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FULL PAPER

Role of shear wave elastography as an adjunct to axillary ultrasonography in predicting nodal metastasis in breast cancer patients with suspicious nodes

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Objective: To evaluate the role of shear wave elastography (SWE) of suspicious axillary lymph nodes and its combination with B-mode USG in predicting nodal metastasis in breast cancer patients.

Methods: Prospective observational study was performed from June 2018 to August 2020 on breast cancer patients with suspicious axillary nodes on USG. B-mode features (cortical thickness, effacement of fatty hilum, non-hilar blood flow and round shape) and SWE parameters (Emax, Emin, Emean and ESD) of the node with the thickest cortex were evaluated. Diagnostic performances of USG, SWE and their combination were estimated using pathological status of the node on biopsy as the gold standard.

Results: Of the 54 patients evaluated, optimal elasticity maps were obtained in 49 nodes of 49 patients (mean age, 46.3 ± 12.1 years; 48/49 (98%) females). On biopsy, 38 nodes (77.6%) had metastasis, while 11 (22.4%) had reactive hyperplasia. Emax, Emin, Emean and ESD of both cortex and hilum were significantly higher in metastatic than reactive nodes. Emax (cortex) ≥14.9 kPa had the best diagnostic performance (sensitivity, 73.7%; specificity, 81.8%). Cortical thickness ≥6.7 mm had the best diagnostic performance among B-mode features (sensitivity, 89.5%; specificity, 72.7%). Combining cortical thickness with effacement of fatty hilum and/or non-hilar blood flow yielded sensitivity of 89.5% and specificity of 90.9%. Addition of Emax (cortex) to cortical thickness and combination of ≥2 B-mode features increased their specificities to 90.9 and 100%, respectively.

Conclusions: Metastatic axillary nodes are stiffer than reactive nodes on SWE in breast cancer patients. Emax (cortex) has the best diagnostic performance in differentiating between reactive hyperplasia and nodal metastasis. Combination of Emax (cortex) and cortical thickness increases the specificity for diagnosing metastasis, especially in nodes showing only cortical thickening.

Advances in knowledge: Combination of SWE and B-mode USG is highly specific for differentiating metastasis from reactive hyperplasia in suspicious nodes of breast carcinoma patients, especially in nodes with only cortical thickening.

INTRODUCTION

Breast cancer is the most common cancer and the leading cause of cancer deaths among females worldwide.[1] Axillary lymph node involvement is an important prognostic factor, making it a necessary part of evaluation of breast cancer patients.[2,3] Among the available imaging modalities, ultrasonography (USG) is the preferred modality for the evaluation of axilla.[4] The American College of Radiology recommends USG as the first-line imaging modality for evaluation of axillary nodes due to its high accuracy in detecting morphological changes due to metastasis, with sensitivity and specificity of 51–80% and 86–100%, respectively.[5–7] However, both metastatic and benign reactive nodes are frequently encountered in breast cancer patients and their morphological features on USG can often overlap.[8–10] Thus, USG-guided biopsy

has become a routine method for confirming nodal metastasis prior to surgery. It has high sensitivity of 80–88% and specificity of 98–100% for detecting nodal metastasis, but is an invasive procedure.[11,12] Hence, there emerges a need to explore a non-invasive alternative technique to improve the diagnostic accuracy of USG and thereby reduce the number of biopsies.

Ultrasound shear wave elastography (SWE), a novel imaging technique, has been successfully used for the assessment of a wide range of pathologies in different organs based on the tissue stiffness or elasticity values.[13] Multiple studies have been done on SWE of axillary nodes, but its role in nodes with only cortical thickening and as an adjunct to B-mode USG is yet to be studied in detail.[14–21] This is important because cortical thickening on USG is frequently encountered in both benign reactive hyperplasia and nodal metastasis, invariably resulting in false-positive results. The few studies that evaluated the utility of combination of SWE and B-mode USG had focussed on its role in increasing the sensitivity for diagnosing nodal metastasis,[14,17,18] but there is paucity of literature regarding the role of this combination in increasing the specificity. Diagnostic performance of SWE has been compared with that of individual B-mode features in a few of the prior studies.[14,18,20] However, metastatic nodes often express multiple suspicious morphological features and thus comparison of SWE with the combination of multiple B-mode features is essential to ascertain its practical utility.

This study was thus undertaken to evaluate the role of SWE of suspicious axillary lymph nodes in predicting nodal metastasis and to assess the combined utility of B-mode USG and SWE in differentiating metastasis from reactive hyperplasia in axillary nodes in breast carcinoma patients.

METHODS AND MATERIALS

After obtaining approval from the Institute's Ethics Committee, a prospective observational study was conducted from June 2018 to August 2020.

Study population

Patients with biopsy-proven invasive breast carcinoma (cT0-4, cN0-3, M0-1) and suspicious axillary nodes on USG were included in the study after obtaining written informed consent. The patients in whom stable elasticity maps of the suspicious nodes could not be obtained due to their deep location were excluded from the study. Fifty-four consecutive breast carcinoma patients with suspicious nodes on baseline USG of the axilla were evaluated. In five patients, stable elasticity maps could not be obtained due to deep location of the lymph nodes. Therefore, 49 nodes of 49 patients in whom quantitative SWE assessment could be performed were included in the analysis. Nineteen patients out of them were part of a parallel study on node positive breast cancer patients, in which the diagnostic performance of axillary USG and ultrasound-guided wire localisation after neoadjuvant chemotherapy were assessed.[22]

B mode USG

All patients were subjected to axillary USG on Aixplorer ultrasound system (SuperSonic Imagine, Aix-en-Provence, France) by one of the three investigators, each having at least 12 years' experience in breast radiology, using a 4–15 MHz linear array transducer. Lymph nodes with diffuse or focal cortical thickening >3 mm were considered suspicious for metastasis.[10] The lymph node with maximum cortical thickness was identified for evaluation of B-mode features, SWE assessment and subsequent biopsy. The B-mode features assessed were cortical thickness, effacement of fatty hilum, non-hilar blood flow and round shape, defined as ratio of long axis to short axis diameter less than two.[7]

Shear wave elastography

In the same sitting, SWE was then performed by switching over to the SWE mode. Ensuring that the lymph node is at the centre of the field of view, an SWE box was placed over it. Keeping the probe still for 10–20 s till the colour map stabilised, elastography images were obtained. The range of the elasticity map was reduced from the default setting of 180 kPa to an appropriate level at which areas within the node showing subtle increase in stiffness became apparent. Because the same range was not used in all patients, the qualitative SWE features were not analysed. For obtaining the quantitative SWE features, non-overlapping regions of interest (ROI), measuring 1 mm in diameter, were placed over the stiffest area of the cortex and hilum of the node. One mm ROIs were used so that multiple non-overlapping ROIs could be placed within the nodes, especially in those with small cortices and hila. Three such ROIs were drawn and the highest value among the three readings was taken for each parameter. The quantitative parameters evaluated were – Emax – the maximum value of elasticity, Emin – the minimum value of elasticity, Emean – the mean value of elasticity and ESD – the standard deviation (SD) of elasticity.

Ultrasound guided core biopsy

After SWE, the same node was subjected to ultrasound guided biopsy using 18G Monopty core biopsy instrument (Bard Biopsy Systems, Arizona, USA) in the same sitting. Pathological status of the node on biopsy served as the reference standard for evaluating the diagnostic performance of USG and SWE. The pathologist was blinded to the USG and SWE findings of the lymph node.

Statistical analysis

Statistical analysis was performed using Stata 14.2 (StataCorp LP, Texas, USA). Mean ± SD or median with interquartile range was used to describe the quantitative variables. Wilcoxon rank sum test was used to compare the quantitative SWE parameters in metastatic and non-metastatic lymph nodes as they were not following a normal distribution. Receiver operating characteristic curves were drawn for cortical thickness and SWE parameters, to assess the best cut-off for predicting nodal metastasis. The value with the highest Youden's index was considered as the optimal cut-off value. Sensitivity, specificity and positive likelihood ratios of a positive test were calculated for B-mode USG features and SWE parameters. Combined

diagnostic accuracy of B-mode USG and SWE was ascertained by combining the features with the best individual diagnostic performance in each category. All statistical tests were two-sided and a p-value less than 0.05 was considered significant.

RESULTS

Study population

The demographics and clinical features of the 49 patients have been summarised in Table 1. The mean age of these patients was 46.3 ± 12.1 years. All patients except one were females and 25/49 (51%) were post-menopausal. All of them presented with the chief complaint of breast lump with a mean duration of 6 ± 9.4 months. Upper outer quadrant was the most common location of the primary breast lump (32/49, 65.3%) and Luminal-like subtype was the most common molecular subtype (19/49, 38.8%).

Axillary ultrasonography and ultrasound guided biopsy

On axillary USG, a total of 284 suspicious lymph nodes were seen in the 49 patients, all of them in the ipsilateral axilla. The median number of suspicious nodes per patient was three (interquartile range, 2–6). Twenty-nine patients (59.2%) had only suspicious level I nodes, while 18 (36.7%) had level II and 7 (14.3%) had level III suspicious nodes. In addition, suspicious internal mammary and supraclavicular nodes were present in one patient (2%) and four patients (8.2%), respectively.

Ultrasound-guided biopsy was performed in all 49 patients and it revealed metastasis in 38 nodes (77.6%) and reactive hyperplasia in 11 nodes (22.4%).

Diagnostic performance of SWE

The elasticity values of the cortex were obtained for all 49 nodes, while those of the hilum could be obtained in 32 nodes that had preserved fatty hila. The median values of all the SWE parameters (Emax, Emin, Emean and ESD) of both the cortex and the hilum were significantly higher in metastatic nodes than reactive hyperplasia (Table 2, Figures 1 and 2).

The diagnostic performances of Emax, Emin and Emean of the cortex are shown in Table 3. All three parameters had high diagnostic performance in distinguishing metastasis from reactive hyperplasia. Although the area under the curve (AUC) was maximum for Emax, the difference with that of Emean and Emin were not statistically significant (p = 0.73 and 0.40, respectively). The best cut-off values of Emax, Emin, Emean and ESD of the cortex for distinguishing metastasis from reactive hyperplasia with maximum sensitivity and specificity were 14.9, 12.2, 13.3 and 1 kPa, respectively. As the SWE parameters of hilum could not be assessed in all nodes due to loss of fatty hilum in many nodes, their diagnostic performances were not ascertained.

DIAGNOSTIC PERFORMANCE OF B-MODE USG

The median cortical thickness was higher in metastatic nodes than reactive nodes (p < 0.001). Effacement of fatty hilum was more commonly present in metastasis (32/38, 84.2%) than in reactive hyperplasia (4/11, 36.4%) (p = 0.004). Non-hilar blood

Table 1. Demographics and clinical features of the study population (n = 49)

Variable	Number of patients (%)/ Mean ± SD
Age (Mean ± SD, years)	46.3 ± 12.1
Gender	
Female	48 (98%)
Male	1 (2%)
Menstrual status	
Pre-menopausal	23 (46.9%)
Post-menopausal	25 (51%)
Not applicable (male)	1 (2%)
Symptoms	
Breast lump	49 (100%)
Mastalgia	10 (20.4%)
Nipple retraction	4 (8.2%)
Nipple discharge	1 (2%)
Duration of symptoms (Mean ± SD, months)	6 ± 9.4
Location of breast lump (quadrant)	
Upper outer	32 (65.3%)
Upper inner	4 (8.2%)
Lower outer	6 (12.2%)
Lower inner	4 (8.2%)
Central	3 (6.1%)
T stagea	
cT2	20 (40.8%)
cT3	12 (24.5%)
cT4b	15 (30.6%)
cT4c	2 (4.1%)
N stagea	
cN1	33 (67.4%)
cN2a	6 (12.2%)
cN3a	5 (10.2%)
cN3b	1 (2%)
cN3c	4 (8.2%)
M stage	
M0	44 (89.8%)
M1	5 (10.2%)
Histological subtypea	
Invasive carcinoma, no special type	48 (98%)
Mucinous carcinoma	1 (2%)
Molecular subtypea	

(Continued)

Table 1. (Continued)

Variable	Number of patients (%)/ Mean ± SD
Luminal-like	19 (38.81%)
Her2neu-like	13 (26.5%)
Basal-like	17 (34.7%)

[a]Based on American Joint Committee on Cancer staging system, eighth edition[23]

flow was also significantly more common in metastasis (28/38, 73.7%) than in reactive hyperplasia (3/11, 27.3%) (p = 0.01). Although round shape was observed in 11/38 (28.9%) metastatic nodes and none of the reactive nodes (0/11, 0%), the difference was not statistically significant (p = 0.05) (Table 2).

Among the B-mode USG features, cortical thickness had the highest sensitivity and specificity with an AUC of 0.878. The best cut-off value of cortical thickness for differentiating metastasis from reactive hyperplasia was 6.7 mm, with a sensitivity of 89.5% and specificity of 72.7%. When cortical thickness ≥6.7 mm was combined with presence of effacement of hilum and/or non-hilar blood flow, the sensitivity and specificity were 89.5 and 90.9%, respectively (Table 3).

Sensitivities and specificities of the SWE parameter and B-mode feature of the cortex with the best diagnostic performances were compared with each other. Emax (cortex) had a higher specificity than cortical thickness (81.8% vs 72.7%), while the sensitivity was lower (73.7% vs 89.5%). However, the differences were not statistically significant (p = 0.61 and 0.08, respectively).

Diagnostic performance of combination of B-mode USG and SWE

Because cortical thickness and Emax (cortex) showed the best diagnostic performance among the B-mode features and SWE parameters of the cortex, respectively, diagnostic performance of their combination was ascertained. On combining with Emax (cortex) ≥14.9 kPa, the specificity of cortical thickness ≥6.7 mm increased from 72.7% to 90.9% (p = 0.27) while the sensitivity reduced significantly from 89.5% to 65.8% (p = 0.01). Similarly, on adding Emax (cortex) to combination of at least two B-mode features (cortical thickness ≥6.7 mm with effacement of hilum and/or non-hilar blood flow), specificity increased from 90.9% to 100% (p = 0.31), but the sensitivity reduced significantly from 89.5% to 65.8% (p = 0.01). The combination of Emax (cortex) and cortical thickness showed a similar specificity as combination of at least two B-mode features (90.9% each) but a significantly lower sensitivity (65.8% vs 89.5%, p = 0.01) (Table 3).

DISCUSSION

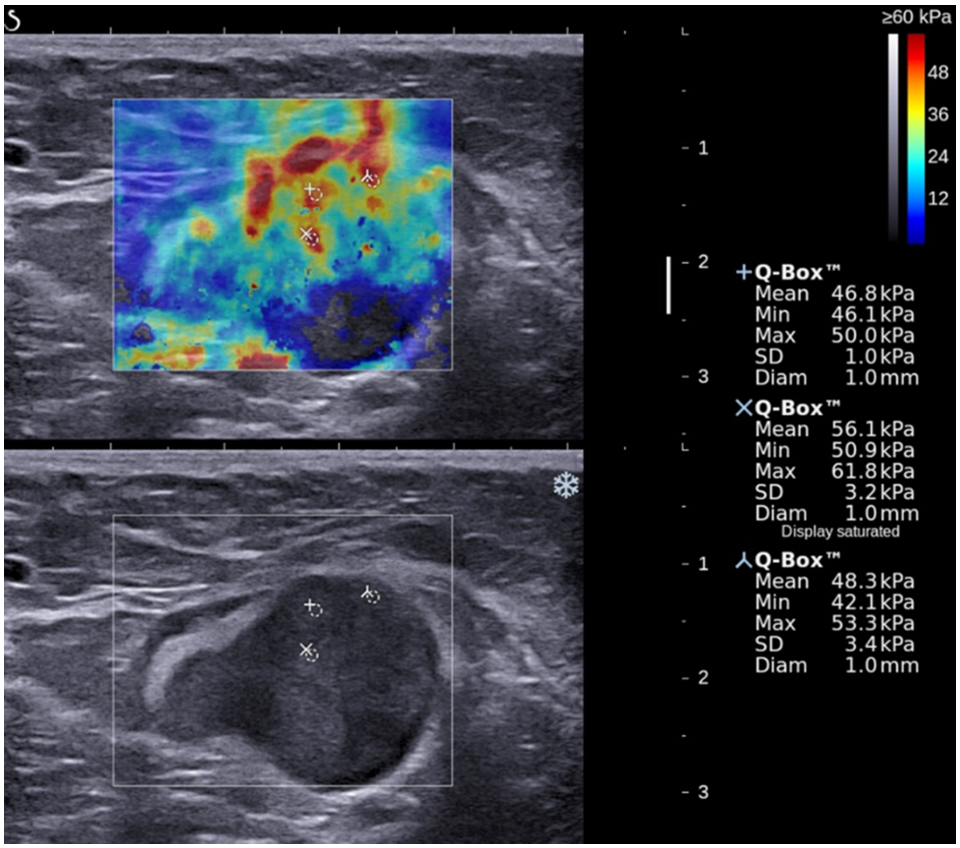
USG is the most widely used modality for evaluation of axillary lymph nodes in breast cancer patients. However, in our study, using the criteria of cortical thickening on USG, 11/49 nodes (22.4%) yielded false-positive results as they had reactive hyperplasia with no metastasis on biopsy. Thus, additional techniques need to be explored for increasing the specificity of USG. We evaluated the diagnostic performances of individual SWE and

Table 2. Comparison of quantitative SWE parameters and B-mode USG features of nodes with their pathological status (n = 49)

Parameter	Nodal status on core biopsy		p value
	Metastasis	Reactive hyperplasia	
SWE of cortex[a]	*n = 38*	*n = 11*	
Emax (kPa)	25.9 (14.8–45.3)	12.6 (11.4–14.8)	**0.001**
Emin (kPa)	21.15 (12.2–39.1)	10.5 (8.5–11.4)	**0.002**
Emean (kPa)	24.75 (13.3–43.7)	11.6 (9.5–13.2)	**0.001**
ESD (kPa)	1.6 (1.3–2.2)	0.9 (0.7–1.8)	**0.03**
SWE of hilum[a]	*n = 23*	*n = 9*	
Emax (kPa)	32.9 (19.7–46.6)	15.6 (9.8–17.2)	**0.004**
Emin (kPa)	28.5 (16.5–40.1)	8.9 (8.1–15)	**0.004**
Emean (kPa)	31.5 (18–43.9)	12.2 (8.4–15.5)	**0.002**
ESD (kPa)	1.8 (1.1–3)	0.8 (0.6–1.4)	**0.008**
B-mode USG features	*n = 38*	*n = 11*	
Cortical thickness in mm[a]	10.25 (7.7–12.8)	6 (5.2–7.2)	**<0.001**
Effacement of fatty hilum	32 (84.2%)	4 (36.4%)	**0.004**
Non-hilar blood flow	28 (73.7%)	3 (27.3%)	**0.01**
Round shape	11 (28.9%)	0	0.05

SWE, shear wave elastography; USG, Ultrasonography
[a]Each value is depicted as median (interquartile range)

Figure 1. 40-year-old female with breast carcinoma. Shear wave elastography image of suspicious axillary node with cortical thickening and partial effacement of fatty hilum shows a heterogenous cortex with hard areas within and maximum Emax of 61.8 kPa. Biopsy of the node revealed metastasis.

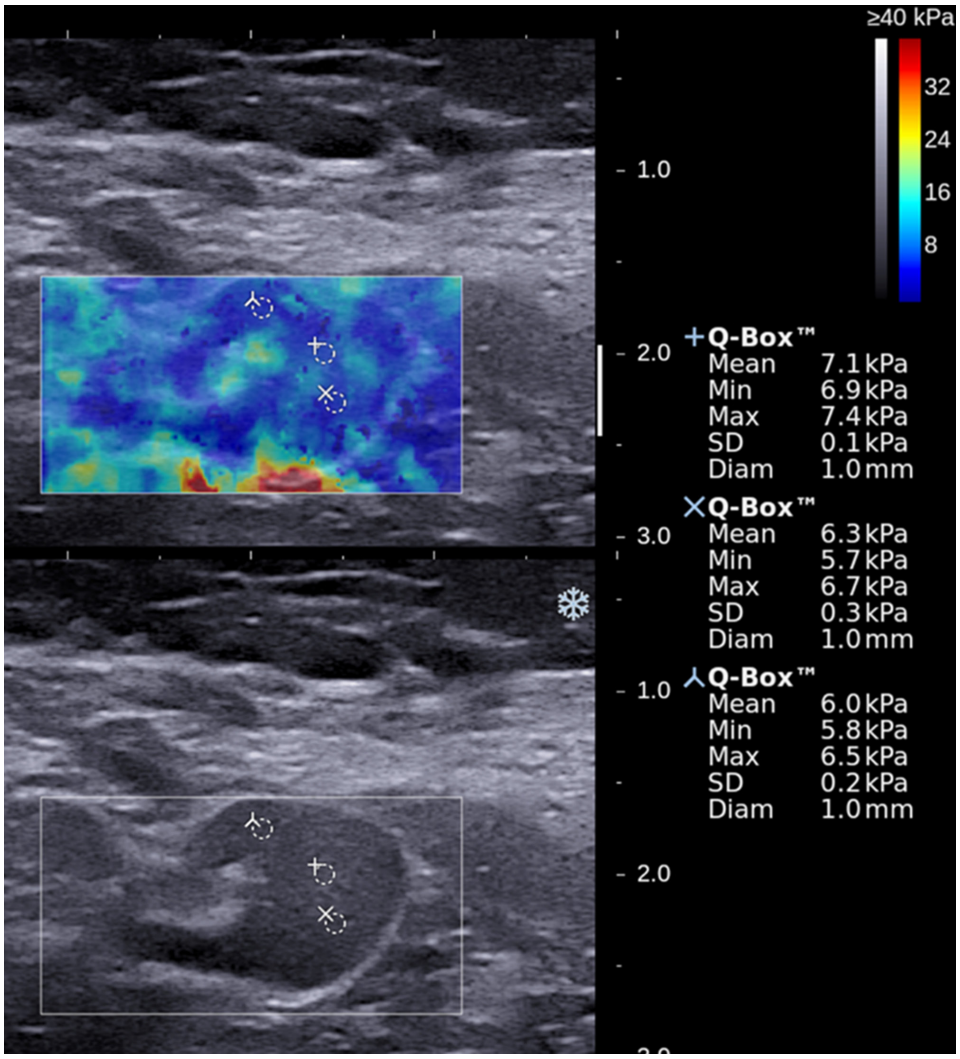


B-mode USG parameters in nodes with cortical thickening to identify the best parameters that can differentiate reactive hyperplasia from metastasis. These parameters were then used to determine the diagnostic performance of combination of SWE and USG, which was then compared with the combination of multiple USG features to assess the practical utility of SWE.

Among the B-mode USG features, cortical thickness showed the best diagnostic performance for detecting nodal metastasis. Our patients had a high nodal burden and advanced disease at presentation and we found that a higher cut-off of 6.7 mm had high sensitivity and specificity of 89.5% and 72.7%, respectively. Different cut-off values have been reported in the earlier studies due to differences in the study population. Zhu et al conducted a study on early breast cancer patients and found 3.5 mm to be the best cut-off for cortical thickness for predicting metastasis, with a sensitivity of 76% and specificity of 83%.[10] A study by Seo et al on patients with suspicious nodes showed that a cut-off of 4.85 mm for cortical thickness had sensitivity of 82.4% and specificity of 100%.[18] The cut-off is higher in our study due to high nodal burden in the study population.

We found that the metastatic nodes were stiffer and had higher elasticity values of both the cortex and the hilum in comparison with the benign nodes. Huang et al conducted a meta-analysis including the seven studies available on quantitative elastography, out of which all except one were on SWE, and found that quantitative elastography of axillary nodes had pooled sensitivity and specificity of 82% and 88%, respectively.[16] Similar to the earlier *in-vivo* and *ex-vivo* studies on SWE,[17–21] our study also showed that the SWE parameters of both cortex and hilum were higher in metastatic nodes than reactive nodes. We found that Emax (cortex) had the best diagnostic performance for differentiating metastasis from reactive hyperplasia with the cut-off of 14.9 kPa having a sensitivity of 73.7% and specificity of 81.8%. Prior studies have reported Emax and Emean as the best parameters for detection of metastasis, with cut-offs in the range of 20.9–38.6 kPa and 14.75–30.6 kPa, respectively.[14,17–21] The higher cut-offs obtained in these studies could be attributed to the differences in the SWE technique and the study population. In the prior studies, larger 2–3 mm ROIs were used, including the perinodal tissue, for stiffness assessment. In contrast, we used smaller one mm ROIs, which were placed exclusively in either the cortex or the hilum for accurate assessment of their elasticity parameters. Also, all the prior studies were performed on patients who underwent upfront surgery, indicating early-stage disease. We, on the other hand, had many patients with locally advanced disease at presentation, which is likely to have a bearing on the stiffness values. Also, unlike the prior studies that included nodes with normal cortical thickness as well, our study included only those with increased cortical thickness.

Figure 2. 35-year-old female with breast carcinoma. Shear wave elastography image of suspicious axillary node with only cortical thickening shows a relatively homogenous and soft cortex with maximum Emax of 7.4 kPa. Biopsy of the node revealed reactive hyperplasia.



In our study, Emax (cortex) had higher specificity (81.8 *vs* 72.7%, $p = 0.61$) but lower sensitivity (73.7% vs 89.5%, $p = 0.08$) than cortical thickness, although the differences were not statistically significant. Luo et al had shown that Emax has higher sensitivity (93.3% vs 91.7%) and higher specificity than USG (88.5% vs 82%).[17] In a study by Seo et al, as compared to cortical thickness, Emax had similar sensitivity (82.4% each) and lower specificity (95% vs 100%) while evaluating suspicious nodes.[18] Although a statistical comparison was not performed in this regard in both these studies, these results show that SWE is as good as B-mode USG for detecting nodal metastasis.

We found that the combination of SWE and USG helps in improving the specificity for diagnosing nodal metastasis at the expense of drop in sensitivity. High specificity of 90.9% was achieved when Emax (cortex) was combined with cortical thickness using cut-off values of 14.9 kPa and 6.7 mm, respectively. In nodes having multiple suspicious USG features, the specificity increased further to 100% by addition of Emax (cortex). Limited literature is available in this regard and that too on a different subset of patients. In an *ex-vivo* study on patients with clinically node negative patients, Kilic et al showed that on combining multiple B-mode features including cortical thickness and short axis length with cortical stiffness, specificity of 100% can be attained, but with low sensitivity of 34%, similar to the results in our study.[14] Chang et al reported similar results in a retrospective study on strain elastography, in which a high specificity of 100% but low sensitivity of 52.6% was obtained by combining it with B-mode USG.[24] However, they had excluded the patients who underwent neoadjuvant chemotherapy, indicating that the included patients had early stage disease.[24] A few studies have evaluated the role of SWE in increasing the sensitivity of B-mode USG by considering the presence of either high stiffness or suspicious B-mode morphology as a feature of metastasis. The study by Kilic et al yielded a higher sensitivity of 83% for combination of cortical thickness and stiffness as compared to 75% for either of the features used alone.[14] Seo et al conducted a retrospective study on patients with suspicious nodes on B-mode USG and

Table 3. Diagnostic performance of quantitative SWE and B-mode USG of axillary nodes based on pathological status of the nodes (n = 49)

Variables	AUC	Cut off	TP	FP	TN	FN	Se, % (95% CI)	Sp, % (95% CI)	LR+ (95% CI)
SWE of cortex									
Emax	0.831	14.9 kPa	28	2	9	10	73.7 (58-85)	81.8 (52.3–94.9)	4.1 (1.5–11.1)
Emin	0.809	12.2 kPa	29	2	9	9	76.3 (60.8–87)	81.8 (52.3–94.9)	4.2 (1.5–11.4)
Emean	0.825	13.3 kPa	29	2	9	9	76.3 (60.8–87)	81.8 (52.3–94.9)	4.2 (1.5–11.4)
ESD	0.714	1 kPa	32	5	6	6	84.2 (69.6–92.6)	54.6 (28–78.7)	1.9 (1.2–2.8)
B-mode USG features									
Cortical thickness	0.878	6.7 mm	34	3	8	4	89.5 (75.9–95.8)	72.7 (43.4–90.3)	3.3 (1.7–6.3)
Effacement of fatty hilum	-	-	32	4	7	6	84.2 (69.6–92.6)	63.6 (35.4–84.8)	2.3 (1.4–3.8)
Non-hilar blood flow	-	-	28	3	8	10	73.7 (58-85)	72.7 (43.4–90.3)	2.7 (1.4–5.3)
Cortical thickness + effacement of fatty hilum and/or non-hilar blood flow	-	Cortical thickness ≥ 6.7 mm	34	1	10	4	89.5 (75.9–95.8)	90.9 (62.3–98.4)	9.8 (1.4–70.4)
Combination of SWE and B-mode USG									
Emax (cortex) + cortical thickness	-	Cortical thickness ≥ 6.7 mm, Emax (cortex) ≥ 14.9 kPa	25	1	10	13	65.8 (49.9–78.8)	90.9 (62.3–98.4)	7.2 (1–53.5)
Emax (cortex) + Cortical thickness + effacement of fatty hilum and/or non-hilar blood flow	-	Cortical thickness ≥ 6.7 mm, Emax (cortex) ≥ 14.9 kPa	25	0	11	13	65.8 (49.9–78.8)	100 (74.1–100)	-

AUC, area under the curve; CI, confidence interval; FN, false negatives; FP, false positives; LR+, positive likelihood ratio; kPa, kilo Pascals; Se, sensitivity; Sp, specificity; SWE, shear wave elastography; TN, true negatives; TP, true positives; USG, Ultrasonography

reported a sensitivity of 94.1% for the combination of cortical thickness ≥4.85 mm and Emax (cortex) ≥20.9 kPa, which was higher than the sensitivity of 82.4% obtained for cortical thickness alone.[18]

We also compared the diagnostic performance of combination of SWE and USG with that of combination of multiple USG features to evaluate the usefulness of SWE. As compared to combination of Emax (cortex) and cortical thickness, similar specificity and higher sensitivity were achieved on combining cortical thickness with at least one other B-mode feature. Therefore, the role of SWE in nodes that exhibit multiple suspicious features is very limited. However, it could be useful in evaluation of nodes having solitary finding of increased cortical thickness that could either be due to metastasis or benign reactive hyperplasia. To the best of our knowledge, none of the prior studies have focussed on this aspect of SWE in patients with suspicious nodes.

The major limitation of our study is its small sample size and thus these early results need validation with larger studies. We did not analyse the utility of qualitative elastography as the same range was not used in all examined nodes. Further studies are required to ascertain the optimum range of the elasticity map to be used for axillary lymph node assessment.

To conclude, SWE is useful in differentiating metastasis from reactive hyperplasia in nodes with suspicious features on USG. Early experience suggests that SWE can be used in combination with B-mode USG to increase its specificity in nodes showing only cortical thickening.

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