MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2023.12.346.351

OPEN ACCESS

Key Words
Ultrasonography, breast cancer, axillary lymph node

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Received: 22 November 2023
Accepted: 14 December 2023
Published: 15 December 2023

Citation: D. Nitinkumar Chaudhari, Manish Nagendra, Shahir Merchant and Manmeet Kaur, 2023. The Clinical Impact of Ultrasound in Detecting Axillary Metastasis in Breast Cancer Patients without Apparent Axillary Disease: A Study on Effectiveness. Res. J. Med. Sci., 17: 346-351, doi: 10.59218/makrjms.2023.12.346.351

The Clinical Impact of Ultrasound in Detecting Axillary Metastasis in Breast Cancer Patients without Apparent Axillary Disease: A Study on Effectiveness

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ABSTRACT
The goal of performing preoperative ultrasonography on breast cancer patients who do not have clinical axillary illness is to find axillary lymph node metastases as reliably as possible. But it's important to test how well ultrasound can detect axillary illness. Research participants were 400 women who had treatment for invasive breast cancer at tertiary care cancer institute. When it came time for staging, every patient had an ipsilateral axillary ultrasound. In addition to analyzing the preoperative ultrasonography descriptively the results of the cohort were compared with their corresponding histology and cytology data. All statistical analysis was carried out using SPSS V 22. The axillary ultrasound diagnostic index was determined with the following values sensitivity at 31.9%, specificity at 81.4%, positive predictive value (PPV) at 36.9%, negative predictive value (NPV) at 80.2% and an overall diagnostic accuracy of 70.4%. Among the patients, ductal invasive breast carcinoma emerged as the predominant histological type, accounting for 78.5% and T2 staging was assigned to 50.75% of the tumors. Patients with breast cancer who did not have any visible signs of axillary disease were not able to have their nodal status determined by axillary ultrasound in this study.

INTRODUCTION

Breast cancer is a significant worldwide health concern that necessitates accurate detection techniques for efficient treatment and better patient outcomes. The involvement of axillary lymph nodes is a crucial factor in breast cancer staging that dramatically affects treatment choices and prognostic evaluations[1]. Personalized treatment approaches must take into account the precise identification of axillary metastases yet, early symptoms of axillary illness may not always be detected by traditional clinical examinations. Advanced imaging technologies, especially ultrasound, have become indispensable tools in the therapy of breast cancer due to this diagnostic problem[2]. A thorough evaluation of the axilla is required because nodal metastasis is present in (20-40%)[3] of patients with non-palpable axillary disease and it is one of the most significant prognostic factors ins the managements of primary breasts cancers. As a result, axillary ultrasounds has become a useful tool for identifying patients who are at risk of nodal involvement[4,5] Variations in echogenicity, sizes, shapes or boundaries, lack of homogeneity, changes in cortical thickness and loss of fatty hilum on grayscales examination are among the ultrasound findings associated with malignant lymph nodes. A suspicious lymph node's Doppler study may reveal anomalies in the vascular pattern[6].

In order to detect axillary metastases in breast cancer patients who do not exhibit obvious axillary illness upon clinical examination, this introduction aims to investigate the clinical use of ultrasonography. We want to uncover the importance of ultrasonography in early identification, how it shapes individualized treatment plans and how it directs focused approaches as we explore its many uses[7]. Beyond these technical aspects the introduction also highlights how ultrasonography can help patients with breast cancer live better lives generally and lessen the burden of morbidity. The American College of Surgeons Oncology Group (ACOSOG) study Z0011 recently produced practice-changing results that eliminate the need for axillary lymph node dissection (ALND) in patients with clinical T1-T2 tumors treated with breast-conserving therapy and fewer than three metastasized axillary lymph nodes[8]. In this patient subgroup, radiation was found to be a preferable option to ALND according to the results of the AMAROS study. The effectiveness of preoperative fine needle aspiration biopsy (FNAB) as a less invasive axillary technique and axillary ultrasonography was questioned in these studies its applicability in Mexico is still unclear[9].

Aims and objective: The Clinical Impact of Ultrasound in Detecting Axillary Metastasis in Breast Cancer Patients without Apparent Axillary Disease a Study on Effectiveness.

MATERIALS AND METHODS

We included 400women who were diagnosed with cancer and treated at tertiary care cancer institute. We retrieved the information from patient's medical records. Using the TNM (tumor, node and metastasis) staging approach, all patients were categorized. Every patient's demographic and clinical details were meticulously documented. A clinical evaluation was a part of the diagnostic process. All patients also have axillary ultrasounds using the Aloka ProSound Alpha 7 system, which has a frequency range of 13.3-3.61 MHz, a 38 mm linear transducer, and other advanced technology. Axillary ultrasonography results were classified as "suspicious" or "non-suspicious" based on 3 factors lymph node shape, fatty hilum presence and cortical bone thickness. Patients were only asked to undergo FNAB prior to surgery if their ultrasound readings were abnormal. After a mastectomy, macrometastases, also known as pN1a disease, were defined as clusters of malignant cells larger than 0.2 mm in the lymph nodes that were removed. When it came to histology the results were considered definitive.

We have descriptive statistics, sensitivity, specificity, PPV, NPV, FN, FP and accuracy. Analyzing the categorical data between the disparities of ultrasonography findings and the histopathology reports, chi-square tests were utilized. We computed the positive and negative likelihood ratios as well as the diagnostic odds ratio (OR) with a 95% confidence interval (CI). The link between suspicious sonographic features and metastatic lymph nodes was identified using a logistic regression model. The level of statistical significance was established at $p<0.05$. All statistical analysis was carried out using SPSS V 22.

RESULTS

Invasive breast cancer and non-palpable axillary illness were detected in 400 women who had treatment between 2020 and 2023. This study does not include patients who have recently had neoadjuvant chemotherapy. Females (mean age 53.8) who had not yet entered menopause made up the bulk. For 78.5% of patients the histology was ductal invasive breast carcinoma and for 50.75 percent of tumors, the stage was T2. Table 1 displays the demographic and tumor features. Clinical characteristics of the patients and biological characteristics of the primary breast tumor (Table 1) shows that 89 patients or 22.25 percent, had ultrasound-confirmed suspicious lymph nodes. According to the final axillary histology, 93 out of 400 women who underwent breast surgery and had axillary treatment discovered metastatic lymph nodes (Table 2). True positive cases (TP) constitute the 31

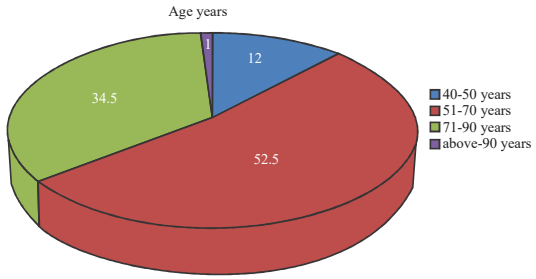

Fig. 1: Graphical representation of distribution of age in years

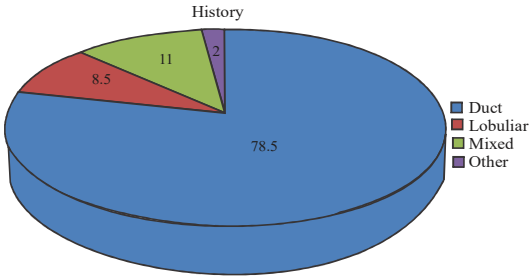

Fig. 2: Distribution of respondents based on their histology

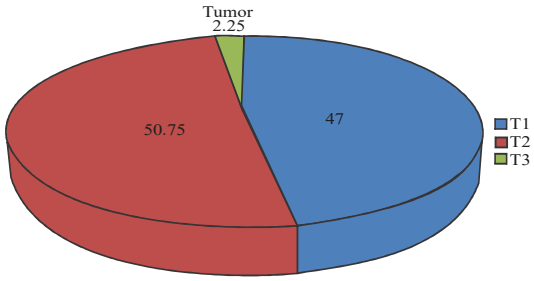

Fig. 3: Distribution of respondents based on Tumor

patients out of 84 who had worrisome axillary ultrasonography and whose axillary histology revealed subsequent metastasis false-positive cases (FP) constitute the 53 patients who did not show any metastasis. Contrarily, out of 316 patients whose axillary ultrasounds came back negative, 62 (true-negative cases TN) had metastases confirmed by histology and 254 (FN) had no such findings. "Sensitivity (Sen) Specificity (Spe) Predictive Positive Value (PPV) Negative Predictive Value (NPV) and Diagnostic Accuracy (DA)."

DISCUSSION

Author chose the population between the age of 20 to over 60 Years, in which the age group 41-50 shows the highest number of Patient and the age

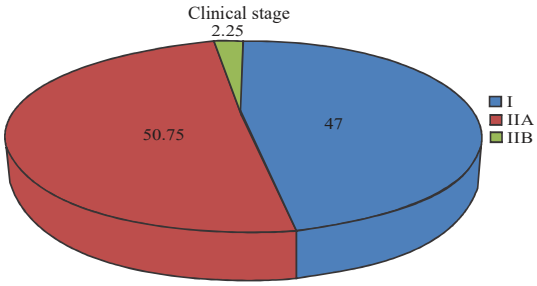

Fig. 4: Distribution of respondents based on clinical stage

group 20-30 shows the least number of Patient. The most of the cases i.e. 37 (52.86%) presented within 4-6 months of onset of their illness. Least number of cases were found to have duration more than 9 months of their illness. The patients presented with breast lump. Most of the carcinoma breast cases 84.29 % present with lump only. Least common presentation is lump with nipple discharge 7.14%.

A thorough evaluation of the axilla is necessary[10]. "But there are certain drawbacks, such as a large variation in explorers a lack of accuracy in assessing axillary lymph nodes ands a reduced sensitivity to a higher concentration of adipose tissue, which can lead to false negatives in the clinical axillar evaluation of up to 40%[11]. The National Cancer Institute of is among the oncological institutes with significant expertise in axillary clinical examination, with an incidence of 24% for axillary lymph node metastases. However, there is a need for complementary strategies in this area. Axillary ultrasonography prior to surgery is now standard practice for the diagnosis of breast cancer, according to clinical guidelines. The high morbidity surgery ALND is avoided by patients with non-suspicious ultrasonography thanks to SLNB. Axillary ultrasonography, on the other hand, directs FNAB of worrisome axillary lymph nodes in the direction of accurate disease staging and treatment alterations. However, there is a lack of consensus within the literature about the diagnostic precision and practicality of axillary ultrasound[12,13].

According to multiple studies, axillary ultrasonography has a sensitivity of 7.4-95% and a specificity of 44-100% when it comes to detecting metastases in the axillary lymph nodes[14,15]. At 96.3% specificity and 18.2% sensitivity in 2008 the group studied by Cowher *et al*. We found a sensitivity of 31.9%[16]. It was determined that ultrasound did not have enough diagnostic accuracy to identify metastases in this patient cohort. There is definitely space for progress in this area however, axillary ultrasound will not achieve 100% sensitivity or PPV. Many studies have excluded individuals without ultrasonographic signs suggestive for metastasis but have not excluded patients with neoadjuvant

Table 1: Characteristics of axillary lymph nodes observed by ultrasound

	Sonographic characteristics Suspicious of metastasis		No suspicious of metastasis		Total	
Variables	n	Percentage	n	Percentage	n	Percentage
Axillary ultrasound	89	22.25	311	77.75	400	100
Cortical of lymph node						
Diffuse cortical thickening	6	1.5	2	0.5	8	2
Focal cortical thickening	23	5.75	2	0.5	25	6.25
Simple cortical thickening	44	11	5	1.25	49	12.25
Without cortical thickening	8	(1.9)	310	77.5	318	79.4
Total	81	18.25	319	79.75	400	100
Fatty hilum of the lymph node						
Loss of the fatty hilum	17	4.25	0	(0)	17	4.25
Unconventionality of the fatty hilum	19	4.75	0	(0)	19	4.75
Normal fatty hilum	49	12.25	315	78.75	364	91
Total	85	21.25	315	78.75	400	100
Lymph node shape						
Not preserved	22	5.5	2	0.5	24	6
Conserved	61	15.25	315	78.75	376	94
Total	83	20.75	317	79.25	400	100

Table 2: The results of the axillary lymph node histopathological examination and the axillary ultrasound are summarized in this contingency table

	Histopathological study		
Axillary ultrasound	Positive	Negative	Total
Suspicious of metastasis	31	53	84
No suspicious of metastasis	62	254	316
Total	93	307	400

Table 3: Diagnostic indices of the alteration of each one of the characteristics of the axillary lymph nodes obtained by ultrasound

	Evaluation of the criteria of the ultrasound study				
	Sens	Spes	PPVs	NPVs	Das
Diffuse cortical thickening	3.9	97.8	39.5	77.9	76.8
Focal cortical thickening	11.2	93.8	34.8	78.2	75.1
Simple cortical thickening	19.5	86.4	31.2	77.5	71.5
Loss of the fatty hilum	10.9	96.8	59.7	76.5	75.3
Unconventionality of the fatty hilum	4.8	94.7	22.8	76.8	74.8
Not preserved shape	11.2	95.1	43.5	76.2	74.7

Data are presented as %

Table 4: Diagnostic indices of the alteration of each one of the characteristics of the axillary lymph nodes obtained by ultrasound

	Evaluation criteria of the axillary ultrasound study						
	Cortical	Hilum	Shapes	Cortical+Hilums	Cortical+Shapes	Hilum+Shapes	Hilum+Shape+Corfticals
Sen	28.9	14.8	11.2	14.2	9.8	7.8	6.48
Spe	79.8	92.8	94.8	91.8	95.2	96.8	97.2
PPV	34.4	41.5	43.7	37	38.2	54.8	49.5
NPV	79.5	78.1	78.5	78.5	79.4	77.2	79.1
DA	69.2	75.2	76.4	74.9	76.8	16.8	76.9

Data are presented as %

Table 5: Diagnostic indices of axillary ultrasound and fine needle aspiration biopsy for the diagnostic of axillary metastasis in patients with breast cancer

Diagnostic indices of axillary ultrasound and FNAB		
Diagnostic index	Axillary ultrasound	Fine needle aspiration
Sensitivity	31.9	73.8
Specificity	81.4	92.8
Positive predictive value	36.9	86.8
Negatives predictive values	80.2	86.2
Diagnostics accuracy	70.4	85.4

treatment, hence data on the specificity of axillary ultrasonography are rare[17,18]. According to this data, the specificity value is 82.5%. The current study found that axillary ultrasonography had a positive predictive value of 37.1%. Because of this, we cannot use this value to confirm the presence of metastasis. Nevertheless, we were able to assume a low likelihood of metastasis due to the negative predictive value of 79.6%. For this reason the idea that SLNB can go undetected in individuals with normal axillary ultrasonography is a significant one. The majority of these patients, according to the latest findings, will have a minimal tumor disease burden when it comes to axillary lymph node metastases[19]. Ultrasound has a poor diagnostic accuracy of 70.4% in our data, with the large negative predictive value being the main culprit.

A large number of false-positive cases (62.8%) were detected by axillary ultrasonography. Plus, just 26.3% of patients who underwent FNAB after a worrisome ultrasound actually found metastases. Because of these findings, more caution should be exercised in the use of ultrasound for preoperative assessment and in the selections of patients for FNABs however, all patients wills undergo evaluation by SLNBs and if required, ALNDs. I intend to go. In order to avoid a dual surgical procedure a larger financial

impact and a lengthier hospital stay, it is crucial to emphasize the significance of high-sensitivity ultrasound findings when referring patients with extensive axillary diseases to FNAB as they wills help determine which patients will definitely requires ALNDs and which ones can forego SLNB[20].

According to Whitman *et al*. the likelihood of metastasis increases when the size of the lymph node is bigger than 2 cm. A study conducted in 2013 by More *et al*. with 110 women found that axillary nodes that did not have metastases were larger than those that did[21,22]. It is likely that the axillary ultrasound reports did not include the size of the lymph nodes since this finding was deemed to have lows sensitivity for the identification of metastases in axillary lymph nodes. Lymph node change is associated with the morphological abnormalities. According to multiple studies, cortical thickness of more than 2 mm is the first sign of metastasis in lymph nodes. Our research did not find any correlation between axillary illness and cerebral morphologic alterations[11,18]. The mosts crucial morphological findings for lymph node metastasis, according to Nori *et al*., was the disappearance of the fatty hilum. This finding was consistent with our investigation and it was even more accurate than cortical thickening (83.3% vs. 35%)[22,23]. Lymphoid hyperplasia was linked to the irregular shape of the fatty hilum. A higher probability of axillary metastasis was associated with loss of fatty hilum, which the only ultrasound is finding in our sample that has a strong positive predictive value (PPV) for diagnosing axillary metastasis. Thus, fatty hilum replacement may serve as a reliable marker of axillary metastases. The removal of the fatty hilum, however, reduces diagnostic accuracy when evaluated in conjunction with additional sonographic findings.

The use of FNAB improves the ultrasound's diagnostic accuracy nonetheless the findings may differ based on the quality of the equipment and the sharpness of the pictures and operator expertise is still a crucial element. Consequently, it is recommended to take the biopsy in multiple suspect regions and have a cytologist verify the sample's quality. We conclude that suspicious axillary ultrasounds does not predict positives cytology, as our study shows diagnostics concordances of 26.2% between the ultrasounds and the cytological examination. It is important to consider the cytological study's results in order to reduce the occurrence of false negatives, unsuccessful operations, or insufficient results. Core needle biopsy (CNB) has been found to be more effective than FNAB in terms of sensitivity and number of repeated biopsies but it has also been associated with a larger number of problems. However this risk can be mitigated by ensuring that the personnel performing the surgery are well trained[14,24]. "Axilla surgery decisions have been impacted by the worldwide acceptance of the ACOSOG Z0011 study since its release. The majority of patients (97.75%) in our study exhibited non-palpable axillary disease and T1-T2 lesions. Because using FNAB as an indicator of ALND can increase its use by up to 20.8% the results of this study allow us to propose the following change in the axillary ultrasound approach instead of using it to diagnose all patients with axillary metastasis, it should only be used in patients with a high burden of tumor disease in the axilla"[25,14,26,27].

Some axillary lymph node ultrasonographic results were not noted in clinical records, which is a limitation of our retrospective analysis. This study emphasizes the significance of developing standardized criteria for evaluating axillary lymph nodes in a prospective manner.

CONCLUSION

Although axillary ultrasonography is a widely accessible diagnostic tool the results of this study at the Cancer Institute are inconclusive regarding its effectiveness as the primary method for "determining nodal status prior to surgery in patients with breast cancer who do not exhibit clinical evidence of axillary disease. The study found several drawbacks, including low sensitivity and dubious clinical utility. The only ultrasonographic findings of axillary lymph nodes with high positive predictive value (PPV) should be relied upon in order to maximize the utility of axillary ultrasound. By reducing pointless procedures and guaranteeing more accurate preoperative assessments in the treatment of patients with breast cancer, this strategy seeks to improve the study's accuracy. Understanding the function of axillary ultrasonography in the comprehensive care of patients with breast cancer may be improved by more study and protocol improvement."

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