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ASSESSING THE USE OF VARIOUS RADIOLOGICAL MODALITIES IN EVALUATING AUXILIARY LYMPH NODES IN PATIENTS WITH PRIMARY BREAST CANCER

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ABSTRACT

Background: The axillary lymph nodes are the most prevalent location of breast cancer metastases. One of the most important and dependable prognostic variables for individuals with breast cancer is the presence of axillary lymph nodes. It's critical to distinguish benign axillary lymph nodes from malignant ones as soon as possible in order to enhance survival and outcomes and avoid treatable lesions from becoming incurable.

Aim: The current study aimed to evaluate the axillary lymph nodes in participants undergoing colour doppler, strain wave elastography, and greyscale ultrasonography, and to correlate the results histopathologically.

Additionally, the results of combined greyscale ultrasonography and elastography were compared to those of greyscale ultrasound in terms of specificity, sensitivity, and negative and positive predictive values.

Methods: After histopathology confirmed a diagnosis of carcinoma in the breast, 68 subjects had their axillary lymph. nodes evaluated for vascularity, shape, size, hilum presence/absence, cortical thickness, long/short axis ratio (L/S ratio), and fatty hilum thickness ratio (C/F ratio). Histopathology verified the diagnosis after it was established.

Results: It was shown that round form in morphology, irregular nodular borders, elevated cortical thickness, elevated/compressed or missing hilum, and higher C/F ratio all favoured malignancy.

Based on the resistivity index, vascular flow pattern type, and peak systolic/end-diastolic velocity/ratio, benign and malignant lymph nodes were distinguished. The mean strain ratio was greater in malignant lymph nodes than in benign lymph nodes.

Conclusions: Because ultrasound is accurate, easily accessible, radiation-free, and reasonably priced, it should be routinely included in the initial screening of subjects with breast carcinoma. This includes strain elastography, colour Doppler, and greyscale ultrasound.

Keywords: Axillary lymph nodes, Colour Doppler, Elastography, Grayscale ultrasound, Primary breast cancer, Prospective study.

INTRODUCTION

One of the most prevalent cancers that mostly affects women worldwide is breast cancer. Before distant metastases by hematogenous spread occur, breast cancer often spreads via intraductal growth and local invasion to the lymphatics in a predictable and step-by-step manner.1.

The axillary lymph nodes are the most often affected location of breast cancer metastases. One of the most important and dependable prognostic variables for individuals with breast cancer is the presence of axillary lymph nodes. It's critical to distinguish benign axillary lymph nodes from malignant ones as soon as possible in order to enhance survival and outcomes and avoid treatable lesions from becoming incurable. It is essential to distinguish between benign and malignant axillary lymph nodes in order to improve survival and results.2

Sentinel lymph node (SLN) receives the early lymphatic outflow from cancer breast and aids in the precise estimation of the lymph node status of the remaining axillary lymph nodes. Due to its high cost, the requirement for nuclear medicine, the false-negative rate, arm weakness, restricted shoulder motions, discomfort, lymphedema, post-procedure problems, waiting times, and frozen section facilities, sentinel lymph node biopsies are not widely accepted in poor nations. Therefore, it is essential to use and employ non-invasive techniques like strain wave elastography, colour Doppler, and ultrasonography in order to distinguish benign lymph nodes from malignant lymph nodes. These techniques are effective and beneficial in this regard.3

Malignant axillary lymph nodes and breast cancer can be diagnosed and treated to increase survival rates, enhance quality of life, and reduce related mortality. In this study, axillary lymph nodes in women with breast cancer were evaluated by strain wave elastography, colour doppler, and greyscale ultrasonography, and their histologic correlation was examined.

The current study also examined the specificity, sensitivity, negative and positive predictive values, and combination of elastography and greyscale ultrasound results with greyscale ultrasound results.

MATERIALS AND METHODS

In order to evaluate axillary lymph nodes in people with breast cancer using strain wave elastography, colour doppler, and greyscale ultrasonography and to correlate them histopathologically, the current prospective observational clinical investigation was carried out. The current study also examined the specificity, sensitivity, negative and positive predictive values, and combination of elastography and greyscale ultrasound results with greyscale ultrasound results.

All subjects gave their written and verbal informed permission after being fully told about the study's concept. A total of 68 patients, ranging in age from 35 to 78, were enrolled in the study, with a mean age of 52.4±4,62 years.

Female participants in the research had a confirmed histopathologic diagnosis of breast cancer based on radiographic imaging and histology, where the axis of the axillary lymph nodes was less than 5 mm. participants with a history of previous axillary interventions, neoadjuvant chemotherapy, radiotherapy planned participants with a history of bilateral breast surgery related to bilateral cancer breast were excluded from the research.

Using a multi-frequency linear array transducer, strain wave electrocardiography, colour doppler, and greyscale ultrasonography were performed in the axillary lymph nodes of all afflicted participants. When primary breast cancer patients were in the supine position with their shoulders abducted 90 degrees, an ultrasonography of the ipsilateral axilla was performed. In order to properly examine every axillary component, the axillary levels were positioned in a straight line.

In order to narrow the axillary region, compression of the variable amount was applied using a transducer, which also aids in radiation penetration and picture quality improvement. The morphology of the lymph nodes was also evaluated, and in those whose axillary lymph nodes seemed normally, the most representative lymph node in the lower axilla was chosen for additional examination. All participants underwent conventional techniques for strain wave elastography, colour doppler ultrasonography, and greyscale ultrasound. The cortical/fatty hilum thickness ratio (C/F), long axis/short axis ratio (L/S), focal thickening of the cortex, border sharpness, presence/absence of fatty hilum, and oval or round appearance were among the features seen on greyscale ultrasonography. Pulsatility index (PI), systolic/diastolic (S/D) ratio, and resistivity index (RI), where the maximum value was obtained, were evaluated using colour doppler ultrasonography. Vascularity distribution of lymph nodes was done and described as mixed vascular patterns, peripheral non-hilar, central perihilar, and hilar nodes.

The results assessed were then correlated to the obtained histopathologic findings to confirm the diagnosis. For further analysis, the size and number of the largest lymph nodes were correlated histopathologically. Hence, 68 lymph nodes were assessed in 68 study subjects.

The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA and t-test for results formulation. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at $p<0.05$.

Results

In order to evaluate axillary lymph nodes in people with breast cancer using strain wave elastography, colour doppler, and greyscale ultrasonography and to correlate them histopathologically, the current prospective observational clinical investigation was carried out. The current study also examined the specificity, sensitivity, negative and positive predictive values, and combination of elastography and greyscale ultrasound results with greyscale ultrasound results. There were 68 participants in all, ages 35 to 78, with a mean age of 52.4±4.62 years, in the research. Six research individuals, four nulliparous females and sixty-four multiparous females with a positive family history of breast cancer, were included in the study. There were 36 and 31 research participants with right- and left-sided breast cancer, respectively.

Among 68 assessed lymph nodes, 46 lymph nodes showed metastasis and 22 nodes were benign. Table 1 provides an overview of the features of the illness. The findings revealed that whereas compressed/centric localization was observed in 9.09% (n=2) and 89.13% (n=41) of people with benign and malignant lymph nodes, it was missing in 6.52% (n=3) of subjects with malignant axillary lymph nodes. Subjects with benign lymph nodes showed central maintained hilum in 90.09% (n = 20) and malignant lymph nodes in 4.34% (n = 2) of cases, respectively. 94.45% (n=21) and 6.52%v (n=3) of the individuals with benign and malignant nodes, respectively, had the oval form. 82.60% (n=38) of the individuals had irregular nodular borders in malignant nodes. In benign nodes, the vascular pattern was mostly mixed, as shown in 45.45% (n=10) research individuals; in malignant nodes, on the other hand, the hilar flow pattern was prevalent and observed in 58.82% (n=40) study patients.

When the vascular pattern of the malignant axillary lymph nodes was evaluated, 82.60% (n=38) of the study individuals had a mixed pattern; in contrast, the most prevalent pattern in the benign axillary lymph nodes was hilar, which was followed by non-hilar in 31.81% (n=7) of the study subjects. Cortical/fatty hilum thickness ratio (C/F) was 0.80±0.44 and 4.59±4.77, cortical thickness was 2.25±0.73 and 8.08±4.87, and long axis/short axis ratio (L/S) was 12.32±2.87 and 1.71±8.21, respectively. The S/D ratio for benign and malignant nodes was 3.12±0.51 and 6.45±5.68, respectively.

Table 2 indicates that all these characteristics were $p<0.0001$ higher in malignant axillary lymph nodes than in benign axillary lymph nodes.

The results of the combined examination, colour doppler, electrometry, and greyscale ultrasonography were evaluated and linked with the histopathologic findings. The findings demonstrated that malignant tumours corrected to histology were 97.91% (n=47), whereas 1 case (2.08%) was negative. Benign tumours were 90% (n=18) confirmed on histopathology and 2 instances were false negatives. Colour Doppler revealed that for malignant cases, 97,91% (n=47) had histopathologic correlation and 4.16% (n=2) had false positives; for benign cases, 15% (n=3) had false positives and 85% (n=17) had correlated histopathologic results. Comparable findings were seen with elastography: in malignant tumours, 95.83% (n=46) of patients demonstrated correlation on histopathologic evaluation, whereas in 90% (n=18) of instances, histopathologic correlation was observed, and in 0% (n=2) of cases, this correlation was not observed.

Combined data showed that In contrast, benign tumours had 90% (n=18) positive histopathologic results and 10% (n=2) negative incorrect values. Malignant tumours were 97.91% (n=47) right, with a false result observed in just 1 instance.

Table 3 illustrates that this difference was statistically significant with $p<0.0001$.

DISCUSSION

In order to evaluate axillary lymph nodes in people with breast cancer using strain wave elastography, colour doppler, and greyscale ultrasonography and to correlate them histopathologically, the current prospective observational clinical investigation was carried out. The current study also examined the specificity, sensitivity, and negative and positive predictive values of the combined elastography and greyscale ultrasonography results to the results of greyscale ultrasound. The research had 68 patients in total, ranging in age from 35 to 78 years, with a mean age of 52.4±4,62 years.

Six research individuals, four nulliparous females and sixty-four multiparous females with a positive family history of breast cancer, were included in the study. There were 36 and 31 research participants with right- and left-sided breast cancer, respectively. Out of the 68 lymph nodes that were evaluated, 46 had metastases, and 22 had benign nodes. The findings revealed that whereas compressed/centric localization was observed in 9.09% (n=2) and 89.13% (n=41) of people with benign and malignant lymph nodes, it was missing in 6.52% (n=3) of subjects with malignant axillary lymph nodes. Subjects with benign lymph nodes showed central maintained hilum in 90.09% (n = 20) and malignant lymph nodes in 4.34% (n = 2) of cases, respectively. 94.45% (n=21) and 6.52%v (n=3) of the individuals with benign and malignant nodes, respectively, had the oval form.

82.60% (n=38) of the individuals had irregular nodular borders in malignant nodes. In benign nodes, the vascular pattern was mostly mixed, as shown in 45.45% (n=10) research individuals; in malignant nodes, on the other hand, the hilar flow pattern was prevalent and observed in 58.82% (n=40) study patients. These findings aligned with the findings of Latif MA et al4 (2016) and Chang W et al5 (2018), whose authors observed comparable illness features.

According to the study's assessment of the vascular pattern, 82.60% (n=38) of the study subjects had a mixed pattern in their malignant axillary lymph nodes, while 45.45% (n=10) of the study subjects had a hilar pattern, followed by non-hilar in 31.81% (n=7) of the subjects.

For benign and malignant nodes, the S/D ratio was 3.12±0.51 and 6.45±5.68, respectively; for RI, it was 0.64±0.08 and 0.80±0.17, and for PI, it was 1.16±0.23 and 1.58±0.34. The ratios for cortical thickness and fatty hilum thickness (C/F) were 2.25±0.73 and 8.08±4.87, and for long axis/short axis ratio (L/S), they were 12.32±2.87 and 1.71±8.21, respectively.

When comparing malignant axillary lymph nodes to benign ones, all these metrics showed a substantial increase ($p<0.0001$). These findings corroborated those of research by Liu H et al6 in 2018 and Park Y et al7 in 2014, the authors of which reported ultrasonography parameters compared to the current investigation. The results of the combined examination, colour doppler, electrometry, and greyscale ultrasonography were evaluated and linked with the histopathologic findings.

The findings demonstrated that malignant tumours corrected to histology were 97.91% (n=47), whereas 1 case (2.08%) was negative. Benign tumours were 90% (n=18) confirmed on histopathology and 2 instances were false negatives. Colour Doppler revealed that for malignant cases, 97,91% (n=47) had histopathologic correlation and 4.16% (n=2) had false positives; for benign cases, 15% (n=3) had false positives and 85% (n=17) had correlated histopathologic results.

Comparable findings were seen with elastography: in malignant tumours, 95.83% (n=46) of patients demonstrated correlation on histopathologic evaluation, whereas in 90% (n=18) of instances, histopathologic correlation was observed, and in 0% (n=2) of cases, this correlation was not observed. The combined data demonstrated that malignant tumours were accurate in 97.91% of cases (n=47), with only 1 instance showing a false positive whereas, benign tumors had 90% (n=18) positive histopathologic result and negative false values were seen in 10% (n=2) cases. This difference was statistically significant with $p<0.0001$. The present findings have similarities to those reported by Maxwell F et al. (2015) and Choudhary J et al. (2017), who also found comparable findings in axillary lymph nodes linked with breast cancer on greyscale, colour doppler, and elastography.

CONCLUSION

With all due to its limitations, the current study comes to the conclusion that ultrasonography, which includes strain elastography, colour Doppler, and greyscale ultrasonography, ought to be a regular part of the initial screening process for patients diagnosed with breast carcinoma because of its many benefits, including cost-effectiveness, accuracy, ease of use, and lack of radiation. The current study did, however, have many shortcomings, such as biases related to geographic location, a limited sample size, and a brief monitoring period. Therefore, further long-term research with bigger sample sizes and longer observation periods will aid in coming to a conclusive result.

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TABLES

Characteristics	Benign % (n=22)	Malignant % (n=46)
Hilum Localization		
Absent	0	6.52 (3)
Compressed/Eccentric	9.09 (2)	89.13 (41)
Central and maintained	90.09 (20)	4.34 (2)
Shape type		
Irregular nodular margins	4.54 (1)	82.60 (38)
Round	0	10.86 (5)
Ovoid	95.45 (21)	6.52 (3)
Vascularity		
Mixed flow pattern	45.45 (10)	13.04 (6)
Peripheral non-hilar flow pattern	13.63 (3)	4.34 (2)
Central prehilar flow pattern	31.81 (7)	0
Hilar flow pattern	9.09 (2)	82.60 (38)

Table 1: Disease-related characteristics

Parameter	Benign % (n=22)	Malignant % (n=46)	Total
Vascular Pattern			
Mixed	9.09 (2)	82.60 (38)	40
Non-hilar	31.81 (7)	2.17 (1)	8
Prehilar	13.63 (3)	2.17 (1)	2
Hilar	45.45 (10)	13.04 (6)	16
Variables	**Mean± S.D**	**Mean± S.D**	p-value
Systolic/diastolic ratio	3.12±0.51	6.45±5.68	<0.0001
Resistivity index (RI)	0.64±0.08	0.80±0.17	<0.0001
Pulsatility index (PI)	1.16±0.23	1.58±0.34	<0.0001
Cortical/fatty hilum thickness ratio(C/F),	0.80±0.44	4.59±4.77	<0.0001
Cortical thickness	2.25±0.73	8.08±4.87	<0.0001
Long axis/short axis ratio (L/S)	12.32±2.87	1.71±8.21	<0.0001

Table 2: Comparison of axillary lymph nodes and ultrasound parameters to histopathologic findings

Parameter	Benign % (n=22)	Malignant % (n=46)	Total
Combined			
Malignant	10 (2)	97.91 (47)	<0.0001
Benign	90 (18)	2.08 (1)	
Elastography			
Malignant	10 (2)	95.83 (46)	<0.0001
Benign	90 (18)	4.16 (2)	
Color Doppler			
Malignant	15 (3)	97.91 (47)	<0.0001
Benign	85 (17)	2.08 (1)	
Greyscale			
Malignant	10 (2)	97.91 (47)	<0.0001
Benign	90 (18)	2.08 (1)	

Table 3: Association of histopathologic findings to greyscale, elastography, color doppler, and combined results