



Original Research Article

Role of spectral doppler in evaluation of palpable breast masses in co-relation with ultrasound guided FNAC

Jeevika MU¹, Mahesh BG^{1,*}, Harikiran Reddy¹, Yashas Ullas L²,
Mounisha Kethineni¹

¹Dept. of Radiodiagnosics, JJM Medical College, Davangere, Karnataka, India

²Dept. of Radiodiagnosics, Sri Devaraj Urs Medical College, Kolar, Karnataka, India



ARTICLE INFO

Article history:

Received 05-02-2021

Accepted 21-04-2021

Available online 24-11-2021

Keywords:

Breast ultrasound

Resistive index

Pulsatility index spectral doppler and

Ultrasound guided FNAC.

ABSTRACT

Background: Breast disease is one of the most common complaints of females belonging to any age group. The breast masses range from benign to malignant. Breast carcinoma is the second most common cause of mortality in females. Therefore, early diagnosis is important for better management. The aim of this study is to assess the value of flow velocity and RI, in evaluating solid breast masses, to compare it with pathology results, and to determine specific gray scale characteristics with Doppler parameters of lesion with FNAC correlation in differentiating benign from malignant lesions.

Materials and Methods: This prospective study was conducted at Department of Radio-Diagnosis, Bapuji Hospital & Chigatere General Hospital, Davangere attached to Jaya Jagadhguru Murugarajendra Medical College, Davangere. Total number of subjects selected for the study was 50 patients of age ranging between 17-56 years. Initially sonography was performed and data was obtained. Then tissue diagnosis was obtained in all 50 cases and final diagnosis was obtained. Patients who are referred to ultrasound with palpable breast masses were included in this study. The detailed physical and clinical examination was done for all the study subjects, in addition to sonography and histopathological examination. In this study all US examinations were performed with a 6-13 MHz high frequency linear-array transducer of voluson E6 model. FNAC/Surgical Biopsy of these ultrasonographically detected breast lesions were done. FNAC of breast lesions were done under ultrasound guidance. FNAC was avoided in those patients with prolonged BT, CT, PT and decreased platelets counts. After correction of these abnormalities, patients were subjected to FNAC.

Results: In the present study, spectral doppler shows sensitivity of 92% and specificity of 96% in diagnosing breast lesions when compared with FNAC. In the present study, benign tumor was seen in 26 cases and malignant tumor was observed in 24 cases. Compared with benign, malignant tumor showed significantly increased RI, PI and Vmax. USG diagnosis of Palpable Breast Masses showed that, carcinoma was seen in 23 (46%), Fibroadenoma 14 (28%), Abscess and Phyllodes Tumour in 5 (10%) cases each and Galactocoele in 1 (2%) case. In the current study, FNAC diagnosis of palpable breast masses showed that, Fibroadenoma in 16 (32%) cases, IDC in 13 (26%) cases, IDC with Metastatic Lymphadenopathy and Carcinoma in 5 (10%) cases each, Abscess in 3 (6%), Galactocoele and lipoma in 2 (4%) cases each, Benign Papillary Neoplasm and Infiltrating Ductal Carcinoma G-II in 1 (2%) case each. Clinical diagnosis of palpable breast masses showed that, carcinoma was observed in 27 (54%) cases, Fibroadenoma 20 (40%) cases, Galactocoele in 2 (4%) cases and Metastalgia in 1 (2%) cases.

Conclusion: Ultrasound with colour Doppler is safe, relatively inexpensive, widely available, free of radiation hazards, non-invasive essential modality for evaluation of breast lesions and should be one of the first investigations for evaluating a breast lesion before proceeding to aggressive invasive procedures.

This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](https://creativecommons.org/licenses/by-nc-sa/4.0/), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprint@ipinnovative.com

1. Introduction

Breast cancer is the leading cause of deaths (15%) among females in developed and developing countries worldwide, with over 1 million new cases in the world each year. Though breast cancer is thought to be a disease of developed countries, the 50% of cases and 58% of deaths occur in developing countries. Detection of cancer in the early stage can improve the survival of patients and cancer control can be achieved.¹

According to WHO in India about 1 lakh new patients with breast cancer are diagnosed annually and an estimated 70,218 Indian women die due to breast cancer every year. Early diagnosis of breast cancer remains to be pivotal in reducing the number of deaths due to breast cancer. FNAC of breast masses was first introduced by Martin and Ellis long back in 1930 and this can be used for diagnosis of breast lesions.²

Age standardised cancer mortality trends was found highest for breast cancer when compared to all other cancers in India. Breast cancers usually presents as a lump or mass in the breast. It is a major concern to the patient and it need to be evaluated as early as possible.³ “Lump” in breast, is therefore, a cause of great anxiety both to the patient and family members. The main motive behind the evaluation of such a newly detected palpable lump is basically to rule out malignancy. Evaluation of breast lumps involves the rational use of a detailed history, clinical breast examination, imaging modalities and tissue diagnosis.⁴

Though the final diagnosis is made by histopathological examination of the excised tissue, routine excision of all breast lumps would not be rationale, because as much as 80% of lumps are benign. Thus the need is the utilisation of less invasive and cost effective method(s) of diagnosis without resorting to a more painful and invasive surgical biopsy. The modality should also be acceptable to the patient, accurate, easy to apply, reproducible and must not need too much preparations.⁵

Given the common occurrence of breast cancer and the importance of accurately diagnosing a clinically palpable breast lump, with non-invasive techniques without routinely resorting to formal biopsy which is much invasive, the study is proposed to evaluate the accuracy of Ultrasonography (USG) and Fine Needle Aspiration Cytology (FNAC) in the diagnosis of newly detected clinically palpable breast lumps in comparison to the final histopathological (HPE) report of the biopsied specimens. Although the accuracies of FNAC and Ultrasonography in the diagnosis of breast lumps have been tested individually in other studies, study comparing FNAC and Ultrasonography using upon the same population is not reported in literature. Our study is designed to compare the results of FNAC and Ultrasonography in the diagnosis of newly detected clinically palpable breast lumps

in the same population.⁶ There is a need to correlate the radiological and cytological findings of breast lesions with histopathological diagnosis to evaluate the diagnostic accuracy of sonomammography and breast FNAC. Study aimed to correlate radiological and cytological findings of breast lesions with histopathological diagnosis.

2. Materials and Methods

This prospective study was conducted at Department of Radio-Diagnosis, Bapuji Hospital & Chigatere General Hospital, Davangere attached to Jaya Jagadhguru Murugarajendra Medical College, Davangere. The duration of study was December 2018 to September 2020. The study has been approved by the Institutional Ethics Committee of JJM Medical College.

Total number of subjects selected for the study was 50 patients of age ranging between 17-56 years. Initially sonography was performed and data was obtained. Then tissue diagnosis was obtained in all 50 cases and final diagnosis was obtained. Patients who are referred to ultrasound with palpable breast masses were included in this study. Already diagnosed cases and patients not willing to give consent were excluded from the study. The detailed physical and clinical examination was done for all the study subjects, in addition to sonography and histopathological examination. In this study all US examinations were performed with a 6-13 MHz high frequency linear-array transducer of voluson E6 model. FNAC/Surgical Biopsy of these ultrasonographically detected breast lesions were done. FNAC of breast lesions were done under ultrasound guidance. FNAC was avoided in those patients with prolonged BT, CT, PT and decreased platelets counts. After correction of these abnormalities, patients were subjected to FNAC.

2.1. Statistical analysis

Categorical data was represented in the form of frequency and percentage. Chi Square test was used to know the association between variables and Fisher's exact test for all 2 x 2 tables where P value of chi square test was not valid due to small counts. Quantitative data was represented as Mean±SD. Analysis of quantitative data was done using unpaired t-test. Histopathological findings were correlated with ADC values for diagnoses. Sensitivity, specificity, positive predictive validity, negative predictive validity accuracy of the test findings will be calculated. ROC curve will be applied to know the area covered for the accuracy. P-value of <0.05 was considered statistically significant. Analysis was done by using IBM SPSS software Version 22.

* Corresponding author.

E-mail address: maheshgurappa18@gmail.com (Mahesh BG).

3. Results

In the present study, receiver operating curve (ROC) for USG suggest the excellent sensitivity with 92% and with specificity with 96% in diagnosing breast lesions is shown when compared with FNAC which is considered as gold standard (Table 1).

In the present study, it was found that mean score of malignant cases found significantly higher than benign cases.

In the present study, benign tumor was seen in 26 cases and malignant tumor was observed in 24 cases. Compared with benign, malignant tumor showed significantly increased RI, PI and Vmax (Table 2).

In the present study, USG diagnosis of Palpable Breast Masses showed that, carcinoma was seen in 23 (46%), Fibroadenoma 14 (28%), Abscess and Phyllodes Tumour in 5 (10%) cases each and Galactocoele in 1 (2%) case (Table 3)

In the current study, FNAC diagnosis of palpable breast masses showed that, Fibroadenoma in 16 (32%) cases, IDC in 13 (26%) cases, IDC with Metastatic Lymphadenopathy and Carcinoma in 5 (10%) cases each, Abscess in 3 (6%), Galactocoele and lipoma in 2 (4%) cases each, Benign Papillary Neoplasm and Infiltrating Ductal Carcinoma G-II in 1 (2%) case each (Table 4).

In the present study, Clinical diagnosis of palpable breast masses showed that, carcinoma was observed in 27 (54%) cases, Fibroadenoma 20 (40%) cases, Galactocoele in 2 (4%) cases and Metastalgia in 1 (2%) cases (Table 5).

4. Discussion

Patients with palpable breast masses commonly present for imaging evaluation.⁷ Breast cancer is the most common cancers in the world among women.¹ Fine Needle Aspiration Cytology (FNAC) for the diagnosis of breast masses. FNAC of breast lump is now a well-established modality for accurately determining the nature of breast lumps. Ultrasound is also useful in evaluation of breast lesions. Breast ultrasound is now a well-established method and several studies have suggested that sonomammography can be useful in differentiating between benign and malignant lesions presenting as breast masses.⁸

The purpose of this study was to compare the result of breast FNAC and breast ultrasound with histological diagnosis to assess its diagnostic accuracy. Early screening and diagnosis of breast lesions and categorization into different groups of breast pathology can be helpful in accurate management of the breast lesions. In a study done by Wasan et al breast ultrasound had a sensitivity of 100%, specificity of 91.6 which is comparable to our study in which the sensitivity was 90.6% and specificity was 97.8%. Benign lesions of the breast were more readily diagnosed by ultrasound than malignant lesions.⁹

According to Nandan Kumar et al the sensitivity and specificity of breast ultrasound in categorising breast lesions as benign and malignant was 85.4% and 89.31%, which is slightly lesser compared to our study.¹⁰ Studies done by Puja B. Jarwani et al¹¹ and Ambedkar Raj, Kulandai Velu et al,¹² showed that breast FNAC had a sensitivity ranging from 82% to 97.5% and specificity of more than 99%, which is comparable to our study. Study done by Shanmugasamy K et al showed that the sensitivity, specificity and diagnostic accuracy of breast FNAC in diagnosis of malignancy was 93.5%, 100% and 98.3% respectively.

Mammography and sonography have been used in attempt to reduce the biopsy rate. However, mammography has not yet become widely available, is time consuming, costly and presents with radiation hazards. Hence, now a days the technique of breast ultrasonography is evolving as a new modality in diagnosis and management of breast diseases. In the present study fibroadenoma accounted for maximum number of cases i.e. 16 (32%).

Starvas AT et al studied 750 breast lesions and fibroadenoma accounted for 338 (48%) of all lesions.¹³ Fibroadenoma represents the most common benign tumour of young age group. Freely mobile mass (mouse in breast) is its classical presentation. In the present study, 18 cases were below 30 years of age. Fornage et al. studied sonographic patterns of 100 fibroadenomas, 71% of the lesions were homogenous, whereas 295 showed a variable degree of texture inhomogeneity, 90% were hypoechoic, 4% hyperechoic, 2% had mixed pattern, 1% anechoic and 1% isoechoic.¹⁴

In the present study, out of 16 fibroadenoma, 12 (75%) were hypoechoic and 4(25%) were of mixed echogenicity. In the same study, 57% of the lesions had regular margins, 16% had lobulated margins, whereas 25% had irregular margins. In the present study, out of 16 fibroadenomas, 12 (75%) had regular margins and 4(25%) had lobulated margins. In 1983, Beuglet C et al. Studied 2000 sonomammograms, 73% of the lesions showed acoustic enhancement.¹⁵

The present study, out of 3 cases of breast abscess, 2 were lactating mothers and 1 was post-traumatic. All 3 cases were hypoechoic, with irregular and ill-defined margins, internal echoes and showed posterior acoustic enhancement. Ultrasound guided aspiration was done in all 3 cases. In 1 case, abscess was drained surgically and findings were confirmed. Phyllodes tumour tends to occur at around 30 years of age. In the present study, 2 cases of phyllodes tumour were encountered. The present study, two cases of lipoma were studied. It was diffuse homogeneous mass lesion with echogenicity higher than normal breast. Soskia et al. performed 500 breast examination, out of which 18% were non-palpable and 8% were palpable masses. In their study they found that lipoma had medium level, homogeneous echoes with thin peripheral capsules.¹⁶

Table 1: Area under the curve forUSG

Area	Std. Error	Asymptotic (p-value)	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.940	.039	.000	.863	1.000

Table 2: Means score comparison of Age, RI, PI andVmax among benign and malignant

	Group	N	Mean	Std. Deviation	Mean Difference
Age (years)	Benign	26	34.5	15.1	-18.96
	Malignant	24	53.5	8.9	p-value=.000*
RI	Benign	26	.60	.07	-.16
	Malignant	24	.77	.08	p-value=.000*
PI	Benign	26	.83	.21	-.65
	Malignant	24	1.4	.21	p-value=.000*
V max (ms-1)	Benign	26	.09	.05	-.20
	Malignant	24	.29	.08	p-value=.000*

*statistically significant

Table 3: USG diagnosis of palpable breast masses

USG Diagnosis	Frequency	Percent
Abscess	5	10.0
Carcinoma	23	46.0
Fibroadenoma	14	28.0
Galactocoele	1	2.0
Lipoma	2	4.0
Phyllodes Tumour	5	10.0
Total	50	100.0

Table 4: FNAC diagnosis of palpable breast masses

FNAC Diagnosis	Frequency	Percent
Abscess	3	6.0
Benign Papillary Neoplasm	1	2.0
Fibroadenoma	16	32.0
Galactocoele	2	4.0
Lipoma	2	4.0
Phyllodes Tumor	2	4.0
IDC	13	26.0
IDC with Metastatic Lymphadenopathy	5	10.0
Infiltrating Ductal Carcinoma G-II	1	2.0
Carcinoma	5	10.0
Total	50	100.0

Table 5: Clinical diagnosis of palpable breast masses

Clinical Diagnosis	Frequency	Percent
Carcinoma	27	54.0
Fibroadenoma	20	40.0
Galactocoele	2	4.0
Metastalgia	1	2.0
Total	50	100.0

Infiltrating ductal carcinoma is the most common and lethal form of breast cancer accounting for 65-85% of invasive cancer. In the present study we came across 24 (44%) malignant lesions, out of which 13 are IDC, 5 are IDC with metastatic lymphadenopathy, 1 is IDC with grade II and 5 are other carcinomas.

Power Doppler sonography was performed with color box adjusted to include the lesion and a small margin of normal breast tissue. The color sensitivity was adjusted so that only the background color was suppressed and small vessels could be detected. During the exploration, care was taken to apply as little pressure as possible with the probe to prevent vessels from collapsing. The exploration with power Doppler sonography was considered positive if atleast one vessel was depicted within the lesion and it showed an arterial flow pattern when pulsed Doppler imaging was used. If intralesional vascularization was detected then pulse wave Doppler sonography was performed to obtain spectral waveforms. The resistive index (RI) and pulsatility index (PI) were calculated for all these waveforms. The RI value is calculated as (peak systolic velocity (PSV) - end diastolic velocity (EDV) / PSV. The PI values was calculated as (peak systolic velocity – minimum diastolic velocity)/ (mean velocity). The calculations were done automatically using the equipment's inbuilt software. In our study, RI values equal to or greater than 0.67 and PI values greater than 0.85 were considered significant.

5. Conclusion

Ultrasound is a safe and effective method for evaluation of breast lesion. In maximum number of cases the synchronized evaluation and characterization of breast lesion by ultrasound will help in overall assessment of breast lesions. Taking into consideration the physical findings and the woman breast cancer risk profile (age, personal history, family history of breast cancer) along with sonographic features of breast lesion will help in reaching a probable diagnosis of the lesion and play a vital role in management of the patient. Non-invasive procedure like ultrasound is essential before proceeding to invasive procedures. The identification of common lesion like breast cyst by ultrasound which has a diagnostic accuracy of 100% obviates the need for any further intervention.

Among remaining lesions, even slightly doubtful features on ultrasound should be subjected to histological diagnosis as ultrasound cannot accurately differentiate all benign lesions from malignant lesions. Management of a solid breast lesion depends on its ultrasonographic features whether to go for FNAC/BIOPSY or follow-up sonomammography.

In colour Doppler study of solid lesions, a greater number of malignant lesions showed vascularity as compared to benign lesions. But even presence of vascularity cannot be used as a definite criterion to diagnose a lesion as malignant

as some benign lesions do show vascularity. Ultrasound and colour Doppler though not 100% accurate in differentiating benign from malignant lesion, when grey scale findings are used along with colour Doppler, will definitely help the clinician to decide the further management of the lesion. Thus, ultrasound with colour Doppler is safe, relatively inexpensive, widely available, free of radiation hazards, non-invasive essential modality for evaluation of breast lesions and should be one of the first investigations for evaluating a breast lesion before proceeding to aggressive invasive procedures.

6. Sources of Funding

No financial support was received for the work within this manuscript.

7. Conflicts of Interest

No conflicts of interest.

References

- Gupta K, Chandra T, Kumaresan MH, Venkatesan B, Patil AB. Role of Colour Doppler for Assessment of Malignancy in Solid Breast Masses: A Prospective Study. *Int J Anat Radiol Surg*. 2017;6(1):59–65.
- Anto J, Richie, Mellonie P. Radiological and Cytological Correlation of Breast Lesions with Histopathological Findings in a Tertiary Care Hospital in Coastal Karnataka. *Int J Contemp Med Res*. 2019;6(2):1–4.
- Krithika S, Ilangovan G, Balganesan H, Pavithra A. Ultrasound evaluation of palpable breast masses in correlation with fine needle aspiration cytology. *Int J Contemp Med Surg Radiol*. 2020;5(2):27–33.
- Pruthi S. Detection and evaluation of a palpable breast mass. *Mayo Clin Proc*. 2001;76(6):641–7. doi:10.4065/76.6.641.
- Tiwari M. Role of fine Needle aspiration cytology in diagnosis of breast lumps. *Kathmandu Univ Med J*. 2007;5(2):215–7.
- Takhellambam YS, Lourembam SS, Sapam OS, Kshetrimayum RS, Ningthoujam BS, Khan T, et al. Comparison of Ultrasonography and Fine Needle Aspiration Cytology in the Diagnosis of Malignant Breast Lesions. *J Clin Diagn Res*. 2013;7(12):2847–50.
- Tiwari P, Ghosh S, Agrawal VK. Evaluation of breast lesions by digital mammography and ultrasound along with fine-needle aspiration cytology correlation. *J Can Res Ther*. 2018;14(5):1071–4.
- Heinig J, Witteler R, Schmitz R, Kiesel L, Steinhart J. Accuracy of classification of breast ultrasound findings based on criteria used for BI-RADS. *Ultrasound Obstet Gynecol*. 2008;32(4):573–8. doi:10.1002/uog.5191.
- Al-Saadi WI, Ahmed BS, Mahdi QA, Qader I, Idrees Y. Non Palpable Breast Mass. *Mustansiriyah Med J*. 2011;15(1):20–4.
- Kumar N, Shilpa N. Mammographic and Sonomammographic evaluation of Breast Masses with pathological correlation. *Innovative Journal of Medical and Health Science*. 2016;6:132–135.
- Jarwani PB, Patel DC, Patel SM, Dayal A, Dayal A. Fine Needle Aspiration Cytology in a Palpable Breast. *GCSMC J Med Sci*. 2013;2(2):1–5.
- Shanmugasamy K, Vaithy KA, Bhavani K, Kotasthane DS. Cytological evaluation of benign breast lesions with Histopathological correlation. *Indian J Pathol Oncol*. 2016;3(2):328–35.
- Stavros AT, Thickman D, Rapp CL, Dennis MA, Parker SH, Sisney GA, et al. Solid breast nodules: use of sonography to distinguish between benign and malignant lesions. *Radiology*. 1995;196(1):123–34. doi:10.1148/radiology.196.1.7784555.

14. Fornage BD, Toubas O, Morel M. Clinical, mammographic, and sonographic determination of preoperative breast cancer size. *Cancer*. 1987;60(4):765–71. doi:10.1002/1097-0142(19870815)60:4<765::aid-cnrcr2820600410>3.0.co;2-5.
15. Beuglet C, Soriano RZ, Kurtz AB, Goldberg BB. Fibroadenoma of the breast: Sonomammography correlated with pathology in 122 patients. *Radiology*. 1983;140:369.
16. Hilton S, Leopold G, Olson LK, Wilson SA. Real time breast sonography: Application in 300 consecutive patients. *AJR*. 1986;147:479–86. doi:10.2214/ajr.147.3.479.

Mahesh BG, Post Graduate Student

Harikiran Reddy, Associate Professor

Yashas Ullas L, Post Graduate Student

Mounisha Kethineni, Post Graduate Student

Author biography

Jeevika MU, Professor and HOD

Cite this article: Jeevika MU, Mahesh BG, Reddy H, Ullas L Y, Kethineni M. Role of spectral doppler in evaluation of palpable breast masses in co-relation with ultrasound guided FNAC. *Panacea J Med Sci* 2021;11(3):527-532.