DOI: 10.7860/IJARS/2016/20371:2148

Original Article

Radiology Section

Mammographic and Sonomammographic Evaluation of Breast Masses with Pathological Correlation: A Prospective Original Study

JAIPAL R BEERAPPA, BALU S, NANDAN KUMAR L D, ANURADHA KAPALI, RAGHURAM P

ABSTRACT

Introduction: Breast lumps are common problem affecting females, which require proper workup, early diagnosis and treatment. Mammography is used as both screening modality and as an efficient technique to evaluate clinically suspected breast lesions. High-resolution sonography is a adjunct modality used in detecting lesions in dense breast and supplementary assessment of breast lesions.

Aim: To determine the sensitivity, specificity, PPV, NPV of mammography, sonomammography and both modalities together combined in assessment of breast lesions.

Materials and Methods: One hundred and two palpable or suspicious breast masses from 97 patients were evaluated with sonomammography, mammography and were correlated with appropriate pathological examination. Sensitivity, specificity, positive predictive, negative predictive values and accuracy were computed for mammography, sonomammography and combined tests. Characteristics of mammography and sonomammography of breast lesions which help to differentiate benign from malignant lesions are assessed.

Results: Combining the mammography and USG, sensitivity, specificity, PPV, NPV were 92.22%, 98.02%, 92.99% and 86.2% respectively. The study showed that there was no significant difference in sensitivity between mammography and USG (p=0.23). But there was a significant difference in mammography alone and mammography USG combination (p=0.002) and USG alone and combination (p=0.0015).

Conclusion: Combined mammographic, sonomammographic evaluation of breast masses was more accurate than either method alone. Irregular shape, high density, spiculated margins, microcalcification, posterior acoustic shadowing, heterogeneously hypoechoic nature, internal vascularity and associated features like skin, nipple thickening and retraction favor malignancy. Oval shape, surrounding halo, wider than tall lesion, anechoic or homogenously hypoechoic lesion with posterior acoustic enhancement favor benign lesion.

Keywords: Benign, Malignant breast lesions, Sensitivity, Specificity.

INTRODUCTION

Breast lumps are common problem affecting females, which require proper workup, early diagnosis and treatment. According to GLOBOCAN (WHO), 70218 women died in India due to breast cancer in the year 2012, , more than any other country in the world [1]. Hence, a palpable mass in a woman's breast requires proper evaluation and appropriate imaging [2].

The established management of palpable breast lesions includes the triple assessment, which includes physical examination, imaging and fine needle aspiration or core biopsy [3]. Mammography is cost efficient and accepted technique for evaluation of clinically suspected breast lesions, it is also used for screening of breast cancer [2]. High-resolution sonography is a useful modality that helps to additionally evaluate breast lesions and also helps to characterize a mammographically non-detected palpable abnormality in dense breast [4].

Therefore a study was conducted to evaluate the role of ultrasound and mammography in diagnosing breast lesions individually and when combined. Also, to assess the mammographic and sonomammographic characteristics of benign and malignant breast lesions.

MATERIALS AND METHODS

This was a prospective study, conducted in a tertiary referral hospital. Total 102 palpable or suspicious breast masses from 97 patients were evaluated with sonomammography, mammography and assigned a BI-RADS (Breast Imaging-Reporting and Data System) category findings were correlated with appropriate pathological examination Fine Needle Aspiration Cytology (FNAC) or histopathology (HPE). The study period was for two years from October 2013 to September 2015. Informed consent was obtained from all the patients. Ethical committee approval was obtained for the study. The patients with palpable lump, clinically suspected breast lesions, breast complaints like nipple discharge, retraction, skin thickening were included in the study. The patients in whom complete work up was not possible (mammogram, sonomammogram and FNAC/ HPE) were excluded from the study.

STATISTICAL ANALYSIS

Descriptive statistics were reported using mean and standard deviation for continuous variables, number and percentages for categorical variables. Cross tabs were done between USG (Ultrasonography), Mammography with HPE for various outcomes. Sensitivity, specificity, positive predictive negative predictive values and accuracy were computed for each outcome.

McNemar chi-square test was done to compare the proportions of various tests. The p-value less than 0.05 was considered statistically significant. All the analyses were performed using SPSS version-18.

RESULTS

Out of 102 cases, 55 cases were diagnosed as benign, 47 were diagnosed as malignancy. Fibroadenomas were most common 27 (26.5%) amongst benign lesions followed by fibrocystic disease 10 (9.8%) and cyst 7 (6.67%). There were 3 cases each of papilloma, phyllodes and inflammatory mastitis. Radial scar and seroma accounted to single case each. Pathologically malignant lesions included atypical ductal hyperplasia (ADH), ductal carcinoma in situ (DCIS), infiltrating ductal carcinoma, lobular carcinoma, papillary carcinoma and inflammatory carcinoma.

Out of 102 cases, mammography could pick up 78 lesions. Amongst 78 cases, 32 were benign and 46 were malignant. In 24 cases, mammography was normal or negative for lesions. On pathological correlation, 2 out of 32 benign lesions were malignant. 42 out of 46 malignant lesions on mammography were correctly diagnosed as malignant. 3 malignant and 21 benign cases were missed in mammography.

Out of 102 cases, Ultrasonography (USG) could pick up 99 lesions. Amongst 99 cases, 48 were benign and 51 were malignant. In 3 cases, USG was normal or negative for lesions. On pathological correlation, 3 out of 53 benign lesions were malignant. 43 out of 51 malignant lesions were correctly diagnosed as malignant. 3 malignant cases were missed in USG.

Combining the mammography and USG, sensitivity, specificity, PPV, NPV were 92.22%, 98.02%, 92.99% and 86.2% respectively [Table/Fig 1]. The study showed that there was no significant difference in sensitivity between mammography and USG (p=0.23). But there was a significant difference in mammography alone and mammography USG combination (p=0.002) and USG alone and combination (p=0.0015).

Modality	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)	Accuracy (%)
Mammo Benign	52.83	79.46	83.33	65.53	73.53
Mammo Malignant	92.45	89.80	90.74	91.67	91.18
Overall Mammo	74.24	84.21	86.12	79.23	81.89
Sonomammo Benign	94.91	93.88	93.15	85.12	89.22
Sonomammo Malignant	84.91	87.76	88.24	84.31	86.27
Overall Sonomammo	89.45	90.31	91.44	85.0	88.17
Combined Mammo And Sonomammo	92.22	98.02	92.99	86.2	

[Table/Fig-1]: Parameters depicting comparison of benign and malignant lesions by sonomammography.

DISCUSSION

Sensitivity of mammography is low for benign lesion especially in dense breasts and very small lesions. Sensitivity and specificity for malignant lesions are high because microcalcifications are better detected. Similar observations were seen study by Prasad et al., [5] and Sabine M et al., [6]. Sensitivity of mammography, sonomammography and combined mammography and sonomammography in identifying breast lesions is mentioned in [Table/Fig 1].

Sensitivity of sonomammography in detecting benign lesions was high because small cysts and fibroadenomas are better seen even in dense breasts and USG differentiates cyst from solid lesions. Specificity of USG in detecting malignant lesions was less as microcalcifications were not well seen in USG. These observations are similar to Prasad et al., [5], Texidor HS et al., [7].

Overall, sensitivity of USG was 89.45% with specificity of 90.31% and overall sensitivity and specificity of mammography was 74.24% and 84.21% respectively. Combining the mamm-

ography and USG, sensitivity and specificity were 92.22% and 98.02%, respectively.The study showed that there was no significant difference in sensitivity between mammography and USG (p=0.23). But there was a significant difference in mammography alone and mammography USG combination (p=0.002) and USG alone and USG mammography combination (p=0.0015) this is similar to many of the previous studies [5,8].

In our study age of patients ranged from 35 to 76 years. Family history of breast cancer was present in 27 (27.8%) patients, absent in 48 patients. 22 patients were not sure about the family history. Contralateral breast cancer was present in 20 patients, ovarian cancer in 5 patients and endometrial cancer in 2 patients. Size of lesions ranged from 5 mm to 58 mm.

Malignant lesions (80.4%) had commonly irregular shape. Oval shape was observed mainly in benign lesions (68.8%). Characteristic shapes of benign and malignant lesions were similar to description by Sickles EA [9].

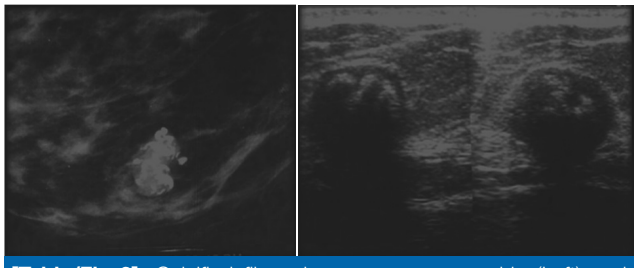
Most of the malignant lesions had high density (89%). Equal density was observed in many benign lesions (56.3%). In present study, none of the lesions had low density on mammography. Density of a mass is related to expected attenuation of equal volume of fibro glandular tissue [10]. These findings are in accordance with study by Prasad et al., [5].

Most of the malignant lesions had spiculated margin (71.8%). Circumscribed margins were usually associated with benign lesions (81.3%), similar to description by Sickles EA [9].

Focal asymmetry was present in malignant lesions (71.8%). Asymmetry was absent in many of the benign lesions (96.9%). Asymmetry is commonly observed with malignant lesions [7]. Architectural distortion was associated with most of the malignant cases (82.6%). Architectural distortion was absent in 96.9% of benign lesions.

Microcalcifications are characteristic of malignancy and 82.6% lesions with microcalcifications are proved to be malignant. Typically, benign calcifications like popcorn calcification, vascular calcification, eggshell, skin calcification are seen only in benign lesions [Table/Fig-2]. The calcification features are similar to many of the similar studies [5,9].

The associated features of malignancy appreciated were



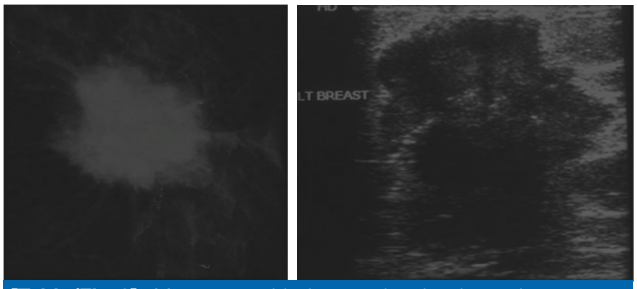
[Table/Fig-2]: Calcified fibroadenoma mammographic (Left) and ultrasound (Right) images showing typically benign calcifications

trabecular thickening, skin thickening, ductal changes, skin retraction and nipple retraction and was present in 47.43% cases [10].

Surrounding halo was present in 68.8% of benign lesions and absent in 95.7% of malignant lesions.

Benign lesions were wider than tall in 62.3% and 80.4% malignant lesions were taller than wide. Most of the fibroadenomas were wider than tall and most of the malignant lesions were taller than wide. Orientation of the lesion is not applicable to round shaped lesions. These features are in accordance with Prasad et al., [5], Buchburger et al., [11] and Calas et al., [12].

All anechoic lesions were proved to be benign (simple cysts), similar to study by Berg et al., [13] and Mainiero MB et al., [14]. Many of hypo- heterogenous lesions are proved to be malignant [Table/Fig-3] and homogenous hypoechoic lesions were benign [15].



[Table/Fig-3]: Mammographic image showing hyperdense mass with irregular shape and spiculated margins (left). USG images showing irregular heterogeneously hypoechoic lesion (right) consistent with malignant lesion.

Posterior acoustic enhancement is associated with benign lesions (43.4%) whereas shadowing is more commonly associated with malignant lesions (60.9%). Combined pattern seen in both benign and malignant lesions (20%). These features are in accordance with Prasad et al., [5].

Internal vascularity is generally a feature of malignancy and was present in 87% of malignant lesions. Vascularity is absent in majority (69.8%) of benign lesions.

Thus, combined mammographic, sonomammographic evaluation of breast masses was more accurate than either method alone and irregular shape, high density, spiculated margins, microcalcification, posterior acoustic shadowing, heterogeneously hypoechoic nature, internal vascularity and associated features like skin, nipple thickening and retraction favor malignancy.

LIMITATIONS

The study was done in a tertiary oncology referral hospital as a result some of the cases were already advanced at the time of evaluation. There was more number of malignant cases than benign for the same reason.

CONCLUSION

Combined mammographic, sonomammographic evaluation of breast masses was more accurate than either method alone. USG is better in cystic lesions, ectasias and small fibroadenomas. Sonomammography has added advantage in guiding FNAC and biopsies. Mammography is better in detecting microcalcifications and early detection of occult malignancies. The sensitivity of mammography decreases in denser breasts.

Irregular shape, high density, spiculated margins, micro-calcification, posterior acoustic shadowing, heterogeneously hypoechoic nature, internal vascularity and associated features like skin, nipple thickening and retraction favor malignancy. Oval shape, surrounding halo, wider than tall lesion, anechoic or homogenously hypoechoic lesion with posterior acoustic enhancement favor benign lesion.

REFERENCES

[1] Breast cancer, India [Internet]. [Place unknown]: Breast cancer India; 2014: Available from http://www.breastcancerindia.net

[2] Barton MB, Elmore JG, Fletcher SW. Breast symptoms among women enrolled in a health maintenance organization: frequency, evaluation, and outcome. *Ann Intern Med*. 1999;130:651-79.

[3] Gonzaga MA. How accurate is ultrasound in evaluating palpable breast masses? *Pan Afr Med J*. 2010; 7:1.

[4] Donegan WL. Evaluation of a palpable breast mass. *N Engl J Med.* 1992;327(13):937-42.

[5] Prasad SN, Houserkova D. A comparison of mammography and ultrasonography in the evaluation of breast masses. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub.* 2007;151(2):315-22.

[6] Sabine M, Susanne W and Achim S. Comparison of written reports of mammography, sonography and magnetic resonance mammography for preoperative evaluation of breast lesions, with special emphasis on magnetic resonance mammography. *Breast Cancer Res*. 2001;3(1): 55-80.

[7] Teixidor SH, Kazam E. Combined mammographic and sonomammographic evaluation of breast masses. *AJR Am J Roentgenol*. 1977; 128:409–17.

[8] Shetty MK, Shah YP, Sharman RS. Prospective evaluation of combined mammographic and sonographic assessment in patients with palpable abnormalities of breast. *J Ultrasound Med*. 2003;22:263-68.

[9] Sickles EA. Mammographic features of 300 consecutive non-palpable breast cancers. *AJR Am J Roentgenol*. 1986; 146(4):661–63.

[10] Zonderland H, Smithuis R. Bi-RADS for mammography and ultrasound 2013. Radiology Assistant [Internet]. [Place unknown]: [Publisher unknown]; oct 2014. Available from: http://www.radiologyassistant.nl/en/p53b4082c92130/bi-rads-for-mammography- and-ultrasound-2013.html.

[11] Buchberger W, Dekoekkoek-Doll P, Springer P, Obrist P, Dünser M. Incidental findings on sonography of the breast: clinical significance and diagnostic workup. *AJR Am J Roentgenol*. 1999;173:921–27.

[12] Julia M, Calas G, Koch HA, Virginia M, Dutra P. Breast ultrasound: evaluation of echographic criteria for differentiation of breast lesions. *Radiol Bras*. 2007;40(1):01–07.

[13] Berg WA, Campassi CI, Ioffe OB. Cystic lesions of the breast: sonographic- pathologic correlation. *Radiology*. 2003;227:183–91.

[14] Mainiero MB, Goldkamp A, Lazarus E, Livingston L, Koelliker SL, Schepps B, et al. Characterization of breast masses. *J Ultrasound Med*. 2005;24:161–67.

[15] Adrada B, Wu Y, Yang W. Hyperechoic lesions of the breast: radiologic- histopathologic correlation. *AJR Am J Roentgenol.* 2013; 200(5):518-30.

AUTHOR(S):

1. Dr. Jaipal R Beerappa
2. Dr. Balu S
3. Dr. Nandan Kumar L D
4. Dr. Anuradha Kapali
5. Dr. Raghuram P

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Radiodiagnosis, Kidwai Memorial Institute of Oncology, Bangalore, Karnataka, India.
2. Associate Professor, Department of Pathology, Kidwai Memorial Institute of Oncology, Bangalore, Karnataka, India.
3. Resident, Department of Radiodiagnosis, Kidwai Memorial Institute of Oncology, Bangalore, Karnataka, India.
4. Assistant Professor, Department of Radiodiagnosis, Kidwai Memorial Institute of Oncology, Bangalore, Karnataka, India.
5. HOD and Professor, Department of Radiodiagnosis, Kidwai Memorial Institute of Oncology, Bangalore, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Jaipal R Beerappa,
Associate Professor, Department of Radiodiagnosis,
Kidwai Memorial Institute of Oncology, Bangalore,
Karnataka. 560029, India.
E-mail: brdrjaipal@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Publishing: **Jul 01, 2016**