



Hyperechoic Lesions on Breast Ultrasound: All Things Bright and Beautiful?

S. K. Ramani¹ Ashita Rastogi² Nita Nair³ Tanuja M. Shet⁴ Meenakshi H. Thakur⁵

¹Department of Radiodiagnosis, Dr. D. Y. Patil Medical College, Navi Mumbai, Maharashtra, India

²Department of Radiodiagnosis, Delhi State Cancer Institute, New Delhi, India

³Department of Surgical Oncology, Tata Memorial Hospital, Mumbai, Maharashtra, India

⁴Department of Pathology, Tata Memorial Hospital, Mumbai, Maharashtra, India

⁵Department of Radiodiagnosis, Tata Memorial Hospital, Mumbai, Maharashtra, India

Address for correspondence Ashita Rastogi, MBBS, DNB, Specialist Radiologist Dubai, UAE
(e-mail: ashitarastogi@hotmail.com).

Indian J Radiol Imaging 2021;31:18–23.

Abstract

Ultrasound (US) lexicon of the Breast Imaging Reporting and Data System (BI-RADS) defines an echogenic breast mass as a lesion that is hyperechoic in comparison with subcutaneous adipose tissue. However, at sonography, only 0.6 to 5.6% of breast masses are echogenic and the majority of these lesions are benign. Approximately, 0.5% of malignant breast lesions appear hyperechoic. The various benign pathologic entities that appear echogenic on US are lipoma, hematoma, seroma, fat necrosis, abscess, pseudoangiomatous stromal hyperplasia, galactocele, etc. The malignant diagnoses that may present as hyperechoic lesions on breast US are invasive ductal carcinoma, invasive lobular carcinoma, metastasis, lymphoma, and angiosarcoma. Echogenic breast masses need to be correlated with mammographic findings and clinical history. Lesions with worrisome features such as a spiculated margin, interval enlargement, interval vascularity, or association with suspicious microcalcifications on mammography require biopsy. In this article, we would like to present a pictorial review of patients who presented to our department with echogenic breast masses and were subsequently found to have various malignant as well as benign etiologies on histopathology.

Keywords

- breast ultrasound
- hyperechoic breast mass
- mammography

Introduction

Breast ultrasound (BUS) is an indispensable technique in the evaluation of breast pathologies, as a primary or an adjunct modality to mammography or magnetic resonance imaging (MRI). The American College of Radiology Breast Imaging Reporting and Data System (BI-RADS)¹ provides unambiguous descriptors for reporting of breast masses on ultrasound to aid in the differentiation of benign from malignant.

These descriptors include shape, margin, echogenicity, etc. Hyperechogenicity of a mass has traditionally been associated with benignity in the past.² However, in the present decade, many reports have emerged stating that malignant lesions may be hyperechoic on ultrasound^{3–5} and vice versa. In this article, we present a pictorial review of echogenic breast masses that were subsequently found to have various malignant as well as benign etiologies on histopathology.

published online
April 19, 2021

DOI <https://doi.org/10.1055/s-0041-1729124>
ISSN 0971-3026

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Teaching Points

At sonography, only 0.6 to 5.6% of breast masses are echogenic and the majority of these lesions are benign. Approximately, 0.5% of malignant breast lesions appear hyperechoic on BUS. Echogenic lesions with worrisome features such as a spiculated margin, interval enlargement, or association with suspicious calcifications on mammography require biopsy.^{6,7} Similarly, lesions with internal vascularity at US warrant close attention, since up to 64% of primary or secondary breast lymphomas are hypervascular and melanoma metastases are almost always hypervascular.⁴

Benign Pathologies

Fat-Containing Hamartoma

Hamartoma is a pathological entity characterized by abnormal arrangement of normal cells and tissues within an organ. They are more often seen in middle-aged women, presenting as painless masses. On mammography, a circumscribed round or oval, mixed density mass is visualized. On BUS, an oval-to-round circumscribed lesion is identified with an echogenic or echolucent periphery (pseudocapsule formed due to compression of normal surrounding parenchyma).^{3,5} The echogenicity of the lesion depends on the relative ratio of fat and epithelial components, and is often similar to the normal breast parenchyma, giving it a “breast-within-breast” appearance (► Fig. 1).⁸

Lipoma

Lipomas are common benign tumors characterized by proliferation of mature adipocytes and may manifest as soft, painless, palpable lump(s) in the breast. A well-circumscribed radiolucent mass may be seen on mammography. On BUS, it may be hypoechoic, isoechoic, or hyperechoic, albeit

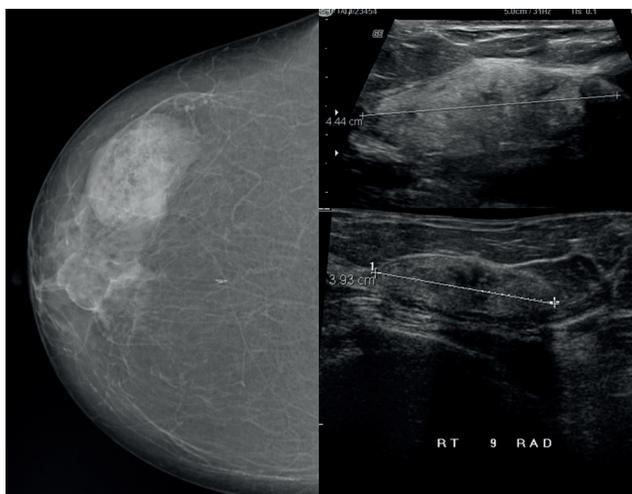


Fig. 1 A 78-year-old woman with diffuse palpable lump in the right breast. Mammogram: well-circumscribed oval lesion with fat lucencies within in the right upper outer quadrant. BUS: echogenic oval lesion with “pseudocapsule” in the right breast at the 9 o’clock position. Diagnosis: hamartoma.

homogenous and with no internal or peripheral vascularity (► Fig. 2).^{3,4}

An echogenic mass that is radiolucent on mammogram does not warrant a biopsy. However, heterogeneous internal echotexture or presence of cystic component or increase in size raises suspicion for liposarcoma and surgical excision could be performed.⁴

Fibrous Tissue

Pseudoangiomatous Stromal Hyperplasia (PASH)

PASH of the breast is a benign mesenchymal tumor resulting from proliferation of myofibroblasts in patients with high density of progesterone receptors. It commonly presents as a diffuse involvement, and presentation as a nodular lesion is rare. When it occurs in the nodular form, it may be seen as a mass or asymmetry on mammography or may even be occult. On BUS, a well-circumscribed solid oval hypoechoic or heterogeneous mass may be seen; however, occasionally it is seen as an echogenic mass.^{3,4} Though it is benign in etiology, excision may be indicated in symptomatic or enlarging lesions or those with atypical imaging features (► Fig. 3).



Fig. 2 A 20-year-old woman with lump in the right breast of 7 months’ duration, gradually increasing in size. Mammogram: radiolucent mass in the lower central quadrant of right breast with coarse calcifications. BUS: well-defined oval hyperechoic lesion in parallel orientation in the right breast at the 6–7 o’clock position. Lumpectomy done. Diagnosis: fatty tissue with dystrophic calcification; lipoma.

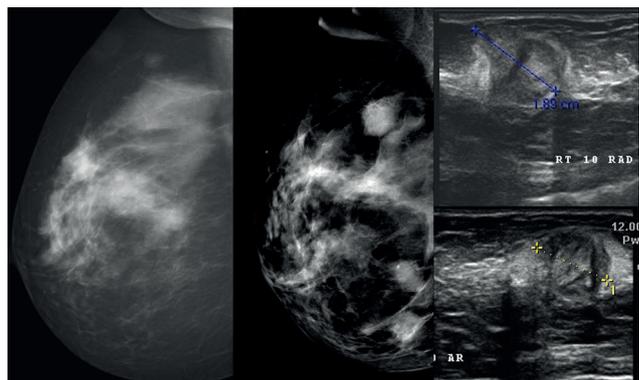


Fig. 3 A 47-year-old woman with fibrosarcoma of anterior abdominal wall. Mammography: bilateral breast masses (increase in size at 6-month follow-up). BUS: well-circumscribed heterogeneous hyperechoic lesions in the left breast at the 1–2 o’clock position and in the right breast at the 10 o’clock position—concerning for metastases. HPE, histopathological examination; PASH, pseudoangiomatous stromal hyperplasia.

Focal Fibrosis

Also known as solitary fibrous tumor of the breast, focal fibrosis has been recognized as distinct pathological entity for a decade. It is characterized by fibrous tissue proliferation with obliteration of the lobular-ductal parenchyma. It may appear as a well-circumscribed mass or an ill-defined lesion. On ultrasound, it may be observed as hypoechoic or echogenic, with the echogenicity resulting from interfaces created by tightly packed fibrous strands without interposed fatty tissue (►Fig. 4).³

Miscellaneous

Fat Necrosis

Fat necrosis is inflammation of the fat within the breast secondary to injury resulting from direct trauma or surgical interventions, such as biopsy, lumpectomy, mastoplasty, or reconstructive surgery, or after radiation therapy.

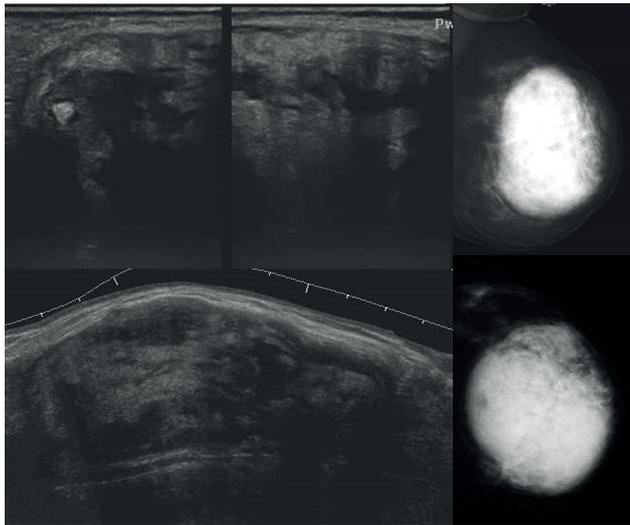


Fig. 4 A 50-year-old woman with left breast lump for 8 months. Mammography: large oval mass seen nearly in entire left breast parenchyma. BUS: encapsulated mixed echogenicity mass suggestive of hamartoma. HPE: solitary fibrous tumor of breast.

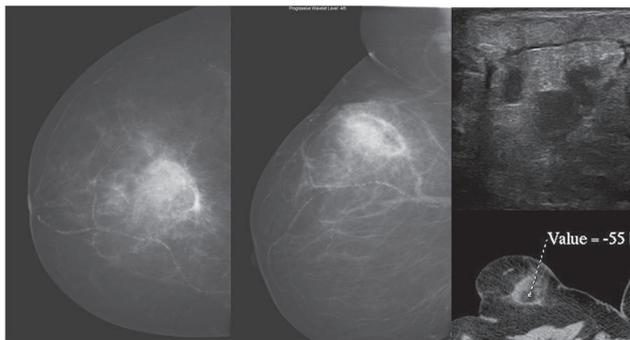


Fig. 5 A 61-year-old woman with seat-belt injury to the right breast. Mammogram: ill-defined mass in the right upper central region. BUS: an iso- to hyperechoic relatively circumscribed mass at the 12 o'clock position of the right breast with hypoechoic areas within. Computed tomography (CT) scan: fat density (HU value = -55) seen within the lesion. Right breast mass, core biopsy: fat necrosis with chronic lymphohistiocytic inflammation.

When symptomatic, it presents as a painless lump. On mammography, common appearances include oil cysts and coarse calcifications, while occasionally it may present as an irregular mass or distortion. On ultrasound, fat necrosis may manifest as an echogenic mass or an anechoic mass with posterior acoustic enhancement or shadowing (►Fig. 5).³⁻⁵ In patients with fat necrosis, clinical history plays an important role in clinching the diagnosis.

Hematoma

Hematoma may form in the breast after trauma or recent surgical intervention and is usually variable in sonographic appearance due to evolving nature of blood products with duration.^{4,5} Hematomas may be visualized as hypoechoic or echogenic masses, which shrink in size over time (►Fig. 6). Biopsy is warranted in cases where the size is increasing, indicating a probable underlying malignant lesion.

Galactocele

Galactoceles are known to form in the breast due to ductal obstruction in a lactating breast secondary to inflammation. They present as palpable masses during lactation or at a short interval after cessation of lactation, and represent cystic spaces filled with milk products. The mammographic as well as sonographic features depend on relative proportions of fat and proteinaceous contents within the galactocele and may appear entirely echogenic in some cases (►Fig. 7).⁴

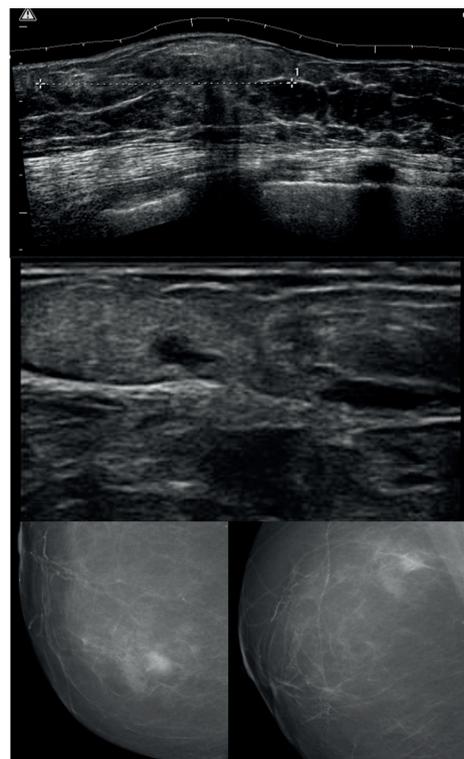


Fig. 6 A 64-year-old woman with a history of fall 5 days back. Mammogram: focal asymmetry in the right breast upper inner quadrant. BUS: heterogeneous hyperechoic lesion in the right breast, which resolved in 2 weeks. Diagnosis: hematoma.

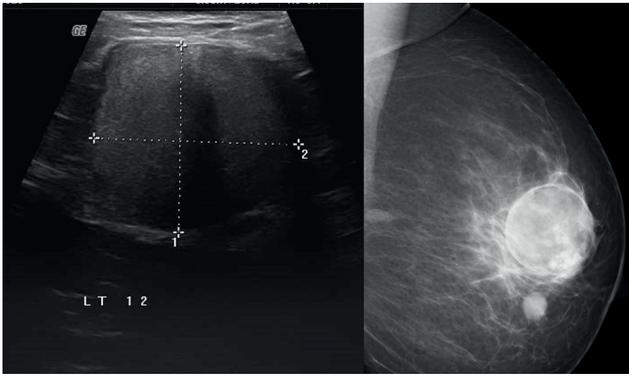


Fig. 7 A 27-year-old woman with left breast lump for 1 month postlactation. Mammogram: well-circumscribed round radiolucent lesion. BUS: well-defined hyperechoic lesion in the left breast at the 12 o'clock position. Diagnosis: galactocele.

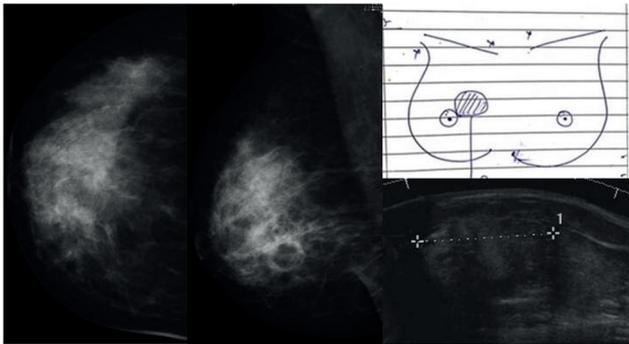


Fig. 8 A 34-year-old woman with right breast lump for 1 month. Mammography: ACR-BIRADS Category 1. BUS: ill-defined area of increased echogenicity in the right breast at the 2 o'clock position (marked by calipers). HPE: Granulomatous mastitis secondaries are from lymphomas/leukemias and melanomas.¹¹ Other tumors that metastasize to breast include lung and ovarian cancers.

Mastitis and Abscess

Mastitis is inflammation of the fat lobules within the breast, which appears echogenic on BUS (► **Fig. 8**). The pattern of involvement may be diffuse and ill-defined or a relatively circumscribed region with hypoechoic or anechoic foci within which abscess formation ensues.^{4,5} On mammography, ill-defined area of increased density and skin thickening may be seen. Patients typically present with fever, pain, local erythema, and induration. Inflammatory breast cancer (IBC) may be indistinguishable from mastitis in its presentation exhibiting an ill-defined area of increased echogenicity without an obvious mass. Hence, a punch biopsy of the skin may need to be performed in nonresolving inflammatory lesions to determine the involvement of subdermal lymphatics (pathologic hallmark of IBC).^{4,9}

Malignant Entities

Highly Cellular Lesions

Lymphoma

Lymphomatous affliction of the breast may be primary or secondary, with the non-Hodgkin's variety occurring more frequently. On mammography, it may manifest as a

well-circumscribed round or oval mass or ill-defined increase in breast density. It is more commonly seen as a hypoechoic and hypervascular solid mass on BUS; however, in up to a fourth of patients, it may have increased echogenicity owing to high cellularity (► **Fig. 9**).^{3,5,10} Mucinous and medullary cancers may also present as well-circumscribed hyperechoic masses, albeit without increase in vascularity.

Metastases

Metastases to the breast from nonmammary primary malignancies are more commonly bilateral and even multiple as compared with primary breast malignancy, with a prevalence of 1.7 to 6.6%. The most common secondaries are from lymphomas/leukemias and melanomas.¹¹ Other tumors that metastasize to breast include lung and ovarian cancers.

On mammography, metastases are generally well-circumscribed with no spiculations or calcifications and commonly located in the upper outer quadrants.^{3,4} On BUS, the conventional picture is that of multiple bilateral hypoechoic solid masses (► **Fig. 10**). Echogenic masses are seen in metastases from lymphoma or melanoma with typically increased internal vascularity; concurrent axillary lymphadenopathy more common in lymphomas is helpful in differentiating these from melanoma secondaries.

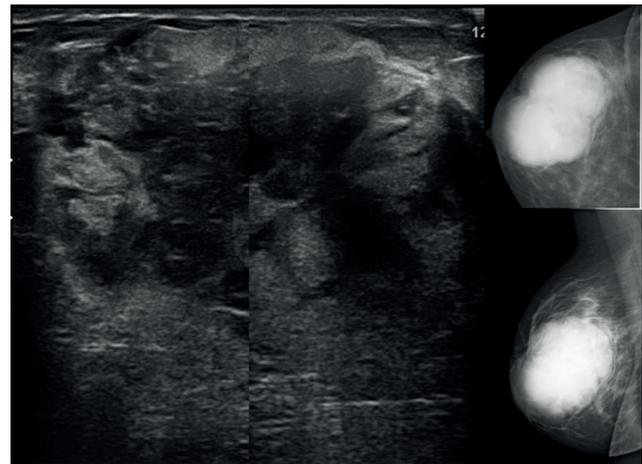


Fig. 9 A 25-year-old woman with a known case of non-Hodgkin lymphoma (NHL) with right breast lump. Mammography: large, lobulated, high-density mass in outer aspect of the right breast. BUS: heterogeneous echogenic mass in the right breast at the 7-11 o'clock position. HPE: NHL, Burkitt's type.

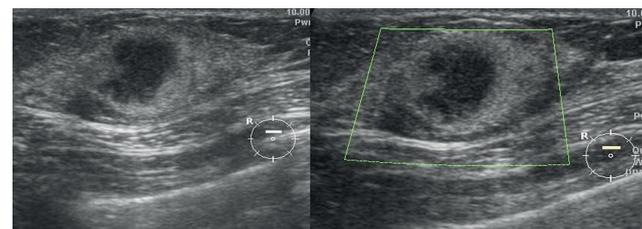


Fig. 10 A 16-year-old girl with a known case of orbital rhabdomyosarcoma with right breast lump. BUS: ill-defined, hyperechoic lesion with central hypoechoic area suggestive of necrotic change in the right breast at the 12 o'clock position. HPE: metastatic alveolar rhabdomyosarcoma.

Vascular

Angiosarcoma

Angiosarcomas, although rare, are highly aggressive neoplasms of the breast stroma arising from the endothelial cells lining the vascular channels. Primary angiosarcoma arises *de novo*, while secondary angiosarcoma arises in previously treated breast—more commonly post radiation therapy (usually after 5–10 years) and occasionally even in patients with lymphedema postsurgery. Up to a third of the patients may present with skin discoloration. On mammography, the lesion may be occult or may present as a mass or focal asymmetry. On BUS, a circumscribed hypervascular mass with heterogeneous echogenicity is commonly observed (►Fig. 11).³⁻⁵ A predominantly hyperechoic mass may be seen attributable to the presence of multiple abnormal anastomotic channels on histopathology.

Fibrous/Highly Cellular

Invasive Carcinoma

Invasive ductal as well as lobular cancers may rarely be visualized as hyperechoic masses on ultrasound. However, the rest of the sonographic features, such as spiculated or irregular margins, nonparallel orientation, perilesional architectural distortion, and posterior shadowing, take precedence in assigning such masses to a malignant category rather than benign based solely on their echogenicity.³⁻⁵

In ductal cancers, hyperechoic appearance may be attributable to intratumoral heterogeneity or to the presence of a predominant echogenic periphery containing strands of collagen fibers and proliferating tumor cells around a small, nearly imperceptible hypoechoic center with sparse tumor cells and greater fibrosis.

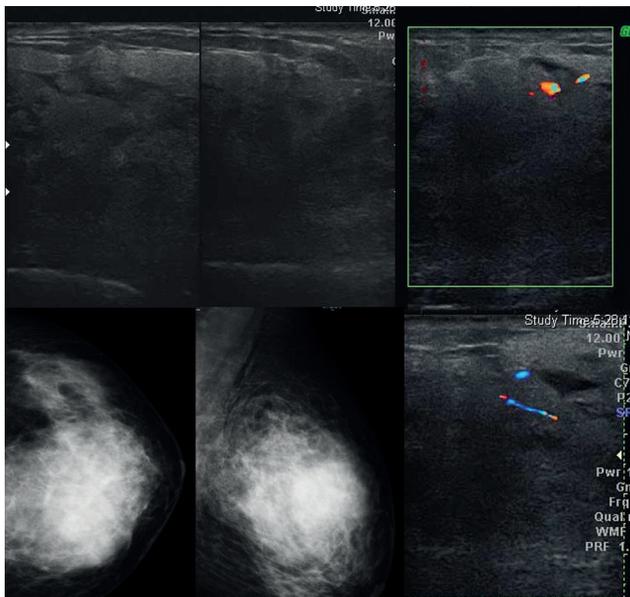


Fig. 11 A 42-year-old woman with a left breast lump for 1.5 years. Mammography: asymmetric increased parenchymal density in the left upper inner quadrant. BUS: diffuse increased echogenicity in upper aspect of the left breast with no discrete mass and few areas of increased vascularity. HPE: low-grade angiosarcoma.

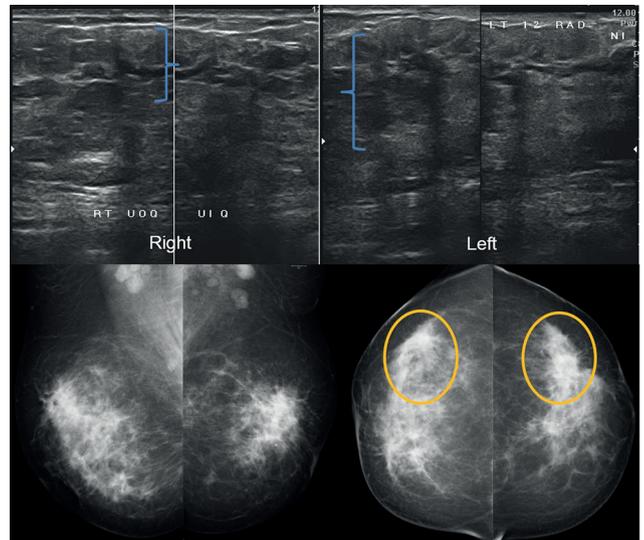


Fig. 12 A 44-year-old woman with lump in both breasts for 6 months. Mammography: focal asymmetries in both breasts' upper outer quadrants. BUS: focal increased parenchymal echogenicity in both breasts' upper outer quadrants. HPE: bilateral invasive lobular carcinomas.

Increased echogenicity of lobular cancers could be ascribed to the pathology responsible for its sometimes occult manifestation on mammography, i.e., diffuse infiltrative growth pattern. The rows of cells infiltrating into the surrounding parenchyma and around normal ducts create multiple reflective surfaces responsible for hyperechoic appearance on BUS (►Fig. 12). Jones et al found 5% of the invasive lobular cancers to have an echogenic appearance on ultrasound.¹²

Conclusion

It is essential that the hyperechoic breast lesions should be categorized based on the most worrisome ultrasound finding and be correlated with mammographic appearance, and biopsy should be performed for histologic evaluation, as necessary.

Financial Support and Sponsorship

Nil.

Conflict of Interest

The authors declare no conflict of interest.

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