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RADIOLOGICAL EVALUATION OF COMMON AND ATYPICAL SITES OF BREAST CANCER METASTASES ON NECK CHEST ABDOMEN PELVIS COMPUTED TOMOGRAPHY

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Abstract

Background: *Breast cancer is the most often diagnosed form of cancer in females, and the primary cause of death is the distant metastatic spread of the disease. For the sake of effective staging, prognostication, and treatment planning, it is important to accurately identify metastases, both at common sites such as bone, lung, and liver, as well as at unusual regions(peritoneum,colon,pelvis).*

Objective: *In order to provide a complete whole-body evaluation that improves clinical decision-making and patient treatment, the objective of this study is to examine the role that Neck, Chest, Abdomen, and Pelvis (NCAP) CT scanning plays in detecting both conventional and atypical metastatic patterns in breast cancer patients.*

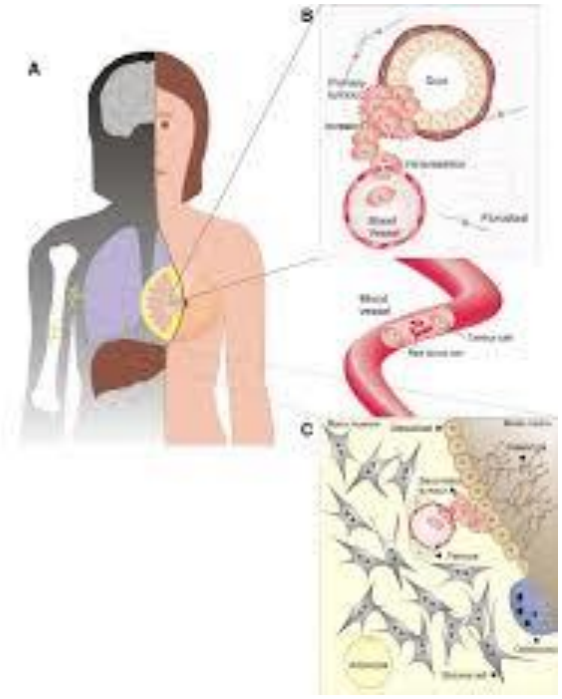
Methodology*: This 4 month descriptive study reviewed clinical records and NCAP(neck,chest,abdomen,pelvis) CT scans of patients diagnosed with breast cancer to evaluate the distribution of metastatic disease. Each CT scan was examined for the presence, and anatomical distribution of metastases across the neck, chest, abdomen, and pelvis. Both common metastatic sites such as bone, lungs, liver and atypical locations were assessed in detail. Lesions were documented according to type, and frequency.*

Results: *In this study of 80 breast cancer patients, metastases were detected in most cases, with 93.8% showing disease spread. Half of the patients had metastases to common sites like bone, liver, lung, and lymph nodes, while 15% had atypical locations, and 27.5% had both. Over half of the patients (52.5%) had multiple metastatic sites, highlighting extensive disease involvement.*

Conclusion: *This study shows that breast cancer metastases often develop in more than one common or unusual region, especially in those between the ages of 51 and 70. The results show how aggressive metastatic disease is and how important it is to have comprehensive CT screening.*

INTRODUCTION

Breast cancer metastasis is the process by which cancerous cells from the initial (primary) location in the breast travel to other organs or tissues by blood circulation, lymphatic routes, or direct extension. These new growths are termed metastatic lesions.Breast cancer is one of the most common causes of cancer deaths across the world, especially when it spreads from the breast to other parts of the body.In accordance to a study, "distant metastases from breast cancer are often located in the lungs, liver, and bones. [1] Breast cancer often metastasizes to various distant organs beyond the breast. The most common place for cancer to spread is to the bones, especially the spine, ribs, pelvis, and long bones. The lungs are also often affected, and they often have more than one nodule or pleura involvement. In general, the most common and well-known places for breast cancer to spread are the bones, lungs, and liver.A significant NLP study revealed that breast cancer exhibits the highest five-year incidence rate of bone metastases among solid tumors, approximately 41% .[2]



Anatomical presentation of Breast Cancer Metastasis[13]

Imaging is an important tool for finding and describing metastatic disease.Imaging not only shows whether metastases have happened, but it also helps figure out how they spread, which organs they affect, and what the lesions look like.This information is necessary for correctly staging the disease, planning treatment, keeping an eye on how well the treatment is working, and judging how the disease is getting worse.A retrospective study conducted in Ghana revealed that multi-detector CT scan is the preferable modality for monitoring metastatic breast cancer, owing to its high accuracy in assessing the extent of local disease, detecting metastasis, and identifying treatment-related complications.[3] A CT scan of the abdomen and pelvis has demonstrated its ability to detect occult metastatic disease beyond the liver and skeletal system. In a seminal CT evaluation study involving 260 breast cancer patients, extra hepatic and extra-skeletal metastases were identified in 26 patients (10%), demonstrating that CT has the capacity to detect secondary involvement that may not be clinically anticipated.[4] Evidence from Nigeria shows that chest and upper abdominal CT scans has more sensitivity than chest X-rays, but they can still give false positives up to 14% of the time.[5] This shows that we need to improve the accuracy of

our tests. In Pakistan, most reports still rely on chest X-rays, ultrasounds, or bone scans. Because of this, there isn't enough information about how common atypical or extra-hepatic metastases that are only found through CT are. This emphasizes the need for up-to-date, CT-based regional evidence.How successfully can NCAP(Neck,Chest,Abdomen,Pelvis) CT detect common and atypical metastatic locations in breast cancer patients at Tertiary care Hospital? That is the fundamental question that this study aims to solve. The current study fills a knowledge gap by creating relevant research questions concerning the occurrence of metastases across numerous locations (lung, liver, bone, lymph nodes, peritoneum, adrenal glands, etc.) in a local environment utilizing standardized CT staging techniques.Furthermore, studying metastatic trends in a rural Pakistani population is especially important considering the clinical behavior of breast cancer across areas. Globally, the proportion of metastatic breast cancer patients who develop bone metastases may exceed 70% in advanced disease settings[6], with brain metastases occurring in up to "10-15% of patients".Distant metastases is still the main cause of disease and mortality in people with metastatic breast cancer. This makes it important to get precise radiologic assessments so that diagnosis and treatment may begin quickly. Computed tomography (CT) is quite good at finding both common and less common metastatic locations because it is very sensitive to problems in the chest and abdomen. In this context, Jimah B.B. et al. (2024) performed a comprehensive prospective analysis of CT imaging to determine the distribution and burden of metastatic disease in patients with advanced breast cancer, providing significant insights into transmission patterns critical for clinical assessment and treatment planning.[7]Accurate imaging is still an important part of treating breast cancer, especially for finding distant metastases that might not show up on normal imaging. Chest X-ray and abdomen ultrasound are often the first tests done, although they aren't very good at finding on time or mild metastatic disease. Acknowledging this deficiency, Rajasooriyar et al. (2020) performed a retrospective analysis of staging CT scans of the chest, abdomen, and pelvis in asymptomatic breast cancer patients with normal baseline imaging. Their research highlights the significance of CT in detecting occult metastases in a limited yet clinically relevant cohort of patients, emphasizing the necessity of a targeted, risk-adjusted methodology for staging particularly in resource limited settings where enhancing diagnostic efficacy and reducing superfluous exposures are critical.[8]

MATERIAL AND METHODS

This study is performed as a descriptive, cross-sectional analysis with the main objective of precisely assessing the identification and distribution of metastatic lesions in breast cancer patients with NCAP(Neck,Chest,Abdomen,Pelvis) CT scans at a tertiary care hospital. A sample size of 80 participants was determined using a 95% confidence level, a 10% margin of error, and an estimated 3% prevalence, with participants selected through convenient sampling over four months after the synopsis approval. The inclusion criteria involved females with the age exceeding 18y who have been diagnosed with breast cancer. Exclusion criteria included prior history of other malignancies and treatments, other primary cancers, incomplete clinical history, and at early stages of breast cancer. The equipment used in the study included a Toshiba 64-slice CT scanner. A CT scan of the neck, chest, abdomen, and pelvis is performed using a multi-slice CT scanner, with the patient positioned supine and arms raised above the head. The scan will extend from the base of the skull to the pubic symphysis. The scan is acquired with a **slice thickness of 3–5 mm**, which provides sufficient anatomical detail while maintaining manageable data volume. Image reconstruction is done in axial, coronal, and sagittal planes. Intravenous iodinated contrast will be administered at 1.5–2 ml/kg via power injector at 3–4 ml/sec, followed by scanning in the venous phase (60–70 seconds post-injection) to enhance detection of soft tissue metastases (liver, lymph nodes, etc.).

RESULTS

There were 80 breast cancer patients in the research. Most of the patients were between 61 and 70 years old (28.7%), followed closely by those between 51 and 60 years old (27.5%). 16.3% of the sample were patients between the ages of 41 and 50. Younger age groups had smaller percentages: 6.3% were 31 to 40

years old, 5.0% were 21 to 30 years old, and only 2.5% were under 20 years old. Also, 13.8% of the patients were above 70 years old.Metastasis was found in most of them. Imaging showed that 75 patients (93.8%) had metastatic disease, while just 4 patients (5.0%) did not.Metastatic involvement were seen. Forty (50.0%) of the patients had metastases to typical places like the bones, liver, lungs, and lymph nodes. Twelve patients (15.0%) had atypical metastatic locations, which shows that a significant number of patients had metastases that were not in the normal places.Furthermore, 22 patients (27.5%) demonstrated metastases to both common and atypical sites, underscoring the presence of both typical and atypical propagation across a significant portion of the sample. Only 5 patients (6.3%) did not have any metastases.In this study, 56.3% of patients had no atypical metastases, while the rest had several rare locations. Omentoperitoneal and pelvic lymph nodes were the most common atypical sites (7.5% each), followed by spinal canal involvement (5%) and sigmoid colon–ovary metastasis (3.8%). Omental, adnexal, diaphragmatic, ovary, supraglottic, and hilar lymph nodes were less prevalent (2.5% each), while the skin, sigmoid colon, diaphragm, and chest wall with ovaries were isolated (1.3% each). These findings suggest that atypical metastases, however rare, include several anatomical locations.17 (21.5%) did not have any metastases. There were 22 patients (27.8%) with several common locations, 13 (16.5%) with mediastinal lymph nodes, and 11 (13.9%) with lung metastases. There were 6 patients (7.6%) with bone metastases, 4 (5.1%) with liver metastases, and lesser numbers with isolated lymph nodes: 1.3% with axial lymph nodes, 2.5% with cervical and axial lymph nodes, and 3.8% with various lymph nodes.

Table no.1

Age		
	Frequency	**Percent**
less than 20yrs	2	2.5
21-30 years	4	5.0
31-40 years	5	6.3
41-50 years	13	16.3
51-60 years	22	27.5
61-70 years	23	28.7
above 70 yrs	11	13.8
Total	80	100.0

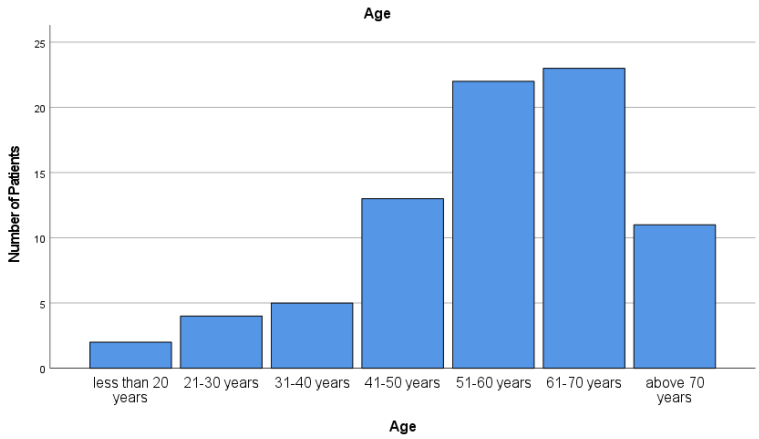


Figure 1:Age Distribution Bar Graph

Table no.2

Metastatic Site		
	Frequency	Percent
No Mets	5	6.3
Both Sites	22	27.5
Common Site	40	50.0
Atypical Site	12	15.0
Total	79	98.8
System	1	1.3
Total	80	100.0

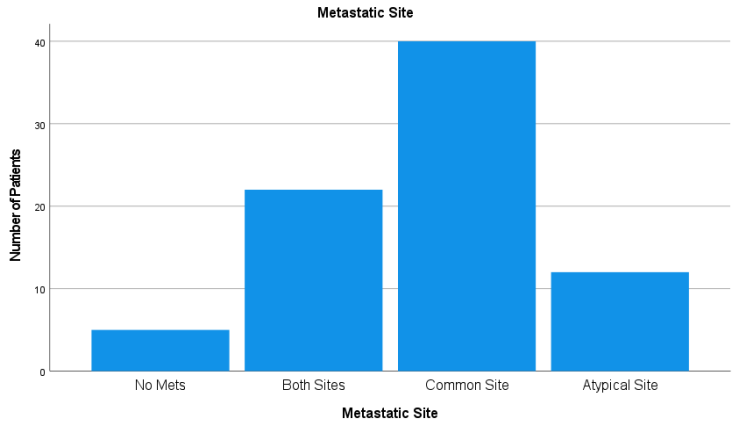


Figure 2;Frequency of Different Metastatic Patterns on Bar Chart

Table no:3

Metastasis Detection; Metastatic Extention Crosstabulation

Count					
		Metastatic Extention			
		No Mets	Single	Multiple	Total
Metastasis detection	No	5	0	0	5
	Yes	1	32	42	75
Total		6	32	42	80

Table no:4

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	65.778	2	.000
Likelihood Ratio	32.000	2	.000
Linear-by-Linear Association	27.857	1	.000
N of Valid Cases	80		

DISCUSSION

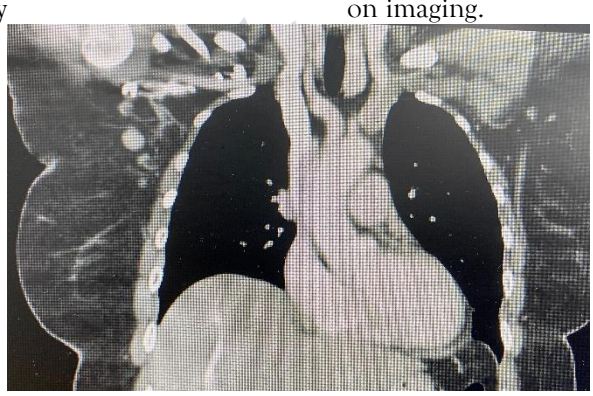
In our analysis of 80 breast cancer patients, the most considerable proportion (28.7%) was within the 61–70 years age group, closely followed by individuals in the 51–60 years age group (27.5%). A significant proportion (16.3%) were aged 41 to 50 years. Smaller yet significant proportions were younger: 6.3% aged 31–40, 5.0% aged 21–30, and 2.5% were under 20. Furthermore, 13.8% were over 70 years old. This age pattern indicates that although a significant proportion of cases occurred in older, often postmenopausal, women, a notable minority presented at relatively young age.This distribution partially corresponds with global and regional tendencies. According to global data from the Global Burden of Disease Study 2019, nearly 49% of breast cancer cases worldwide in 2019 occurred in individuals aged 50 to 69 years, and the proportion of patients aged 70 years and older has been increasing over the past decades.[9]A retrospective imaging review by Mensah et al. (2021) at a tertiary oncology centre in Ghana found that the most frequent metastasis sites were lymph nodes, lung (55.3%), bone (44.6%), and liver (39.8%).[10]This mirrors our own findings and supports the notion that lymphatic and multi-site spread not merely bone-dominant metastasis may be more common in certain populations, possibly due to differences in tumor biology, patient demographics, or staging practices.In our study of breast cancer patients, the majority (93.8%) exhibited metastatic disease on imaging, whereas just 5.0% showed no visible metastases. The high rate of metastasis shows that most patients either had a late-stage disease when they came in or had a disease biology that was very aggressive, which led to the disease spreading widely by the time of the imaging examination.Smith J. et al. (2020) performed a retrospective analysis of 512 breast cancer patients receiving staging CT and PET/CT scans. They said that 85% of patients with locally advanced disease had signs of metastasis when they first had imaging done. Most of them involved lymph nodes, the lungs, and bones.[11]In this study, 56.3% of patients had no atypical metastases, while the remaining 43.7% showed involvement of rare or unusual locations. Omentoperitoneal and pelvic lymph node metastases were the most common atypical sites followed by spinal canal involvement and mixed sigmoid colon–ovary metastases.Mensah YB et al. (2021) documented a comparable distribution of atypical metastatic locations in a group of breast cancer patients receiving CT imaging, which included the omentum, adnexal tissues, and spinal canal involvement. [3]In this study, metastatic extension among 80 breast cancer patients showed that 6.3% had no detectable metastases, 40.0% exhibited metastasis at a single site, and the majority (52.5%) had multiple metastatic sites. This indicates that multi-site involvement is the most common pattern, reflecting advanced disease at the time of presentation and the aggressive nature of metastatic breast cancer.Zhao Y et al. (2024) performed a SEER-based population study and demonstrated that multi-site metastases were present in a majority of patients with distant-stage breast cancer, confirming that extensive disease involvement is a frequent pattern and has important prognostic implications.[12]

Case 1

A 68-year-old female patient presented persistent bone pain,localized tenderness,numbness and weakness.She has a prevoius history of breast cancer.Underwent multi-slice NCAP(Neck,Chest,Abdomen,Pelvis) CT scan to evaluate metastatic sites.Bone mets in the thoracic vertebral region has diagnosed.

Case 2

A 55-year-old female patient presented with palpable lumps in the axilla,pain and discomfort in the armpit,she has been diagnosed of breast caner for more than 2 years.A whole body NCAP(Neck,Chest,Abdomen,Pelvis) CT was done to rule the areas of metastasis.She was diagnosed with the axillary lymph nodes involvement of mets on imaging.



CONCLUSION

This study emphasizes thorough CT imaging for breast cancer metastases. Most of the 80 patients had multi-site metastatic disease involving mediastinal lymph nodes, lungs, bones, and liver. The omentoperitoneal area, pelvic lymph nodes, and spinal canal were also atypical. The majority of patients were 51–70 years old, with younger patients(35-50). The findings show that metastatic breast cancer is aggressive and requires thorough screening for optimal management.

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