BEYOND THE LUMP
A GUIDE TO UNDERSTANDING BREAST IMAGING PATHOLOGY

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Learning Objectives

1. Review Breast anatomy in radiographic images and diagnostic/screening tools
2. Classify Breast masses using BIRADS identification system for risk assessment
3. Identify Compare common, key breast pathologies using various imaging modalities within the BI-RADS framework
1. Breast Tissue and Gross Anatomy
3. Diagnostic/Screening Tools
4. BI-RADS classification system
   a. BI-RADS 2 example
   b. BI-RADS 3 example
   c. BI-RADS 4 example
   d. BI-RADS 5 example
   e. BI-RADS 6 example
5. Compare and Contrast Imaging Modalities
Breast Anatomy: Tissue Types

Breasts are made up of adipose, glandular, and connective tissue

1. Adipose tissue: energy rich source that also plays a role in endocrine function of the breast
2. Glandular tissue: promotes production of milk
3. Connective tissue: consists of Coopers ligaments, collagen, and elastin. All provide structural support to the breast.

Article: Avni Skandhan et al. rID: 25714
1. **Nipple/Areolar complex**: where milk ducts converge
2. **Ducts**: carry milk from lobules to nipple
3. **Lobes**: 14-18 lobules distributed circumferentially around the nipple
4. **Lobules**: small glands inside lobes that produce milk.
There is no "normal" appearance to breast tissue; however, some common structures that can be identified include:

- **Fibroglandular tissue**: homogeneously dense structures
- **Fat**: appears round and radiolucent
- **Cooper's ligaments**: curved, linear and radiopaque

Article: Avni Skandhan et al.  rID: 25714
Case: Stefano Pacifici. rID: 25751
**US: Breast Anatomy**

- **Fibroglandular tissue**: variably hyperechoic
- **Fat**: appears round and hypoechoic
- **Cooper's ligaments**: curved, linear and hyperechoic

*Article: Avni Skandhan et al. rID: 25714*

**MRI: Breast Anatomy**

- **T1**:
  - **Fibroglandular/connective/ductal tissue**: low signal
  - **Fat**: moderate-high signal

*Article: Avni Skandhan et al. rID: 25714*
## Diagnostic/Screening Tools for Breast Masses

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Mammogram</strong></td>
<td>• initial screening tool for breast mass in females &gt; 30 yrs old</td>
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<tr>
<td></td>
<td>• screening tool to detect breast cancer even when there is no mass.</td>
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<td>• depending on the country, can start as early as 45.</td>
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| **Ultrasound**| • initial screening tool for breast mass in females < 30 yrs old or those with dense breasts |
|              | • reasonable sensitivity but poor specificity                               |
|              | • distinguishes benign vs malignant mass features                           |

| **MRI**      | • sensitivity >90% to detect breast cancer                                  |
|              | • used as screening for patients with high risk or BRACA gene mutation      |
|              | • superior to mammo for assessing dense breasts                            |
|              | • distinguishes benign vs malignant mass features                           |

**Article:** The Radswiki rID: **14761**  
**Article:** Natalie Yang rID: **2681**  
**Article:** Joshua Yap rID: **12182**
# Breast Imaging-Reporting and Data System (BI-RADS) Overview

**Breast Malignancy Risk Assessment Tool**

<table>
<thead>
<tr>
<th>BI-RADS 0</th>
<th>Inconclusive, need additional imaging</th>
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<tbody>
<tr>
<td>BI-RADS 1</td>
<td>Negative-no abnormalities present</td>
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<tr>
<td>BI-RADS 2</td>
<td>Benign; mass is fibroadenoma, cyst, lipoma, etc.</td>
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<tr>
<td>BI-RADS 3</td>
<td>Probably benign, repeat imaging in 6 mos</td>
</tr>
<tr>
<td>BI-RADS 4</td>
<td>Suspicious for malignancy, biopsy recommended</td>
</tr>
<tr>
<td>BI-RADS 5</td>
<td>Highly suggestive of malignancy</td>
</tr>
<tr>
<td>BI-RADS 6</td>
<td>Has biopsy proving malignancy</td>
</tr>
</tbody>
</table>

**Article:** Yuranga Weerakkody et al.  
**rID:** 10003
Applying BI-RADS
Common features & masses

BI-RADS 1: refer to earlier slides for images of normal breast
BI-RADS 2: Simple breast cyst, fibroadenoma, fat necrosis
BI-RADS 3: Specific US features
BI-RADS 4: Invasive ductal carcinoma, invasive lobular carcinoma
BI-RADS 5/6: Invasive breast cancer, no specific type, infiltrating ductal carcinoma
BI-RADS 2 - Benign Finding
Simple Breast Cyst

**REASSURING FEATURES**
- Parallel ovoid shape
- Circumscribed margin
- Discernible normal parenchymal elements
- Density similar to ath of surrounding fibroglandular tissue

**Mammo** - solitary large well-circumscribed mass in the right outer breast centrally, completely encircled by a low-density halo.

**US** - Hypoechoic mass without vascularity.

*Case: Henry Knipe, rID: 52358*
BI-RADS 2 - fibroadenoma

**Mammo** - Heterogeneous fibroglandular tissue in the central breasts. Large, **well-defined, lobulated non-calcified soft tissue abnormality** with a radiolucent halo around the lesion.

**US** - Well-defined, lobulated solid **hypoechoic mass** measuring 3.8 x 6.2 cm.

**REASSURING FEATURES**
- No nipple retraction
- No significant lymphadenopathy
- No skin thickening

*Case: Ammar Ashraf, rID: 90946*
Note the subtle lucencies in the subareolar breast tissue. They are the early changes of fat necrosis.

US - Thin rim of calcification is visible and the necrotic fat is slightly echogenic.

2 yrs later
The typical serpiginous circumferential calcification of fat necrosis.

Case: Garth Kruger, rID: 21553
**BI-RADS 3 - Ultrasound features**

**WHAT TO LOOK FOR**

- Refraction shadowing without an associated mass
- Complicated cyst with uniform low-level echoes
- Microlobulated or oval mass composed of clustered microcysts
- Hypoechoic mass, circumscribed, oval, parallel, without posterior features or with minimal posterior enhancement
- Hyperechoic mass with central hypoechoic to anechoic components and surrounding edema

**Case:** Paresh K Desai, rID: 5875
A large oval-shaped mass with a partially obscured and slightly lobulated margin is noted in the medial central part of the left breast. US - Thick-walled cystic lesion without a solid component which is probably benign. Based on the size and associated pain, US-guided fine needle aspiration was performed for the patient as a palliative treatment. Follow-up US & annual screening mammography recommended.

Case: Mohammadtaghi Niknejad, rID: 157908
Mammo - Area of parenchymal distortion localized to the upper outer quadrants of the right breast. Small amorphous calcifications and initial retraction of the retroareolar region.

Ultrasound examination confirms a nodule with spiculated, hypoechogenic margins.

BI-RADS 4
Invasive breast cancer, no specific type

Case: Valerio Giacalone, rID: 99880
Three mass-like lesions with irregular margins in the left breast's upper part, causing mild surrounding parenchymal distortion.

Rounded mass with irregular & spiculated margin and several internal micro-calcifications is noted at upper outer quadrant of left breast which is suspicious for cancer.
BI-RADS 5
Invasive breast carcinoma of no special type

**Spiculated** high-density mass at central part of right breast with parenchymal distortion and skin retraction. Focal-like densities deep inner central and UOQ, suggestive of satellite lesions

MOST COMMON TYPE OF BREAST CANCER (70-80%).

Case: Mohammadtaghi Niknejad rID: 161500
BI-RADS 5
Invasive breast carcinoma of no special type

Hypoechoic mass with irregular and spiculated margins and surrounding parenchymal distortion shear wave elastography with mass and surrounding stroma yellow and red suggesting malignancy

Case: Mohammadtaghi Niknejad rID: 161500

Peak age of presentation of ~50-60 years
An irregular, high-density lesion with spiculated margins, clustered microcalcifications, architectural distortion and nipple retraction.

Dense mass with irregular and spiculated margin and internal microcalcifications with adjacent parenchymal distortion.

Case: Mohammadtaghi Niknejad, rID: 97661

Case: Praveen Jha, rID: 17840
On X-ray, popcorn calcifications are a classic description of involuting fibroadenomas.

On X-ray, fibroadenoma shows well-defined circumscribed equal density mass.

Small TNBC lesions (<2 cm) can mimic benign lesions (i.e. fibroadenoma) on US and mammo.

TNBC usually demonstrates more suspicious features and greater roundness on US whereas fibroadenoma is more ovoid.

Case: Bahman Rasuli rID: 96868
Case: Sandeep Singh Awal rID: 78260
Case: Ahmed Abdelrahman rID: 78448
Take Home

Golden rule: always look at previous imaging.

One more: breast ultrasound is a hands-on procedure. Do it in real-time with your own eyes or get bitten.

Last one: screening studies need to be read in an uninterrupted environment free of phones.

~ Advice courtesy of case by Garth Kruger, Radiopaedia.org, rID: 19716

Consult Radiopaedia when needed!
References