breast cancer without cancer diffusion by CT scan of whole body and bone-scintigraphy scan (Cox & Spratt, 2021). In our radiology setup, pre-surgical contrast and non-contrast computed tomography are normally performed. Permission was obtained from the institutional review board. All research participants were enlisted after taking written informed consent.

A helical CT unit (Aquilion 64; Toshiba) with and without contrast was pre-surgically carried out since this is the common method in Pakistan. Computed tomography scan was carried out with the patient in the prone position face lying down while the CT scanner rotates around the breast. In each case, a single breath-hold was asked for during examination. Axial images were recreated in the coronal and sagittal sections at 5 mm intervals. A PA&CS was used to evaluate images in all three planes (axial, coronal, and sagittal). The mediastinal window settings were 35–40 window level range and 400 window width. Tumor status was classified using the TNM staging system, which includes tumor, node, and metastasis categories. The ROI average was used to assess the computed tomography score for the HU. Data was filled by the researcher in designated performa and images were taken of the patient's CT scan. Complete descriptive statistics of metastasis sites are to be identified for further research and data analysis for the project. IBM SPSS® software was used for the statistical analysis of the data.

RESULTS

Overall 50 women with primary breast cancer administer at the radiology setting of (DHQ/Teaching Hospital, Gujranwala) between 23rd January 2022 to 23rd April 2022 were assessed for the study. All the victims underwent CT procedure pre-surgery. Of the 50 women, 21 patients were identified with metastatic breast tumor, and 29 women with primary breast cancer. In the current study, both sides of axillary lymph nodes, pulmonary, hepatic, and bone status were examined. Entire patients were females, with a median age of 45years. The size of tumor was formed on post-diagnostic size measurement of the tumor. According to the TNM classification, the average tumor of the 50 cases was T2 (37%), including 16 (31.4%) cases that fall in the T4 category, lymph nodes N0(12%), N1(70%), and N2(18%) in 9 cases. Out of 50 cases, 21 patients (42%) had metastasis at the time of diagnosis. The pathological analysis showed that 11 (22%) cases were invasive ductal carcinoma and 2 (4%) sufferer were inflammatory cancer. Among 50 patients, 11 (22%) of them had ALN metastasis,2(4%) bone metastasis, 4 patients (8%) had pulmonary metastasis, and (2%) had hepatic metastasis. In some patients, the Mets were extended to more than one region, such as hepatic and bone-in (2%), pulmonary and bone-in (4%) pulmonary, hepatic and bone-in (6%) cases, and pulmonary, ALN in 7 cases (14%) respectively.

1.1 Distribution of population

		TUMOR	LYMPH_NODES	METASTASIS	HISTOLOGICAL _TYPE	METASTASIS SITE	METASTASIS SITE	METASTASIS SITE	METASTASIS SITE	OTHERS
N	**Valid**	50	50	50	50	50	50	50	50	50
	Missing	1	1	1	1	1	1	1	1	1
Median		1.50	1.00	.00	2.00	1.00	1.00	1.00	1.00	4.00
Std. Deviation		1.055	.550	.499	.839	.198	.274	.141	.510	.930
Minimum		0	0	0	0	0	0	0	0	0
Maximum		3	2	1	2	1	1	1	2	4

The total 50 breast cancer patients were taken as the sample population for this study.

1.2 Analyses of the breast cancer on the basis of TNM classification

		Frequency	**Percent**
Valid	T1	6	11.8
	T2	19	37.3
	T3	9	17.6
	T4	16	31.4
	Total	50	98.0
	N0	6	11.8
	N1	35	68.6
	N2	9	17.6
	Total	50	98.0
M0		29	56.9
M1		21	41.2
Total		50	98.0

1.3 CT scan (n = 50) organ-based review of metastatic breast cancer

BONE METASTASIS SITE					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	YES	2	3.9	4.0	4.0
	NO	48	94.1	96.0	100.0
	Total	50	98.0	100.0	
Missing	System	1	2.0		
Total		51	100.0		

PULMONARY METASTASIS SITE					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	YES	4	7.8	8.0	8.0
	NO	46	90.2	92.0	100.0
	Total	50	98.0	100.0	
Missing	System	1	2.0		
Total		51	100.0		

HEPATIC METASTASIS SITE					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	YES	1	2.0	2.0	2.0
	NO	49	96.1	98.0	100.0
	Total	50	98.0	100.0	
Missing	System	1	2.0		
Total		51	100.0		

ALN METASTASIS SITE					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	11	21.6	22.0	22.0
	NO	36	70.6	72.0	94.0
	ALN, PULMONARY, HEPATIC, BONE	3	5.9	6.0	100.0
	Total	50	98.0	100.0	

DISCUSSION

Accurate metastasis and its extent evaluation are critical in pre-surgical classification and management planning for primary breast cancer patients. Traditionally, mammogram and ultrasound imaging are common breast imaging modalities for cancer evaluation and assessment of TNM status, While MRI scan of breast is generally used to examine the histological confirmation of the extent of cancer. Despite advancements in these modes, there are still limitations in respect of sensitivity and specificity together with effective cost. In our clinical setting, we commonly performed contrast CAP computed tomography in stage III-IV breast cancer patients. Although, we usually preferred a plain chest CT scan for patients with stages I-II breast cancer. In case if we found any abnormal lesion then, we will use the contrast CT scan for examination. MDCT scanners can acquire multiple computed tomography datasets per rotation of the x-ray tube. They have the ability to scan substantial anatomical regions several times faster than single-detector helical computed tomography scanners. Furthermore, by the use of thin collimation, MDCT significantly betters the temporal and spatial resolution of images obtained for the detection of lesions. As a result, CT has the potential to be useful as a method for accurately assessing metastasis status.

It is therefore deduced that computed tomography allows a non-invasive assessment of metastasis in breast cancer patients. Also, it is proved to be a precise method for diagnosis of the extent of metastasis to other regions apart from, which leads to better cancer management, which is the prognosis of this research.

CONCLUSION

In conclusion, TNM staging and metastasis sites were unconventional prognostic factors in CT for predicting breast cancer metastasis and its extent. Breast cancer patients with T2N1M1 staging and at ALN site were considered more prevalent. CT is a potential imaging modality for predicting metastasis in ALN, pulmonary, hepatic, and bone in breast cancer patients A cross-sectional study on the value of contrast enhanced CT for pre-operative metastasis and its extent evaluation in breast cancer patients is validated for its management and treatment planning. This study will bring out the importance as well as the potency of CT, which allows a non-invasive assessment for the diagnosis of breast cancer metastasis including its extent, which is safe and convenient as compared to other invasive and radioactive methods for breast cancer assessment.

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