

Efficiency of Ultrasonography and Fine Needle Aspiration Cytology in the Diagnosis of Breast Lumps in a Selected Population of Jammu and Kashmir

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ABSTRACT

Introduction: Breast cancer is considered to be one of the commonest cause of death among middle aged women worldwide. Ultrasonography and Fine Needle Aspiration Cytology (FNAC) have commonly been used to differentiate between malignant and benign breast masses. The aim of the present study was to compare the sensitivity, specificity and predictive values of ultrasonography and FNAC for the diagnostic accuracy of breast masses.

Material and Methods: This prospective study was based on 50 patients who were referred to the Department of Radiodiagnosis and Imaging, Government Medical College and Associated Hospitals, Srinagar, Jammu and Kashmir for evaluation of breast lesions. All Ultrasonographic examinations were performed with (iU22 Phillips) using a high frequency 7-10 MHz linear array transducer. Evaluation of breast masses was done with respect to shape, margins, width to anteroposterior dimension ratio, posterior echoes and echogenicity. Cytopathology was done in the form of fine needle aspiration cytology (FNAC) in all the cases as it is less invasive.

Results: The sensitivity, specificity, positive predictive value, negative predictive value and the diagnostic accuracy of Ultrasonography were 88.8%, 68.2%, 38.0%, 96.5% and 72% respectively.

Conclusions: Ultrasonography is useful in the characterization of breast masses. Thus it can be considered as an important diagnostic modality as it improves the specificity of the diagnosis for the majority of both malignant and benign breast nodules.

Keywords: Ultrasonography, Breast lumps, fine needle aspiration, diagnostic accuracy.

INTRODUCTION

Breasts are secondary sexual characteristic in females which are constantly under physical changes related to menstrual cycle, pregnancy, lactation and menopause under the influence of hormones.^{1,2} Breast cancer is the most common malignant neoplasm affecting women worldwide. It accounts for 20% of all cancers and is one of the commonest causes of death in middle aged women in the western world and In United Kingdom approximately 25,000 new cases are registered per year with a high mortality accounting for 15,000 deaths per annum. The leading cause of death among 40-44 year old women in United States is breast cancer. In India, it is the second most common type of cancer in women after cervical cancer. By 2020, it is set to overtake cervical cancer as the most common type of cancer.³ The importance of diagnostic accuracy of the breast lump lies in the fact that the breast cancer is one of the most treatable of all human malignancies. Among the diagnostic modalities, Ultrasonography (USG) plays a key role in differentiating cystic and solid masses. It is useful in the evaluation of palpable

masses not visible in radiographically dense breasts, abscesses, masses that are not completely evaluable with MG and in young patients susceptible to radiation damage.⁴

Ultrasound examination of the breast is indicated during First examination (before mammography or MRI) for the evaluation of a palpable lump in women under age 30 years, evaluation of a mass demonstrated on mammography, any focal asymmetry or focal change in architecture on the mammogram when compared with previous study performed after complete mammographic workup, suspicious finding requiring biopsy on MRI or a nuclear medicine study, guidance for intraoperative or percutaneous breast biopsy and aspiration, evaluation of breast implants, adjunctive examination to evaluate nipple discharge or to evaluate focal pain.^{5,6}

USG plays an important role in differentiating cystic and solid masses and aids in evaluation of palpable masses not visible in radiographically dense breasts, abscesses, masses that are not completely evaluable with MG and in young patients susceptible to radiation damage.⁴ Breast ultrasound requires high frequency transducers that are optimized for near field imaging. High resolution linear array, 7.5-12 MHz transducers are used, which are focused at 1.5-2.0 cm, an ideal focal length for breast ultrasound, minimizing volume averaging. It is performed in supine, contralateral posterior oblique position of the patient.^{7,8} Mammography being the primary imaging modality for the early detection of breast cancer, when used in conjunction with ultrasonography, can further increase the cancer detection rate. Although MRI has been shown to be more accurate than ultrasound for evaluation of silicone gel implant integrity⁹, it can be used as the initial evaluation.¹⁰

Fine needle aspiration (FNA) cytology has become widely accepted as a reliable diagnostic tool for diagnosis breast masses. It is a simple and safe method which yields high diagnostic performances.¹¹⁻¹³ FNAC is highly sensitive, specific, rapid, easy to perform, cost effective and can be carried out at OPD level.¹⁴ The present study was aimed to compare the sensitivity, specificity and predictive values of ultrasonography and fine needle aspiration cytology (FNAC) in the diagnosis of breast lumps.

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MATERIAL AND METHODS

This prospective study was conducted in the Department of Radiodiagnosis and Imaging, Government Medical College and Associated Hospitals, Srinagar, Jammu and Kashmir. Ethical approval was obtained from Institutional Review Board of the concerned Hospital and an informed consent was acquired from all the subjects who were willing to participate. The participation was voluntary after the aim of the present study was communicated to the participants. The study was based on 50 patients who were selected as a result of convenience sampling, referred to the Department of Radiodiagnosis and Imaging, Government Medical College and Associated Hospitals, Srinagar, Jammu and Kashmir for evaluation of breast lesions. A detailed breast specific history was taken including menstrual history, history of mastalgia, lactational history, past and family history of any breast problem.

All Ultrasonographic examinations were performed with iU22 Phillips using a high frequency 7-10 MHz linear array transducer. The scanning protocol included both transverse and longitudinal real time imaging of the breast masses with representative hard copy images acquired in each plane, particular attention was given to scanning patients in radial and antiradial planes. Evaluation of breast masses were done with respect to the shape (Oval, round, lobulated or irregular), margins (circumscribed, ill defined, spiculated or micro lobulated), width to anteroposterior dimension ratio, posterior echoes (enhanced, unaffected, decreased) and echogenicity (intensity of internal echoes).

American College of Radiology Breast Imaging Reporting and Data System (BIRADS) was used for establishing the final assessment category for each case. According to which, breast masses were categorized as benign (negative, benign or probably benign) or malignant (showing a suspicious abnormality or highly suggestive of malignancy). Fine needle aspiration cytology (FNAC) was used for cytopathologic evaluation.

STATISTICAL ANALYSIS

Data were entered into an Excel Sheet database (MS Office Excel 2000; Microsoft Corporation, Redmond, WA, USA). The Data was analyzed using descriptive statistics with the help of Minitab 16.1.1 version of statistical software.

RESULTS

Table-1 shows the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of various diagnostic modalities used in the evaluation of breast masses.

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of Ultrasonography were 88.8%, 68.2%, 38.0%, 96.5% and 72% respectively. Spiculation was seen in 44.4% of histologically proven malignant lesions. Margins were seen in 77.7% of histologically proven malignant lesions. Shadowing was seen in 44.4% of histologically proven malignant lesions and microlobulations were seen in 66.6% of histologically proven malignant lesions. Width to antero posterior dimension ratio (<1.4) was seen in 44.4% of histologically proven malignant lesions, 66.6% of Hypoechoic lesions proved to be malignant on histological diagnosis. Calcification was seen in 33.3% of histologically proven malignant lesions. Negative predictive value of Hyperechogenicity was 100%, Negative predictive value of Oval / Ellipsoid shape was 95.4%.

Findings	Ultra-Sonography	FNAC		Total	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value	Accuracy
		Benign	Malignant						
Ultrasonography	Benign	28	1	29	88.8%	68.2%	38.0%	96.5%	72%
	Malignant	13	8	21					
Spiculation	Spiculation Absent	40	5	45	44.4%	97.5%	80%	88.8%	88%
	Spiculation Present	1	4	5					
Angular margins	Angular margins absent	39	2	41	77.7%	95%	77%	95%	92%
	Angular margins present	2	7	9					
Width to a-p ratio	Ratio > 1.4	40	5	45	44.4%	97.5%	80%	88.8%	88%
	Ratio < 1.4	1	4	5					
Hypo-echogenicity	Hypoechoic Absent	38	3	41	66.6%	92.6%	66%	92.6%	88%
	Hypoechoic Present	3	6	9					
Shadowing	Shadowing Absent	39	5	44	44.4%	95%	66.6%	88.6%	86%
	Shadowing Present	2	4	6					
Micro-lobulations	Microlobulations Absent	35	3	38	66.6%	85.3%	50%	92%	82%
	Microlobulations Present	6	6	12					
Ellipsoid / oval shape	Ellipsoid shape Present	21	1	22	95.4%	-	28.5%	88.8%	-
	Ellipsoid shape Absent	20	8	28					
Hyper echogenicity	Hyper echogenicity Present	2	0	2	100%	-	18.7%	100%	-
	Hyper echogenicity Absent	39	9	48					

DISCUSSION

The present study was carried out in the Department of Radiodiagnosis and Imaging, Government Medical College and Associated Hospitals, Srinagar, Jammu and Kashmir over a period of one and a half year from March 2013 to July 2014. With the increased incidence of breast cancers every breast lump needs to be evaluated so as to assure the patient of its nature and the future course a certain lump may take. In addition the importance of diagnostic accuracy of the breast lump lies in the fact that the breast cancer is one of the most treatable of all human malignancies.

The breast US is an essential problem-solving tool in the breast radiologist's armamentarium as reported by Calas et al⁶, which observed that US of the breast successfully distinguished benign from malignant solid nodules. In our study the sensitivity, specificity, positive predictive value, negative predictive value and accuracy for ultrasonography were similar to results reported by Stavros et al¹⁵, Chao et al¹⁶ but contrasting with study conducted by Hasni et al.¹⁷

Spiculation has shown the highest positive predictive value among the sonographic findings of malignancy. It has infrequently been reported in the literature by Murad et al¹⁸ but similar and related findings have been reported often as a "thick, echogenic halo".¹⁹ The hypoechoic spiculations within the fibrous tissue surrounding a cancer may be inconspicuous mammographically because both the spiculations and the adjacent fibrous tissue have the density of water. Sonography can be very helpful in such cases. Most of the spiculated lesions in this series had hypoechoic spiculations. The echogenic spiculations in lesions surrounded by fat are conspicuous mammographically. Sonography is not often necessary for diagnosis of such nodules, but it may be useful for guiding needle biopsy and or localization procedures and for determining the true size of malignant lesions.

In the present study, spiculation was seen in 44.4% of the histologically proven malignant lesions, similar findings have been reported by Buchberger et al.²⁰, while as contradictory results were shown by Hong et al.²¹ and Rahbar et al.²² It has been reported that nodules that are taller than they are wide (larger anteroposteriorly than horizontally) are likely to be malignant as reported by Fine et al.²³, Chen et al.²⁴ and Murad et al.¹⁸ Growth of most fibroadenomas remains within normal tissue planes; therefore, they are usually wider than they are tall. In our study 44.4% of the histologically proven malignant lesions were taller than wide (width to anteroposterior dimension ratio < 1.4) which was considered as a positive finding. Similar results have been reported by other studies.^{6,22}

The angular margins characteristic reported in the present study was similar to what has previously been described as jagged or irregular margins. Angular margins should be distinguished from gently curving lobulations. Historically, this has been the most frequently reported finding and one of the most reliable findings for malignancy Paulinelli et al.²⁵ In our study angular margins were seen in 77.7% of histologically proven malignant lesions. Similar findings have been reported by other authors.^{25,26} Previous studies^{23,25} have mentioned hypoechogenicity as a malignant finding. It is important to compare the echogenicity of the nodule to that of normal breast fat rather than to that of intensely echogenic fibrous tissue. Because hyperechoic fibrous

tissue is more echogenic than anything in the breast except calcification, we do not believe that comparison to fibrous tissue provides much useful information. More useful information can be gained by comparing nodule echogenicity to a structure that has an echogenicity near the middle of the gray-scale spectrum. In the breast, periductal elastic tissue, breast terminal ductal-lobular units, and fat have an echogenicity near the middle of the gray-scale spectrum. Of these, only fat is uniformly present in all patients. Therefore, we have found fat to be the tissue against which the echogenicity of solid nodules can most consistently be compared from patient to patient. To compare the echogenicity of solid nodules to fat, sonographic parameters must be set so that fat is portrayed as gray rather than black. In our study 66.6% of histologically proven malignant lesions were hypoechoic, similar findings have been reported by Buchberger et al.²⁰

Shadowing has previously been reported to be present in a variable percentage of malignant nodules.^{24,27,28} Shadowing is the result of attenuation of the sound beam by desmoplastic host response to breast cancer rather than being due to the tumour itself. Shadowing is most commonly seen in low-grade infiltrating ductal carcinomas and tubular carcinomas probably because they grow slowly enough to allow the intensely shadowing desmoplastic reaction to occur. Amongst all histologically proven malignant lesions, shadowing was observed in 44.4% of the subjects in the present study. Similar findings have been reported by other studies.^{20,29}

US is less sensitive for demonstration of microcalcifications than is mammography. The smaller the calcifications, the lower the sensitivity of US for showing them.^{6,24} However, the currently used high-frequency transducers can show a higher percentage of mammographically visible calcifications than could the previously used lower-frequency transducers. Calcifications appear as bright punctate echoes that appear larger than their true size, but they are not large enough to create acoustic shadowing.²⁴ Majority of malignant solid nodules provide either a very hypoechoic or a mildly hypoechoic and relatively homogeneous background that enhances the ability to identify the bright punctate calcification echoes. Therefore, punctate echogenic calcifications within such malignant nodules are very conspicuous. Conversely, because normal breast tissue includes a large amount of hyperechoic and heterogeneous fibrous tissue, benign calcifications within such a background are sonographically difficult to detect. The net result is that a larger percentage of malignant than benign calcifications are visible sonographically. In our study out of all histologically proven malignant lesions, calcification was observed in 33.3% of the subjects. Similar findings have been reported in a study conducted by Chao et al.¹⁶

Microlobulation is similar to the mammographic finding. These are numerous, small (1-2-mm) lobulations. The risk of malignancy increases as the number of lobulations increases. Microlobulation can also occur in fibroadenomas, becoming more frequent as size of the fibroadenoma increases. Microlobulations are often best seen in the peripheral part of the nodule in an antiradial plane. They can represent several different types of tumor involvement on the periphery of a malignant nodule: intraductal tumour extensions, cancerization of lobules, or small fingers of infiltrating cancer. In the current

study, microlobulation was seen in 66.6% of the subjects. The results are in accordance with the findings of previous studies conducted by Buchberger et al.²⁰ and Rahbar et al.²²

Normal fibrous tissue or focal fibrous change is represented by benign characteristic with the highest negative predictive value and marked hyperechogenicity. In the present study, no malignant lesion was hyperechoic and thus the negative predictive value for hyperechogenicity was 100%. Leucht et al.³⁰ found hyperechoic malignant lesions to be very rare. Similar findings have been reported by Calas et al.⁶ and Chen et al.²⁴

The classical fibroadenoma is characterized by the presence of smooth margins with ellipsoid or oval shape. The negative predictive value for ellipsoid shape in the present study was 95.4%. The results were in accordance to the study conducted by Murad et al.¹⁸ Many fibroadenomas are also smoothly marginated and gently lobulated. Typical fibroadenomas are wider than they are tall. The larger a fibroadenoma becomes, however, the more lobulated and irregular in shape it is likely to become. Consequently, some fibroadenomas are not ellipsoid or gently lobulated. It was also observed that 67% of the malignant lesions did not show involvement of the axillary lymph nodes. Thus, majority of the lesions which were sonographically detected were potentially curable.

CONCLUSION

It was concluded that sonography is a useful modality in the characterization of some breast lumps/masses. It improves the specificity of the diagnosis for the majority of both malignant and benign breast nodules. The results are affected by valid targeted indications, sonographic techniques, optimal machine, transducer characteristics and strict adherence to the criteria for a benign lesion, which require the absence of even a single malignant finding. This approach helps in accurately defining benign solid breast lesions that does not require biopsy which results in reduction of patient discomfort, morbidity and the burden of the cost of health care.

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