e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2023; 15(12); 431-435

Original Research Article

A Hospital-Based Study to Evaluate Sonographic Features of Invasive Ductal Breast Carcinomas for Prediction of Malignancy Grade: An Observational Study

Vijay Kumar[1], Ram Kumar Gupta[2]

[1]Senior Resident, Department of Radiodiagnosis, Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar, India

[2]Senior Resident, Department of Radiodiagnosis, Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar, India

Received: 02-09-2023 Revised: 27-10-2023 / Accepted: 18-11-2023

Corresponding Author: Dr. Ram Kumar Gupta

Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to evaluate sonographic features of invasive ductal breast carcinomas for prediction of malignancy grade.

Material & methods: The present study was conducted in Department of Radiodiagnosis including 200 solid breast masses which were evaluated by ultrasound for the duration of 2 years.

Results: Most common age group was 51-60 years (55%), followed by 60 and more years age group (22%) and 41-50 years age group (20%). Painless mass in breast (75%), Ulceration (16%), Painful mass (24%) were common complaints seen in our study. We noted that 48% patients had duration of symptoms from 6 months to 1 year, while 22% patients had duration of symptoms less than 6 months. Irregular borders, horizontal orientation, circumscribed/lobulated/ microlobulated, hypoechoic patterns, hypovascular, abrupt interfaces, posterior acoustic shadow, microcalcifications, architectural distortion and lymphadenopathy were common findings in all grades of invasive duct carcinoma patients.

Conclusion: Malignancy grade of invasive ductal carcinoma can be predicted by heterogeneous echotexture of mass, abrupt interfaces, calcifications, posterior acoustic enhancement and/or presence of reversal/lack of diastolic flow margins.

Keywords: Breast Ultrasound, Invasive Ductal Carcinoma, Malignancy Grade.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0) and the Budapest Open Access Initiative (http://www.budapestopenaccessinitiative.org/read), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Breast cancer become the most common female cancer in urban India with an annual incidence of approximately 1,44,000 new cases per year. [1] Approximately 80% of breast carcinomas are mainly invasive ductal carcinoma, followed by 10-15% of cases with invasive lobular carcinomas. [2] Ductal carcinoma in situ (DCIS) is defined as a malignant proliferation of epithelial cells confined to endothelial lobular units without invading the basement membrane. [3]

The most common finding of DCIS is the presence of microcalcifications in the mammography screening of asymptomatic patients. [4,5] Invasive duct carcinoma has a high mortality rate due to localized invasion, lymph node spread, and distant metastasis. Prognosis is usually poor with invasive type carcinoma. [6]

An early and accurate recognition of breast tumor with poor prognosis will, therefore, be beneficial for preoperative planning and outcome improvement. Ultrasound is a safe, non-invasive and radiation free adjunct to mammography for the evaluation of palpable breast masses. The use of breast ultrasound has shown remarkable promise in distinguishing benign from malignant solid lesions. [7] It is also used as a primary screening tool for breast cancer in women who are pregnant, young women with high risk for breast cancer and who have increased breast density on mammogram. [8]

Ultrasound is used as a first line modality of imaging for breast masses in patients less than 35 years and as an adjunct to mammography in older patients. [9-12] Breast ultrasonography is considered to be an adjunct to screening mammography, although breast ultrasonography is superior to mammography in detecting lesions in patients with symptomatic DCIS. [13] The most common ultrasonographic findings of DCIS are a hypoechoic mass with an irregular shape and indistinct margin. [14,15] Additional findings include microcalcifications, ductal changes, or

structural distortions. [14-21] Therefore, knowledge of the sonographic appearances of breast cancers and their possible variations determined by the tumor biology is important for the ultrasound radiologist to minimize misdiagnosis.

Hence, present study was aimed to evaluate sonographic features of invasive ductal breast carcinomas for prediction of malignancy grade.

Material & Methods

The present study was conducted in Department of Radiodiagnosis, Indira Gandhi Institute of medical sciences (IGIMS), Patna, Bihar, India including 200 solid breast masses which were evaluated by ultrasound for the duration of 2 years.

Inclusion Criteria

- Patients who were positive for invasive ductal carcinoma (IDC) of breast on core needle biopsy and had both sonographic images and histopathological data available.
- Age of the patients ranged from 31 years to 78 years.

Methodology

Ultrasound examination of breast masses was done on a Philips ultrasound machine unit (HD7/Clearvue 650) using linear, high frequency (3–12 MHz), and curvilinear (2–5 MHz) transducers. Each breast mass was assessed by two radiologists with experience of 10 or more years. Each mass was characterized on sonography based on its shape, orientation, margin, echo pattern, posterior features, calcifications, presence of associated features if any, and color flow. Biopsy specimens were examined and histopathological grading was done by senior pathologists.

Statistical Analysis

The results for qualitative data were presented in frequency and percentage. Chi-square test was used to find association between histological grades of IDC (dependent parameter) and their sonographic features (independent parameters). Ordinal regression was used to predict the contribution of each independent parameter to arrive at the final histological grade, which happens to be the dependent parameter in our study. The statistical analysis was done using SPSS 21.0 in this study. The significance level was used at $P \leq 0.05$.

Results

Table 1: Distribution of malignant breast tumors according to age

Age in years	N	%
0 – 40	6	3
41 – 50	40	20
51 – 60	110	55
>60	44	22

Most common age group was 51-60 years (55%), followed by 60 and more years age group (22%) and 41-50 years age group (20%).

Table 2: Symptoms and Duration of symptoms

Symptoms	N	%
Painless mass in breast	150	75
Ulceration	32	16
Painful mass	48	24
Nipple retraction	20	10
Nipple discharge	10	5
Duration of symptoms		
<6 months	44	22
6 months – 1 year	96	48
1year – 1.5years	34	17
1.5 years – 2 years	26	13

Painless mass in breast (75%), Ulceration (16%), Painful mass (24%) were common complaints seen in our study. We noted that 48% patients had duration of symptoms from 6 months to 1 year, while 22% patients had duration of symptoms less than 6 months.

Table 3:

Ultrasound findings	Histological grade			Total
	N=100	N=50	N=50	
Irregular	80	35	45	160 (80%)
Round	10	5	3	18 (9%)
Oval	10	10	2	22 (11%)
Orientation				
Horizontal	70	30	20	120 (60%)

Indifferent	20	8	22	50 (25%)
Not determinable	8	6	6	20 (10%)
Vertical	2	6	2	10 (5%)
Echo pattern				
Hypoechoic	52	38	30	114 (58%)
Complex	24	9	9	42 (21%)
Anechoic	14	4	6	24 (12%)
Isoechoic	4	3	3	10 (5%)
Hyperechoic	6	1	1	8 (4%)
Margin				
Circumscribed/lobulated/ Microlobulated	88	36	48	172 (86%)
Spiculated/angular	16	14	2	28 (14%)
Boundaries				
Abrupt interface	80	40	40	160 (80%)
Echogenic halo	20	10	10	40 (20%)
Vascularity				
Hypovascular	70	18	32	120 (60%)
Spotty	14	30	6	50 (25%)
Hypervascular	11	1	8	20 (10%)
Absent	5	1	4	10 (5%)
Posterior acoustic features				
Shadowing	46	20	14	80 (40%)
Enhancement	6	8	18	32 (16%)
Combined pattern	5	5	2	12 (6%)
Unchanged	43	17	16	76 (38%)
Others				
Microcalcification	35	22	33	90 (45%)
Architectural distortion	32	28	20	80(40%)
Changes in Cooper's ligaments	5	35	30	70(35%)
Lymphadenopathy	35	15	40	90(45%)

Irregular borders, horizontal orientation, circumscribed/lobulated/ microlobulated, hypoechoic patterns, hypovascular, abrupt interfaces, posterior acoustic shadow, microcalcification, architectural distortion and lymphadenopathy were common findings in all grades of invasive duct carcinoma patients.

Discussion

Majority of the breast carcinomas are usually asymptomatic and the usual mode of presentation is an incidental palpable lump or pain and rarely, they present with nipple discharge and skin changes. [22] With the development of various adjuvant treatment methods including chemotherapy, endocrine therapy, and radiation therapy, the treatment outcome for patients with breast cancer has improved. Ultrasound is used in many ways, not only as an initial diagnostic tool for confirmation of pathology determined from biopsies of the breast but also staging of breast cancer. It is also combined with mammography, a procedure called sonomammography to aid in better detection of breast cancer. [23,24]

Most common age group was 51-60 years (55%), followed by 60 and more years age group (22%) and 41-50 years age group (20%). Painless mass in breast (75%), Ulceration (16%), Painful mass (24%) were common complaints seen in our study. While Kini et al [25] demonstrated that calcifications on preoperative mammography appeared to be associated with an increased risk of local recurrence and that fine linear branching microcalcification observed on mammography was associated with a poor survival rate. In spiculated margins strands of tissues are seen radiating out from an ill marginated mass producing a stellate appearance. Spiculations represent retraction of tissue strands towards the tumor due to fibrosis - as a result of desmoplastic reaction. Posterior acoustic properties of a mass are based on multiple factors like cellular components, stromal reaction and number of histological interfaces between fibrous and cellular components. [26]

We noted that 48% patients had duration of symptoms from 6 months to 1 year, while 22% patients had duration of symptoms less than 6 months. Irregular borders, horizontal orientation, circumscribed/lobulated/ microlobulated, hypoechoic patterns, hypovascular, abrupt interfaces, posterior acoustic shadow, microcalcification, architectural distortion and lymphadenopathy were common findings in all grades of invasive duct carcinoma patients. In a

similar Indian study authors noted that masses with complex solid cystic mass with heterogeneous echotexture, abrupt interfaces, calcifications and/or presence of reversal/lack of diastolic flow may suggest high grade of tumors. The finding of reversal/lack of diastolic flow in a breast mass was the strongest predictor of high grade of tumor in our study and warrants early lymph nodal sampling. Similar findings were noted in present study. Lamb et al [27] investigated the relationship between imaging characteristics and histologic grade. Strain elastography (SE) and shear-wave elastography (SWE) are the two most frequently used ultrasound elastography techniques in the breast. In Strain elastography (SE), stress is applied by repeated manual compression of the transducer, which provides a measurement of the deformed lesion relative to the surrounding normal tissue with a color display. [28] The other technique, shear-wave elastography (SWE), uses an acoustic radiation force impulse created by an ultrasound beam, which allows for the measurement of the propagation speed of shear waves within the tissue and quantifies the stiffness in either kilopascals or meters per second. [29]

Conclusion

Malignancy grade of invasive ductal carcinoma can be predicted by heterogeneous echotexture of mass, abrupt interfaces, calcifications, posterior acoustic enhancement and/or presence of reversal/lack of diastolic flow margins.

References

1. Fact Sheets by Cancer.
2. Orel SG, Schnall MD. MR imaging of the breast for the detection, diagnosis, and staging of breast cancer. Radiology. 2001 Jul;220(1): 13-30.
3. Page DL, Dupont WD. Anatomic indicators (histologic and cytologic) of increased breast cancer risk. Breast Cancer Res Treat 1993;28: 157-166.
4. Dershaw DD, Abramson A, Kinne DW. Ductal carcinoma in situ: mammographic findings and clinical implications. Radiology 1989; 170:411-415.
5. Evans A, Pinder S, Wilson R, Sibbering M, Poller D, Elston C, et al. Ductal carcinoma in situ of the breast: correlation between mammo -graphic and pathologic findings. AJR Am J Roentgenol 1994; 162:1307-1311.
6. Yogalakshmi S, Kavitha M. A Study of Histopathological Spectrum of Breast Lesions. Int J Sci Stud 2019;7(1):1-5
7. Skaane P, Engedal K. Analysis of sonographic features in the differentiation of fibroadenoma and invasive ductal carcinoma. AJR 1998; 170: 109–114
8. Nothacker M, Duda V, Hahn M, Warm M, Degenhardt F, Madjar [2] H, et al. Early detection of breast cancer: benefits and risks of supplementalbreast ultrasound in asymptomatic women with mammographically dense breasttissue. A systematic review. BMC Cancer. 2009; 9:335.
9. Osako T, Takahashi K, Iwase T, Iijima K, Miyagi Y, Nishimura S, et al. Diagnostic ultrasonography and mammography for invasive and noninvasive breast cancer in women aged 30 to 39 years. Breast Cancer 20 07; 14:229-33.
10. McCavert M, O'Donnell ME, Aroori S, Badger SA, Sharif MA, Crothers JG, et al. Ultrasound is a useful adjunct to mammography in the assessment of breast tumours in all patients. Int J Clin Pract 2009; 63:1589-94.
11. Paulinelli RR, Freitas-Júnior R, Moreira MA, Moraes VA, Bernardes-Júnior JR, Vidal Cda S, et al. Risk of malignancy in solid breast nodules according to their sonographic features. J Ultrasound Med 2005; 24:635-41.
12. Costantini M, Belli P, Lombardi R, Franceschini G, Mulè A, Bonomo L. Characterization of solid breast masses: Use of the sonographic breast imaging reporting and data system lexicon. J Ultrasound Med 2006; 25:649-59.
13. Scoggins ME, Fox PS, Kuerer HM, Rauch GM, Benveniste AP, Park YM, et al. Correlation between sonographic findings and clinicopathologic and biologic features of pure ductal carcinoma in situ in 691 patients. AJR Am J Roentgenol 2015; 204:878-888.
14. Wang LC, Sullivan M, Du H, Feldman MI, Mendelson EB. US appearance of ductal carcinoma in situ. Radiographics 2013; 33:213-228.
15. Park JS, Park YM, Kim EK, Kim SJ, Han SS, Lee SJ, et al. Sonographic findings of high-grade and non-high-grade ductal carcinoma in situ of the breast. J Ultrasound Med 2010;29: 1687-1697.
16. Perou CM, Sorlie T, Eisen MB, van de Rijn M, Jeffrey SS, Rees CA, et al. Molecular portraits of human breast tumours. Nature 2000; 406:74 7-752.
17. Cho KR, Seo BK, Kim CH, Whang KW, Kim YH, Kim BH, et al. Noncalcified ductal carcinoma in situ: ultrasound and mammographic findings correlated with histological findings. Yonsei Med J 2008; 49:1 03-110.
18. Izumori A, Takebe K, Sato A. Ultrasound findings and histological features of ductal carcinoma in situ detected by ultrasound examination alone. Breast Cancer 2010; 17:13 6-141.

19. Kim JH, Ko ES, Kim DY, Han H, Sohn JH, Choe DH. Noncalcified ductal carcinoma in situ: imaging and histologic findings in 36 tumors. J Ultrasound Med 2009; 28:903-910.
20. Moon WK, Myung JS, Lee YJ, Park IA, Noh DY, Im JG. US of ductal carcinoma in situ. Radiographics 2002; 22:269-280.
21. Shin HJ, Kim HH, Kim SM, Kwon GY, Gong G, Cho OK. Screeningdetected and symptom - matic ductal carcinoma in situ: differences in the sonographic and pathologic features. AJR Am J Roentgenol 2008; 190:516-525.
22. Tan KH, Simonella L, Wee HL, Roellin A, Lim YW, Lim WY, Chia KS, Hartman M, Cook AR. Quantifying the natural history of breast cancer. British journal of cancer. 2013 Oct;109(8):2035-43.
23. Okello J, Kisembo H, Bugeza S, Galukande M. Breast cancer detection using sonography in women with mammographically dense breasts. BMC medical imaging. 2014 Dec;14(1):1-8.
24. Alshayookh FS, Ahmed HM, Awad IA, Jastaniah SD. Ultrasound alongside with mammogram in women with physically dense breast. Advances in Breast Cancer Research. 2014 Jun 18;2014.
25. Kini V, Vicini F, Frazier R, Victor S, Wimbish K, Martinez A. Mammographic, pathologic, and treatment-related factors associated with local recurrence in patients with early-stage breast cancer treated with breast conserving therapy. International Journal of Radiation Oncology* Biology* Physics. 1999 Jan 15; 43 (2):341-6.
26. Gupta K, Kumaresan M, Venkatesan B, Chandra T, Patil A, Menon M. Sonographic features of invasive ductal breast carcinomas predictive of malignancy grade. Indian Journal of Radiology and Imaging. 2018 Jan;28(01): 123-31.
27. Lamb PM, Perry NM, Vinnicombe SJ, WELLS CA. Correlation between ultrasound characteristics, mammographic findings and histological grade in patients with invasive ductal carcinoma of the breast. Clinical radiology. 2000 Jan 1;55(1):40-4.
28. Itoh A, Ueno E, Tohno E, Kamma H, Takahashi H, Shiina T, Yamakawa M, Matsumura T. Breast disease: clinical application of US elastography for diagnosis. Radiology. 2006 May;239(2):341-50.
29. Bercoff J, Tanter M, Fink M. Supersonic shear imaging: a new technique for soft tissue elasticity mapping. IEEE transactions on ultrasonics, ferroelectrics, and frequency control. 2004 Apr;51(4):396-409.