



## SONOGRAPHIC EVALUATION OF BREAST MASSES: PICTORIAL ESSAY

## Radiology

<b>Dr.Suresh Phatak</b>	Professor and Head of department, Dept. of Radio-diagnosis, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharashtra, India - 442001
<b>Dr. Manjeet Sehrawat</b>	Senior Resident, Dept. of Radio-diagnosis, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharashtra, India - 442001.
<b>Dr. Nipun Gupta</b>	Resident, Dept. of Radio-diagnosis, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharashtra, India - 442001.
<b>Dr. Hemant Thakur</b>	Resident, Dept. of Radio-diagnosis, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharashtra, India - 442001.
<b>Dr. Saherish Khan</b>	Resident, Dept. of Radio-diagnosis, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharashtra, India - 442001.
<b>Dr. Pallavi Phatak</b>	Final Year MBBS student, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharashtra, India - 442001.

## ABSTRACT

Ultrasound has taken a leading role in the management of breast disease. The main reasons are its ability to distinguish between cystic and solid lesions, its special advantages in examining the dense breast, and significantly absence of potential radiation hazards. Various benign and malignant features can be easily identified on sonography. It is also very useful in obtaining FNAC/biopsy under USG guidance along with interventional procedures like drainage of breast abscess. In this pictorial essay we are depicting USG findings of various classical breast pathologies encountered in our teaching hospital of rural region.

## KEYWORDS

Breast masses, Neoplasm, Sonomammography, Ultrasound.

**Introduction:** - The diagnosis of probably benign lesion is based on the exclusion of suspicious signs but also on the confirmation of certain parameters showing benign lesions such as: elliptical shape and horizontal orientation; well-defined curvilinear or only slightly lobated margins; the presence of a complete, thin echogenic capsule; echotexture almost completely hyperechoic. [1] The ultrasound technique for breast sonography (B mode) should meet the following criteria linear probes of frequencies between 7.5 and 20 MHz (more often 12—14 MHz) should be used. The frequency must be adapted in relation to the breast volume and the location of the lesion in the breast (lower frequency for deep lesions, high frequency for superficial lesions); total gain and TGC should be used to obtain an adequate and homogeneous signal from the area of skin to the depth of the pectoral muscle; the focal zone must be adjusted in depth relative to the lesion; the lesion must be analyzed in at least two planes: trans-verse and longitudinal or radial (according to the major axis of the lactiferous ducts) and anti-radial. Additional modes like tissue harmonic imaging, compound mode, doppler mode and elastography further help in lesion characterization. [2].

**Cystic lesions:** - are classified into 6 types (type's I—VI), Simple cysts (type I) means anechoic masses with an imperceptible walls, circumscribed border and acoustic enhancement. Clustered cysts (type II) defined as clustered anechoic cysts with no discrete solid components. Cysts with thin septa (type III) seen as cysts within septa of less than 0.5 mm in thickness. Complicated cysts (type IV) were defined according to the American College of Radiology Breast Imaging Reporting and Data System (BI-RADS) 4 as lesions with homogeneous low-level echoes that otherwise meet the criteria specified of simple cysts, including cystic lesions containing fluid-debris levels or floating echogenic debris. Cystic masses with septa or a wall greater than 0.5 mm in thickness or mixed cystic and solid masses with at least a 50% cystic component were classified as cystic masses with a thick wall/septa or nodules (type V). Solid masses with eccentric cystic foci were considered complex solid and cystic masses (type VI). [3] [Fig1]

**Fibrocystic changes (FCCs):** - are the most frequent benign

conditions of breast, diagnosed in 50% of women examined clinically and in 90% of women in histopathological studies. These benign disorders have two important implications in the area of breast cancer diagnosis and management. First, FCCs can mimic breast cancer clinically, on mammography and breast ultrasonography, leading to unnecessary breast biopsies and patient anxiety. Second, some types of FCCs represent risk factor for the subsequent development of breast cancer [4] USG spectrum of focal fibrocystic changes include solid mass, cysts, heterogeneously echogenic tissue, and absent sonographically visible focal change. [5] [Fig2]

**Galactocele:** - is a cystic dilatation of the terminal ducts and ductules containing milk, so the appearance of a galactocele may vary during the monitoring. To begin with it appears as an anechoic cyst with possible septation, as the milk is fresh with homogeneously emulsified fat globules in a liquid component. Later in the course of disease the content becomes moderately echogenic, when the fat tends to form increasingly large and less emulsified globules, which are distributed unevenly or are suspended above the liquid component. [6] [Fig 3]

**Fibroadenomas:** - are benign tumors which commonly present in late adolescence. They are classified according to their histology and size. Simple fibroadenomas are most common type and usually present as mobile masses upto 3 cms. in diameter. Giant fibroadenomas are more uncommon but typically present in adolescence. Fibroadenomas associated with other soft tissue masses should raise possibility of various inherited syndrome. [7] On US images, fibroadenoma appears as a well-circumscribed elliptical mass that is either hypo or isoechoic and has uniform echogenicity. The lesion is typically larger in the transverse diameter than in the anteroposterior and has very well-demarcated margins. A fibroadenoma may have no effect on ultrasound transmission, or acoustic enhancement or shadow may be seen on US images. [8] [Fig 4] Fibroadenomas that consist of sclerosing adenosis, papillary apocrine metaplasia, epithelial calcifications, and/or cysts greater than 3 mm are considered as complex fibroadenoma. The relative risk of developing breast cancer in patients with complex fibroadenoma is more, compared to women with noncomplex fibroadenoma. [9] [Fig5]

**Juvenile fibroadenoma:** - is seen on ultrasound as a circumscribed oval hypoechoic or isoechoic mass, which resembles that of simple fibroadenoma. Juvenile fibroadenoma frequently shows posterior acoustic enhancement and hypervascularity on color Doppler. [10] [Fig6]

**Phylloides tumor:** - on USG, seen as well-defined masses with low-level echoes. Only few with an echogenic rim, and homogenous internal echoes; while remaining have nonuniform pattern, with mostly weak scattered echoes and a few echogenic spots. Other findings include posterior enhancement, intramural cysts with a diameter between 3 and 10 mm are also seen. They are round or ovoid with smooth walls, usually multiple, and marginally located. The malignant phylloides tumor is lobulated with rather smooth contours and had inhomogeneous internal echoes but no posterior shadowing. [11] [Fig7]

**Hamartomas:** - Their USG appearance differs widely owing to the marked variability in the adipose and fibrous tissue contents. In most cases, they appear as solid, well-defined, oval formations lying parallel to the skin plane. The echo structure is inhomogeneous with hypoechoic areas intermixed with hyperechoic band-like or nodular areas, reflecting the presence of adipose, epithelial, and fibrous connective tissues. Hypervascularization is absent on color Doppler imaging. [12] All hamartomas are well compressible with a transducer [13] [Fig8]

**Intraductal papillary neoplasms:** - of breast form a wide spectrum of pathological changes with benign intraductal papillomas occupying one end of spectrum and papillary carcinoma at the other end. Intraductal papillomas can occur anywhere in ductal system and broadly classified into central and peripheral types. Three basic patterns are recognized on USG. Intraductal mass with or without ductal dilatation, intracystic mass and predominantly solid pattern with intraductal mass totally filling the duct. A distinct vascular pedicle is seen within the central core with branching vessels arborising within the mass. [14] [Fig9 a and b]

**Ductal Ectasia:** - Duct ectasia predominantly affects ducts in the retroareolar region and is defined as nonspecific dilatation of one or more ducts. Sonographic evaluation demonstrates anechoic smooth-walled branching structures that taper peripherally. Duct ectasia can also be seen in the spectrum of malignant disease. Sonographic features favouring malignancy include the location of the ectasia; a peripheral location favours a malignant process, whereas a central location indicates a benign process. Other features that suggest a malignant process include irregularity of the duct margin, focal thickening of the duct wall, and the presence of adjacent hypoechoic tissue. [15] [Fig10]

**Breast abscesses:** - are complications of infectious mastitis and generally occur in young women. Breast abscesses can be classified according to clinical presentation into puerperal abscesses (in breast feeding women) and Nonpuerperal Abscesses (outside breast feeding period and as per location central and peripheral). [16] At US, mastitis appears as an ill-defined area of altered echotexture with increased echogenicity in the infiltrated and inflamed fat lobules, hypoechoic areas in the glandular parenchyma, and associated mild skin thickening with occasional distended lymphatic vessels (17) Two sonographic signs, interstitial fluid and hypoechoic wall are relatively specific for breast abscess and may aid in the diagnosis of breast disease [18]. [Fig11a and b]

**Tuberculosis of the breast:** - is a rare entity. Etiologically it can be subdivided into Primary Breast Tuberculosis and Secondary Tuberculosis. On ultrasound, three different patterns of breast tuberculosis are described, depending upon the imaging morphology visualized on sonomammography. The most common type is nodular type, followed by diffuse type, and sclerosing type. Nodular group included multiple round to oval focal hypoechoic lesions in breast. When abnormal hypoechoic irregular areas were seen spanning the entire breast parenchyma, the lesion was included under the category of diffuse type. Lesions with heterogenous irregular hyperechoic areas inside the breast lesions are included as the sclerosing variant. [19] [Fig 12 a and b]

**Gynaecomastia:** - is seen on USG as nodular, poorly defined or flame shaped. All masses retroareolar in location, with most of them

hypoechoic, avascular, parallel to the chest wall, without posterior enhancement or shadowing. In cases with no mass majority show increased AP depth at the nipple [20] [Fig 13]

**Carcinoma breast:** - Ultrasound characteristics of malignant breast mass include irregular shape, vertical orientation, margins irregular or indistinct, hypoechoic echostructure, heterogenous internal echo pattern, no change in shape with compression, irregular posterior shadowing, increased vascularity and distorted surrounding architecture. [21] [Fig14] Of all the sonographic features, posterior acoustics are the strongest predictor of histological grade. Compared with grade 1 and grade 2 lesions, grade 3 lesions were more likely to display posterior enhancement and less likely to show posterior shadowing, which are classically considered to be good sonographic predictors of malignancy [22] [Fig 15, 16]. Cystic masses with a thick wall/septa or nodules (type V) and complex solid and cystic masses (type VI) should undergo biopsy with pathologic confirmation, even if these masses have oval and well-circumscribed margins. [3] [Fig17] Sonography is useful in detection of metachronous contralateral breast cancers. [23] [Fig18]



Fig 1] Anechoic lesion with thin walls, clear fluid contents and posterior acoustic enhancement suggestive of simple cyst.

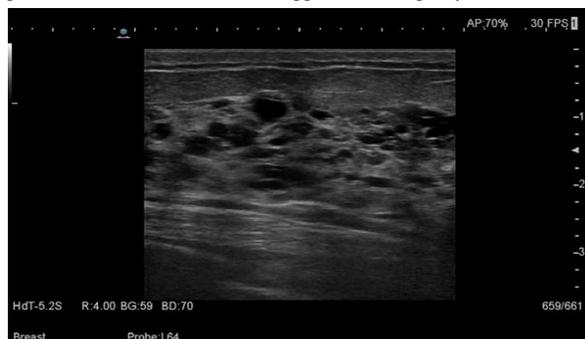


Fig 2] Patient presented with nodularity of breast. USG showing cysts, solid tissue and heterogenous echogenic breast tissue indicating focal fibrocystic changes.

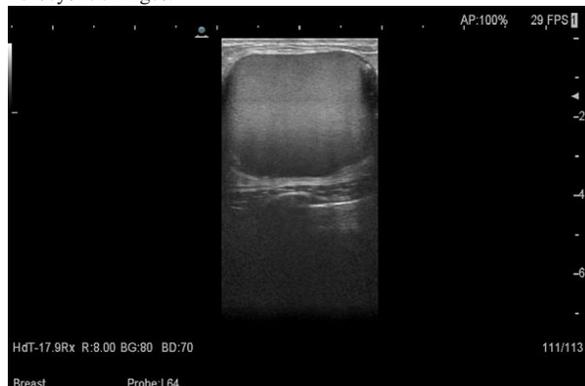


Fig 3] well defined lesion containing echogenic debris and fat fluid

levels in a lactating patient. On aspiration white coloured fluid was seen indicating galactocele.



Fig 4] well defined wider than taller lesion with uniform echogenicity suggestive of fibroadenoma.



Fig 5] Elliptical well encapsulated lesion with cystic areas suggestive of complex fibroadenoma.



Fig 6] A large isoechoic breast mass(6x4 cms.) in a 14 year old girl resembling fibroadenoma showing posterior acoustic enhancement indicating juvenile fibroadenoma.



Fig 7] well defined round lesion with inhomogenous internal echoes and fluid filled clefts Histopathology was suggestive of phylloid tumor.



Fig 8] solid, oval, well defined mass showing inhomogenous echostructure, hypoechoic areas mixed with hyper echoic fat indicating hamartoma.



Fig 9 a and b] A small linear solid lesion seen in dilated duct showing a vascular pedicle suggestive of papilloma.

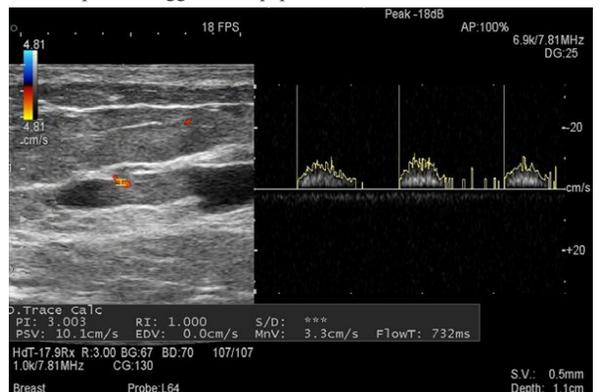


Fig 9 a and b] A small linear solid lesion seen in dilated duct showing a vascular pedicle suggestive of papilloma.



Fig 10] multiple dilated mammary ducts with internal debris indicating ductal ectasia in a patient presented with nipple discharge.

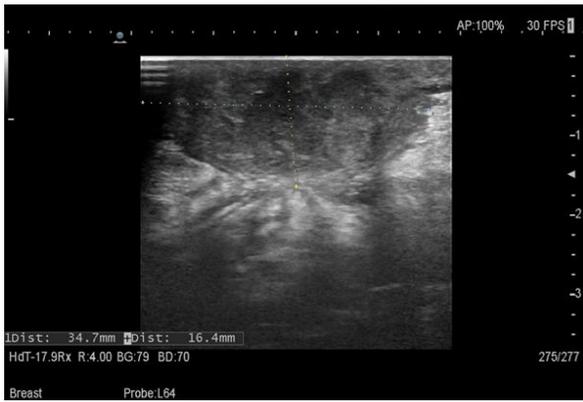


Fig 11a and b] A hypoechoic lesion with debris in breast with well defined walls showing hypervascularity in a lactating lady presented with pain and fever indicating abscess.



Fig 11a and b] A hypoechoic lesion with debris in breast with well defined walls showing hypervascularity in a lactating lady presented with pain and fever indicating abscess.

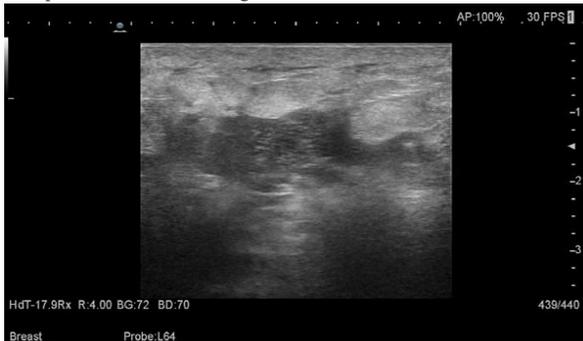


Image 12a and b] Focal hypoechoic lesion with internal echoes, surrounding Inflamed fat, increased vascularity on doppler and axillary reactive lymphadenopathy aspiration revealed features of granulomatous mastitis.



Image 12a and b] Focal hypoechoic lesion with internal echoes, surrounding Inflamed fat, increased vascularity on doppler and axillary reactive lymphadenopathy aspiration revealed features of granulomatous mastitis.

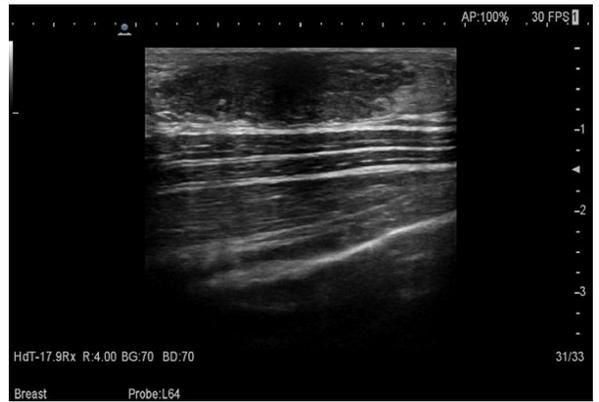


Fig 13] A hypoechoic retroareolar lesion in a male showing no vascularity on doppler suggestive of nodular gynecomastia.



FIG14] Spiculated, hypoechoic, taller than wide showing calcifications biopsy proven carcinoma breast.



Fig15] Biopsy proven Carcinoma breast showing posterior acoustic shadowing indicating low grade of malignancy.



Fig16 Biopsy proven Carcinoma breast showing acoustic enhancement confirming a high grade of malignancy.



Fig17] A complex cystic mass with large solid component biopsy proven carcinoma breast.

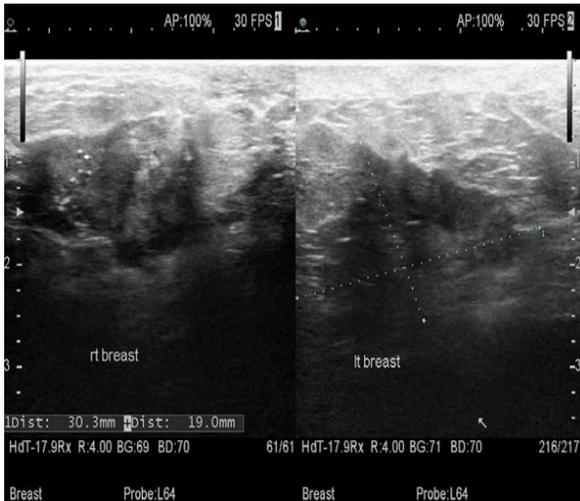


Fig18] Bilateral spiculated hypoechoic masses in both breast with calcification on biopsy proved to be carcinoma breast.

#### References:-

- 1] N. Masciadri, C. Ferranti Benign breast lesions: Ultrasound Journal of Ultrasound 2011; 14: 55-65.
- 2] A. Athanasiou, E. Auberta, A. Vincent Salomon, A. Tardivon Complex cystic breast masses in ultrasound examination Diagnostic and Interventional Imaging (2014) 95, 169–179.
- 3] Yun-Woo Chang, Kwi Hyang Kwon, Dong Erk Goo, Deuk Lin Choi, Hye Kyung Lee, Seung Boo Yang, Sonographic Differentiation of Benign and Malignant Cystic Lesions of the Breast J Ultrasound Med 2007; 26:47–53.
- 4] Guray M, Sahin AA. Benign breast diseases: classification, diagnosis, and management. Oncologist 2006; 11: 435-49.
- 5] Shetty MK, Shah YP Sonographic findings in focal fibrocystic changes of the breast Ultrasound Q; 2002; 18(1):35-40.
- 6] N. Masciadri C. Ferranti Benign breast lesions: Journal of Ultrasound 2011; 14:55-65.
- 7] Jayasinghe Y, Simmons PS Fibroadenoma in adolescence. Curr Opin Obstet Gynecol 2009; 21(5):402-6.
- 8] Neeti B. Goel, Thomas E. Knight, Shilpa Pandey, BS Michelle Riddick-Young, Ellen Shaw de Paredes, Ami Trivedi, Fibrous Lesions of the Breast: Imaging Pathologic Correlation RadioGraphics 2005; 25:1547–1559.
- 9] Merih GÜRAY DURAK, İlgin KARAMAN, Tülay CANDA, Pınar BALCI, Ömer HARMANCIOĞLU Cystic fibroadenoma of the Breast: A Case Report Turkish Journal of Pathology 2011;27, (3):254-265.
- 10] Suk Jung Kim, Young Mi Park, Soo Jin Jung, Kwang Hwi Lee, Ok Hwa Kim, MD, Ji Hwa Ryu, Gi Bok Choi, Sun Joo Lee, Hye Jung Choo, Hae Woong Jeong Sonographic Appearances of Juvenile Fibroadenoma of the Breast J Ultrasound Med 2014; 33:1879–1884.
- 11] Wolfgang Buchberger, Karin Strasser, Kurt Heim, Elisabeth Muller, Hans Schrocksnadel Phylloides Tumor: Findings on Mammography, Sonography, and Aspiration Cytology in 10 Cases AJR 1991; 157:715-719.
- 12] A. Presazzi G. Di Giulio F. Calliada Breast hamartoma: ultrasound, elastosonographic, and mammographic features. Mini pictorial essay J Ultrasound (2015) 18:373–377.
- 13] Tzu-Chieh Chao, Hsiao-Hsiang Chao, Miin-Fu Chen Sonographic Features of Breast Hamartomas J Ultrasound Med 2007; 26:447–452.
- 14] Ganesan S, Karthik G, Joshi M, Damodaran V Br. J. Radiol 2006; 79:843-9.
- 15] Diana M. Ferris-James, Elaine Iuanow, Tejas S. Mehta, Rola M. Shaheen, Priscilla J. Slanetz Imaging Approaches to Diagnosis and Management of Common Ductal Abnormalities RadioGraphics 2012; 32:1009–1030.
- 16] Isabelle Trop, Alexandre Dugas, Julie David, Mona El Khoury, Jean-François Boileau, Nicole Larouche, Lucie Lalonde, Breast Abscesses: Evidence-based Algorithms for Diagnosis, Management, and Follow-up RadioGraphics 2011; 31:1683–1699.
- 17] Ulitzsch D, Nyman MK, Carlson RA. Breast abscess in lactating women: US-guided treatment. Radiology 2004; 232(3):904–909.
- 18] Nguyen SL, Doyle AJ, Symmans PJ Interstitial fluid and hypoechoic wall: two sonographic signs of breast abscess J Clin Ultrasound 2000; 28(7):319-24.
- 19] Sushil G Kachewar, Smita B Sankaye and Devidas S Kulkarni Ultrasound review of seven cases of breast tuberculosis Internet Journal of Medical Update. 2013 July; 8(2):58-61.
- 20] Vandana Dialani, Janet Baum, Tejas S. Mehta Sonographic Features of Gynecomastia J Ultrasound Med 2010; 29:539–547.
- 21] Ian C Bennett and Magdalena A Biggar The role of ultrasound in the management of breast disease AJUM 2011; 14 (2): 25–28.
- 22] Jason Blaichman, James C. Marcus, Tahra Alsaadi, Mona El-Khoury, Sarkis Meterissian, Benoit Mesurulle Sonographic Appearance of Invasive Ductal Carcinoma of the Breast According to Histologic Grade AJR 2012; 199:W402–W408.
- 23] Min Jung Kim, Eun-Kyung Kim, Jin Young Kwak, Byeong-Woo Park, Seung-II Kim, Joohyuk Sohn, Ki Keun Oh Role of Sonography in the Detection of Contralateral Metachronous Breast Cancer in an Asian Population AJR 2008; 190:476–480