The Role of Ultrasound Elastography in Evaluation for Axillary Lymph Nodes of Patients with Breast Cancer

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Abstract

Background: Axillary lymph node status is the most reliable prognostic indicator for disease recurrence and patient survival in breast cancer. Axillary ultrasound is an important mean for detecting metastatic LNs, being non-invasive, available & cheap.

Aim of Study: To investigate the role of strain elastography combined with conventional ultrasound in the diagnosis of axillary lymph nodes in patients with breast cancer.

Patients and Methods: 24 patients diagnosed with breast cancer with enlarged axillary lymph node were included in this study over the course of six months, they were examined bu B mode ultrasound and ultrasound elastography. Finally, findings of B-mode US and elastography were compared with pathological results (reference standard). ROC analysis was constructed to obtain best cutoff values for B-mode criteria, alasticity score and strain ratio.

Results: Elastography score and strain ratio had a higher specifcity (83.3% vs. 33.3%) and a lower sensitivity (88.9% vs. 100%) than gray-scale ultrasonography. Of all the 6 benign axillary lymph nodes analysed in the present study, 2 were determined to be metastatic by gray-scale ultrasonography, while these diagnoses were corrected by RTE. As regards the semi-quantitative assessment; strain ratio, in our study there was a significant increase in mean strain ratio in the malignant nodes (1-8.3) than the benign ones (0.7-3.4) (p=0.005), with the best cutoff value 2.5 which yielded sensitivity of 88.89, specificity of 83.33,accuracy of 90%, PPV 94.1%, NPV 71.4%.

Conclusion: Ultrasound elastography by its qualitative (elasticity score) and quantitative (strain ratio) evaluation has proved to useful in differentiation between benign and malignant nodes as a complementary to conventional ultrasound. Using elasticity score/strain ratio; 11 out of 18 pathologically proved malignant nodes, were diagnosed as malignant, 5 out of 6 benign nodes were diagnosed as benign.

Key Words: *Lymph nodes – Ultrasound elastography – Elasticity – Breast cancer.*

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Introduction

YEARS of cancer statistics have demonstrated that breast cancer is the most common cancer and the second leading cause of cancer-related death in women worldwide. Axillary lymph node status remains a major prognostic indicator for early breast cancer, affecting the clinical staging and patient selection for surgical procedure and adjuvant systemic therapy [1].

The status of the axillary lymph node is one of the independent factors influencing the prognosis of patients with breast cancer. The 5-year survival rate of breast cancer cases with axillary lymph node metastasis decreases by 40% compared to that of non-metastatic patients [2].

Currently, Sentinel Lymph Node Biopsy (SLNB), traditional ultrasound-guided Core Needle Biopsy (CNB), and Fine-Needle Aspiration Cytology (FNAC) are the most common procedures for identifying axillary nodal metastasis in breast cancer patients; however, these methods are invasive, requiring additional time for pathological diagnosis, and false-negative results might affect the efficacy of biopsy, due to improper selection of the target lymph node. Therefore, the use of non-invasive imaging techniques to help predict nodal status before biopsy is of great value [1].

Ultrasonography, mammography, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), and Combined Positon-Emission Tomography (PET)/CT are common non-invasive preoperative methods used in the diagnosis of axillary lymph node. Oblique radiography of mammography can help to detect partial abnormal axillary lymph nodes and reveal if there is lymph node metastasis by evaluating morphology, size, and density [3].

But the evaluation of axillary lymph nodes using mammography is not applicable because mammography cannot cover the entire axillary. Breast MRI has excellent soft-tissue resolution; however, axillary lymph nodes cannot be included in their entirety because of the limited range of the breast coil [4].

Ultrasound, as a non-invasive technique, is often used to distinguish malignant from benign axillary lymph nodes based on morphological characteristics pre-operatively. Ultrasound is a convenient tool as it provides real-time imaging, high soft-tissue resolution, feasibility and cost-efficiency; however, traditional ultrasound has moderate sensitivity for identifying malignant lymph nodes and false-positive results leading to unnecessary biopsy.

With advances in medical imaging, ultrasound elastography has received considerable attention in the last years for its non invasive ability to assess tissue stiffness in various organs [5].

Real-Time (strain) Elastography (RTE) and Shear-Wave Elastography (SWE) are the two most widely used elastographic techniques. RTE demonstrates a colour map imposed on the 2D image, which is obtained through applying constant stress to the tissue. It can be used qualitatively (elasticity score) or semi-quantitatively (strain ratio) to access the stiffness of lesions [6].

Our study will use real time elastography.

Aim of the work:

To investigate the role of strain elastography combined with conventional ultrasound in the diagnosis of axillary lymph nodes in patients with breast cancer.

Patients and Methods

The study was a prospective study, it included 24 patients in this study enrolled at Ain Shams University Hospitals over the course of six months between March 2020 and August 2020. An informed consent explaining the procedure details was obtained from all patients prior to inclusion in this study. The study was conducted according to the stipulations of the ASU ethical and scientific committee. The privacy of participants and confidentiality of data were guaranteed during the various phases of the study. The inclusion criteria were: Patients with breast cancer, only females. The exclusion criteria were: (A) History of neoad-

juvant therapy; (B) Ductal carcinoma in situ; (C) The suspected axillary lymph node located adjacent to the main axillary vessels so that it would be risky to perform a biopsy.

Study tools and procedures: After consent achievement and fully explained about the steps of research, all 24 known patients were subjected to the following: Complete history taking and thorough clinical examination. B-mode ultrasound, and UE were examined to determine LN characteristics. Scores of elastographic classification and a Strain Ratio (SR) were used to evaluate the ultrasound elastograms. The patient's pathology report obtained from the patient.

Technique:

All 24 patients known patient with breast cancer and suspected axillary lymph nodes involvement underwent axillary ultrasound examination by B mode, sonoelastography and finally histopathological examination. Machine: GE healthcare Logic P9 ultrasound with a 6-15MHz superficial linear transducer.

Conventional breast ultrasound:

To examine the axilla the patient was scanned in the supine oblique position with the ipsi-lateral hand behind her head so that the arm is abducted and externally rotated. Axillary US is performed with the same high-frequency linear array transducer that is used for breast imaging. Nodes should be imaged in the orthogonal planes with gray-scale US.

Image analysis and interpretation of conventional ultrasound:

Each examined axillary lymph node was evaluated regarding: Short and long axis diameters. Shape (ovoid or non-ovoid). Cortical thickening (present or not, and if present "diffuse or focal"). Fatty hilum (central, effaced, eccentric or not-preserved) and each examined lymph node was categorized as (benign, indeterminate, and malignant) blinded to the final pathology.

Elastogram evaluation:

Compression with light pressure followed by decompression was repeated until a stable image was obtained and the pressure index scaled up and stably lasted 2 or 3 seconds. Direction of the compression is upward and downward. Real-time elastographic and B-mode images simultaneously appear together as a two-panel image, the elastogram appear in the Region of Interest (ROI) box. The size of the box is adjusted according to the

size of the target lymph node. The color scale ranged from red (ie, softest component) to blue (ie, hardest component), we assess color distribution in cortex and medulla of lymph nodes. Afterward, elastographic images were given elasticity scores of 1 to 5 which based on the percentage of the stiff areas as follows: 1, the green portion occupied almost all of the cortex; 2, the blue portion occupied less than 50% of the cortex; 3, the blue portion occupied more than 50% of the cortex, with scattered the green portions; 4, the blue portion occupied almost all of the cortex; 5, the blue portion occupied almost all of the cortex, with a green ring on the edge of the node. To measure the strain ratio a circular ROI was placed in the axillary fat and a second ROI of the same size and same level was placed over the stiffest part of the examined lymph node (this allow calculation of Strain Ratio (SR).

Histopathologic diagnosis by following and receiving the pathology report from the patient.

Statistical analysis:

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean $\pm$ Standard Deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done: Chi-square (χ^2) test of significance was used in order to compare proportions between qualitative parameters. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the *p*-value was considered significant as the following: Probability (*p*-value). *p*-value ≤0.05 was considered significant. *p*-value ≤0.001 was considered as highly significant. *p*-value >0.05 was considered insignificant.

Results

The mean age of women was 52.54 ± 10.58. The pathological results of 24 axillary lymph nodes were reported, and 18 (75%) were determined to be metastatic, while the other 6 (25%) nodes were determined to be benign. The most common histological type in the examined patients was invasive duct carcinoma 66.7%.

B-mode ultrasound criteria:

The mean $\pm$ standard deviation of transverse diameter, short axis, long axis/short diameter (L/S) diameter, cortical thickness, focal thickening, shape and state hilum in the examined lymph nodes were calculated (Table 1).

Table (1): The mean $\pm$ standard deviation of transverse diameter, short axis, long axis/short diameter (L/S) diameter, cortical thickness, focal thickening, shape and state hilum in the examined lymph nodes.

B mode	Total no.=24
Transverse diameter:	
Mean $\pm$ SD	2.18±0.67
Range	0.9-3.3
Short axis:	
Mean $\pm$ SD	1.13±0.42
Range	0.5-2.1
L/S diameter:	
Mean $\pm$ SD	1.91±0.82
Range	0-3.6
Cortical thickness:	
Median (IQR)	0.8 (0.5-1.3)
Range	0.3-3
Focal thickening:	
No	10 (41.7%)
Yes	14 (58.3%)
Shape:	
Ovoid	12 (50.0%)
Rounded	12 (50.0%)
Hilum:	
Preserved	5 (20.8%)
Compressed	13 (54.2%)
Absent	6 (25.0%)

Table (2): The significance values of B mode ultrasound criteria.

	Benign No.=6	Malignant No.=18	Test value	*p*-value	Sig.
Longitudinal:					
- Mean $\pm$ SD	2.22±0.60	2.17±0.71	0.137•	0.893	NS
- Range	1.6-3.3	0.9-3.3			
Short axis:					
- Mean $\pm$ SD	0.88±0.23	1.22±0.45	−1.735•	0.097	NS
- Range	0.6-1.3	0.5-2.1			
L/S diameter:					
- Mean $\pm$ SD	2.84±0.90	1.86±0.67	2.834•	0.010	S
- Range	1.78-4.13	0.95-3.5			
Cortical thickness:					
- Median (IQR)	0.45 (0.4-0.7)	0.95 (0.5-1.37)	−1.980≠	0.048	S
- Range	0.3-1.5	0.4-3			
- Absent	0 (0.0%)	6 (33.3%)			

The mean long axis diameter of malignant nodes was not significantly higher than benign nodes (*p*=0.893), the mean short axis of malignant nodes was not significantly higher than benign nodes (*p*=0.097) and the mean L/S of malignant nodes was significantly lower than benign nodes (*p*=0.010) also cortical thickness of malignant lymph nodes was significantly higher than benign lymph nodes (*p*=0.048) (Table 2).

Table (3): The focal thickening, shape and state of hilum in benign and malignant lymph nodes.

	Benign No.=6	Malignant No.=18	Test value	p-value	Sig.
Focal thickening:					
- No	2 (33.3%)	8 (44.4%)	0.229*	0.633	NS
- Yes	4 (66.7%)	10 (55.6%)			
Shape:					
- Ovoid	5 (83.3%)	7 (38.9%)	3.556*	0.059	NS
- Rounded	1 (16.7%)	11 (61.1%)			
Hilum:					
- Preserved	4 (66.7%)	1 (5.6%)	10.708*	0.005	HS
- Compressed	2 (33.3%)	11 (61.1%)			
- Absent	0 (0.0%)	6 (33.3%)			

The state of hilum in malignant lymph nodes shows significant difference than in benign lymph nodes (*p*=0.005) while there's no significant difference between benign and malignant lymph nodes regarding the shape (*p*=0.059) or the presence of focal thickening (*p*=0.633) (Table 3).

Table (4): Cutoffs of significant B mode criteria and their diagnostic performance (ROC curve analysis).

Variables	Cut off point	AUC	Sensitivity	Specificity	+PV	–PV
- L/S diameter	≤2.08	0.852	77.78	83.33	93.3	55.6
- Cortical thickness	>0.7	0.773	66.67	83.33	92.3	45.5

Table (5): Diagnostic criteria of B mode criteria.

	TP	TN	FP	FN	Sensitivity	Specificity	PPV	NPV	Accuracy
L/S diameter (≤2.08)	14	5	1	4	77.8	83.3	93.3	55.6	0.792
Cortical thickness (>7)	12	5	1	6	66.7	83.3	92.3	45.5	0.708
Focal thickening	10	2	4	8	55.6	33.3	71.4	20.0	0.500
Shape (rounded)	11	5	1	7	61.1	83.3	91.7	41.7	0.667
Absent or compressed Hilum	17	4	2	1	94.4	66.7	89.5	80.0	0.875
Total B mood	18	2	4	0	100.0%	33.3%	81.8%	100.0%	0.833

p-value >0.05: Non significant.   *: Chi-square test.
p-value <0.05: Significant.   • : Independent *t*-test.
p-value <0.01: Highly significant.   ≠: Mann-Whitney test.

Table (6): Diagnostic performance of the B mode summation score (ROC curve analysis).

	TP	TN	FP	FN	Sensitivity	Specificity	PPV	NPV	Accuracy
Total B mood	18	2	4	0	100.0%	33.3%	81.8%	100.0%	0.833

Table (7): Distribution of elasticity score in benign and malignant lymph nodes. (Chi-squared test).

ES	Benign No.=6	Malignant No.=18	value	p-value	Sig.
1	1 (16.7%)	0 (0.0%)	12.444*	0.014	S
2	3 (50.0%)	1 (5.6%)			
3	1 (16.7%)	1 (5.6%)			
4	1 (16.7%)	11 (61.1%)			
5	0 (0.0%)	5 (27.8%)			
Mean ± SD	2.33±1.03	4.11±0.76	–4.550*	0.000	HS
Range	1-4	2-5			

p-value >0.05: Non significant.   • : Independent *t*-test.
p-value <0.05: Significant.   ≠: Mann-Whitney test.
p-value <0.01: Highly significant.

Table (9): Median value, of strain ratio in benign and malignant nodes. (*t*-test).

Strain ratio	Benign No.=6	Malignant No.=18	Test value	p-value	Sig.
Median	1.15 (1-2.5)	3.5 (2.9-5)	16.000*	0.000	HS
≤2.5	6 (100.0%)	2 (11.1%)			
>2.5	0 (0.0%)	16 (88.9%)			

The mean value of malignant nodes was significantly higher than benign nodes (*p*-value <0.0001).

The mean value of strain ratio is significantly higher in malignant nodes than benign (*p*-value <0.0001).

Table (8): Cutoff value of elasticity score and its diagnostic performance. (ROC curve analysis).

Variables	Cut off point	AUC	Sensitivity	Specificity	+PV	–PV
ES	>3	0.903	88.89	83.33	94.1	71.4

Table (10): Best strain ratio cutoff value and its diagnostic performance (ROC curve analysis).

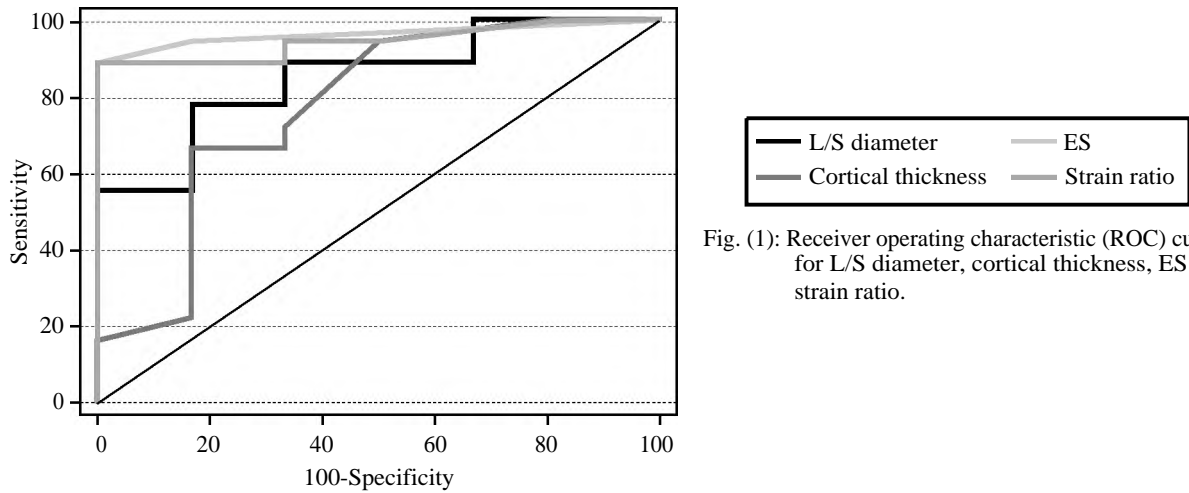|	Cut off point	AUC	Sensitivity	Specificity	+PV	–PV
Strain ratio	>2.5	0.889	88.89	83.33	94.1	71.4

Fig. (1): Receiver operating characteristic (ROC) curve for L/S diameter, cortical thickness, ES and strain ratio.
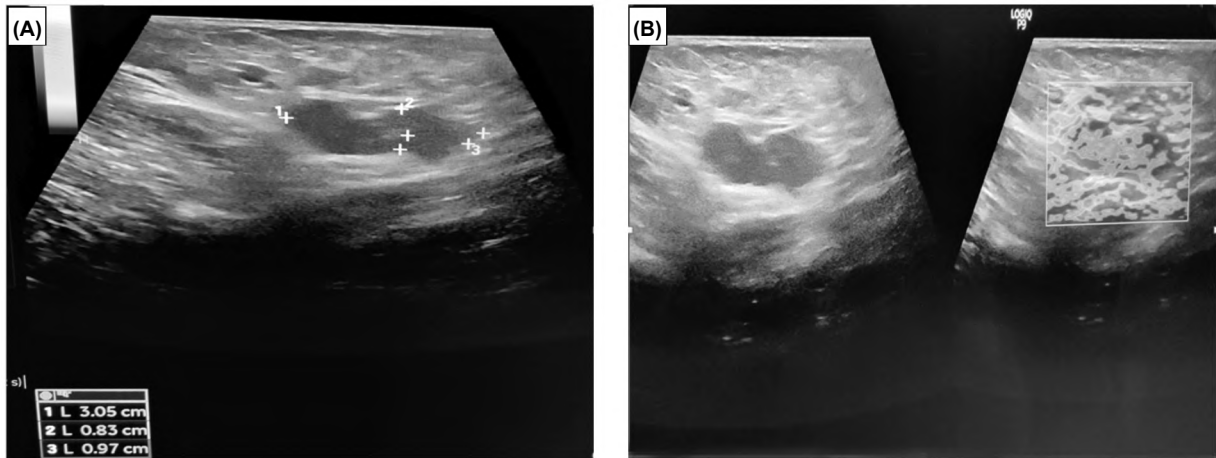

Fig. (2): (A) Enlarged sized hypoechoic axillary LN which is oval in shape, with increased focal cortical thickening & large, with eccentric hilum, "Considered as Indeterminate LN" by B mode. (B) Strain Elastography examination revealed the hard areas of the cortex (blue in color) representing <50% of the cortex (score 2) "considered as benign". The measured strain ratio (SR)=1, "Considered as benign". Pathological examination revealed reactive lymph node.
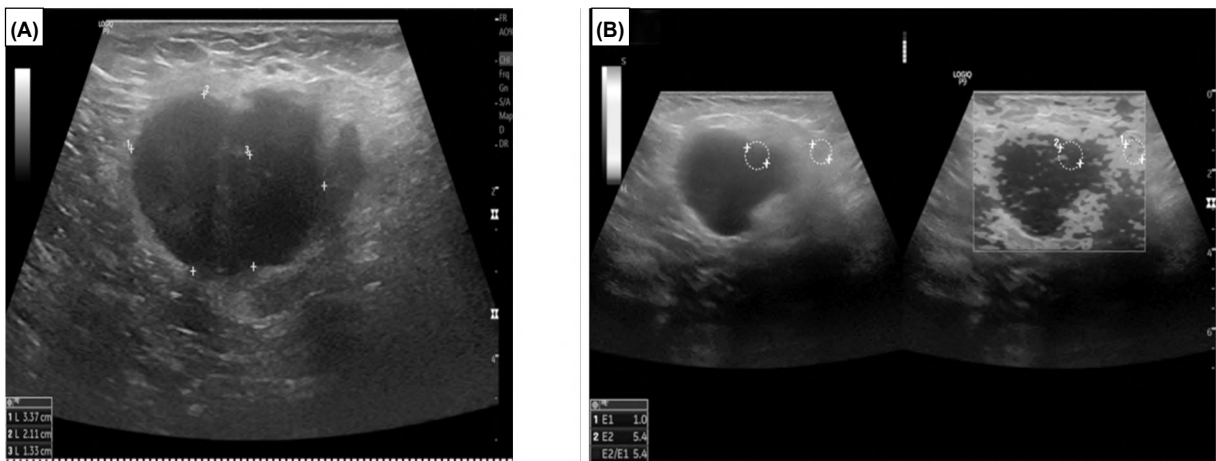

Fig. (3): (A) Axillary lymph node hypoechoic rather rounded in shape, with focal cortical thickening & faint eccentric hilum. "Considered as malignant LN" by B mode. (B) By ultrasound elastography the hard areas of the cortex (blue in color) representing most of the cortex (score 4)" Considered as malignant". The measured strain ratio (SR)=5.4, "Considered as Malignant", pathological examination revealed metatstatic lymph node.
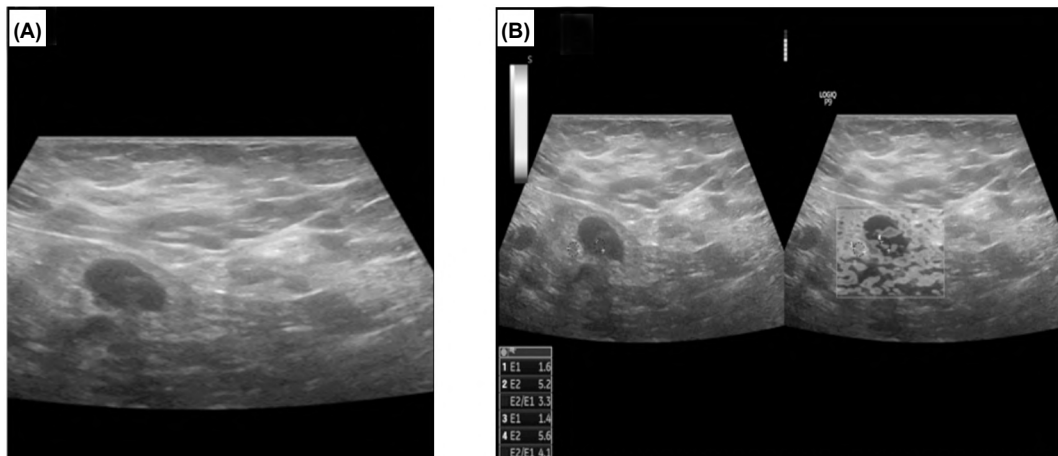
Fig. (4): (A) Axillary lymph node round in shape, with rather diffuse cortical thickening & faint compressed fatty hilum, "considered as intermediate LN" by B mode. (B) Ultrasound elastography showed thard areas of the cortex (blue in color) representing most of the cortex with surrounding green rim (score 5) considered as malignant ". The measured strain ratio (SR)=4, "considered as malignant" pathology examination revealed to be metastatic lymph node.

Discussion

Lymphatic metastasis is an important prognostic factor in patients with cancer. Determination of nodal status is also critical for appropriate treatment planning. Although lymph nodes can be detected and visualized by several imaging modalities including Ultrasound (US), Computed Tomography (CT) and Magnetic Resonance Imaging (MRI), the differentiation between benign and malignant lymph nodes remains challenging [7].

Enlarged reactive nodes are frequently present along the lymphatic drainage pathways, particularly of large and necrotic tumors, which may mimic lymph node metastasis [8].

Ultrasound (US) is the noninvasive diagnostic tool most commonly used in the assessment of the axilla. The dimensional (transverse diameter greater than a threshold value, ratio between longitudinal and transverse diameters, cortical thickness) and morphological criteria (abnormal shape, altered hilum, regional nodal grouping, extra capsular tumor spread, or presence of necrosis) on which the US diagnosis of nodal metastases is based, however, are not completely reliable [9].

In this study we used Ultrasound Elastography to differentiate between benign and malignant enlarged axillary lymph nodes with pathologic correlation of results. This study included 24 female patients diagnosed with breast cancer, their age ranged from 35 to 75 years.

Choi et al., [10] classified the B mode ultrasound findings of 64 axillary lymph nodes into 4 criteria:

Transverse diameter, longitudinal to transverse diameter ratio, presence of the hilum, and shape of the cortex, they found that the mean transverse diameter of metastatic axillary lymph nodes (11.3 ±6.4mm) was significantly larger than the diameter of reactive axillary lymph nodes (5.1 ± 1.6mm; $p<0.001$) in contrast to our study which found that the mean transverse diameter of lymph nodes wasn't significant in differentiation between benign and metastatic lymph nodes ($p=0.097$). Also no difference was found in the mean longitudinal to transverse axis diameter ratios between reactive and metastatic lymph nodes ($p=0.286$) as opposed to our study where the mean longitudinal to transverse axis diameter ratios was significantly lower in malignant lymph nodes than benign lymph nodes ($p=0.010$).

Absence of the hilum and eccentric cortical thickening were associated with metastatic lymph nodes ($p=0.004$ and 0.012, respectively) in agreement to our study.

In our study of 24 axillary lymph nodes by B mode US, we evaluated 5 criteria; longitudinal axis diameter, short axis, L/S diameter ratio, cortical thickness and the state of hilum. We found that; the mean longitudinal axis of malignant nodes (2.17±0.71cm) was not significantly higher than that of benign nodes (2.22 ±0.60) (p-value=0.893). the mean transverse axis of malignant lymph nodes (1.22±0.45cm) (was also not significantly higher than that of benign nodes (0.88 ±0.23cm) (p-value= 0.097). The mean longitudinal to transverse diameter (L/T) ratio in malignant nodes (1.86 ±0.67cm) was significantly higher than its mean value in

benign nodes (2.84±0.90) (*p*-value=0.010). The median cortical thickness in malignant nodes 0.95 (0.5-1.3cm) was significantly higher than that of benign nodes 0.45 (0.4-0.7cm) 0 (*p*-value=0.048) compressed and faint hila were significantly associated with malignant nodes (*p*=0.005), round shape was not significantly associated with malignant nodes (*p*=0.059).

Regarding the whole conventional ultrasound findings in our study, 2/24 (8.3%) LNs diagnosed by US as benign. While collectively 22/24 (91.7%) LNs diagnosed by US as malignant, (12/24 (50%) of LNs were actually categorized as indeterminate LNs), and out of which 9/12 (25%) LNs proved to be benign by pathology.

These results match with a study done by Chang et al., [11], who analyzed 140 visible axillary lymph nodes on conventional US imaging and all of them underwent elastography. They found that the metastatic nodes had a thicker cortex as compared to non-metastatic axillary lymph nodes. Also Abe et al., [12] reported that cortical thickening was the most sensitive for the detection of axillary lymph node metastases.

In our study the most sensitive B mode criteria was the state of hilum, the pathologically proven malignant LNs (18/24 LNs) showed mostly (effaced or eccentric) hila versus the benign LNs (6/24 LNs) which showed mainly central hila. This criterion sensitivity (94.4%) agrees with study done by Abe et al., [12]. Their study was conducted on 50 patients with 60 enlarged axillary lymph nodes (20 male and 30 female), underwent Grey scale, color-power Doppler US and strain elastography, and found that lost or compressed nodal hilum were the most sensitive ultrasound feature predictive of malignancy that was found in 42 (93.33%) out of 45 malignant lymph nodes and false positive in one lymph node.

Also, in our study LNs that showed eccentric or lost fatty hila were mostly proved to be malignant by pathology (94.4%), this result compared with the results found by Youk et al., [13], stated that (82%) of the LNs showed eccentric or lost hila are confirmed to be malignant.

In our study, there was no significant difference between benign and metastatic lymph nodes in shape unlike the study by Youk et al., [13], significantly larger proportions of metastatic axillary lymph nodes had a round shape (80% vs. 63%, *p*=0.033).

Regarding the qualitative scoring of strain elastography in our study we used the same score as Xu et al., [6] where elastography scores were reported on a scale of 1 to 5. Te pattern of the elastograms of the lymph nodes were divided into two groups: Those with or those without hila. In our study, according to the ROC curve analysis, the cutoff value for malignancy was >3 for elastography ultrasound. The nodes that were scored 1 or 2 or 3 were considered benign, and those that were scored 4 or 5 were considered metastatic based on elastography. The sensitivity, specificity, PPV, NPV and accuracy were 88.89, 83.33, 94.1, 71.478%, respectively while Xu et al., cut off was 3 and it showed higher sensitivity and specificity (93%, 93%) respectively.

Choi et al., [10] has proposed a 4-point scoring system where score 1 stands for absent or very small blue area, score 2 indicates small, scattered blue areas, with total blue area <45%, score 3 indicates large blue area, with total blue area ≥45% and score 4 stands for blue area all over the node area with or without a surrounding green rim". Cutoff value for malignancy was best at score >2, which yielded resulted of 88.9% sensitivity, 73.3% specificity, 86.7% accuracy, 88.9% PPV and 83.3% NPV.

Furukawa et al., [14] also used a similar four pattern score in 45 patients where score 1; >80% of the node area is soft (red or green), score 2; 50-80% of the node area is soft (green or red), score 3; 50-80% of the area is blue and score 4; >80% of the node area is blue. They found that scores 3 and 4 are only observed in malignant nodes. 32 of 34 malignant nodes (94.1%) showed score 3 and 4, whereas score 1 and 2 are encountered in all 11 benign nodes and 2 of 34 malignant nodes (5.9%). Score >2 as cutoff for malignancy yielded results of 74.4% sensitivity and 97.1% specificity.

Zhang et al., [15] used score in a study of 112 subjects with 155 lymph nodes with B-mode sonography and elastography to evaluate the value of elastography in the differential diagnosis of the benign and malignant superficial lymph nodes. They found that most of the elastographic findings of the benign lymph nodes; 66 of 68 (97.1%), were rated as scores 1 and 2 and most of the malignant ones; 72 of 87 (71.3%), were rated as scores 3 and 4. Two benign lymph nodes and 10 malignant ones were indeterminate. Using score >2 as cutoff for malignancy, yielded sensitivity of 74.7%, specificity of 97.1% and accuracy of 84.5%.

As regards the semi-quantitative assessment; strain ratio, in our study there was a significant increase in mean strain ratio in the malignant nodes (1-8.3) than the benign ones (0.7-3.4) ($p=0.005$), with the best cutoff value 2.5 which yielded sensitivity of 88.89, specificity of 83.33, accuracy of 90%, PPV 94.1%, NPV 71.4%.

Choi et al., [10] as well stated that the strain ratio for metastatic axillary lymph nodes (7.1 ±9.0) was significantly higher than the ratio for reactive axillary lymph nodes (3.5±3.9); ($p=.007$). With the best strain ratio cutoff of 2.3, the sensitivity, specificity, PPV, NPV, and accuracy were 82.8%, 56.3% 61.5%, 77.3%, and 67.2%, respectively.

In agreement with our study, Zhang et al., [15] found that the strain ratio of the malignant lymph nodes was higher than that of the benign ones with the best strain ratio cutoff point was 2.395, with the sensitivity and specificity of 78.41% and 98.51%, AUC was 0.915.

In the study done by Xu et al., [6], the strain ratio ranged from 0.49 to 46.55. The strain ratio for metastatic axillary lymph nodes (12.64±5.30) was significantly higher than that for reactive axillary lymph nodes (2.35±1.80). With the best strain ratio cutoff of 2.62, the sensitivity, specificity, PPV, NPV, and accuracy were 87%, 76%, 80%, 83% and 81%, respectively.

The difference in the results between our study and the other studies probably was related to the different type of device used, Choi and co-workers utilized EUB-850 scanner (Hitachi Medical Corporation, Tokyo, Japan), while in our study we used (GE LOGIQ P9). Also tissue compression can influence elastographic images. Extensive experience may be needed to obtain reproducible results [10].

Elastography score and strain ratio had a higher specifcity (83.3% vs. 33.3%) and a lower sensitivity (88.9% vs. 100%) than gray-scale ultrasonography. Of all the 6 benign axillary lymph nodes analysed in the present study, 2 were determined to be metastatic by gray-scale ultrasonography, while these diagnoses were corrected by RTE.

Conclusion:

Ultrasound elastography by its qualitative (elasticity score) and quantitative (strain ratio) evaluation has proved to useful in differentiation between benign and malignant nodes as a complementary to conventional ultrasound. Using elasticity score/strain ratio; 11 out of 18 pathologically proved malignant nodes, were diagnosed as malignant, 5 out of 6 benign nodes were diagnosed as benign.

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دور قياس مرونة الآنسجة بإستخدام الموجات فوق الصوتية لتقييم العقد الليمفاوية الإبطية للمرضى بسرطان الثدى

تعتبر حالة العقدة الليمفاوية الإبطية أكثرالعوامل موثوقية فى سرطان الثدى لتكرار المرض وبقاء المريض.

الموجات فوق الصوتية الإبطية هى وسيلة مهمة للكشف عن آفات العقد الليمفاوية الخبيثة، كونها غير جراحية ومتوفرة ورخيصة.

ومع ذلك، فإن المؤشرات، التى يتم تقديمها بهذه الطرق والتى تعكس الآفات الحميدة أو الخبيثة، تتداخل دائماً إلى حد كبير، مما يتسبب فى صعوبات فى التمييز. ذلك يتطلب إضافة خزعة الغدد الليمفاوية أو الإستئصال الجراحى إذا تم العثور على عقد ليمفاوية مشبوهة مما تطلب الحاجة إلى تقنية غير جراحية للتمييز الدقيق بين العقد الليمفاوية الحميدة والخبيثة.

تعد الموجات فوق الصوتية لقياس المرونة Ultrasound elastography طريقة واعدة للتمييز بين العقد الليمفاوية الإبطية الحميدة والخبيثة عن طريق قياس مرونة الآنسجة التى لا تنعكس على الموجات فوق الصوتية التقليدية. وهو يستخدم المفهوم الإكلينيكى الراسخ بأن الآفات الخبيثة غالباً ما تكون أكثر صلابة من الآنسجة الطبيعية.

هدفت دراستنا إلى تحقيق تمايز أفضل بين الغدد الليمفاوية الإبطية الحميدة والخبيثة عن طريق الموجات فوق الصوتية لقياس المرونة كطريقة مكملة للموجات فوق الصوتية التقليدية. فى البداية، تم فحص العقد الليمفاوية الإبطية المتضخمة بواسطة الموجات فوق الصوتية التقليدية لتوصيف المعايير المشبوهة مثل الشكل والحجم وسمك القشرة ووجود نقير دهنى، ولكن وحدها، لم تكن دقيقة بما يكفى للتمييز.

وجدنا أن الموجات فوق الصوتية التقليدية أظهرت أعلى حساسية ودقة (١٠٠٪، ٨٨.٣٣٪ على التوالى) من Elastography. ولكن مع خصوصية أقل نسبياً (٣٣.٣٪).

ثبت أن التصوير المرن بالموجات فوق الصوتية من خلال تقييمه النوعى (درجة المرونة) والكمى (نسبة الإجهاد) مفيد فى التمايز بين العقد الحميدة والخبيثة كمكمل للموجات فوق الصوتية التقليدية.

بإستخدام درجة المرونة/نسبة الإجهاد، ١١ من أصل ١٨ عقدة خبيثة ثبت أنها خبيثة، تم تشخيص ٥ من ٦ عقد حميدة على أنها حميدة.