Int. j. adv. multidisc. res. stud. 2025; 5(2):430-435

Received: 21-01-2025
Accepted: 01-03-2025

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Comparison of Physical Examination and Ultrasound in Detecting the T and N Stage of Breast Cancer: A Validation Study

[1] Dr. Sana Arooj, [2] Dr. Muhammad Aizaz Kamal, [3] Dr. Gulalai, [4] Dr. Durdana Ghaffar, [5] Dr. Faridullah, [6] Dr. Hadayatullah

[1] Medical Officer, Surgical Department, Services Hospital Peshawar, Pakistan
[2] Postgraduate Resident, Department of Surgery, Qazi Hussain Ahmad Medical Complex, Pakistan
[3] Postgraduate Resident, Department of Radiology, Khyber Teaching Hospital Peshawar, Pakistan
[4] Postgraduate Resident, Department of Surgery, Hayatabad Medical Complex Peshawar, Pakistan
[5] Postgraduate Resident, Department of Medicine, Khyber Teaching Hospital Peshawar, Pakistan
[6] Postgraduate Resident, Department of Orthopaedics, Hayatabad Medical Complex Peshawar, Pakistan

DOI: https://doi.org/10.62225/2583049X.2025.5.2.3858 Corresponding Author: **Dr. Muhammad Aizaz Kamal**

Abstract

Objectives

The following study is aimed at determining the accuracy and effectiveness of determining the T and N stages of breast cancer through clinical breast examination (CBE) while keeping ultrasound as the standard modality.

Materials and Methods

This retrospective analysis was conducted in the department of surgery at a tertiary care hospital, where a total of 125 patients were enrolled and admitted through OPD and emergency over a period of 6 months. The variables that were included in the study are the following: Name, age, contact number, date of admission, medical record number (MR number), type of breast cancer, physical examination, and ultrasound findings. Data was collected in a pre-designed proforma, added to a Microsoft Excel sheet, and analyzed through SPSS software version 23.0. The data was described in the form of descriptions, charts, and tables.

Results

Out of 125 patients, the tumor size of 85 (68%) patients and the N stage of 60 (48%) patients were almost accurately assessed through CBE in comparison to ultrasound. Lymph nodes could not be palpated on CBE in 39 (31.2%); however, they were identified on ultrasound. Out of fifteen patients in which no mass could be palpated on CBE, ultrasound could identify minute masses in 12 patients. In 28 patients (22.4%), there was an overestimation of tumor size by 1 cm during CBE as compared to ultrasound, and in 2 patients, there was an underestimation by 1 cm.

Conclusion

Undeniably, ultrasound is a more accurate investigation to diagnose and detect the T stage and N stage of breast cancer; however, a proper clinical breast exam (CBE) can also help detect the signs related to breast cancer, hence aiding in early diagnosis and prompt management.

Keywords: Breast Cancer, Screening, Clinical Examination, Tumor Size, Nodal Status

Introduction

Physical examination of the breast, also known as clinical breast exam (CBE), is so crucial in detecting both benign and malignant breast diseases that health care professionals are specifically instructed to practice and master this technique. A proper examination both visually and manually will allow identification of lesions and pathologies in the skin, areola, nipple, and axilla as well. These signs help in directing the clinician towards the diagnosis of breast cancer, especially in potentially high-risk patients. Such signs are more often not noticed by the patients themselves, and early detection proceeds towards timely management when treatment is most effective. For women with a higher risk of breast cancer due to family history or genetics, regular CBEs can be particularly important for monitoring changes.

Although the trend of CBE is declining worldwide, with the advent of more advanced screening modalities such as ultrasound, mammogram, and MRI, its importance cannot be underestimated. Some advantages that advocate the use of CBE include low cost, manageable, applicable, and readily available in all clinical and social settings. For a significant number of women,

particularly young women in whom mammography has lower sensitivity, breast cancer is detected by CBE. In societies where screening participation and breast cancer awareness are not up to par, a physician-directed breast examination holds great importance. The most common symptom and sign that prompts a patient to undergo CBE is a palpable breast lump and dull pain in the breast [1]. However, the efficacy of CBE in reducing breast cancer mortality has not been shown by well-designed clinical trials [2] mainly due to low sensitivity and higher false-positive rates [3]. Indeed, only 35% sensitivity for CBE is probably the best that can be achieved in community-based settings in the United States [4]. Clinical examination sometimes overestimates the tumor size and does not allow deeper assessment of the mass [5]. Discrepancies among clinical examination (CE), ultrasonography (USG), mammography, pathological examination (PE), and magnetic resonance imaging have been reported in determining the T and N stages of breast cancer [6-7]. Studies have reported high-definition ultrasound to be more accurate than mammograms in diagnosing breast cancer [8-9].

The aim of this study is not to decide which modality is better than the other in diagnosing breast cancer but only to analyze the efficacy of CBE in assessing the tumor size and nodal status while using ultrasound as the standard procedure.

Materials and Methods

After taking the hospital ethical committee into confidence and maintaining all the rules and regulations related to conducting a clinical trial, this retrospective analytical study was begun in the surgical department of a tertiary care hospital in Peshawar Khyber Pakhtunkhwa. The study comprised of 125 patients, all females and belonging to all ages, who were added to the study through consecutive non-probability sampling. The study duration was 6 months, and data from August 2024 to December 2024 was kept in perspective. Data was collected on a pre-designed Performa from the emergency, elective OPD, and the wards. The variables that were included in the study are the following: Name, age, contact number, date of admission, medical record number (MR number), type of breast cancer, clinical examination, and ultrasound findings. A clinical examination was performed by the senior most surgical resident and ultrasound by an experienced operator. The similarity and disparity in CBE and ultrasound findings were assessed. Inclusion criteria had patients related to breast cancer, and all other pathologies were excluded; only ultrasound was used as a screening tool. The data was entered from proformas into a Microsoft Excel sheet and then transferred to SPSS version 23.0 for analysis. The results were depicted in the form of descriptions, tables, and charts.

Results

The following study was designed to assess the efficacy of clinical breast examination (CBE) in determining accurate tumor size and nodal status while keeping ultrasound as the standard modality. The mean age of presentation was 47.8 ± 1.6, and all patients were females.

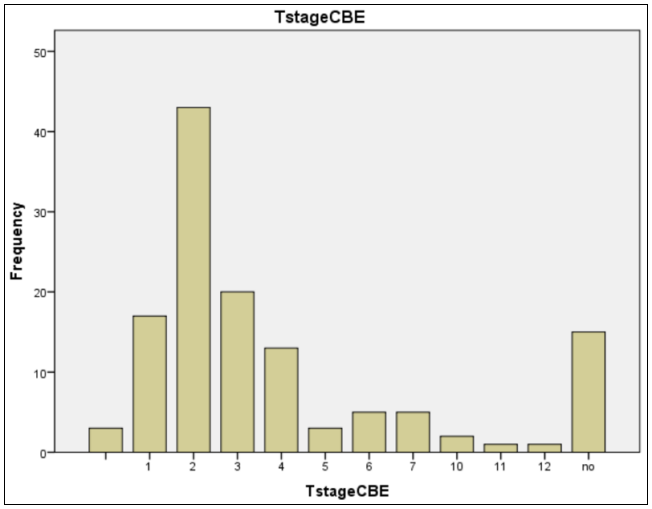
Out of 125 patients, 76 (60.8%) patients had left breast carcinoma, and 49 (39.2%) patients had right breast carcinoma (all diagnosed through ultrasound). Complete details of tumor size through CBE are given in Table 1, with the maximum number of patients having tumor size 2 cm (n = 43, 34.4%) and one each with 11 and 12 cm. The mean tumor size was 2.7 ± 2.25 cm. In fifteen patients (12%), no mass was palpated on CBE. In comparison, the maximum size measured through ultrasound was 10 cm (n = 3, 2.4%) with the greatest number of patients at 2 cm (n = 46, 37.8%), and no mass could be visualized in six patients (n = 3, 2.4%). Complete details of tumor size through ultrasound are given in Table 2 Bar Chart 2.

For nodal status, it was observed that the highest number of patients on CBE were N0 (n = 65, 52%), i.e., no axillary lymph nodes palpable, and the least number had N3 (n = 3, 2.4%), i.e., metastasis to infra-clavicular and supra-clavicular or axillary and internal mammary lymph nodes. Complete details are illustrated in Table 3 and Pie Chart 1. In comparison, most patients on ultrasound were N1 (n = 60, 48%), and three patients were identified as N3 (n = 3, 2.4%). Complete details are illustrated in Table 4 and Pie Chart 2.

Out of 125 patients, the tumor size of 85 (68%) patients and the N stage of only 60 (48%) patients were almost accurately assessed through CBE in comparison to ultrasound. Lymph nodes could not be palpated on CBE in 39 (31.2%); however, they were identified on ultrasound. Out of fifteen patients in which no mass could be palpated on CBE, ultrasound could identify minute masses in 12 patients. In 28 patients (22.4%), there was an overestimation of tumor size by 1 cm during CBE as compared to ultrasound, and in 2 patients, there was an underestimation by 1 cm. A Pearson chi square test was applied to assess the correlation between T stage and N stage measured through CBE and US; the results were statistically significant (p-value < 0.05), indicating the satisfactory reliability of CBE in identifying tumor size and nodal status. Age and type of breast cancer had no statistically significant correlation with the T stage and N stage of breast cancer (p-value > 0.05). Details are shared in Table 5.

Table 1: Tumor size measured on clinical examination (TstageCBE)

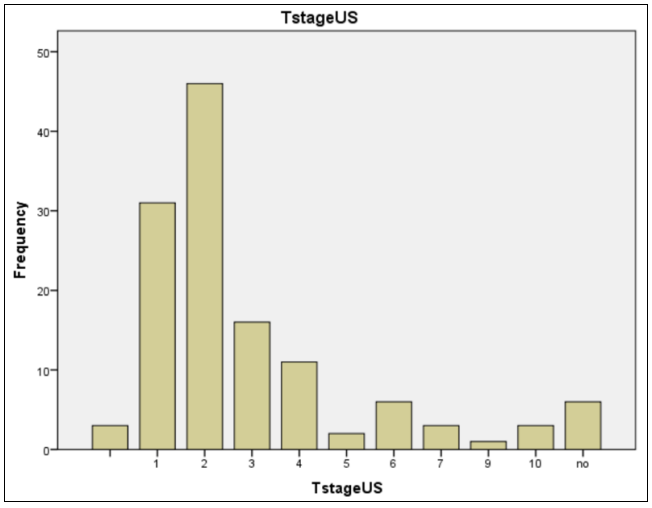
Tumor size	Frequency	Percentage
1	17	13.6
2	43	34.4
3	20	16
4	13	10.4
5	3	2.4
6	5	4
7	5	4
10	2	1.6
11	1	0.8
12	1	0.8
No mass palpated	15	12
total	125	100



Bar chart 1: Tumor size measured on clinical examination (TstageCBE)

Table 2: Tumor size measured on ultrasound. (TstageUS)

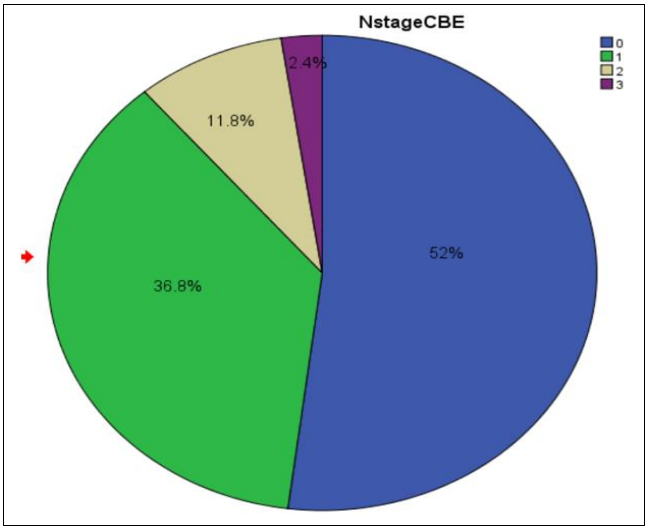
Tumor size	Frequency	Percentage
0.5	3	2.4
1	31	24.8
2	46	36.8
3	16	12.8
4	11	8.8
5	2	1.6
6	6	4.8
7	3	2.4
9	1	0.8
10	3	2.4
No mass seen	3	2.4
Total	125	100



Bar chart 2: Tumor size measured on ultrasound (TstageCBE)

Table 3: Nodal status on clinical breast examination (NstageCBE)

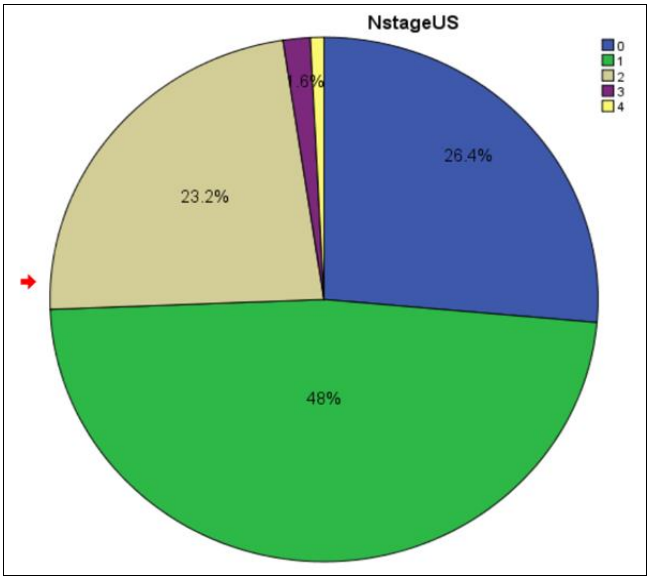
N stage	Frequency	Percentage
0	65	52
1	46	36.8
2	11	8.8
3	3	2.4
Total	125	100



Pie chart 1: Nodal status on clinical breast examination (NstageCBE)

Table 4: Nodal status on ultrasound (NstageUs)

N stage	Frequency	Percentage
0	33	26.4
1	60	48
2	29	23.2
3	2	1.6
4	1	0.8
Total	125	100



Pie chart 2: Nodal status on ultrasound (NstageUS)

Table 5: Statistical correlation between variables

Variable	Outcome	P-value
Age	T stage on CBE	0.294
Age	T stage on US	0.237
Age	N stage on US	0.514
Type of disease	T stage on US	0.592
Type of disease	N stage on CBE	0.109
Type of disease	N stage on US	0.766
T stage on CBE	T stage on US	0.000
N stage on CBE	N stage on US	0.000

Discussion

In developing nations and third-world countries, late presentation of breast cancer with a larger tumor size and distant metastasis is very common [10], with multiple factors to account for such as poverty, lack of awareness, religious beliefs, and other socioeconomic factors. In contrast, the statistics are remarkably different in the westernized worlds, where early presentation and timely diagnosis have significantly decreased the morbidity and mortality from breast cancer due to advanced treatment options and a robust health care system [11-12]. In comparison to other countries, breast cancer in Western countries is generally diagnosed at a much earlier stage, meaning more cases are detected as Stage 1 or 2 [13].

Clinical breast examination (CBE) is an easy, non-invasive, and often reliable method for detecting the relevant signs related to breast cancer. The size of the tumor plays a vital role in planning surgical management as well as deciding upon the need for adjuvant and neo-adjuvant treatment [14-15].

In our study, the mean tumor size measured through CBE was 2.7 ± 2.25 cm and 2.5 cm ± 2 cm on ultrasound in comparison to a retrospective analysis by Cortadellas T *et al* [16] where the tumor size was 1.2 cm on CBE and 1.4 cm on ultrasound.

Hence there was slight overestimation (1 cm in most cases) in T-stage measurement, which correlates with the findings of Maden *et al* [17], where the overestimation in tumor size was mostly attributed to improper examination technique. In another study, the mean overestimation in size was 0.82 cm on CBE when analyzed through pathological examination [18]. There was no statistically significant correlation between age and the T-stage in our study (p-value > 0.05), as evidenced by Cuesta AB *et al* [19], which stated that patient age did not interfere with the interpretation of imaging tests.

Although ultrasound is a more accurate modality in measuring tumor size as compared to clinical examination, there have been reports of underestimation when compared with pathological specimens. This inaccuracy is because of technical difficulties, especially in elderly patients with large tumors, as pointed out by Bosch *et al* [20]. The size of the ultrasound transducer probe is too small to measure larger tumors, especially spiculated lesions; therefore, some studies have advocated the use of MRI for more accurate assessment [21].

Axillary nodal involvement (ANI) remains an essential prognostic factor for breast cancer patients, as it implies the necessity of systemic adjuvant treatment and locoregional irradiation. According to this study, the N stage of only 60 (48%) patients was almost accurately assessed through CBE in comparison to ultrasound. The highest number of patients on CBE were N0 (n = 65, 52%), i.e., no axillary lymph nodes palpable; in comparison, most patients on ultrasound were N1 (n = 60, 48%). Therefore, physical examination lacks the sensitivity for detection of microscopic or even sub-centimeter axillary lymph node metastases. The negative predictive value of CBE in ANI is 50 to 60%; therefore, further imaging studies are mandatory in accurate staging of the axilla [22-23].

Conclusion

The results of this study are encouraging. Although the advent of more advanced techniques such as ultrasound, MRI, and mammograms has made CBE almost obsolete in the staging of breast cancer, its importance cannot be underestimated, especially in low-resource settings with a lack of awareness. Health care professionals and patients themselves should be properly trained in performing CBE that will help in early diagnosis and detection of breast cancer. Further multicentric clinical trials and meta-analysis should be performed to highlight the importance of a thorough clinical breast exam (CBE).

Acknowledgment

None.

Declaration of Patient's Interest

Patient's consent was not required, as patients were not physically enrolled in this study.

Financial Support and Sponsorship

None. The whole project was self-funded by the authors.

Conflicts of Interest

There are no conflicts of interest.

Use of Artificial Intelligence (AI)-assisted Technology for Manuscript Preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript, and no images were manipulated using AI.

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