INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN BIOLOGY AND MEDICINE
ISSN: 2455-944X
www.darshanpublishers.com
Volume 3, Issue 12 - 2018

Original Research Article

DOI: http://dx.doi.org/10.22192/ijcrbm.2018.03.12.002

Ultrasound and MRI evaluation of axillary lymph node status in breast cancer

Ramesh Chander, **Lohit Shivashish, *** Jatinder Pal Singh Multani, * N.S. Neki**

* Professor & Head, **Junior Resident, *** Associate Professor,
Dept. of Radiodiagnosis, Govt. Medical College, Amritsar, India, 143001
****Professor, Dept of Medicine, Govt. Medical College/Guru Nanak Dev Hospital, Amritsar, India
Corresponding Author: **Dr. Lohit Shivashish**, Junior Resident, Dept. of Radiodiagnosis,
Govt. Medical College, Amritsar, India, 143001
E-mail: *lohitshivashish7@gmail.com*

Abstract

Aims and objectives:

1. To evaluate the status of axillary lymph nodes by ultrasound and magnetic resonance imaging in newly diagnosed breast cancer patients.
2. To assess accuracy of ultrasound and magnetic resonance imaging.

Materials and Methods:

60 patients of biopsy proven breast carcinoma were subjected to clinical examination, ultrasound and multiparametric magnetic resonance imaging for evaluation of axilla for lymph node status and further evaluated by histopathology.

Observations :

Status of axillary lymph nodes is one of the most important prognostic factors for breast cancer survival and.axillary staging of patients with early-stage breast cancer is essential in the treatment planning. The aim of this study was to evaluate the diagnostic accuracy of preoperative ultrasound and magnetic resonance imaging (MRI) for detection of metastatic axillary lymph node in breast cancer cases.

Conclusion:

With high sensitivity and specificity, USG and MRI are effective methods to differentiate metastatic axillary lymph nodes in breast cancer patients, which can provide useful information for surgical procedure selection.

Keywords: Usg, MRI, Axillary lymph node metastasis, Breast cancer.

Introduction

Status of axillary lymph nodes is one of the most important prognostic factors for breast cancer survival and is necessary for making treatment decisions. Another advantage is that, if the surgeon is aware of metastatic axillary nodes prior to surgery, the axillary lymph nodes dissections can be well planned.[1]

Several imaging techniques are currently available for preoperative assessment of lymph node status including mammography, ultrasonography, magnetic resonance imaging (MRI), and positron emission tomography/computed tomography (PET/CT).[2] Axillary ultrasonography is useful in excluding nodal

stage N2 and N3 (according to TNM staging) invasive ductal metastases.[3]

Physical examination–It is the oldest and simplest non-surgical method for evaluation of Axillary lymph node status. The limitation with physical examination is that it is highly inaccurate and having very low sensitivity and high false positive rate. In few studies, sensitivity and false positive rate are 31.6%, and 53.6% respectively.[4,5]

Ultrasonography- Provides the best means to assess the axillary nodes, gives its relatively sensitive and highly specific capabilities. A normal or benign-appearing axillary lymph node should have an oval or lobulated shape and a smooth, well-defined margin. The lobulated shape is because of concurrent constrictions and bulges of both the cortex and fatty hilum. The cortex should be slightly hypoechoic and uniformly thin, measuring 3 mm or less. Nodes that meet this description have a very high negative predictive value for excluding metastases. The echogenic hilum should constitute the major part of the node. Arterial flow in the hilum can be demonstrated with colour doppler imaging. Morphologic criteria such as cortical thickening, hilar effacement and non-hilar cortical blood flow are more important than size criteria in the identification of metastases. Characteristics of lymph nodes that are concerning for malignancy besides overall size include round shape, absence of the fatty hilum and increased concentric or focal cortical thickness greater than 3 mm, all being predictors of malignancy. Various studies have shown that axillary ultrasound has a sensitivity and specificity up to 73% and 96% respectively for detecting malignant involvement of nodes. It also helps in guiding biopsies of axillary lymph nodes, if needed.[6-11]

Fig showing Normal lymph node: On ultrasound, lymph nodes typically are smooth, gently lobulated ovals with a hypoechoic cortex measuring less than 3 mm in thickness with a central echogenic hilum

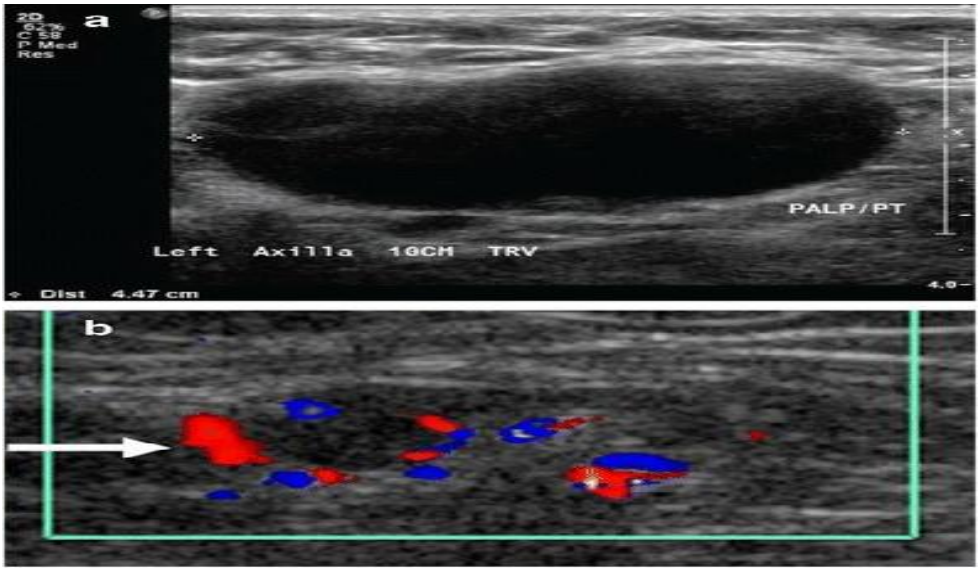


Fig showing abnormal lymph nodes: characteristics concerning for malignancy: **a.** absence of the fatty hilum and **b.** increased focal cortical thickness greater than 3 mm with colour Doppler US that shows hyperaemic blood flow in the hilum and central cortex or abnormal (non-hilar cortical) blood flow.

USG is the most widely used method for the evaluation of lymph nodes. Moreover, preoperative lymph node staging with US combined with either fine needle aspiration or core needle biopsy can achieve high diagnostic accuracy. The assessment of axillary nodal status, size, morphology, cortical thickness, and vascularity are used as feasible diagnostic criteria. Of these criteria, longitudinal-transverse (LT) axis ratio, concentric or eccentric cortical thickening and absent or displaced fatty hilum on gray scale US and higher peripheral vascularity on power Doppler US are reported as the most reliable criteria for predicting metastatic lymph nodes.[12-16]

MRI -The preoperative MR images of patients with diagnosis of breast cancer are evaluated to determine axillary lymph node status. Axillary lymph node size, long axis to short axis ratio, cortical thickness to anteroposterior (AP) diameter ratio, the presence of a fatty hilum and contrast enhancing patterns (homogenous or heterogenous) on postcontrast series are noted. Additionally, the presence of a comet tail sign on postcontrast series is also noted. Comet tail sign was first described for breast lesions by Kaiser. It is a tail extending from an enhancing breast lesion into the parenchyma. The tail is usually directed towards nipple or the ductal system. This sign might represent ductal infiltration or angiogenesis. Diffusion weighted imaging is important predictor of axillary lymphnode metastasis.[17-18]

Aims and Objective

1. To evaluate the status of axillary lymph nodes by ultrasound and magnetic resonance imaging in newly diagnosed breast cancer patients.
2. To assess accuracy of ultrasound and magnetic resonance imaging in evaluation of axillary node status, in comparison with surgical and histopathological findings.

Materials and Methods

This study was conducted after taking approval from Institutional Ethics Committee, Govt. medical college, Amritsar.

Study design: Observation study

Study setting: The proposed study was carried out in the department of Radiodiagnosis and Imaging in collaboration with department of surgery, pathology and radiotherapy, Government Medical College, Amritsar.

Subject and inclusion criteria:

Ultrasound and MRI study was planned to include 60 patients of FNAC biopsy proven breast cancer for evaluation of axillary lymph node status. Before recruitment in present study written informed consent of patient was taken.

Exclusion criteria:

1) Patients with metallic implants and other contraindications of MRI.
2) Patients having allergy to MRI Contrast.
3) Patients not proved breast cancer on histopathology.

Methodology:

All patients underwent clinical examination, ultrasound and multiparametric magnetic resonance imaging evaluation of axilla for lymph node status.

After clinical palpation patients were categorised into two groups. Those patients who had clinically palpable axillary lymph nodes were categorised as Group A, while those who had clinically non palpable lymph nodes were categorised as Group B. We performed ultrasound and MRI examination of breast and bilateral axilla in all sixty patients.

Clinical examination:

All enrolled patients underwent clinical evaluation for the breast and the axilla.All palpable axillary lymph nodes on clinical examination were assumed as positive for metastasis. If a node was not palpable, itwas assumed as negative for metastasis.

Ultrasound:

Ultrasound examination was performed using an US scanner MINDRAY DC-8 Machine and PHILIPS HD 11-XEwith linear array transducers of frequency 9-12 MHz. On ultrasound primary tumour size, shape, margin, echotexture and calcification was evaluated. All the following three levels of axillary lymph nodes were examined bilaterally.

Any abnormal lymph node found in these areas was noted as suspicious for metastasis. Lymph node of size < 10 mm in short axis on ultrasound was assumed as negative for metastasis.The criteria for abnormal lymph nodes include round shape, a long to short axis ratio < 1,thickening or asymmetry of cortex, hypoechoic echotexture and loss of central fatty hilum.

Magnetic resonance imaging:

The magnetic resonance imaging study was performed using a 1.5T MR scanner SEIMENS AERA in our department. All patients were scanned in the standard prone position, using dedicated bilateral breast coil.T1W, T2W, DWI and T2 STIR images of breast and axillary lymph nodes were obtained in transverse and sagittal planes and T2 scan obtained in coronal plane. Following the conventional MRI, post contrast sequence was obtained in axial plane following intravenous administration of Gd-DTPA (0.1 mmol/kg). The study images were taken after contrast. All the three level of axillary lymph nodes were examined and lymph nodes suspicious for metastasis were noted. The criteria of lymph nodes for metastatic involvement included size >10 mm, rounded shape, eccentric cortical hypertrophy, abnormal diffusion and abnormal signal intensity enhancement. All lymph nodes detected as abnormal on ultrasound and magnetic resonance imaging were advised for histopathology.

Observations

Table 1 below depicts the age distribution of the female patients in our study.

Table 1 Patient distribution based on age group

Age (years)	No.
30-39	4
40-49	24
50-59	15
60-69	10
70-79	6
80-89	1

The majority of the patients in our study belonged to the younger age group. 43 patients (71.6%) of the total 60 patients had age between 30-59 years.

Table 2

Site	No. of patients
Right breast	38
Left breast	22

The above table depict that 38 of the total 60 patients (63.34%) had lesion in their right breast, compared to only 22 patients who had a lesion in their left breast (36.66%). None of the 60 patients had bilateral lesions.

Table 3 Diagnostic performance result of ultrasound in axillary lymph nodes detection in both group A and group B' (clinically palpable and non palpable axilla) patients (n=60)

Ultrasound diagnosis of axillary lymph node	Histopathology positive	Histopathology negative
Abnormal 30	25	5
Normal 16	3	13

In 60 patients including both clinically palpable and non-palpable patients, 30 patients (50.0%) had abnormal axillary nodes on ultrasound. Of these 30 patients, 25 patients (83.34%) had metastatic nodes on histopathology. In 16 patients (26.67%) who had normal axillary nodes on ultrasound, 3 patients (18.75%) had metastatic nodes on histopathology.

Table 4 Diagnostic accuracy of ultrasound in detection of axillary lymph node metastasis in both in both group a and group b (clinically palpable and non palpable) axillary nodes.(n=60)

Sensitivity	Specificity	Positive predictive value	Negative predictive value
89.28%	72.23%	83.34%	81.25%

X^2: 10.8; df: 1; p=0.001

Thus the sensitivity, specificity, positive predictive value, negative predictive value and P value of ultrasound in axillary lymph node detection was 89.28% , 72.23%, 83.34%, 81.25% and 0.001 respectively in both clinically palpable and non palpable axillary node patients. All detected axillary lymph nodes on MRI were sent for histopathology and compare with histopathology diagnosis.

Table 5 Diagnostic performance result of MRI in axillary lymph nodes detection m both group a and group b (clinically palpable and non palpable axilla) :(n=60)

MRI diagnosis of axillary lymph nodes	Histopathology positive	Histopathology negative
Abnormal 32	27	5
Normal 16	4	12

In both clinically palpable and non palpable axillary nodes patients, MRI detected abnormal lymph nodes in 32 patients (53.34%) . Of these 32 patients, 27 patients (84.37%) had metastatic nodes confirmed on histopathology. In 16 patients (26.67%) with normal axillary nodes on MRI, 4 patients (25.0%) had metastatic axillary nodes confirmed on histopathology.

Table 6 Diagnostic accuracy of MRI in detection of axillary lymph node metastasis in both group a and group b (both clinically palpable and non palpable) patients.(n=60)

Sensitivity	Specificity	Positive predictive value	Negative predictive value
87.09%	70.58%	84.37%	75.0%

X^2: 16.4; df: 1; p=0.001

Thus sensitivity, specificity, positive predictive value, negative predictive value and p value of MRI in both clinically palpable and clinically non palpable axilla was 87.09% , 70.58%, 84.37%, 75.0 % and 0.001 respectively as described above.

Table 7 Diagnostic performance result of combined ultrasound and MRI in axillary lymph nodes detection in both group A and group B (clinically palpable and non paipable axilla) patients: (n=60)

Imaging features of abnormal axillary node		Histopathology positive	Histopathology negative
Positive	Negative		
36	-	33	03
-	14	01	13

In both clinically palpable and non palpable axillary nodes patients MRI and ultrasound as a combined modalities detected abnormal lymph nodes in 36 patients (60.0%). Out of 36 patients, 33 patients (91.67%) had metastatic nodes on histopathology. In 14 patients (23.34%) out of 60 patients with normal axillary nodes, one patient (7.14%) had metastatic axillary node on histopathology.

Table 8 Diagnostic accuracy of combined MRI and ultrasound in detection of axillary lymph node metastasis in both group A and group B (clinically palpable and non palpable axillary nodes) patients.(n=60)

Sensitivity	Specificity	Positive predictive value	Negative predictive value
97.05%	81.25%	91.67%	92.85%

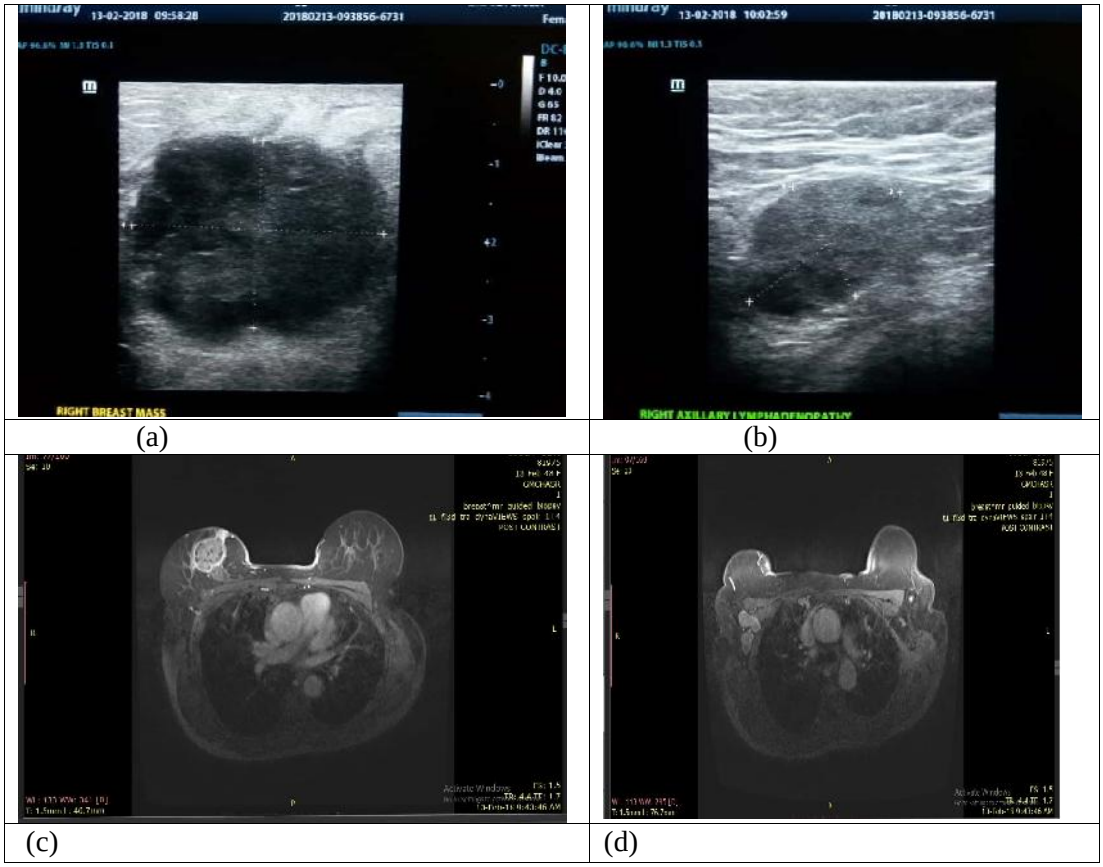
X^2: 33.1; df: 1; p=0.001

Thus as a combined modalities, ultrasound and MRI had sensitivity , specificity, positive predictive value, negative predictive value and p value of 97.05% , 81.25%, 91.67%, 92.85% and 0.001 respectively in both clinically palpable and non palpable axillary node patients.

Table 9 Comparative diagnostic accuracy of ultrasound, MRI and combined modalities in both group A and group B (clinically palpable and non palpable axillary nodes) patients (n=60)

Accuracy	Ultrasound	MRI	Ultrasound +MRI
sensitivity	89.28 %	87.09%	97.05%
specificity	72.23%	70.58%	81.25%

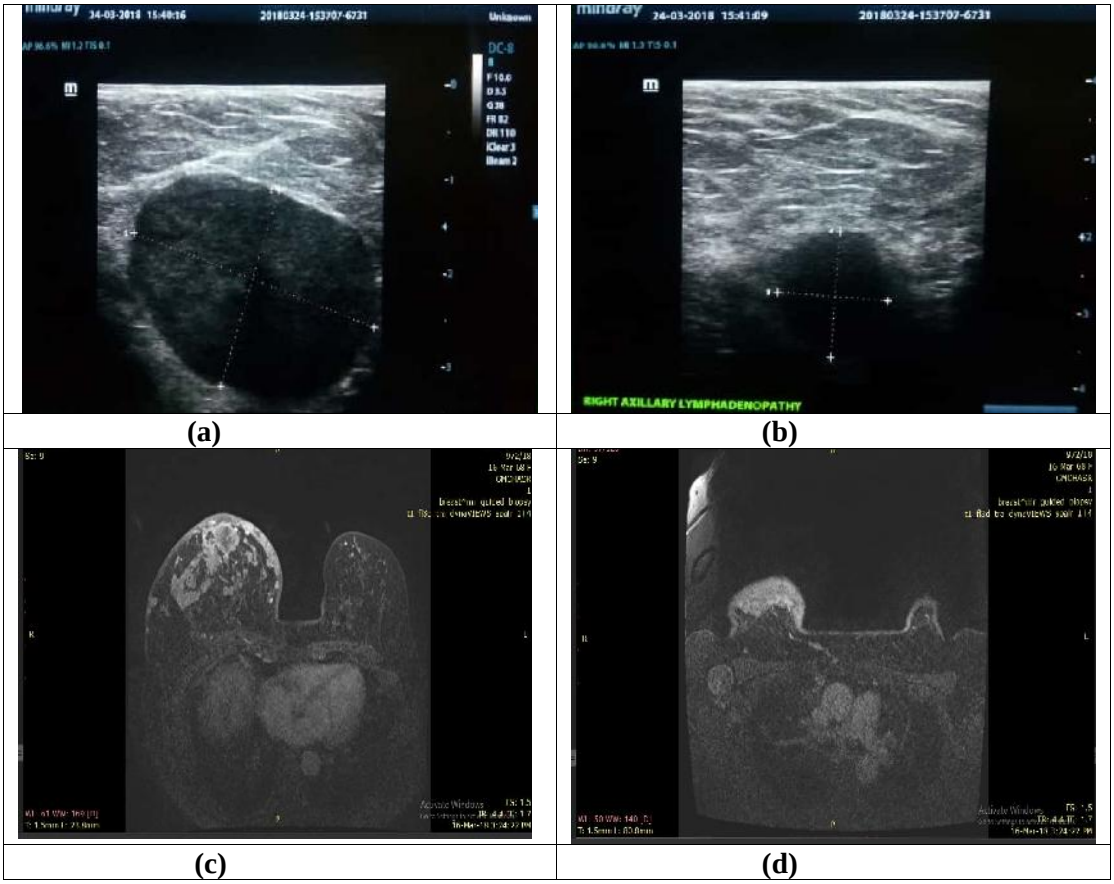
Cases



(a) (b)

(c) (d)

70 yr / female with Right breast lump/mass for 6 months.Images shows-(a) Ultrasound image of right breast shows a hypoechoic mass lesion in right outer upper quadrant extending to retroareolar region. (b) Ultrasound image of right axilla shows hypoechoic level II axillary lymphnode with loss of central fatty hilum. (c) Breast mass lesion shows homogenous enhancement after contrast administration.(d)Axillary lymphnode shows homogenous enhancement after contrast administration.



50 yr / female patient with Right breast lump/mass for 1 year. Images shows-(a) Ultrasound image of right breast shows hypoechoic mass lesions seen in retroareolar region. (b) Ultrasound image of right axilla shows hypoechoic level II axillary lymphnode with loss of central fatty hilum. (c) Breast mass lesion shows homogenous enhancement after contrast administration. (d) Axillary lymphnode shows homogenous enhancement after contrast administration.

Discussion

The present study was conducted on 60 patients who presented with breast cancer in the department of Radiodiagnosis, Government Medical College & Hospital, Amritsar.

USG - In our study, we included 60 patients of primary breast cancer. In total of 60 patients (when combined Group A and Group B), 30 patients had abnormal axillary lymph nodes on ultrasound and 16 patients had normal axillary lymph nodes. Of these 30 patients, 25 patients had metastatic nodes confirmed on histopathology, while in 16 patients who had normal axillary nodes on ultrasound, 3 patients had confirmed metastatic nodes on histopathology. Thus sensitivity , specificity , positive predictive value , negative predictive value and p value of diagnosing metastatic lymph nodes on axillary ultrasound was 89.28% , 72.23% , 83.34%, 81.25% and 0.001 respectively.

Table 10

Study done on detection of abnormal axillary lymph node on USG	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Strauss HG et al.	90%	91.7%	-	-
Mainiero MB et al.	59%	100%	-	-
Lee B et al.	53.7%	85.1%	81.0%	60.0%
Stachs A et al.	47.6%	95.7%	85.9%	77.0%
Koehler KE et al.	53.6%	75.5%	77.3%	51.3%
Ha SM et al.	60%	62.4%	-	-
Present Study	89.28%	72.23%	83.34%	81.25%

Our study shows comparable or better sensitivity and specificity of ultrasound in detection of axillary nodes metastasis than previous studies done by StachsA et al, Koehler KE et al, Mainiero et al. , Lee B et al. , Ha SM et al. and similar sensitivity to Strauss HG et al. and specificity shows similar to previous studies by Koehler K et al.

MRI -In our study we evaluated axillary nodes with MRI and compared with histological diagnosis. In total group of 60 patients, MRI detected abnormal lymph nodes in 32 patients, of which, 27 patients had metastatic nodes confirmed on histopathology. In 16 patients, who had normal axillary nodes on MRI. A patients had metastatic nodes confirmed on histopathology . Thus, sensitivity , specificity, positive predictive value , negative predictive valueand p value of MRI in detection of axillary lymph nodes metastasis was 87.09% , 70.58% ,84.37% , 75.0% and 0.001 respectively.

Table 11

Study done on detection of abnormal axillary lymph node on MRI	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Yoshimura G et al.	79%	93%	-	-
Murray AD et al.	100%	56%	38%	100%
Memarsadeghi M et al.	100%	98%	-	-
He N et al.	66.4%	94%	-	-
Kim EJ et al.	75.8%	83.9%	-	-
Ha SM et al.	57.3%	72%	78.18%	-
Zhou P et al.	95%	95%	-	-
Present Study	87.09%	70.58%	84.37%	75.0%

Our study shows comparable or better sensitivity and specificity for lymph node metastasis detection to previous studies by Yoshimura G et al. , He N et al. , Kim EJ et al. , Ha SM et al. and specificity shows similar result to Ha SM et al. study. Additionally.

Combined USG AND MRI - In all 60 patients (clinically palpable and non-palpable) combined modalities detected abnormal lymph nodes in 36 patients, of which 33 patients had metastatic nodes on histopathology. In our study of the 14 patients, who had normal axillary nodes on combined modalities, only one patient had metastatic nodes on histopathology. Thus, the sensitivity , specificity, positive predictive value, negative predictive value and p value of combined modalities was 97.05% , 81.25 % , 91.67%, 92.85 % and 0.001 respectively. Thus, the results of our study shows better sensitivity and specificity in comparison to studies done by Valente SA and Ha SMet al. The sensitivity and specificity of combined modalities was better than individual modalities in detection of axillary lymph node metastasis in our study.

Table 12

Study done on detection of abnormal axillary lymph node on USG and MRI	sensitivity	specificity	positive predictive value	negative predictive value
Valente SA et al.	56.5 %	89 %	-	-
Ha SM et al.	65.3%	60.4%	-	-
Present Study	97.05%	81.25%	91.67%	92.85%

Summary and Conclusions

We performed a prospective study in 60 patients with breast cancer and evaluated the role of ultrasound and MRI in detection of axillary node metastasis in breast cancer patients. The accuracy of ultrasound and MRI in detection of axillary node metastases was correlated with surgical and histopathological findings.

The majority of the patients in our study belonged to the age group 30-59 years. 43 of the total 60 patients (71.6%) had age between 30-59 years.

When compared with surgical and histopathological finding, ultrasound had sensitivity and specificity of89.28% and 72.23% in detection of axillary lymph node metastases in breast cancer patient, MRI had sensitivity and specificity of 87.09% and 70.58% respectively for similar detection. When ultrasound and MRI were used as combine modalities, the sensitivity and specificity of combined modalities was 97.05% and 81.25% respectively. MRI and ultrasound were found to be equally accurate in detection of axillary node metastasis in breast cancer. When used as combined modalities the accuracy of imaging increases significantly in detection of axillary node metastasis in breast cancer.

References

1. Valente SA, Levine GM, Silverstein MJ, Rayhanabad JA, Weng-Grumley JG, LingyunJi et al. Accuracy of predicting axillary lymph node positivity by physical examination, mammography, ultrasonography, and magnetic resonance imaging. Ann surg oncol. 2012: 2200-7.
2. Choi YJ, Shin YD, Kang YH, Lee MS, Lee MK, Cho BS et al. The effects of preoperative 18F-FDG PET/CT in breast cancer patients in comparison to the conventional imaging study. Journal of breast cancer. 2012;15(4):441-8.
3. Neal CH, Daly CP, Nees AV, Helvie MA. Can preoperative axillary US help exclude N2 and N3 metastatic breast cancer?. Radiology. 2010;257(2):335-41.
4. Specht MC, Fey JV, Borgen PI, Cody III HS. Is the clinically positive axilla in breast cancer really a contraindication to sentinel lymph node biopsy? Journal of the American College of Surgeons. 2005;200(1):10-4.
5. Lanng C, Hoff mann J, Galatius H. Assessment of clinical palpation of the axilla as a criterion for performing the sentinel node procedure in breast cancer. Euro J Surg Oncol. 2007;33(3):281-4.
6. Shetty MK, Carpenter WS. Sonographic evaluation of isolated abnormal axillary lymph nodes identified on mammograms. J Ultrasound Med. 2004;23(1):63–71.
7. Bedi DG, Krishnamurthy R, Krishnamurthy S, Edeiken BS, Le-Petross H, Fornage BD et al. Cortical morphologic features of axillary lymph nodes as a predictor of metastasis in breast cancer: in vitro sonographic study. American Journal of Roentgenology. 2008 Sep;191(3):646-52.
8. Choi YJ, Ko EY, Han BK, Shin JH, Kang SS, Hahn SY. High-resolution ultrasonographic features of axillary lymph node metastasis in patients with breast cancer. The Breast. 2009;18(2):119-22.
9. Deurloo EE, Tanis PJ, Gilhuijs KG, Muller SH, Kröger R, Peterse JL et al. Reduction in the number of sentinel lymph node procedures by preoperative ultrasonography of the axilla in breast cancer. European Journal of Cancer. 2003;39(8):1068-73.
10. Gogas J, Markopoulos C, Kouskos E, Gogas H, Mantas D, Antonopoulou Z et al. Granular cell tumor of the breast: a rare lesion resembling breast cancer. European journal of gynaecological oncology. 2002;23(4):333-4.
11. Lee MC, Joh JE, Chau A. Axillary staging prior to neoadjuvant chemotherapy. The roles of sentinel lymph node biopsy and axillary ultrasonography. Cancer Control. 2012;19(4):277-85.

12. De Kanter AY, van Eijck CH, van Geel AN, Kruijt RH, Henzen SC, Paul MA et al. Multicentre study of ultrasonographically guided axillary node biopsy in patients with breast cancer. Br J Surg. 1999;86:1459-62.
13. Tate JJ, Lewis V, Archer T, Guyer PG, Royle GT, Taylor I. Ultrasound detection of axillary lymph node metastases in breast cancer. Eur J Surg Oncol. 1989;15:139–41
14. Damera A, Evans AJ, Cornford EJ, Wilson AR, Burrell HC, James JJ et al. Diagnosis of axillary nodal metastases by ultrasound-guided core biopsy in primary operable breast cancer. Br J Cancer. 2003;89:1310–3.
15. Lernevall A. Imaging of axillary lymph nodes. Acta Oncol. 2000;39:277–81.
16. Yang WT, Metreweli C, Lam PK, Chang J. Benign and malignant breast masses and axillary nodes: evaluation with echo-enhanced color power Doppler US. Radiology. 2001;220:795–802.
17. Luciani A, Pigneur F, Ghozali F, Dao TH, Cunin P, Meyblum E et al. Ex vivo MRI of axillary lymph nodes in breast cancer. European journal of radiology. 2009;69(1):59-66.
18. Chung J, Youk JH, Kim JA, Gweon HM, Kim EK, Ryu YH et al. Role of diffusion-weighted MRI: predicting axillary lymph node metastases in breast cancer. Acta Radiologica. 2014;55(8):909-16.

Access this Article in Online	
	Website: www.darshanpublishers.com
Quick Response Code	Subject: Medical Sciences

How to cite this article:
Ramesh Chander, Lohit Shivashish, Jatinder Pal Singh Multani, N.S. Neki. (2018). Ultrasound and MRI evaluation of axillary lymph node status in breast cancer. Int. J. Curr. Res. Biol. Med. 3(12): 9-18.
DOI: http://dx.doi.org/10.22192/ijcrbm.2018.03.12.002