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Breast ultrasound lexicon and BI-RADS® classification

Breast ultrasound (BUS) is used to improve the specificity of mammographic and clinical findings. BUS has become the imaging-guidance method of choice for percutaneous procedures such as cyst aspiration, needle biopsy and pre-operative localization.

The development of a universally accepted lexicon to accurately describe imaging features has significantly improved the ability to communicate with commonly understood terminology that minimizes the risk for interpretive, communication or management errors.

The assignment of assessment categories (BI-RADS® CLASSIFICATION) is based on the assessment of multiple features, not any single feature of a sonographic finding. It is essentially the summation of pertinent findings and a final conclusion as to the normal, benign or potentially malignant nature of a given sonographic finding. The goal is to insure, to the greatest degree possible, appropriate management of sonographic findings.

The Breast Imaging and Reporting Data System (BI-RADS®) for breast ultrasound is based on the Breast Imaging and Reporting Data System for mammography.

The following are reprinted with permission of the American College of Radiology:

BI-RADS® – US

A. Masses: A mass occupies space and should be seen in two different projections.
Shape (select one) **Description**
❏ Oval Elliptical or egg-shaped (may include 2 or 3 undulations, i.e. "gently lobulated" or "macrolobulated")
❏ Round Spherical, ball-shaped, circular, or globular

❏ Irregular Neither round nor oval in shape

Orientation (select one) **Description**
❏ Parallel Long axis of lesion parallels the skin line ("wider than tall" or horizontal)
❏ Not parallel Long axis, not oriented along the skin line ("taller than wide" or vertical, includes round)

Margin (select one) **Description**
❏ Circumscribed A margin that is well defined or sharp, with an abrupt transition between the lesion and surrounding tissue
❏ Not circumscribed* The mass has one or more of the following features: indistinct, angular, microlobulated or spiculated
❏ Indistinct No clear demarcation between a mass and its surrounding tissue
❏ Angular Some or all of the margin has sharp corners, often forming acute angles
❏ Microlobulated Short cycle undulations impart a scalloped appearance to the margin of the mass
❏ Spiculated Margin is formed or characterized by sharp lines projecting from the mass

Lesion Boundary (select one) **Description**
❏ Abrupt interface The sharp demarcation between the lesion and surrounding tissue can be imperceptible or a distinct well-defined echogenic rim of any thickness
❏ Echogenic halo No sharp demarcation between the mass and surrounding tissue, which is bridged by an echogenic transition zone

Echo Pattern (select one) **Description**
❏ Anechoic Without internal echoes
❏ Hyperechoic Having increased echogenicity relative to fat or equal to fibroglandular tissue
❏ Complex Mass contains both anechoic and echogenic components
❏ Hypoechoic Defined relative to fat; masses are characterized by low-level echoes throughout (e.g. appearance of a complicated cyst or fibroadenoma)
❏ Isoechoic Having the same echogenicity as fat (a complicated cyst or fibroadenoma may be isoechoic or hypoechoic)

Posterior Acoustic Features (select one) **Description**
❏ No posterior acoustic features No posterior shadowing or enhancement
❏ Enhancement Increased posterior echoes
❏ Shadowing Decreased posterior echoes; edge shadows are excluded
❏ Combined pattern More than one pattern of posterior attenuation, both shadowing and enhancement

Surrounding Tissue Description
Identifiable effect (select all that apply)
❏ Duct changes Abnormal caliber and/or arborization
❏ Cooper's ligament changes Straightening or thickening of Cooper's ligaments
❏ Edema Increased echogenicity of surrounding tissue; reticulated pattern of angular, hypoechoic lines
❏ Architectural distortion Disruption of normal anatomic planes
❏ Skin thickening Focal or diffuse skin thickening (Normal skin is 2 mm or less in thickness except in the periareolar area and lower breasts)
❏ Skin retraction/irregularity Skin surface is concave or ill-defined, and appears pulled in

ACR BI-RADS®–US Lexicon Classification Form

For each of the following categories, select the term that best describes the dominant lesion feature.
Wherever possible, definitions and descriptors used in BI-RADS® for mammography will be applied to ultrasound.
* Note: Irregular is used as descriptor of shape rather than margin Copyright 2003 American College of Radiology

B. Calcifications: Calcifications are poorly characterized with ultrasound but can be recognized particularly in a mass.

Calcifications Description
If present (select all that apply)
❏ Macrocalcifications Greater than or equal to 0.5 mm in size
❏ Microcalcifications out of mass Echogenic foci that do not occupy the entire acoustic beam and do not shadow. Less than 0.5 mm in diameter
❏ Microcalcifications in mass Embedded in a mass, microcalcifications are well depicted. The punctate, hyperechoic foci will be conspicuous in a hypoechoic mass

C. Special Cases: Special cases are those with a unique diagnosis or finding.

Special Cases (select all that apply)

Description
❏ Clustered microcysts A cluster of tiny anechoic foci each smaller than 2-3 mm in diameter with thin (less than 0.5 mm) intervening septations and no discrete solid components

- ❏ Complicated cysts Most commonly characterized by homogeneous low-level internal echoes Complicated cysts may also have fluid-fluid, or fluid-debris levels that may shift with changes in patient's position
- ❏ Mass in or on skin These masses are clinically apparent and may include sebaceous or epidermal inclusion cysts, keloids, moles and neurofibromas
- ❏ Foreign body May include marker clips, coil, wire, catheter sleeves, silicone, and metal or glass related to trauma
- ❏ Lymph nodes - intramammary Lymph nodes resemble small kidneys with an echogenic hilus and hypoechoic surrounding cortex. Found in the breast, including axilla
- ❏ Lymph nodes - axillary Lymph nodes resemble small kidneys with an echogenic hilus and hypoechoic surrounding cortex. Found in the breast, including axilla

D. Vascularity

Vascularity (select one)
- ❏ Not Present or not assessed
- ❏ Present in lesion
- ❏ Present immediately adjacent to lesion
- ❏ Diffusely increased vascularity in surrounding tissue

E. Assessment Category (select one)

Assessment Category (select one) **Description**
- ❏ **Category 0** – Incomplete Additional imaging evaluation needed before final assessment

Final Assessment
- ❏ **Category 1** – Negative No lesion found (routine follow-up)
- ❏ **Category 2** –Benign finding No malignant features; e.g. cyst (routine follow-up for age, clinical management)
- ❏ **Category 3** – Probably benign finding Malignancy is highly unlikely, e.g. fibroadenoma (initial short interval followup)
- ❏ **Category 4** – Suspicious abnormality Low to moderate probability of cancer, biopsy should be considered
- ❏ **Category 5** – Highly suggestive of Almost certainly cancer, appropriate action should be taken malignancy
- ❏ **Category 6** – Known cancer Biopsy proven malignancy, prior to institution of therapy

This US lexicon classification form is for data collection and does not constitute a written US report.

American College of Radiology **BI-RADS® – US**

ASSESSMENT CATEGORIES

a. Assessment is Incomplete

Category 0
Need Additional Imaging Evaluation:
In many instances, the US examination completes the evaluation of the patient. If US is the initial study, other examinations may be indicated.
An example would be the need for mammography if US were the initial study for a patient in her late 20's evaluated with US for a palpable mass that had suspicious sonographic features. Another example might be where mammography and US are nonspecific, such as differentiating between scarring and recurrence in a patient with breast cancer treated with lumpectomy and radiation therapy. Here, MRI might be the recommendation.
A need for previous studies to determine appropriate management might also defer a final assessment.

b. Assessment is Complete — **Final** Categories

Category 1
Negative:
This category is for sonograms with no abnormality, such as a mass, architectural distortion, thickening of the skin or microcalcifications. For greater confidence in rendering a negative interpretation, an attempt should be made to correlate the ultrasound and mammographic patterns of breast tissue in the area of concern.

Category 2
Benign Finding(s):
Essentially a report that is negative for malignancy. Simple cysts would be placed in this category, along with intramammary lymph nodes (also possible to include in Category 1), breast implants, stable postsurgical changes and probable fibroadenomas noted to be unchanged on successive US studies.

Category 3
Probably Benign Finding—Short-interval Follow-Up Suggested:
With accumulating clinical experience and by extension from mammography, a solid mass with circumscribed margins, oval shape and horizontal orientation, most likely a fibroadenoma, should have a less than 2 percent risk of malignancy. Although additional multicenter data may confirm safety of follow-up rather than biopsy based

on US findings, short-interval follow-up is currently increasing as a management strategy. Nonpalpable complicated cysts and clustered microcysts might also be placed in this category for short-interval follow-up.

Category 4
Suspicious Abnormality—Biopsy Should be Considered:
Lesions in this category would have an intermediate probability of cancer, ranging from 3 percent to 94 percent. An option would be to stratify these lesions, giving them a low, intermediate, or moderate likelihood of malignancy. In general, Category 4 lesions require tissue sampling. Needle biopsy can provide a cytologic or histologic diagnosis.
Included in this group are sonographic findings of a solid mass without all of the criteria for a fibroadenoma and other probably benign lesions.

Category 5
Highly Suggestive of Malignancy—Appropriate Action Should be Taken:
(Almost certainly malignant)
The abnormality identified sonographically and placed in this category should have a 95 percent or higher risk of malignancy so that definitive treatment might be considered at the outset. With the increasing use of sentinel node imaging as a way of assessing nodal metastases and also with the increasing use of neoadjuvant chemotherapy for large malignant masses or those that are poorly differentiated, percutaneous sampling, most often with imaging-guided core needle biopsy, can provide the histopathologic diagnosis.

Category 6
Known Biopsy-Proven Malignancy—Appropriate Action Should Be Taken:
This category is reserved for lesions with biopsy proof of malignancy prior to institution of therapy, including neoadjuvant chemotherapy, surgical excision or mastectomy.

BREAST ULTRASOUND
LEXICON & BIRADS CLASSIFICATION

G.W. Eklund, M.D., FACR

OR
How do you describe it?
How do you classify it?

The Goal

Eliminate the confusion and ambiguity in breast imaging reporting and recommendations.

Bring continuity and clarity to breast imaging reporting and recommendations.

Breast ultrasound report

- Clinical history
- Comparison study, if available
- Scope of exam (targeted, quadrant, full breast)
- Findings (pertinent, including absence of findings associated with imaging or clinical concerns)
  - Size
  - Location & transducer orientation
  - Character
- Correlation:
  - Clinical
  - Imaging (mammographic, previous sono, MRI, gamma)
- Final assessment (what the findings mean)
- Recommendation
  - Additional imaging
  - Follow-up
  - Intervention

Breast ultrasound report

Type & Object of study

"Left upper-outer quadrant assessment of mammographically detected asymmetric density."

"Bilateral, whole breast ultrasound to assess multiple bilateral nodular densities."

"Sonographic assessment of right upper central area of palpable induration in mammographically dense parenchyma."

Breast ultrasound report

Findings

"3x2-cm, irregular, shadowing, hypoechoic mass at 3:30 o'clock, 4-cm from the nipple."

"2.2-cm simple cyst in medial right subareolar area. Incidental 4-mm simple cyst at 5 o'clock, 3-cm from the nipple."

"No sonographic abnormalities are seen in the area of palpable concern."

"The palpable lump is shown to be a 1x2-cm area of loculated fatty tissue."

Breast ultrasound report

Correlation

"Sonographic findings explain the mammographic concern."

"Sonographic findings do not explain the clinical concern of palpable induration."

"Mammographic and sonographic concerns are concordant."

"I am unable to feel or sonographically define the clinically described lump in the upper central right breast."

Breast ultrasound report

Assessment Categories (BI-RADS)

- **Category 0 - Incomplete**
- **Category 1 – Negative**
- **Category 2 – Benign finding**
- **Category 3 – Probably benign finding**
- **Category 4 & 5 – Biopsy**
  - 4a –low suspicion
  - 4b –moderate suspicion
  - 4c – high suspicion
  - 5 – Almost certainly malignant
- **Category 6 – Known malignancy**

CATEGORIES ARE ASSIGNED ON THE BASIS OF THE IMAGING FINDINGS IN CONTEXT OF HISTORY AND CLINICAL INFORMATION

Assessment Categories
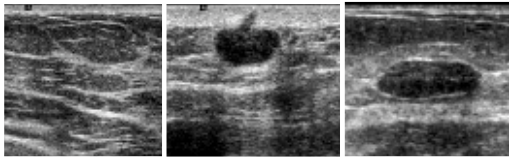
Category 1
Normal

Category 2
Benign

Category 3 Probably Benign

(Age 54, 1st mammogram)

Assessment Categories
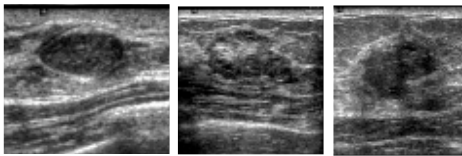
Category 4a Low suspicion

(Age 54, increase in size past year)

Category 4b Moderate suspicion
(palpable but unchanged clinically in 2 yrs)

Category 4c High suspicion

Assessment Categories
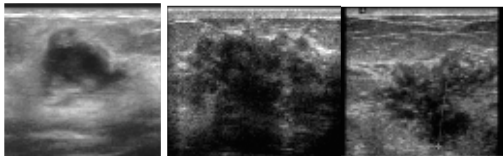
Category 5
Almost certainly malignant

Breast ultrasound report

Assessment

"Normal right breast ultrasound. Category 1"

"Benign finding. Category 2"

Simple cyst

Fibroadenoma

Oil cyst

Abscess

Hamartoma Lipoma Hematoma Fat necrosis

"Probably benign finding. Category 3"

Fibroadenoma

Hematoma

Fat necrosis

Breast ultrasound report

Assessment

Incomplete study. Category 0

- MRI to assess extent of disease
- Aspiration to exclude debris-containing cyst
- BSGI to support impression of benign process
- Ductography to identify sonographically occult papilloma
- Comparison films needed to confirm stability

Breast ultrasound report

Assessment categories requiring biopsy – 4 & 5

- Suspicious finding. Low suspicion for malignancy. Category 4A
  - Probable fibroadenoma, but histologic confirmation required
  - Probable cyst with chronic inflammatory change - biopsy required
  - Probable papilloma requiring histologic assessment
- Suspicious finding. Intermediate suspicion for malignancy. Category 4B
- Suspicious finding. "High" suspicion for malignancy. Category 4C
- Suspicious finding. Almost certainly malignant. Category 5

Known malignancy. Category 6

Breast ultrasound report

Recommendation

- Return to routine screening mammography
- Clinical monitoring with repeat sonogram in 3 months
- Repeat right breast mammogram and sonogram in 6 months
- Breast MRI study
- BIOPSY
  - Sono-guided core biopsy
  - Stereotactic core biopsy
  - Excisional biopsy

Breast ultrasound report

COMMUNICATION THAT IS CLEAR, CONCISE AND FREE OF AMBIGUITY

TRANSLATION:

SAY WHAT YOU MEAN!

MEAN WHAT YOU SAY!

USE THE RIGHT WORDS!

Radial   Sagital

1:30 o'c, 5.5-cm f/n   AnM-Radial   Axial
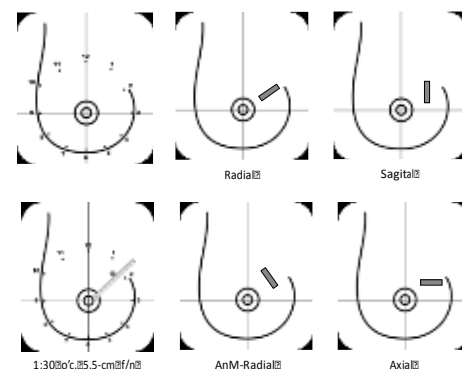
LEXICON

ECHO PATTERNS

- Isoechoic
- Hyperechoic
- Hypoechoic   } echogenicity relative to fat
- Anechoic
- Heterogenous or mixed
- Complex
- Posterior acoustic effects
  - No effect
  - Enhancement "shadowing"
  - Attenuation "shadowing"
  - Mixed or combined
- Reverberations
- Halos

ECHO PATTERNS (echogenicity)
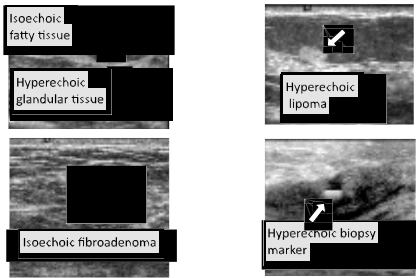
Isoechoic fatty tissue

Hyperechoic glandular tissue

Hyperechoic lipoma

Isoechoic fibroadenoma

Hyperechoic biopsy marker

ECHO PATTERNS (echogenicity)

Hypoechoic echo pattern with "specular echoes" (invasive ductal carcinoma with high-grade DCIS calcifications)

Hypoechoic echo pattern (invasive lobular carcinoma)

ECHO PATTERNS (echogenicity)

Anechoic echo pattern

Intracystic echogenic mass

Complex echo pattern

Heterogeneous echo pattern
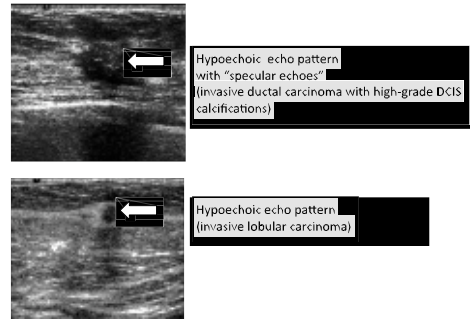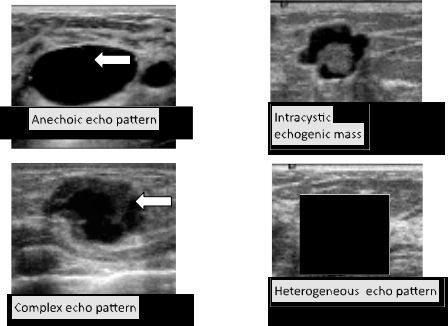
ECHO PATTERNS (echogenicity)
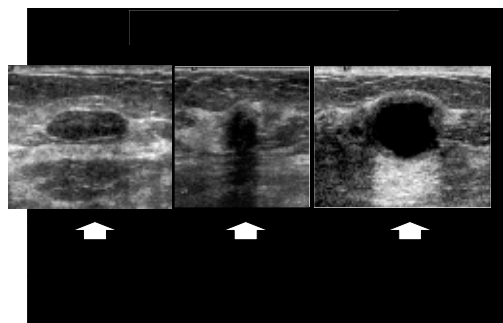
ECHO PATTERNS (echogenicity)
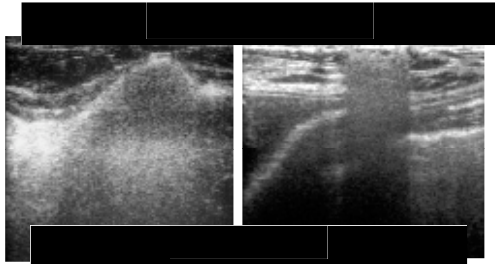
Extracapsular silicone   Silicone in lymph node

ECHO PATTERNS (echogenicity)
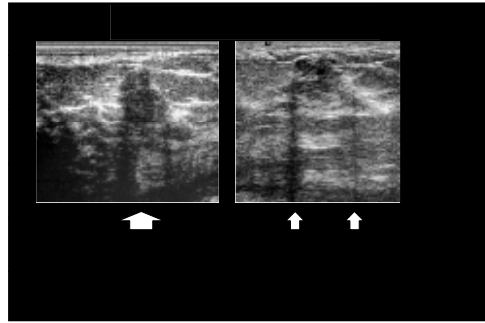
ECHO PATTERNS (echogenicity)
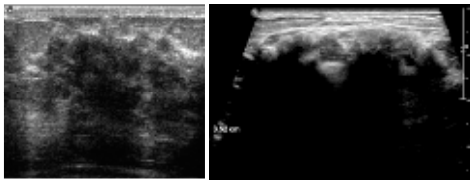
Intense shadowing – Invasive lobular carcinoma

ECHO PATTERNS (echogenicity)
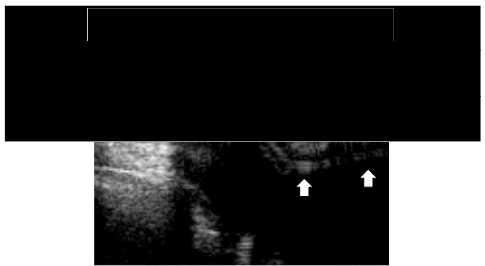
ECHO PATTERNS
(echogenicity) Halo or corona
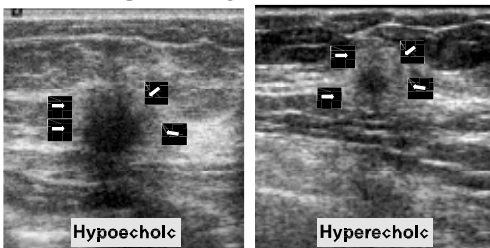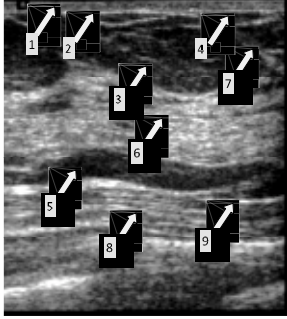
Hypoecholc   Hyperecholc
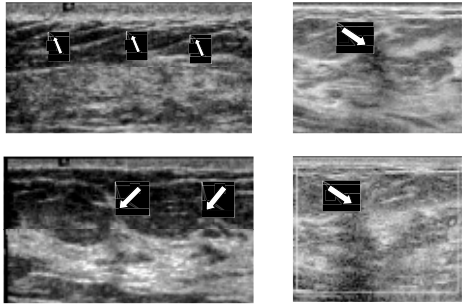
- Skin – superficial and deep layers
- Muscle
- Pectoral fascia – anterior and posterior
- Stroma
  - Cooper's ligaments
  - Fat
  - Fibrous tissue
  - Vascular structures (arteries, veins & lymphatics)
- Parenchyma –
  - Glandular tissue (ducts and TDLUs)
  - Ducts (normal, dilated, cystically dilated,   filling defects)
- Lymph nodes
- Axilla

Normal anatomy
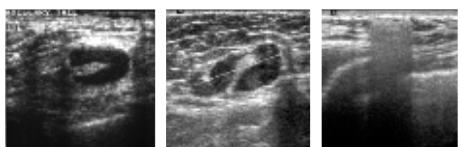
1 – Skin

2 - Deep layer of skin (superficial pectoral fascia)

3 - Fat

4 – Subcutaneous fat

5 - Retroglandular fat

6 – Glandular tissue

7 – Cooper's ligament

8 - Pectoral muscle

9 – Pectoral fascia - deep layer

Cooper's ligaments
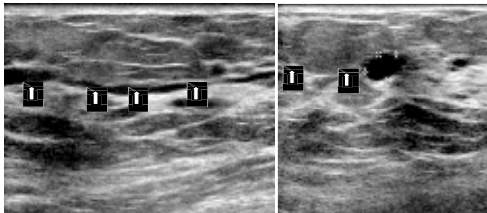
LYMPH NODES
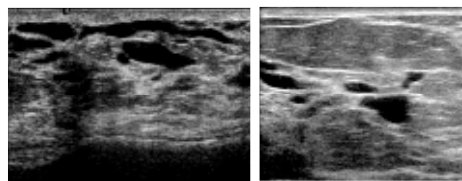
NORMAL   METASTATIC   Silicone-containing

DUCTS
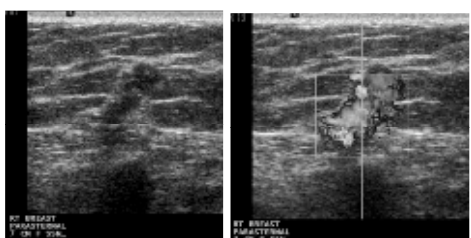
Mild to moderate duct ectasia   Cyst with normal caliber communicating ducts

Duct ectasia

Vascular structures

Arteriovenous malformation

Vascular structures
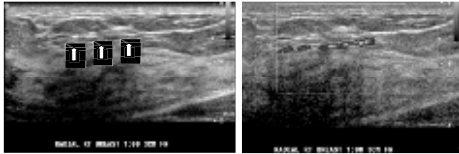
Vascular structure confirmed by Doppler flow

Mondor's disease

- Shape - oval, round, irregular
- Orientation - Parallel, non-parallel (wider than tall vs. taller than wide)
- Margins - circumscribed, non-circumscribed

  (Non-circumscribed = indistinct, angular, lobulated, microlobulated, spiculated)

- Boundary - transitional zone or interface between mass and surrounding tissue, including echogenic or anechoic halos
- Vascularity (Doppler) - not evaluated, none, within lesion, at margin of lesion or diffuse
- Effect on surrounding tissue - ducts, lymphatics, veins, Cooper's ligaments, muscle

  (Edema, architectural distortion, skin thickening, retraction, *converging lines)*

Shape
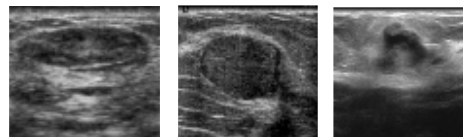
| Oval | Round | Irregular |

Orientation
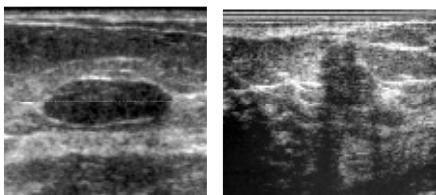
Wider than tall   Taller than wide

(parallel)   (non-parallel)

Margins
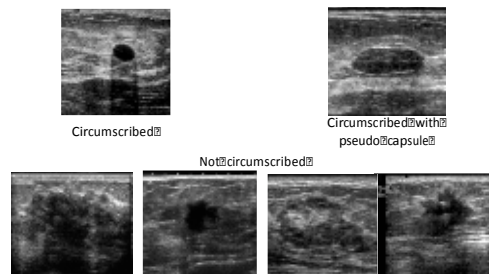
Circumscribed   Circumscribed with pseudo capsule

Not circumscribed

IndisMnct   Angular   Microlobulated   Spiculated

Lobulated   Lobulated   Angular

IndisMnct   Microlobulated   IndisMnct

Lobulation

Microlobulated   Macrolobulated

Lesion boundary

Abrupt interface

Echogenic halo

Vascularity

Not present or not assessed   Present within lesion

Present adjacent to lesion   Diffuse increase surrounding lesion

Effect on surrounding tissue

Edema surrounding mass

Effect on surrounding tissue

Duct extension

Effect on surrounding tissue
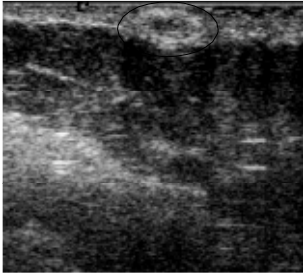
Echogenic rim of infla mmatory change arou nd sebaceous cyst

Pseudo mass
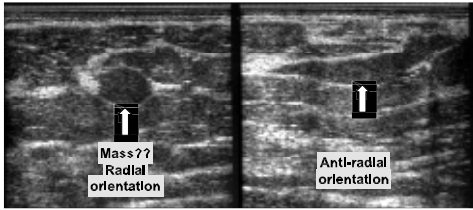
FaXy lobule

Pseudo mass

Loculated fatty tissue vs. lipoma
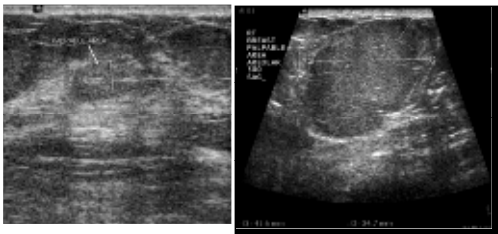
Loculated faXy Mssue   Lipoma

Lipoma
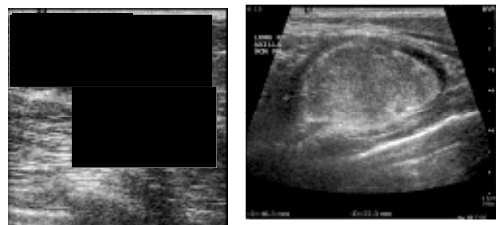
Lipoma
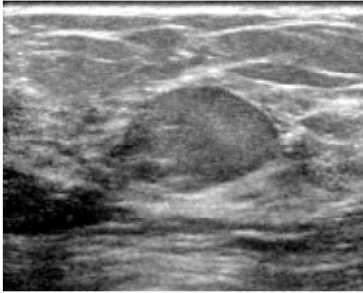
Pseudo mass

Isoechoic area of loculated faXy Mssue
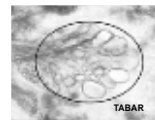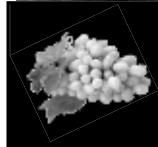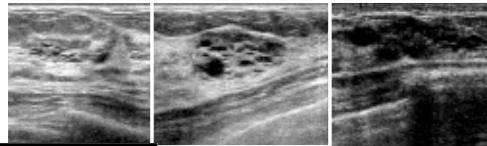

Confirmed by palpa Mon-guided sono graphy

Pseudo mass

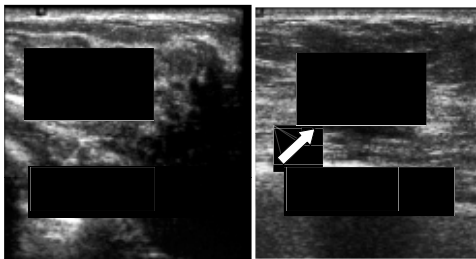Palpable area of loc ulated glandular Mss ue
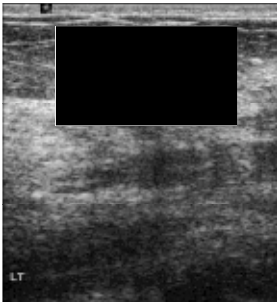
Confirmed by palpation-guided sonography

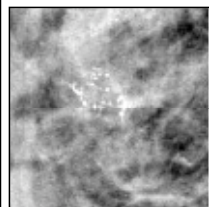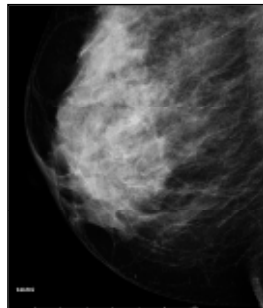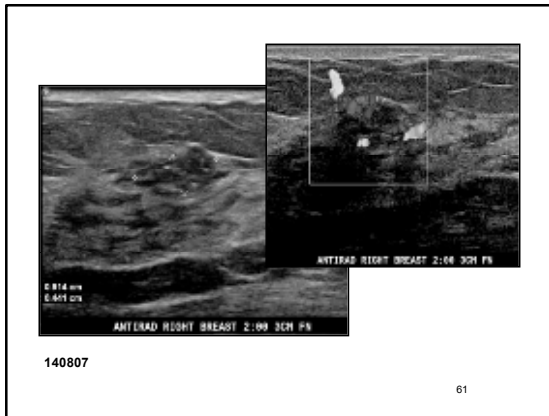## Fibrocystic complex

Calcifications

Calcifications

140807

61

SAY WHAT YOU MEAN!
MEAN WHAT YOU SAY!
USE THE RIGHT
WORDS!

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