Original Article

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Radiology Section

Role of Elastography in the Evaluation of Breast Lesions

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ABSTRACT

Introduction: Breast cancer is 5th most common cause of cancer deaths today. It is the commonest inevitable cancer in women and is the second commonest cancer after cancer of the cervix in India.

Aim: To evaluate the effectiveness of elastography in the differentiation and characterisation of benign and malignant breast masses.

Materials and Methods: The present prospective study conducted from August 2010 to July 2012 in all patients who came to Kamineni Hospital, Hyderabad for screening or with symptoms of lump or pain in the breast in the department of radiology.

Results: A total of 51 women accounting to 57 lesions were evaluated during the study period. Most of the patients were in the age group of 51-60 years. The mean age of the patients was 48.6 years (range 17-77 years). Amongst the symptomatic patients, palpable lump was the most common presentation (58%). Patients who had come for routine mammographic screening accounted for 23.53% (12/51 patients). The frequency of other complaints were: pain and lump in 3.92% patients, and retracted nipple in 3.92% patients. Lumps in both breasts were seen in 1.96% of women who had a past history of vaginal cancer. One patient (1.96%) had past history of carcinoma of contralateral breast. The number of malignant lesions in our study was 25 (49.02%) and benign was 26 (50.98%) in histipathological examination. The ratio of malignant to benign lesions was 0.96. 40 patients had undergone mammography. Abnormal results in the form of mass lesions/calcifications/asymmetry could be identified in 37 patients. In three patients no obvious abnormality could be detected on mammography. In this study sensitivity, specificity, PPV and NPV of sonomammography were 92.00%, 73.1%, 76.67% and 90.4% respectively. the sensitivity, specificity, positive predictive value and negative predictive value for detecting malignant lesions in elastography were 84%, 96.1%, 95.4% and 86.2% respectively.

Conclusion: Elastography has more specificity and positive predictive value compared to mammography and ultrasonography. Elastography has similar diagnostic performance as ultrasonography.

Keywords: Breast mass, Mammography, Sonography

INTRODUCTION

Breast cancer is among the most common causes of cancer deaths today, coming fifth after lung, stomach, liver and colon cancers [1]. 1.05 million new cases were detected worldwide in the year 2001. The incidence in India is 19.1 per lakh. It is the commonest inevitable cancer in women and is the second commonest cancer after cancer of the cervix in India [2]. Great strides in early detection and improved treatment have decreased breast cancer related deaths. Common presentations of breast pathology are mastalgia, nodularity less extent lump. A palpable mass in a woman's breast needs thorough examination [2]. Sceening with mammography in suspected breast lesions reduces the breast cancer mortality. Breast tomosynthesis is a advanced tool where there is no tissue overlapping problem [1].

In patients with dense breasts on mammography, sonography acts as a major imaging modality for detecting and characterising breast lumps. It also acts as an adjunct in further characterising a breast lump. Normally, mammography is not indicated in young females because of the low risk of breast cancer, increased risk of radiation at this stage and poor image quality due to dense fibroglandular breast tissue. Refinement of high frequency technology, particularly with 7-12 MHz probes, has brought out a totally new facet in

USG breast imaging. In these patients, ultrasonography is the ideal imaging modality and can be useful in identifying and characterising breast masses by certain criteria and then guiding further investigations. Further, evaluation of solid masses can be done either by FNAC, large core percutaneous technique or excision biopsy [3,4]. Elastography has more specificity and positive predictive value in evaluation of breast masses for early diagnosis of breast cancer [5].

Objectives

- Mammographic, ultrasonographic and elastographic evaluation of all breast masses in symptomatic and patients coming for screening.
- Correlating elastographic findings with conventional mammography, HRUS and histopathology.
- To evaluate sensitivity and specificity of elastography in predicting benignity versus malignancy in solid breast lesion.

MATERIALS AND METHODS

This prospective study was conducted in the Department of Radiology between the period of August 2010 to July 2012. All patients who came to Kamineni Hospitals, Hyderabad, India, for screening or with symptoms of lump or pain in the breast and who fulfilled the inclusion criteria were studied. Total of 51 women accounting to 57 lesions were evaluated in this study. Patient consent and ethical committee approval taken.

Women presenting with palpable breast masses and solid breast lesions incidentally picked up on X-ray mammogram/ ultrasonography in women who come for routine screening were included in the study. Women who are unwilling to give informed consent, patients with breast implants, patients undergoing chemo or radiotherapy and those with superficial lesions or lesions on skin were excluded from the study.

These patients were evaluated on mammography machine "GE MEDICAL SYSTEM SA" in which anode and filter are molybdenum. Imaging was done at 34 kvp and exposure time of 10 mA. Sonomammography was performed in all patients using PHILIPS IU 22 machine with L12-5 MHz linear array transducer. Elastography was done using the same probe L12-5 MHz linear probe transducer on Phillips IU22 machine in the same sitting of ultrasound.The Elastography images were evaluated and scoring was given according to the classification given by Itoh A et al., [6].

Standard of Reference: Definitive diagnosis was made on the basis of FNAC/core biopsy with or without ultrasound guidance, excision biopsy/mastectomy in patients who underwent surgery.

STATISTICAL ANALYSIS

As cytopathological and histopathological diagnosis were the standard of reference, only those patients who underwent cytopathological/histopathological examination of the lesion were included in the statistical analysis. The sensitivity, specificity, positive predictive value and negative predictive values of mammography, sonography and elastography were calculated. All statistical analysis was done by means of SPSS software version 15.0.

Positive findings (malignancy) on mammography/ultrasound/ elastography confirmed on pathology were considered as true positive. Malignancy not detected on mammography/ ultrasonography/elastography but picked up on pathology was considered as false negative. Malignancy detected on mammography/ultrasonography/elastography but not confirmed pathologically was false positive and when a malignancy was not present either on mammography/ ultrasonography/elastography or pathologically it was true negative.

RESULTS

A total of 51 women accounting to 57 lesions were evaluated during the study period. Most of the patients were in the age group of 51-60 years. The mean age of the patients was 48.6 years (range 17-77 years).

Amongst the symptomatic patients, palpable lump was the most common presentation (58%). Patients who had come for routine mammographic screening accounted for 23.53% (12/51 patients).

The frequency of other complaints was as follows: pain and lump were present in 3.92%, and retracted nipple was present in 3.92%. Lumps in both breasts were seen in 1.96% of women who had a past history of vaginal cancer. One patient (1.96%) had past history of carcinoma of contralateral breast.

Total 40 women of the 51 patients had reported for mammography followed by sonography. Eleven patients had come for sonomammography alone. All the women however were evaluated for sonomammography and elastography in the same sitting. Fine Needle Aspiration Cytology (FNAC) was done for 18 lesions. Core biopsy was done in 20 lesions under ultrasound guidance and six lesions without guidance. 25 women underwent surgery. Surgeries performed were excision biopsy (3), lumpectomy (5) and mastectomy (17). Twelve patients subsequently underwent chemotherapy and radiotherapy.

Mammography

Out of 40 patients who underwent mammography, abnormalities were detected in 37 patients. The abnormal findings on mammography were as follows: single mass lesions in 33 patients; multiple mass lesions in two patients; focal asymmetry in one patient; and microcalcifications with

no detectable mass in one patient.

In patients presenting with multiple lesions, the lesions showed same mammographic characteristics and hence were considered as a single lesion for statistical analysis. The mass lesions detected on mammography were described according to BI-RADS Lexicon.

The shapes of lesions were categorized under irregular, oval, and round [Table/Fig-1]. Out of 35 lesions in six lesions, the shape could not be evaluated because of parenchymal overlap.

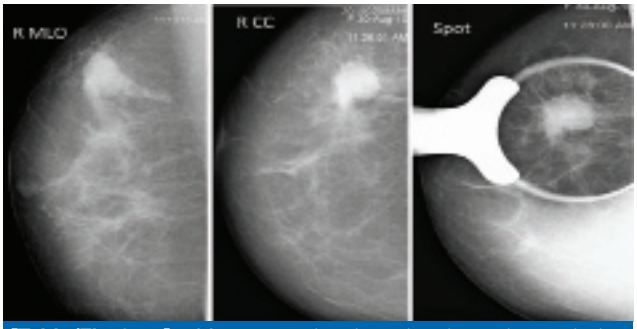
Shape	Benign	Malignant
Irregular	1 (7.14%)	13 (92.85%)
Oval	7 (7.77%)	2 (22.2%)
Round	4 (66.66%)	2 (33.33%)

[Table/Fig-1]: Mammography lesion shape descriptors.

Out of 35 lesions, 16 (45.7%) lesions were hyperdense and 19 (54.2%) were isodense. Fourteen (87.5%) lesions out of 16 hyperdense lesions were malignant. Whereas, six (31.5%) out of 19 isodense lesions were malignant. Calcifications were seen in seven lesions, out of which two lesions showed coarse calcifications. Associated architectural distortion was observed in eight patients. All the lesions with architectural distortion were proved to be malignant on histopathology [Table/Fig-2,3].

Margins	Benign	Malignant
Well defined	6 (66.66%)	3 (33.33%)
Macro lobulated	5 (100%)	0
Micro lobulated	0 (0%)	1 (100%)
Spiculated	0 (0%)	9 (100%)
Angular	0 (0%)	2 (100%)
Ill defined	1 (33.33%)	2 (66.66%)
Partially well defined	4 (66.66%)	2 (33.33%)

[Table/Fig-2]: Mammography lesion margin descriptors.



[Table/Fig-3a-c]: Mammography Irregular hyperdense lesion with architectural distortion in upper outer quadrant of right breast spiculations and architectural distortion are clearly seen on spot compression. Features s/o BIRADS 5 lesion.
67 yr old female came with complaints of lump in right breast since 1 month

On the basis of mammography BI-RADS categorisation (41), the lesions in 36 patients were classified as follows: Category 2 (5); Category 3 (9); Category 4 (11); and Category 5 (10). Focal asymmetry was not included under any BI-RADS category.

Cytological and histological results revealed 24 malignant lesions and 16 benign lesions. In this study the number of true positives was 19, true negatives were 13, false positives were 3, false negatives were 5 by mammography.

The mammographic BI-RADS system showed 79.16% sensitivity, 80 % specificity. The PPV and NPV were 86.36 % and 85.71 %, respectively.

Sonomammography

All the patients were evaluated with sonomammography. Forty eight patients had single lesions, 3 patients had multiple lesions. In the patients with multiple lesions, all the lesions showed same sonographic characteristics, hence considered as single lesion for statistical analysis. The lesions are described according to BI-RADS lexicon.

The lesions which are more than 5 cm were not included in the study.

The number of lesions less than 2 cm was 27 (52.9%) and those more than 2 cm were 24 (47.1%) total number of lesion were 51.

Twenty six (50.9%) lesions were transversely oriented, 18 (35.2%) were oriented vertically. The rest of the lesions did not conform to a particular orientation. 19 (73.1%) out of 26 parallelly oriented lesions were benign. 14 (77.78%) of 18 antiparallel oriented lesions were malignant [Table/Fig-4,5].

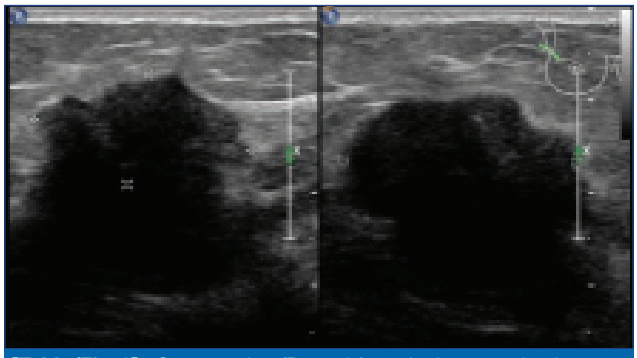
Echogenicity of the lesions were categorised as hypoechoic, isoechoic and heterogenous. There were 36 hypoechoic

Shape	Benign	Malignant
Irregular	6 (25%)	18 (75%)
Oval	17 (73.9%)	6 (26.1%
Round	3 (75%)	1 (25%)

[Table/Fig-4]: Sonography breast lesion shape descriptors.

Margins	Benign	Malignant
Well defined	11 (91.66%)	1 (8.33%)
Macrolobulated	9 (81.82%)	2 (18.18%)
Micro lobulated	2 (40.0%)	3 (60.0%)
Spiculated	0 (0%)	10 (100%)
Angular	0 (0%)	6 (100%)
Ill defined	5 (71.43%)	2 (28.57%)

[Table/Fig-5]: Sonography breast lesion margin descriptors.



[Table/Fig-6]: Sonography (B-mode) and elastography images. Irregular spiculated hypoechoic lesion in right breast at 10'0 clock position. BI-RADS 5 lesion and surrounding tissue is hard on elastography.

Echogenicity	Benign	Malignant
Hypoechoic	15 (41.6)	21(58.4)
Isoechoic	6 (66.66%)	3 (33.33%)
Heterogenous	5 (100%)	0 (0 %)
Hypoechoic with echogenic rim	0 (0%)	1 (100%)

[Table/Fig-7]: Sonography breast lesion echopattern descriptors.

lesions (70.5%), nine isoechoic lesions (17.6%) and five heterogenous lesions (9.8%). One lesion was hypoechoic with an echogenic rim [Table/Fig-6]. The number and percentage of benign and malignant lesions for the sonographic echogenicity are as follows [Table/Fig-7].

Twenty lesions (39.2%) showed internal vascularity, out of which high resistance flow was seen in 12, and low resistance flow in five. Axillary lymph nodes were found in six patients.

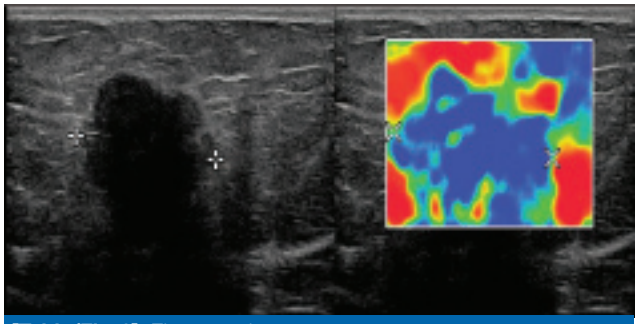
On the basis of sonomammography BI-RADS categorisation [41] which consisted of the above parameters, the lesions in 51 patients were classified as follows: Category 2 (5); Category 3 (16); Category 4 (12); and Category 5 (17).

Cytopathological and histopathological results revealed 25 malignant lesions and 26 benign lesions. On sonography 23 were true positives, 19 were true negatives, seven were false positives and two were false negatives. The sonomammography BI-RADS system showed 92% sensitivity and 73.1% specificity. The PPV and NPV were 76.67 % and 90.4 %, respectively.

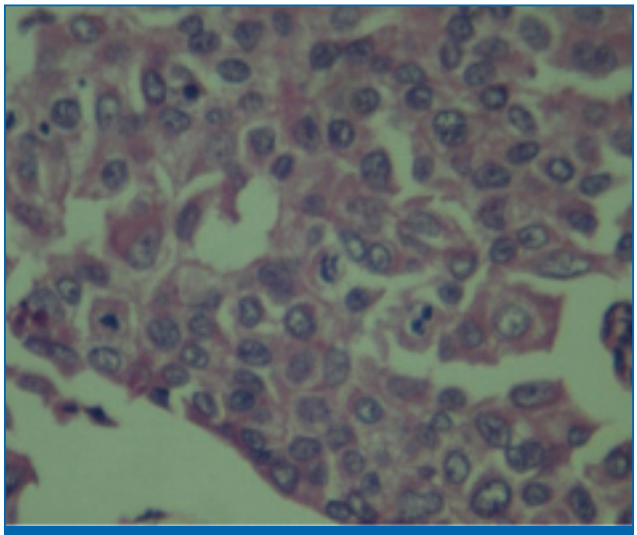
Elastography

All the 57 lesions evaluated by elastography along with B-mode examination [Table/Fig-8]. On the basis of classification by Itoh A et al., the lesions were categorised as follows: Category 2 (25); Category 3 (3); Category 4 (6); and Category 5 (16).

When compared to cytopathological/histopathological analysis false negatives were four, false positives were one,



[Table/Fig-8]: Elastography score 5.



[Table/Fig-9]: Biopsy specimen shows cohesive sheets of malignant duct cells. Findings are suggestive of infiltrating duct cell carcinoma (40X H and E stain).

	Sensitivity	Specificity	PPV	NPV
Elastography	84%	96.1%	95.45%	86.2%
Ultrasonography	92%	73.1%	76.67%	90.4%
Mammography	79.16%	80%	86.36%	85.71%

[Table/Fig-10]: Comparison of elastography, sonography and mammography in breast lesions.

true positives were 20, true negatives were 25 [Table/Fig-9]. False negative findings on UE were found in mucinous carcinoma (1), lymphomas (2) and invasive ductal carcinoma with central necrosis (1).

In one patient elastography showed Score 4 suggesting malignancy but excision biopsy and histopathological examination revealed fibroadenosis which is a benign finding. Hence this was false positive.

The elastography showed sensitivity of 84%, specificity of 96.1%, PPV of 95.45% and NPV of 86.2% [Table/Fig-10].

The specificity of UE was higher than those of mammography and sonography. The specificity of mammography was higher

than that of sonography. The positive predictive value for UE was higher than that of mammography and sonography. The positive predictive value for mammography was higher than that of sonography.

DISCUSSION

Mammography

Abnormal results in the form of mass lesions/calcifications / asymmetry could be identified in 37 patients. In three patients no obvious abnormality could be detected on mammography. Of these, two patients had dense glandular parenchyma which obscured the lesion. This observation correlates with previous study done by Zhi H et al., that the presence of dense parenchyma results in false negative mammography results [7].

Another abnormality seen on mammography was focal asymmetry which was noted in one patient. This was later was corresponded to abscess on histopathology. Micro calcifications without an obvious mass was seen in one patient which was given a Score 4 on BI-RADS scoring. On ultrasound as well as on elastography the lesion was malignant with a Score of 5. This lesion came out to be invasive ductal carcinoma which was correctly diagnosed as a malignant lesion on mammography.

Positive predictive value in our study is higher in comparison with the study by Zhi H et al., [Table/Fig-11] [7]. This can be explained by the higher number of malignant lesions in our study. The number of malignant lesions in our study was higher because of the fact that many patients with benign lesions did not come for histopathological analysis.

Study	Sensitivity	Specificity	PPV	NPV
Zhi H et al., [7]	72.4%	87.1%	70.00%	88.3%
Present study	79.17%	80.00%	86.36%	85.71%

[Table/Fig-11]: Comparison of present study with Zhi H et al., [7] study in abnormal lesion.

In our study we found that nine out of nine lesions with spiculated margins were proven to be malignant. PPV of spiculated margins was 100% for malignancy. Thirteen of 14 lesions with irregular shape were malignant and PPV of irregular shape was 92.8% for malignancy. Microlobulations and angular margins also showed 100% PPV which were noted in three lesions. In a study by Lieberman L et al., the BI-RADS features with the highest positive predictive value were spiculated margins (81%) and irregular shape (73%) [8]. Our study shows similar findings.The positive predictive values of these features in our study are comparable to the latter study.

Study	Sensitivity	Specificity	PPV	NPV
Zhi H et al., [7]	72.6%	73.2%	52.5%	86.0%
Tardivon A et al.,[9]	98.4%	47.5%	65.2%	96.7%
Costantini M et al.,[10]	98.1%	32.9%	67.8%	92.3%
Present study	92.00%	73.1%	76.67%	90.4%

[Table/Fig-12]: Comparison of present study with other studies in margins of the lesion.

Sonomammography

Sensitivity, positive and negative predictive values of our study are comparable with the studies done by Costantini M et al., and Tardivon A et al.,[9,10] [Table/Fig-12].

Specificity is high in our study as compared to the above studies due to very low number of false negatives (2 out of 51).

In comparison with the study done by Zhi H et al., specificity, positive and negative predictive values are well correlating [7]. Sensitivity is high in our study compared to the study done by Zhi H et al., [7]. The difference in the results may be attributed to the difference in the sample size as well as the study population.

In our study sonographic features with high PPV for malignancy were as follows: 10 of 10 lesions with spiculated margins were proven to be malignant with a PPV of 100% for malignancy. eight of 24 irregular shaped lesions were malignant with a PPV of 75% for malignancy. Four out of five lesions with microlobulations were malignant with a PPV of 88.3% for malignancy. All the lesions with echogenic halo were proven to be malignant with a PPV of 100% for malignancy. 14 of 18 lesions with vertical orientation (anti parallel orientation) were malignant with a PPV of 77.8% for malignancy. six out of six lesions with angular margins were malignant with a PPV of 100%.

Sonographic features with high PPV for benignity were as follows: 11 out of 12 lesions with well circumscribed margins were benign with PPV of 91.6%. Total 17 out of 23 oval lesions were benign with PPV of 74%. 19 out of 26 lesions with horizontal orientation (parallel) were benign with PPV of 73%. Nine out of 11 lesions with less than 2-3 macrolobulations were benign with PPV of 80%.

In a study by Costantini M et al., typical signs with a high PPV for malignancy were irregular shape (89.7%), anti parallel orientation (71.3%), non circumscribed margin {spiculated (87.5%), angular (90.6%), microlobulated (100%)} echogenic halo (86.4%) and decreased sound transmission (78.9%) and typical signs of benignity were oval shape(79.7%) and circumscribed margin (87.8%) [10].

PPV of well circumbscribed margins and oval shape for benignity and PPV of irregular shape, anti parallel orientation, spiculated, angular and microlobulated margins and echogenic halo for malignancy in the study conducted by Costantini M et al., [10] are comparable with our study .

Elastography

In a study conducted by Zhi H al., the specificity, PPV and NPV are correlating with our study [7]. The results in our study are correlating with the study of Itoh A et al.,[6]. A cutoff of 3 and 4 was used in our study as well. A study conducted by Tardivon A et al., the sensitivity and NPV are correlating well with the above study [9] whereas, the specificity and positive predictive values are more in our study. This can be attributed to the less number of false positives in our study. Sensitivity of elastography in our study is also comparable with that of a study done by Thomas A et al., [11] and specificity is comparable with a study done by Raza S et al.,[12] [Table/Fig-13].

This shows that the smaller the size of the lesion the greater the

Study	Sensitivity	Specificity	PPV	NPV
Zhi H et al.,[7]	70.1%	95.7%	89%	88.5%
Tardivon A et al.,[9]	78.7%	86.9%	85.7%	80.3%
Itoh A et al.,[6]	86.5%	89.8%	-	-
Thomas A et al.,[11]	77.6%	91.5%	-	-
Raza S et al.,[12]	92.7%	85.8%	-	-
Present study	84%	96.1%	95.4%	86.2%

[Table/Fig-13]: Sensitivity, specificity, PPV, NPV comparison wirh other studies in elastography.

Study	<2cm		>2cm	
	Sensitivity	Specificity	Sensitivity	Specificity
Giuseppetti GM et al.,[13]	86%	100%	65%	62%
Present study	92.8%	100%	72.7%	92.3%

[Table/Fig-14]: Sensitivity, specificity comparison with other studies in relation to the size of the lesion in elastography.

sensitivity as well as specificity of elastography in diagnosing malignant lesions. This is correlating with the above study with a specificity of 100% in lesions with size <2cm [Table/Fig-14].

In all the above mentioned studies the value of elastography in comparison with ultrasound was evaluated in detecting malignant breast lesions. In a study by Zhi H et al., [7] mammographic evaluation was also done as in our study. Their results showed that elastography has more specificity and PPV in detecting malignant lesions in comparison with ultrasonography and mammography. Our study also showed the same results which are correlating with the above studies.

LIMITATION

The main limitation in our study is the low sample volume. In most of the previous studies the sample size was more than hundred,where as in our study it was fifty one.

CONCLUSION

Elastography has more specificity and positive predictive value compared to mammography and ultrasonography. Elastography has similar diagnostic performance as ultrasonography. Elastography is easy and rapid to perform and can be done along with ultrasonography in the same sitting. Elastography can be used as an adjunct to ultrasonography in detecting malignant breast lesions. Elastography is more specific for lesions <2cm in size. As elastography has high specificity in detecting malignant breast lesions unnecessary benign biopsies can be prevented.

REFERENCES

[1] Gokhale S. Ultrasound characterization of breast masses. Indian J Radiol Imaging. 2009;19:242-47.
[2] Popli M. Physiology, pathology and imaging of the young breast. Indian J Radiol Imaging. 2000;10:147-51.
[3] Popli MB. Pictorial essay: Sonographic differentiation of solid breast lesions. Indian J Radiol Imaging. 2002;12:275-79.
[4] Shetty MK, Shah YP, Sharman RS. Prospective evaluation of value of combined mammographic and sonographic assessment in patients with palpable abnormalities of breast . J Ultrasound Med. 2003;22(3):263-68.
[5] Berg WA, Cosgrove DO, Doré CJ, Schäfer FK, Svensson WE, Hooley RJ. et al. Shear-wave elastography improves the specificity of breast US: the BE1 multinational study of 939 masses. Radiology. 2012;262(2):435-49.
[6] Itoh A, Ueno E, Tohno E, Kamma H, Takahashi H, Shiina T, et al. Breast disease: Clinical application of US elastography for diagnosis. Radiology. 2006;239:341-50.
[7] Zhi H, Ou B, Luo BM, Feng X, Wen YL, Yang HY.Comparision of ultrasound elastography, mammography and sonography in diagnosis of solid breast lesions. J Ultrasound Med. 2007;26(6):807-15.
[8] Liberman L, Abramson AF, Squires FB, Glassman JR, Morris EA, Dershaw DD. The Breast Imaging Reporting and Data System: Positive predictive value of mammographic features and final Assessment Categories. AJR Am J Roentgenol. 1998;171(1):35-40.
[9] Tardivon A, El Khoury C, Thibault F, Wyler A, Barreau B, Neuenschwander S. Elastography of the breast: a prospective study of 122 lesions. J Radiol. 2007;88(5 Pt 1):657-62.
[10] Costantini M, Belli P, Lombardi R, Franceschini G, Mulè A, Bonomo L. Characterization of solid breast masses and use of the sonographic Breast Imaging Reporting and Data System Lexicon. J Ultrasound Med. 2006;25(5):649-59
[11] Thomas A, Fischer T, Frey H, Ohlinger R, Grunwald S, Blohmer JU, et al. Real-time elastography-an advanced method of ultrasound: First results in 108 patients with breast lesions. Ultrasound Obstet Gynecol. 2006;28:335-40.
[12] Raza S, Odulate A, Ong EMW, Chikarmane S, Harston CW. Real time elastography in the evaluation of breast masses. J Ultrasound Med. 2010;29(4);551-63.
[13] Giuseppetti GM, Martegani A, Di Cioccio B, Baldassarre S. Elastosonography in the diagnosis of the nodular breast lesions: Preliminary report. Radiol Med. 2005;110:69-76.

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