Original Research Article

Ultrasonographic study of features of invasive ductal breast carcinomas for prediction of malignancy grade

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Abstract

Background: An early and accurate recognition of breast tumor with poor prognosis is beneficial for preoperative planning and outcome improvement. 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. Present study was aimed to evaluate sonographic features of invasive ductal breast carcinomas for prediction of malignancy grade. **Material and Methods:** Present study was conducted in patients with biopsy proven invasive ductal breast carcinomas. **Results:** Total 104, biopsy proven breast cancer patients were considered for present study. All patients were female. Most common age group was 51-60 years (54 %), followed by 61 and more years age group (24 %) and 41-50 years age group (20 %). Painless mass in breast (75 %), Ulceration (18 %), Painful mass (25 %) were common complaints seen in our study. We noted that 47 % 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. **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.

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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] Ultrasound is a safe, non-invasive and radiation free adjunct to mammography for the evaluation of palpable breast masses. 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.[3] All detected breast lesions are not malignant and all the benign masses do not progress to cancer; nevertheless the precision of the final diagnosis can be greatly increased by radiological imaging (mammography, ultrasonography) and pathological diagnosis.[4] Ultrasonography can be helpful in prediction of malignancy grade of invasive ductal breast carcinomas. 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.[5] An early and accurate

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recognition of breast tumor with poor prognosis will, therefore, be beneficial for preoperative planning and outcome improvement. 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. Present study was aimed to evaluate sonographic features of invasive ductal breast carcinomas for prediction of malignancy grade.

MATERIAL AND METHODS

Present study was conducted in department of radiodiagnosis, XXX medical college and hospital, XXX during September 2018 to August 2020 (2 years). Research committee approval was taken for present study. Female patients with biopsy proven invasive ductal breast carcinomas were considered for present study. 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. Clinical details, radiological and histopathological findings were collected in Microsoft excel sheet. Data was analysed by descriptive statistics in form of percentages.

RESULTS

Total 104, biopsy proven breast cancer patients were considered for present study. All patients were female. Most common age group was 51-60 years (54 %), followed by 61 and more years age group (24 %) and 41-50 years age group (20 %).

Table 1: Distribution of malignant breast tumors according to age.

Age in years	No. Of cases	Percentage
0 – 40	2	2%
41 – 50	21	20%
51 – 60	56	54%
61 and above	25	24%

Painless mass in breast (75 %), Ulceration (18 %), Painful mass (25 %) were common complaints seen in our study

Table 2: symptoms

Signs and Symptoms	Number of cases	Percentage
Painless mass in breast	78	75%
Ulceration	19	18%
Painful mass	26	25%
Nipple retraction	9	9%
Nipple discharge	4	4%

We noted that 47 % patients had duration of symptoms from 6 months to 1 year, while 22 % patients had duration of symptoms less than 6 months.

Table 3: Duration of symptoms

Duration	No. Of cases	Percentage
<6 months	23	22%
6 months – 1 year	49	47%
1year – 1.5years	17	16%
1.5 years – 2 years	15	14%

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.

Table 4: Distribution of Sonographic Parameters

Ultrasound findings	Histological grade			Total (n=92)
	1 (n=48)	2 (n=23)	3 (n=21)	
	Shape			
Irregular	40 (83%)	18 (78%)	17 (81%)	75 (82%)
Round	5 (10%)	1 (4%)	2 (10%)	8 (9%)
Oval	3 (6%)	4 (17%)	2 (10%)	9 (10%)
	Orientation			
Horizontal	27 (56%)	14 (61%)	13 (62%)	54 (59%)
Indifferent	13 (27%)	4 (17%)	6 (29%)	23 (25%)
Not determinable	5 (10%)	2 (9%)	1 (5%)	8 (9%)
Vertical	3 (6%)	3 (13%)	1 (5%)	7 (8%)
	Echo pattern			
Hypoechoic	26 (54%)	14 (61%)	12 (57%)	52 (57%)
Complex	11 (23%)	5 (22%)	4 (19%)	20 (22%)
Anechoic	6 (13%)	2 (9%)	3 (14%)	11 (12%)
Isoechoic	3 (6%)	1 (4%)	1 (5%)	5 (5%)
Hyperechoic	2 (4%)	1 (4%)	1 (5%)	4 (4%)
	Margin			
Circumscribed/lobulated/ Microlobulated	41 (85%)	19 (83%)	18 (86%)	78 (85%)

Spiculated/angular	7 (15%)	4 (17%)	3 (14%)	14 (15%)
Boundaries				
Abrupt interface	38 (79%)	20 (87%)	16 (76%)	74 (80%)
Echogenic halo	10 (21%)	3 (13%)	5 (24%)	18 (20%)
Vascularity				
Hypovascular	29 (60%)	15 (65%)	13 (58%)	57 (62%)
Spotty	11 (23%)	5 (22%)	5 (25%)	21 (23%)
Hypervascular	5 (10%)	2 (9%)	2 (10%)	9 (10%)
Absent	3 (6%)	1 (4%)	1 (5%)	5 (5%)
Posterior acoustic features				
Shadowing	23 (48%)	9 (39%)	7 (33%)	39 (42%)
Enhancement	3 (6%)	4 (17%)	7 (33%)	14 (15%)
Combined pattern	2 (4%)	2 (9%)	1 (5%)	5 (5%)
Unchanged	20 (42%)	8 (35%)	6 (29%)	34 (37%)
Other				
Microcalcification	17 (35%)	11 (48%)	13 (62%)	41 (45%)
Architectural distortion	15 (31%)	10 (43%)	13 (62%)	38(41%)
Changes in Cooper's ligaments	2 (4%)	15 (65%)	16 (76%)	33(36%)
Lymphadenopathy	17 (35%)	11 (48%)	14 (67%)	42(46%)

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.[6] 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.[7,8] Tumor size, lymph node status, histological type, histological grade, and lymphovascular invasion are the important prognostic histologic features. Breast ultrasound criteria for characterisation of malignant lesions are mass having ill-defined borders, spiculated / angular margins, grossly hypoechoic lesion, taller than broader-the maximum diameter in the longitudinal plane, associated posterior acoustic shadowing and microcalcifications.[9,10] It has been suggested that "neoductgenesis" may be the underlying mechanism responsible for this worse outcome. This process promotes vascular invasion and consequently excessive lymphatic and hematogenous spread in breast cancer. In a study conducted by Wendie *et al.* showed that pleomorphic calcification seen within a mass was mostly proven on histopathology to be a typically invasive ductal carcinoma.[11] While Kini *et al.*,[12] 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.[13] Fine stands of cancer cells infiltrating into the surrounding tissue appeared to cause backscattering, resulting in posterior shadowing. Posterior enhancement is usually due to fluid component within a mass. Some of the solid cystic malignant masses were seen to be accompanied by both enhancement (from cystic part) and shadowing (from the solid component).[14] Most commonly encountered gray scale ultrasonographic features for malignant breast masses in this study were hypoechoic mass, taller than wide with irregular shape and spiculated margins, having neither posterior acoustic enhancement nor posterior shadowing, presence of intralesional microcalcifications and surrounding echogenic halo. Other associated findings frequently noted were skin thickening, thickened Cooper's ligament, nipple retraction, architectural distortion and axillary lymphadenopathy.[15] 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.[13] Similar findings were noted in present study. Lamb *et al.*,[16] investigated the relationship between imaging characteristics and histologic grade. Contrary to expectations that more malignant masses would show spiculated mass margins and acoustic shadowing, they found that higher-grade

tumors were significantly more likely than lower-grade ones to display poorly defined margins and posterior acoustic enhancement. The new vessels in malignancy are tortuous, non-hierarchical and disorganised with frequent stenosis, occlusions and arteriovenous shunts. Tumour cells produce protein angiogenin, thus correlating with tumor growth and producing new vessels that are tortuous, of irregular caliber and thin walls with no smooth muscle.[17,18] 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.[19] 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.[20]

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.

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