Accreditation Case Review: Mammography and Stereotactic Biopsy

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The Janice Beesley Hartvigsen Breast Care Center at Intermountain Medical Center

Clinical Image Evaluation

Scoring Procedures for Screen Film and
Full Field Digital Mammography

Mammography Accreditation Program

Accreditation Objectives

- Improve quality of mammography
- Reason for clinical image review
  - Quality of patient imaging is key
  - Provide feedback for improvement
- Uniform assessment of performance

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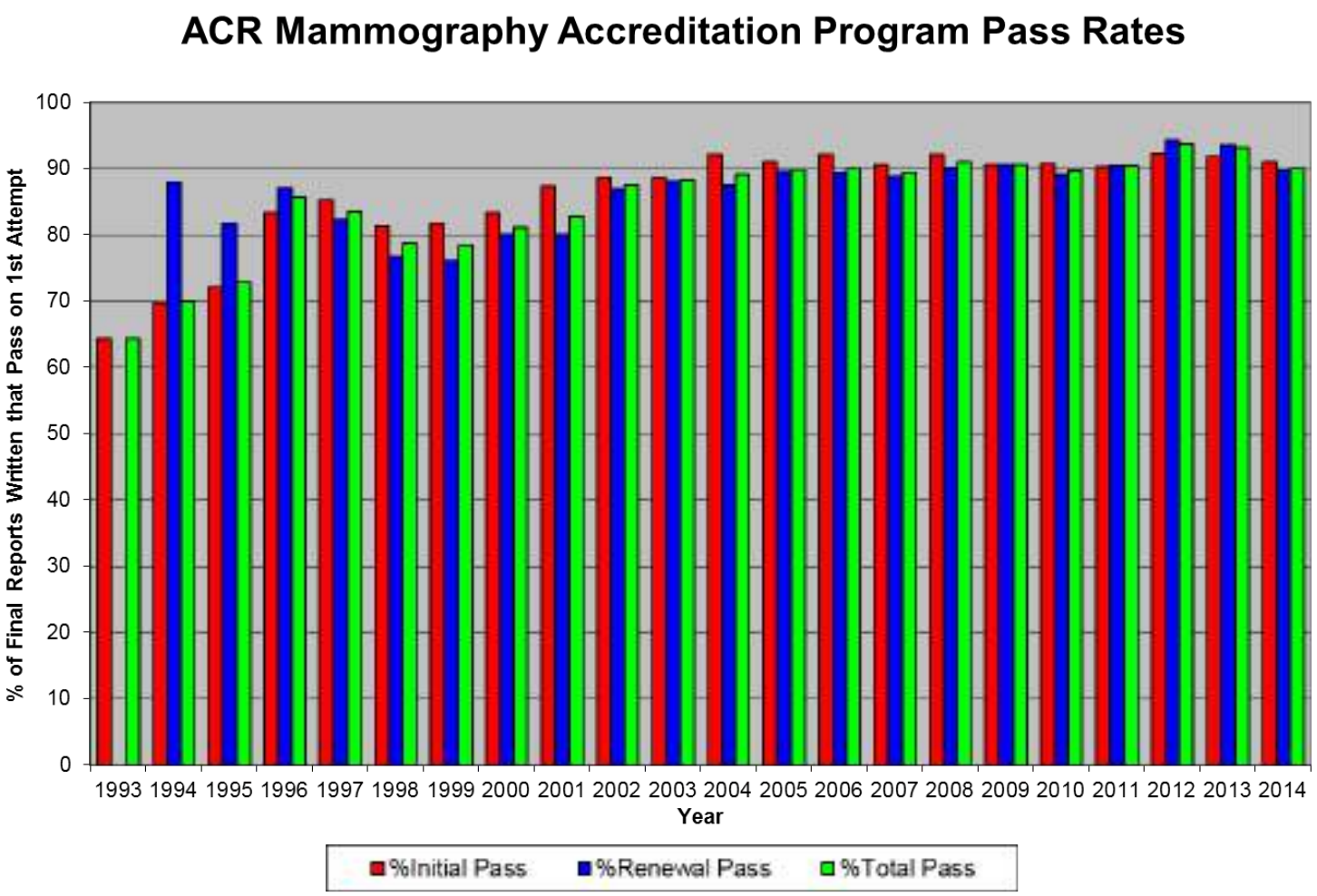
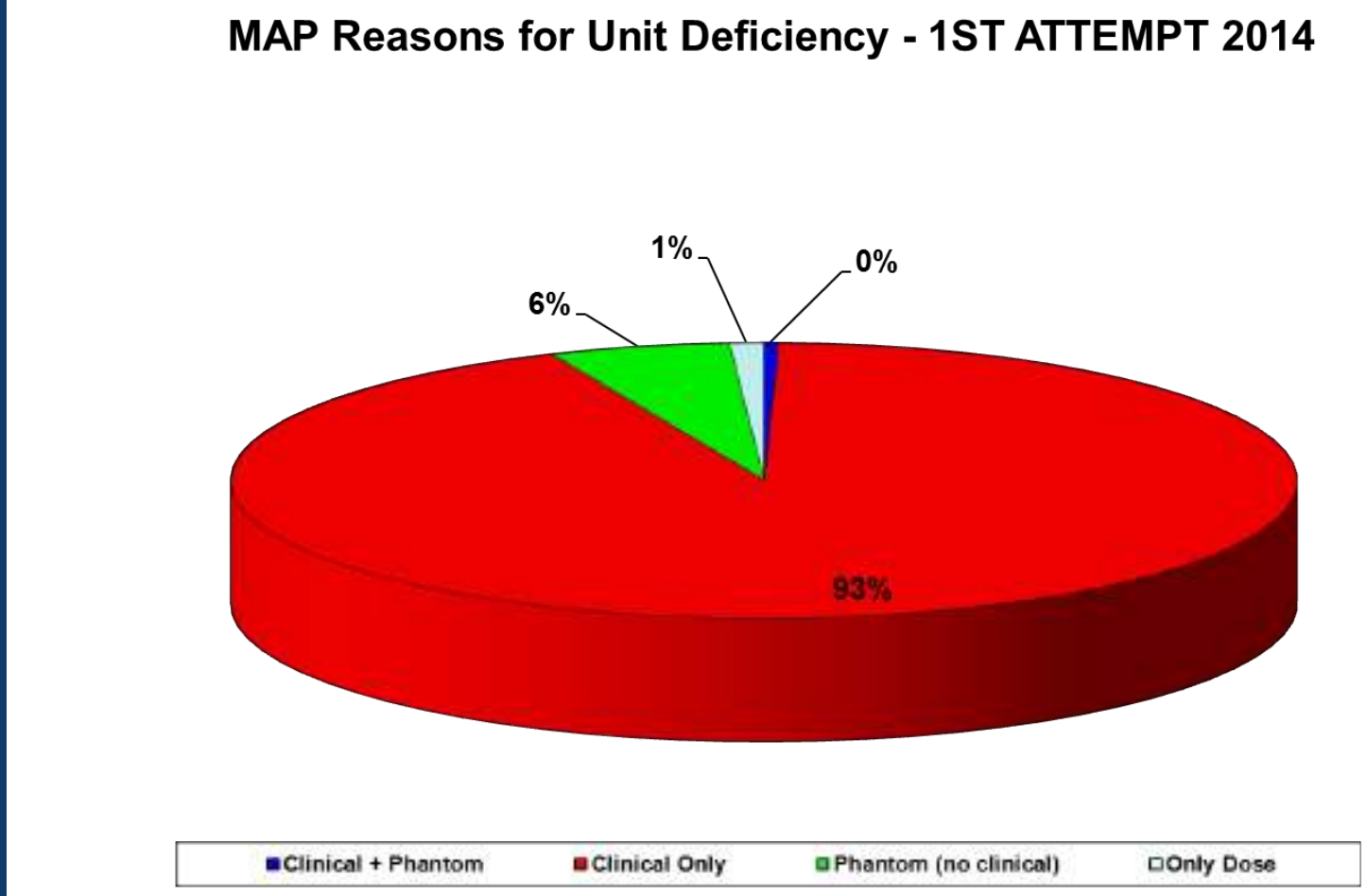
Course Objectives

- Reasons for failed clinical images
  - Categories
  - Deficiencies
  - Problem solving and correcting deficiencies
  - Improving overall quality of images

Course Objectives



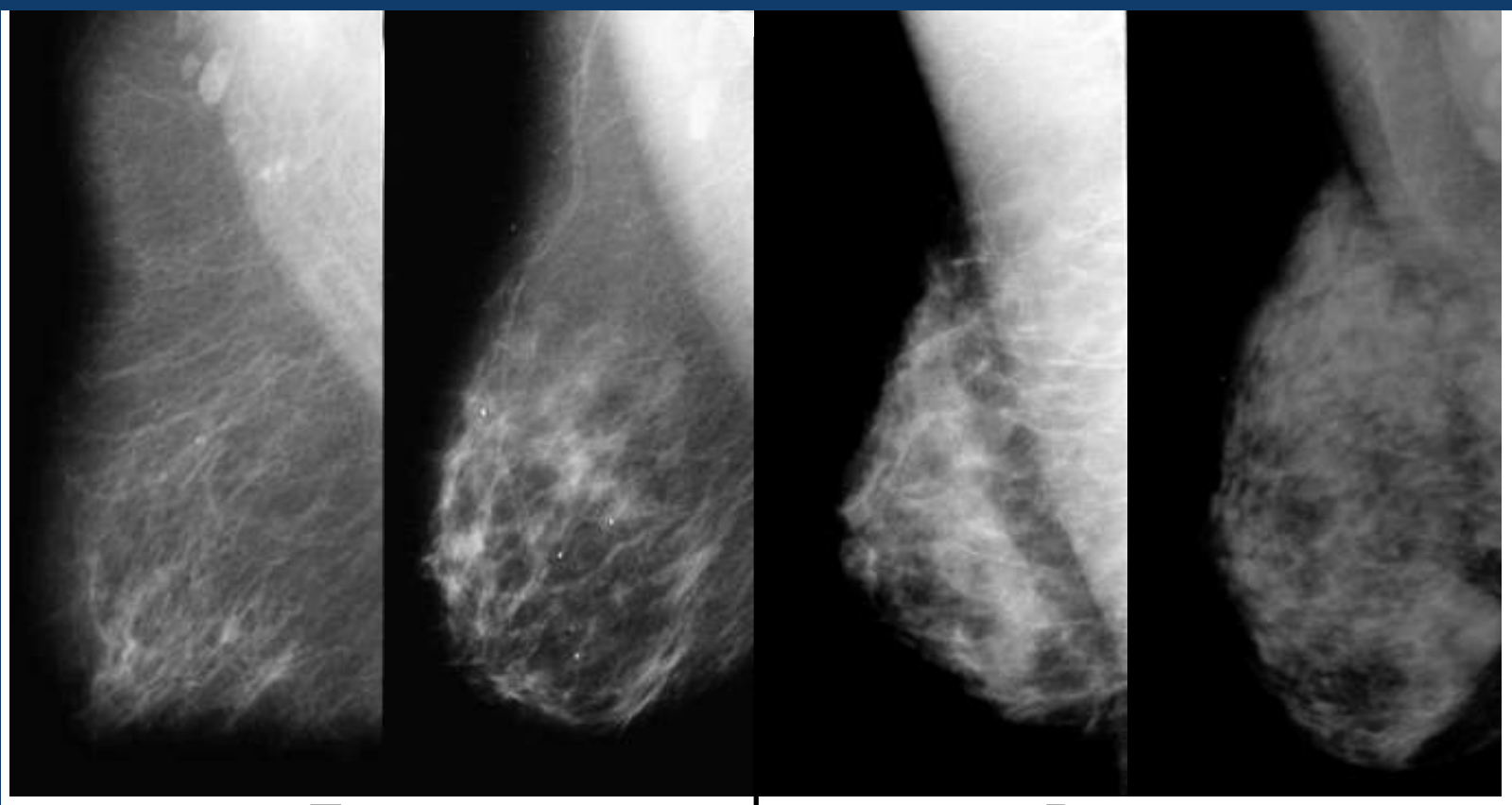
Course Objectives



Course Objectives

Imaging Category	Failure Rate (%)
Positioning	1250 (20)
Exposure	944 (15)
Compression	887 (14)
Sharpness	806 (13)
Contrast	785 (13)
Artifacts	703 (11)
Labeling	465 (8)
Noise	288 (5)
Total	**6128 (100)**

Breast Density Past: The Old Descriptors



Fatty		Dense	
Type 1	**Type 2**	**Type 3**	**Type 4**
Almost entirely fat (<10% fibroglandular)	Scattered fibroglandular densities (10%-50%)	Heterogene-ously dense (51%-75% fibro-glandular)	Extremely dense (>75% fibroglandular)

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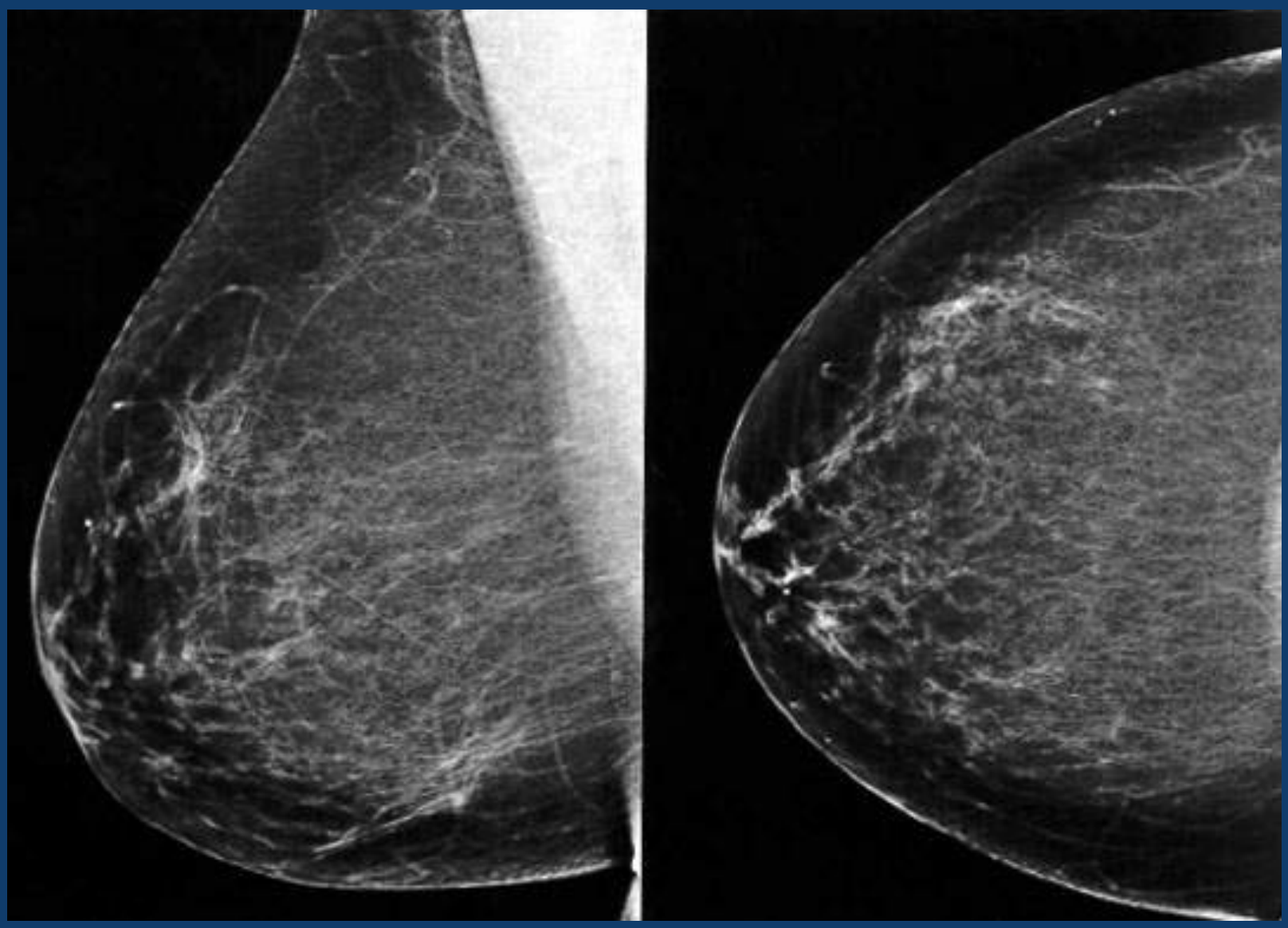
Breast Density Present: BI-RADS 2013

Breast Composition Categories

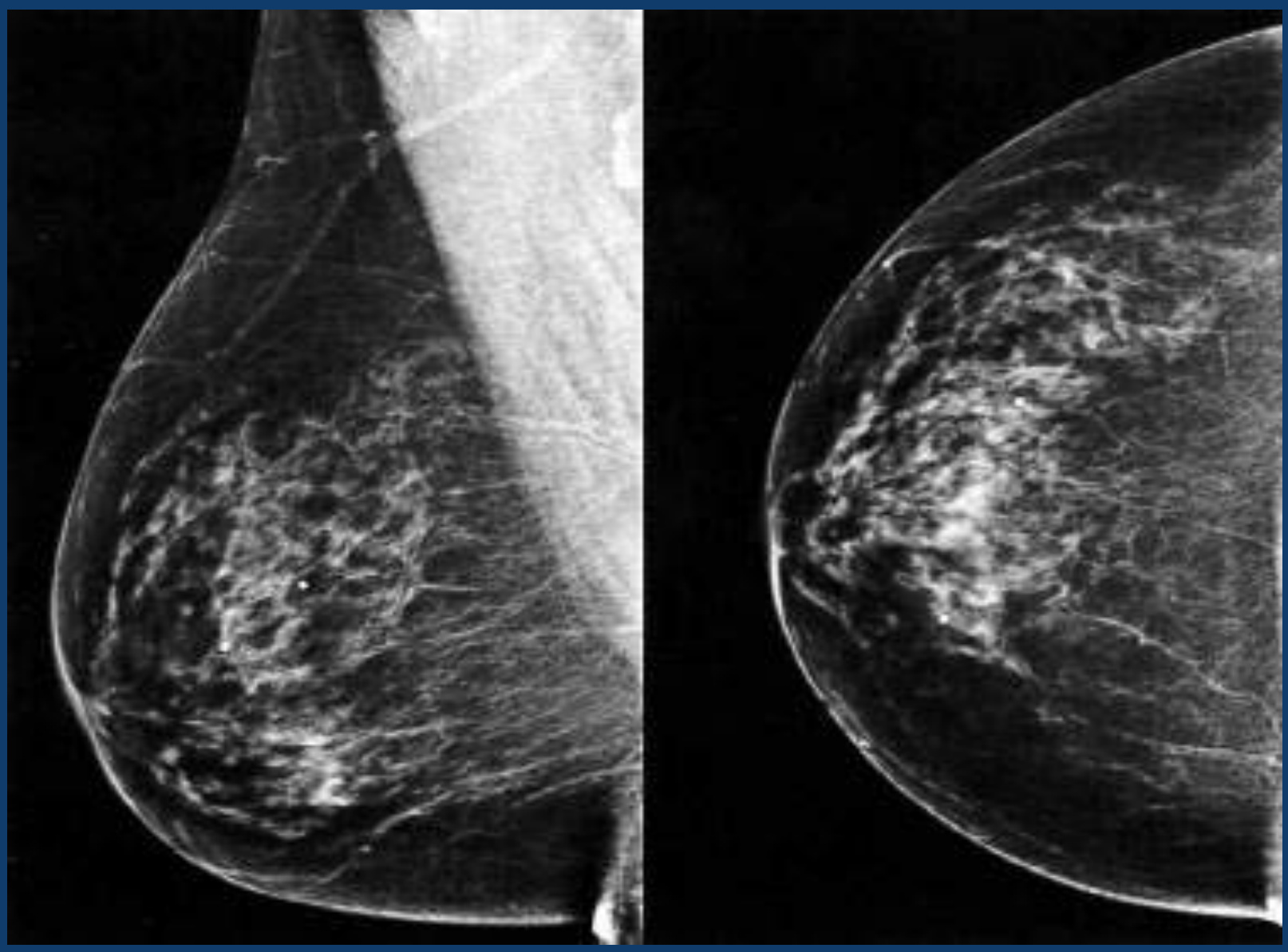
- The breasts are almost entirely fatty
- There are scattered areas of fibroglandular density
- The breast are heterogeneously dense, which may obscure small masses
- The breasts are extremely dense, which lowers the sensitivity of mammography

(ACR BI-RADS ATLAS, 2013)

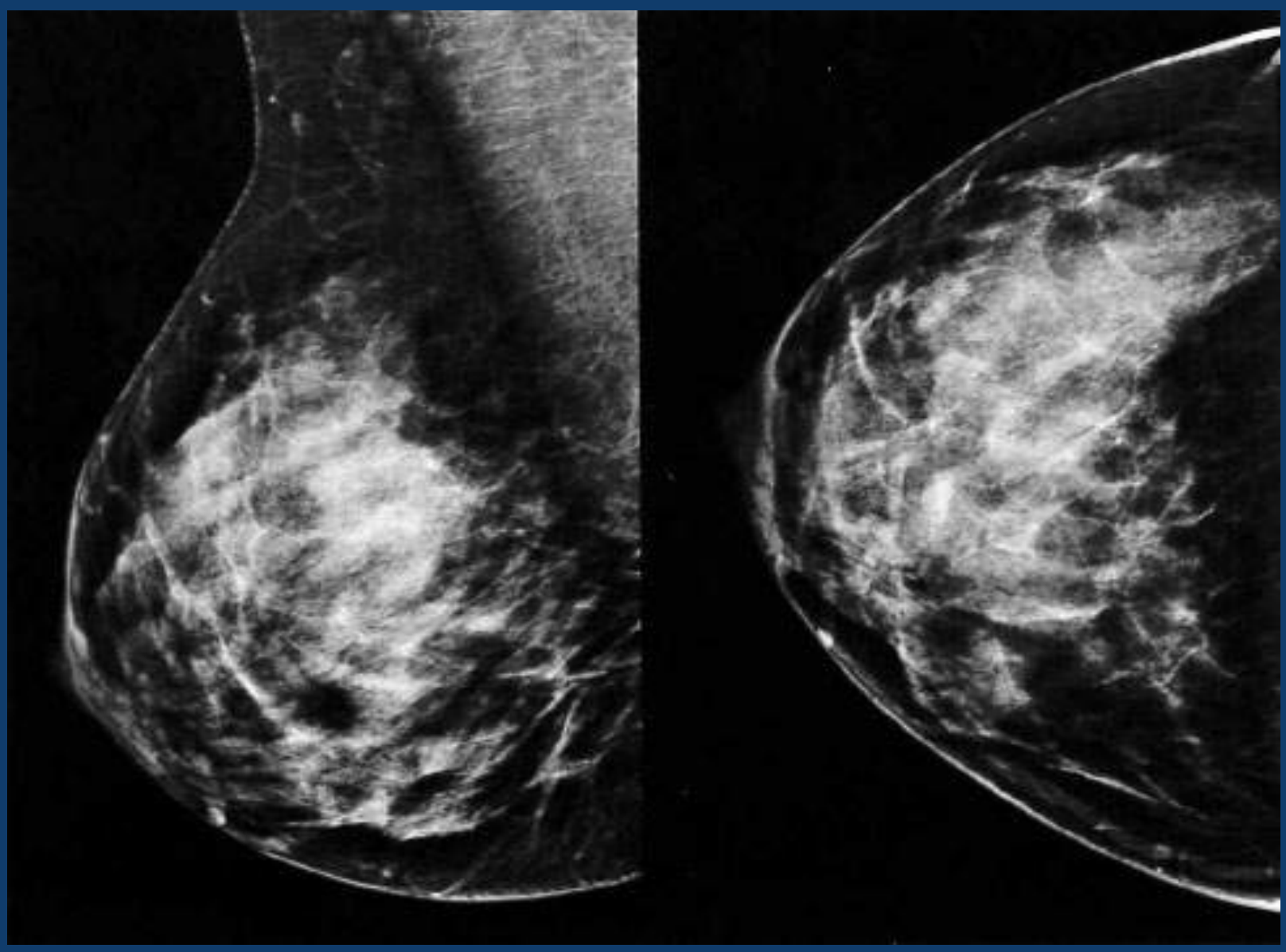
Fatty



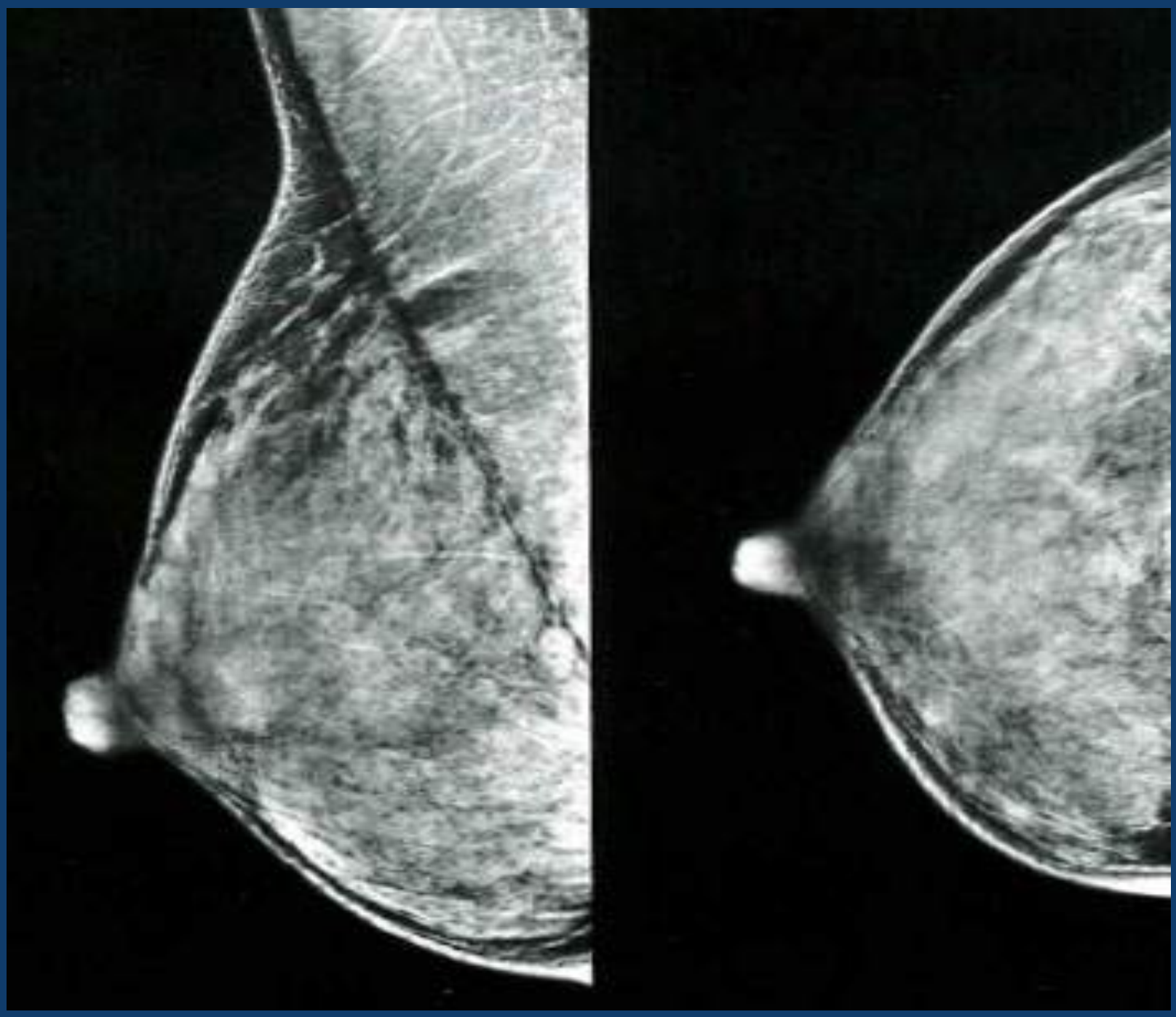
Scattered



Heterogeneously Dense



Extremely Dense

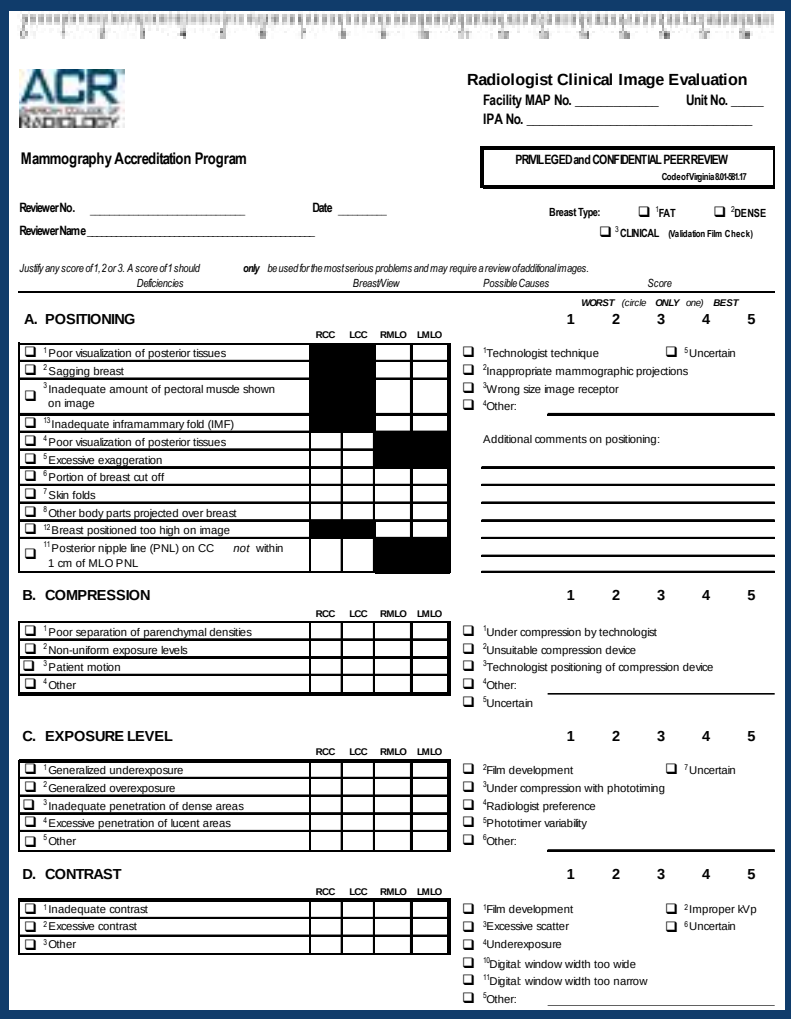


Breast Density Future

We await publication of robust volume-based breast density data, using validated percentage cut points (not necessarily quartiles) that are readily and reproducibly determined at imaging, before again indicating percentage ranges for BI-RADS density categories.

(ACR BI-RADS ATLAS, p 126, 2013)

Overall Clinical Evaluation Form



ACR AMERICAN COLLEGE OF RADIOLOGY

Mammography Accreditation Program

Radiologist Clinical Image Evaluation

Facility MAP No. _____ Unit No. _____

IPA No. _____

PRIVILEGED and CONFIDENTIAL PEER REVIEW
Code of Virginia 8.01-581.17

Reviewer No. _____ Date _____

Reviewer Name _____

Breast Type: ❑ 1FAT ❑ 2DENSE ❑ 3CLINICAL (Validation Film Check)

Justify any score of 1, 2 or 3. A score of 1 should ***only*** *be used for the most serious problems and may require a review of additional images.*

Deficiencies	BreastView	Possible Causes	Score

A. POSITIONING — WORST (circle ONLY one) BEST: 1 2 3 4 5

	RCC	LCC	RMLO	LMLO
❑ 1Poor visualization of posterior tissues				
❑ 2Sagging breast				
❑ 3Inadequate amount of pectoral musde shown on image				
❑ 13Inadequate inframammary fold (IMF)				
❑ 4Poor visualization of posterior tissues				
❑ 5Excessive exaggeration				
❑ 6Portion of breast cut off				
❑ 7Skin folds				
❑ 8Other body parts projected over breast				
❑ 12Breast positioned too high on image				
❑ 11Posterior nipple line (PNL) on CC *not* within 1 cm of MLO PNL				

❑ 1Technologist technique ❑ 5Uncertain
❑ 2Inappropriate mammographic projections
❑ 3Wrong size image receptor
❑ 4Other:

Additional comments on positioning:

B. COMPRESSION — 1 2 3 4 5

	RCC	LCC	RMLO	LMLO
❑ 1Poor separation of parenchymal densities				
❑ 2Non-uniform exposure levels				
❑ 3Patient motion				
❑ 4Other				

❑ 1Under compression by technologist
❑ 2Unsuitable compression device
❑ 3Technologist positioning of compression device
❑ 4Other:
❑ 5Uncertain

C. EXPOSURE LEVEL — 1 2 3 4 5

	RCC	LCC	RMLO	LMLO
❑ 1Generalized underexposure				
❑ 2Generalized overexposure				
❑ 3Inadequate penetration of dense areas				
❑ 4Excessive penetration of lucent areas				
❑ 5Other				

❑ 2Film development ❑ 7Uncertain
❑ 3Under compression with phototiming
❑ 4Radiologist preference
❑ 6Phototimer variability
❑ 8Other:

D. CONTRAST — 1 2 3 4 5

	RCC	LCC	RMLO	LMLO
❑ 1Inadequate contrast				
❑ 2Excessive contrast				
❑ 3Other				

❑ 1Film development ❑ 2Improper kVp
❑ 3Excessive scatter ❑ 6Uncertain
❑ 4Underexposure
❑ 10Digital: window width too wide
❑ 11Digital: window width too narrow
❑ 5Other:

Deficiencies	BreastView	Possible Causes	Score

E. SHARPNESS — 1 2 3 4 5

	RCC	LCC	RMLO	LMLO
❑ 1Poor delineation of linear structures				
❑ 2Poor delineation of feature margins				
❑ 3Poor delineation of microcalcifications				

❑ 1Patient motion ❑ 5Uncertain
❑ 2Poor screen contact
❑ 3Film-screen selection
❑ 4Other:

F. NOISE — 1 2 3 4 5

	RCC	LCC	RMLO	LMLO
❑ 1Visually striking mottle pattern				
❑ 2Noise limited visualization of detail				

❑ 1Film development ❑ 3Improper kVp
❑ 2Recording system speed ❑ 5Uncertain
❑ 10Digital: inadequate SNR
❑ 11Digital: window width too narrow
❑ 4Other:

G. ARTIFACTS — 1 2 3 4 5

	LCC	RCC	LMLO	RMLO
❑ 1Punctate or lint				
❑ 2Scratches or pickoff				
❑ 3Roller marks				
❑ 4Grid related artifacts				
❑ 5Hair, deodorant, etc.				
❑ 6Film handling				
❑ 7Film fogging				
❑ 8Poor screen-film alignment				
❑ 10Digital: image receptor artifact				
❑ 11Digital: laser printer artifact				
❑ 12Digital : laser printer NcanningClines				
❑ 9Other				

❑ 1Poor screen maintenance ❑ 9Uncertain
❑ 2Development related
❑ 3Unsuitable grid or Bucky
❑ 4Film exposed to light
❑ 5Lack of patient preparation
❑ 6Poor cassette closure
❑ 7Damaged cassette
❑ 10Digital: detector calibration (eg., uniformity calibration)
❑ 11Digital: foreign object s calibrated into calibration file
❑ 12Digital: laser printer needs service
❑ 8Other:

H. EXAM ID *(Only fail this category if the patient's name , ID or laterality is missing .)* — 1 2 3 4 5

	RCC	LCC	RMLO	LMLO
❑ 1Patient name and additional patient identifier				
❑ 2Facility name and location (city, state and zip)				
❑ 3Date of examination				
❑ 4View and laterality				
❑ 5Unit identification (if more than one)				
❑ 6Technologist identification				
❑ 7Cassette/screen identification				

❑ 1Technologist error ❑ 5Uncertain
❑ 2Missing or non-standard labeling method
❑ 3Improper positioning of label
❑ 4Other:

OVERALL CLINICAL IMAGE EVALUATION RECOMMENDATION ❑ 2Pass ❑ 1Fail

Circle categories leading to a failing grade. Only fail for artifacts or exam ID problems if they are severe.

A	B	C	D	E	F	G	H
Positioning	Compression	Exposure	Contrast	Sharpness	Noise	Artifacts	Exam ID

ADDITIONAL RECOMMENDATIONS:

❑ 1Recommend reviewing 1999 ACR QC Manual for MQSA film labeling requirements
❑ 2Recommend sending technologist to a hands-on positioning course
❑ 3Excessive collimation: recommend coning to size of film to reduce viewbox glare
❑ 4Check optimal film development conditions with film manufacturer
❑ 5Physician should review Clinical Image Evaluation section of 1999 ACR QC Manual

ADDITIONAL COMMENTS: *(If you find an abnormality, mark it with a grease pencil and comment below.)*

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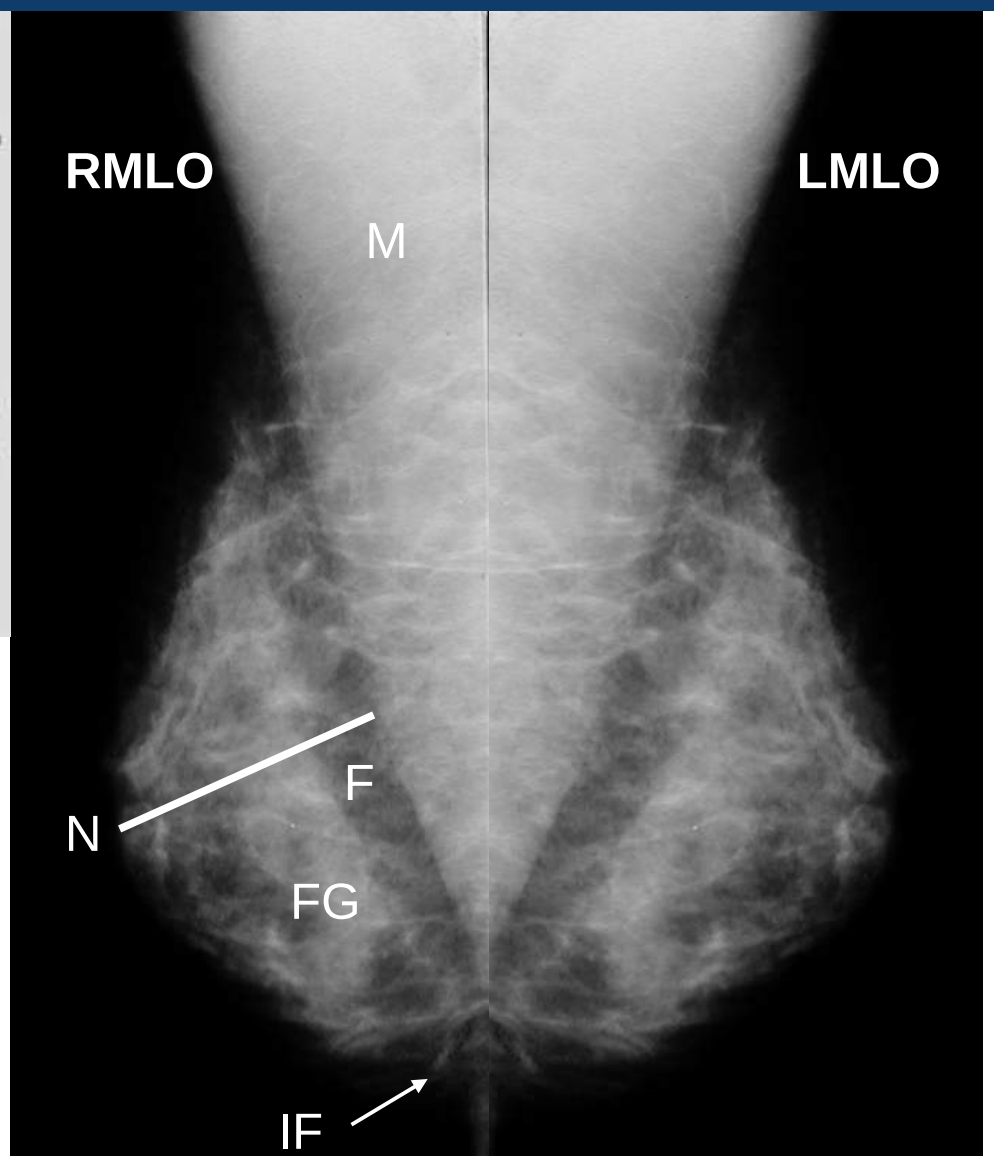
Positioning: MLO Most Common Deficiencies

Deficiency	Frequency (%)
Inadequate pectoral muscle	35
“Sagging” of the breast	22
Poor visualization posterior tissue	22
Skin folds overlying breast tissue	10
Breast positioned too high on image receptor	6
Portion of breast cut off	5

Positioning: MLO Most Common Deficiencies



FG = fibroglandular tissue; M = Pectoralis muscle; N = Nipple; IF = inframammary fold

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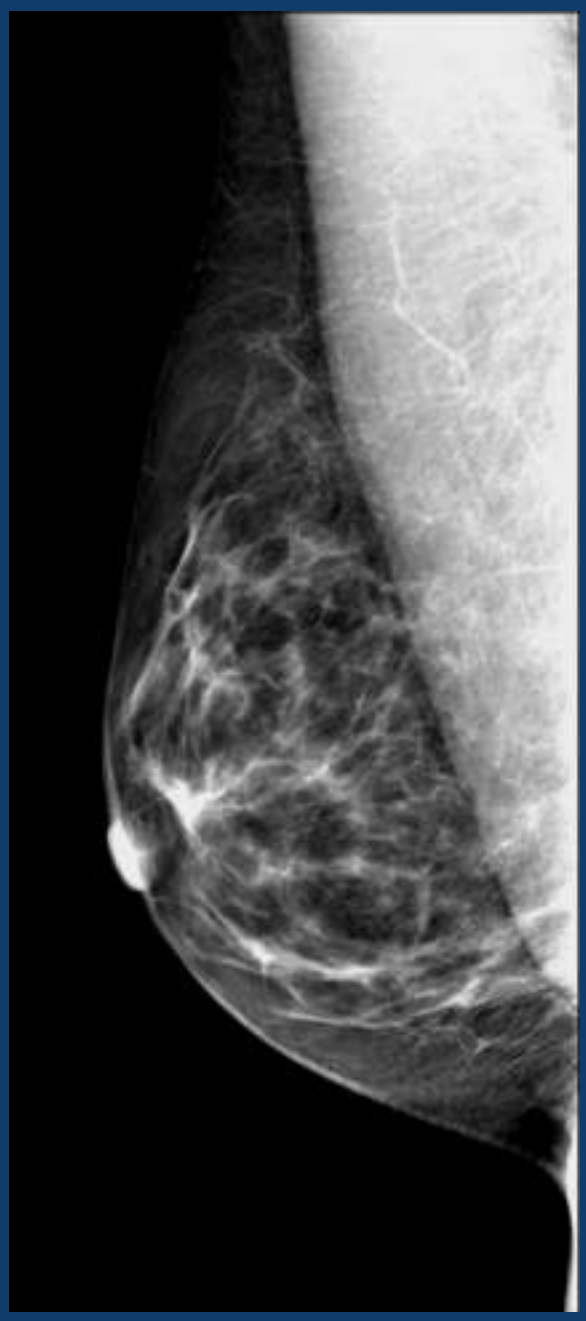
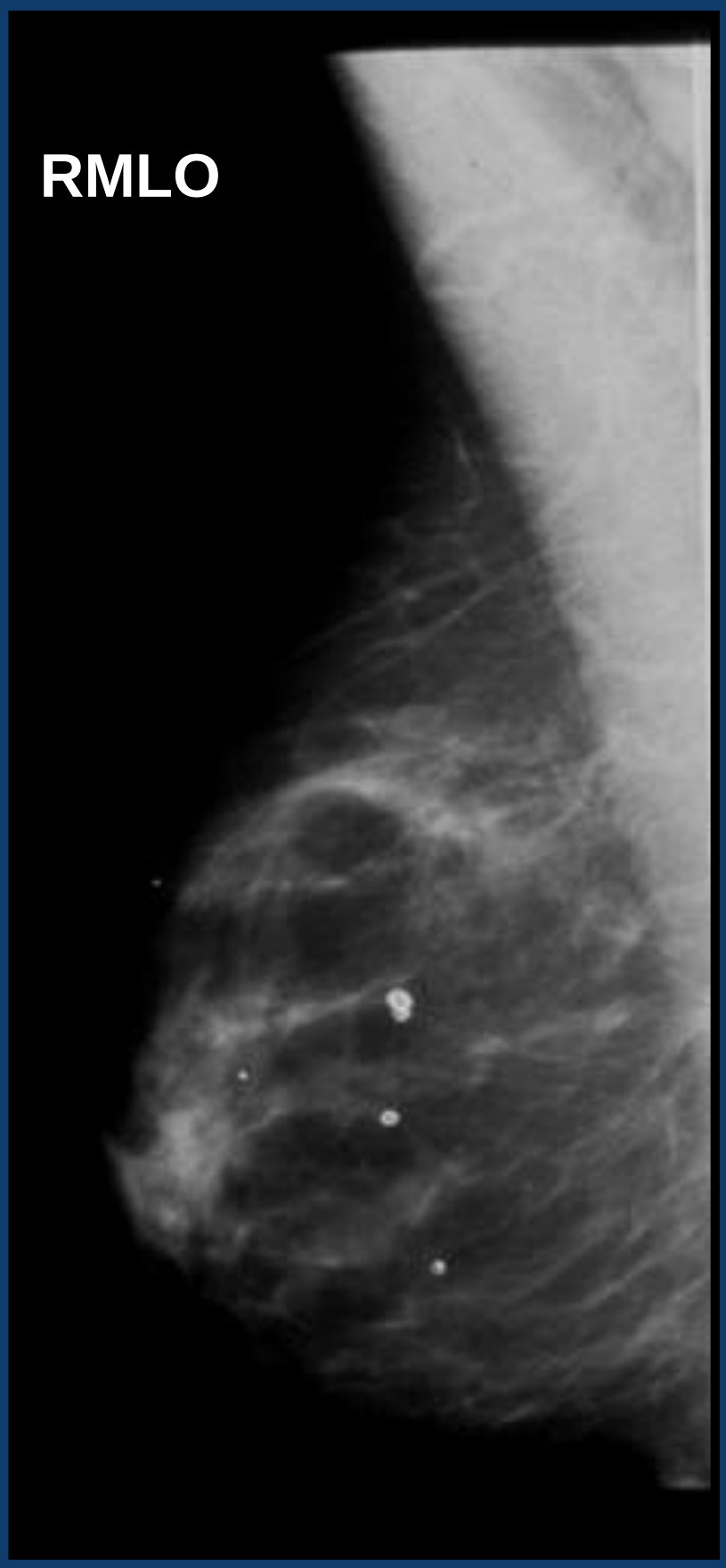
Adequate Pectoral Muscle

RMLO



- Optimal pectoral muscle on a digital image
- Length
  - To nipple line or below
- Shape
  - Convex anterior border
  - Wider superiorly
  - Gradually narrows inferiorly
- Score = 5

Inadequate Pectoral Muscle



- When compared with a straight line, at a minimum the muscle should align with the line or go beyond
- Preferably, it will bulge beyond the edge
- Note difference in width of superior vs inferior aspect of muscle
- Score = 4

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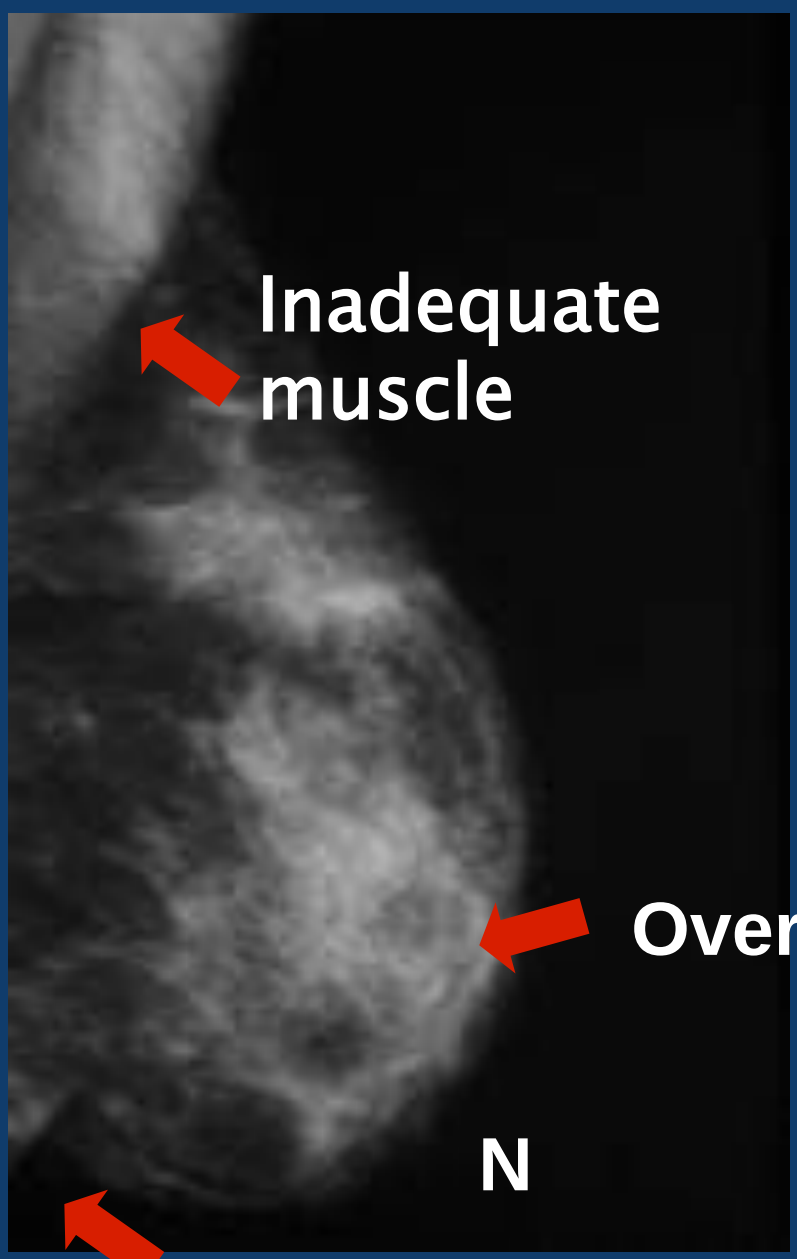
Sagging Breast: Poor Delineation of Structures



Score = 2

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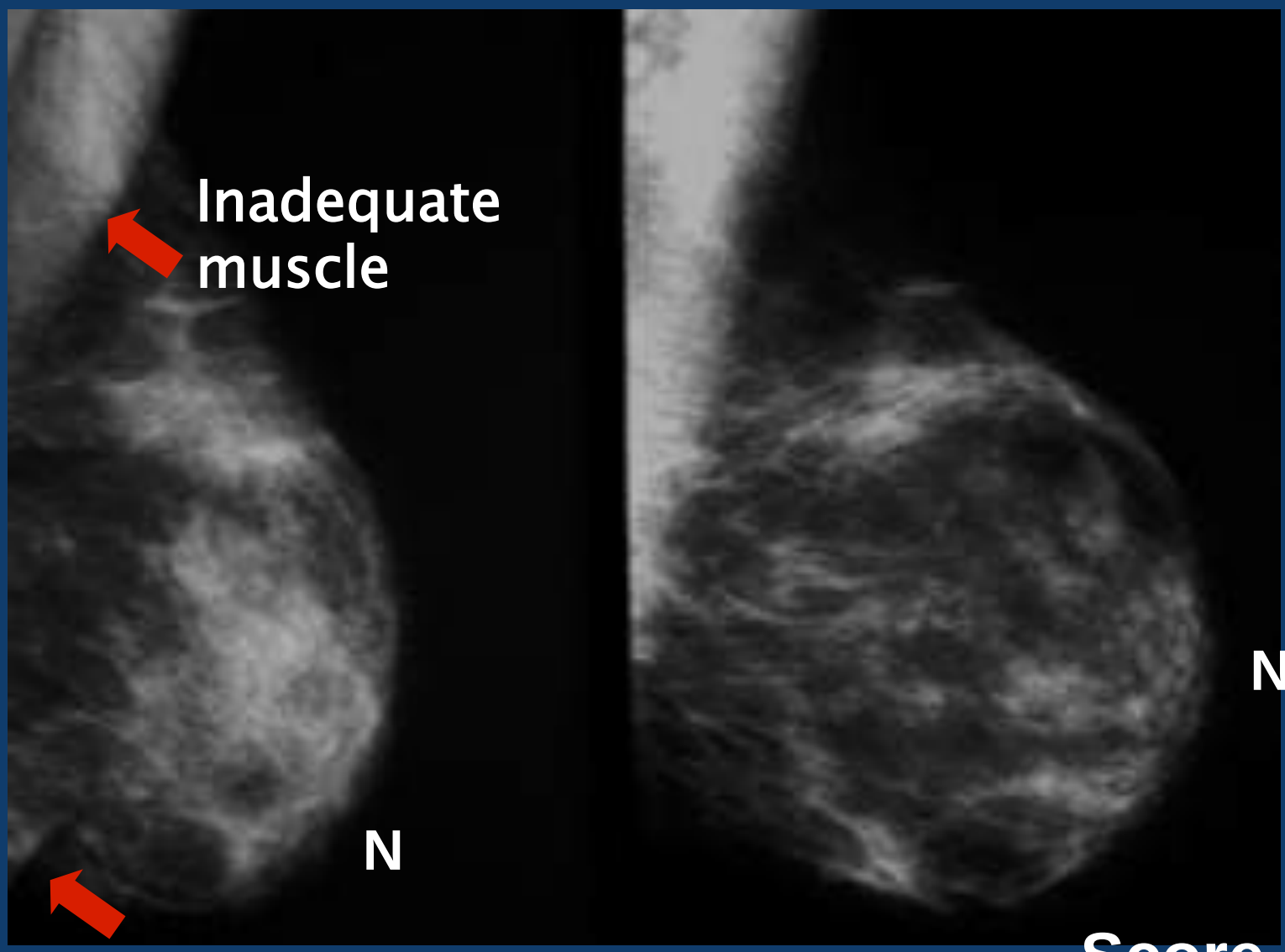
To prevent sagging:
Out and Nipple-Up Maneuver

To prevent sagging:
Out and Nipple-Up Maneuver

Sagging breast

Repeated exam



skin fold

Score = 5

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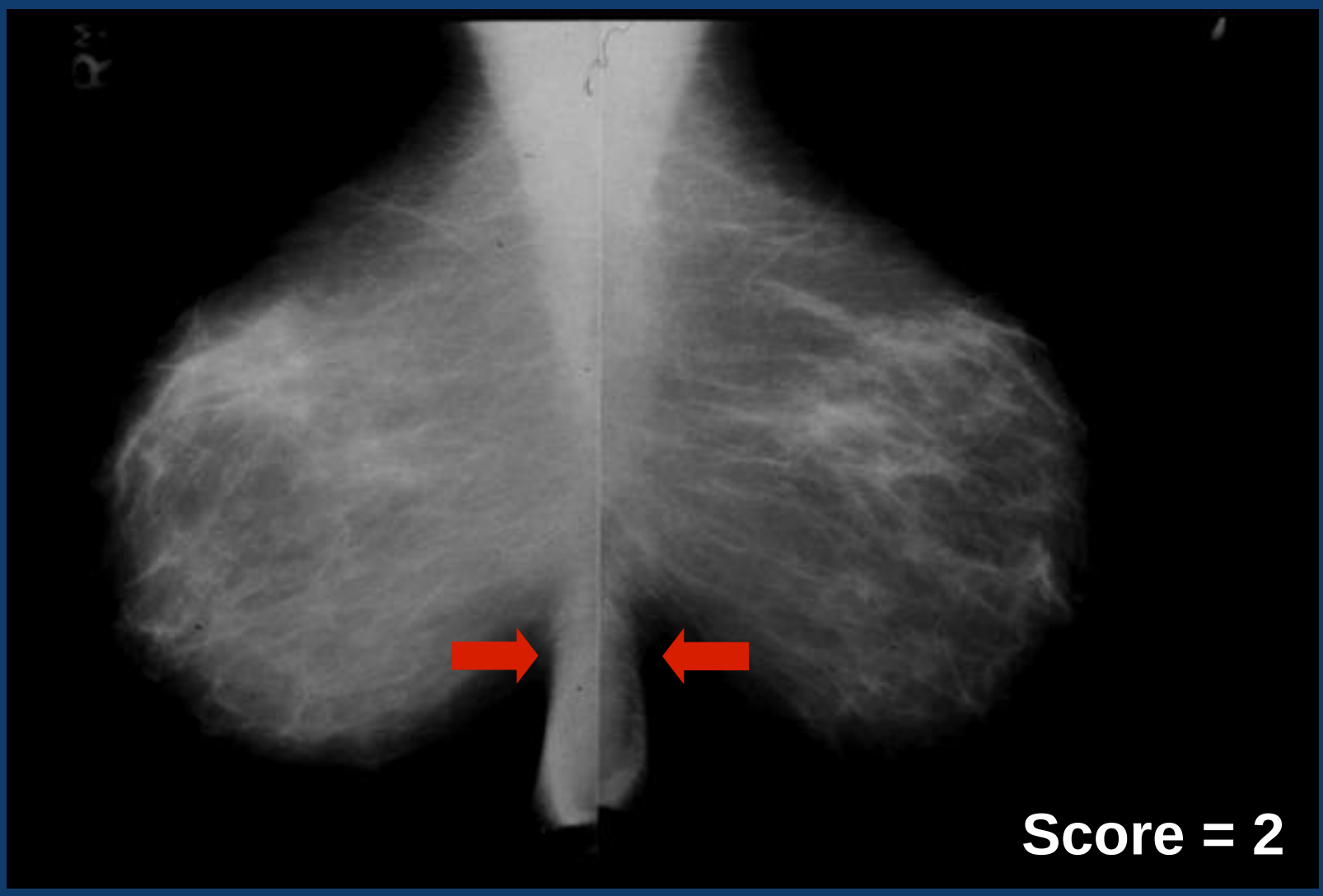
Sagging Breasts with Inframammary Skin Folds



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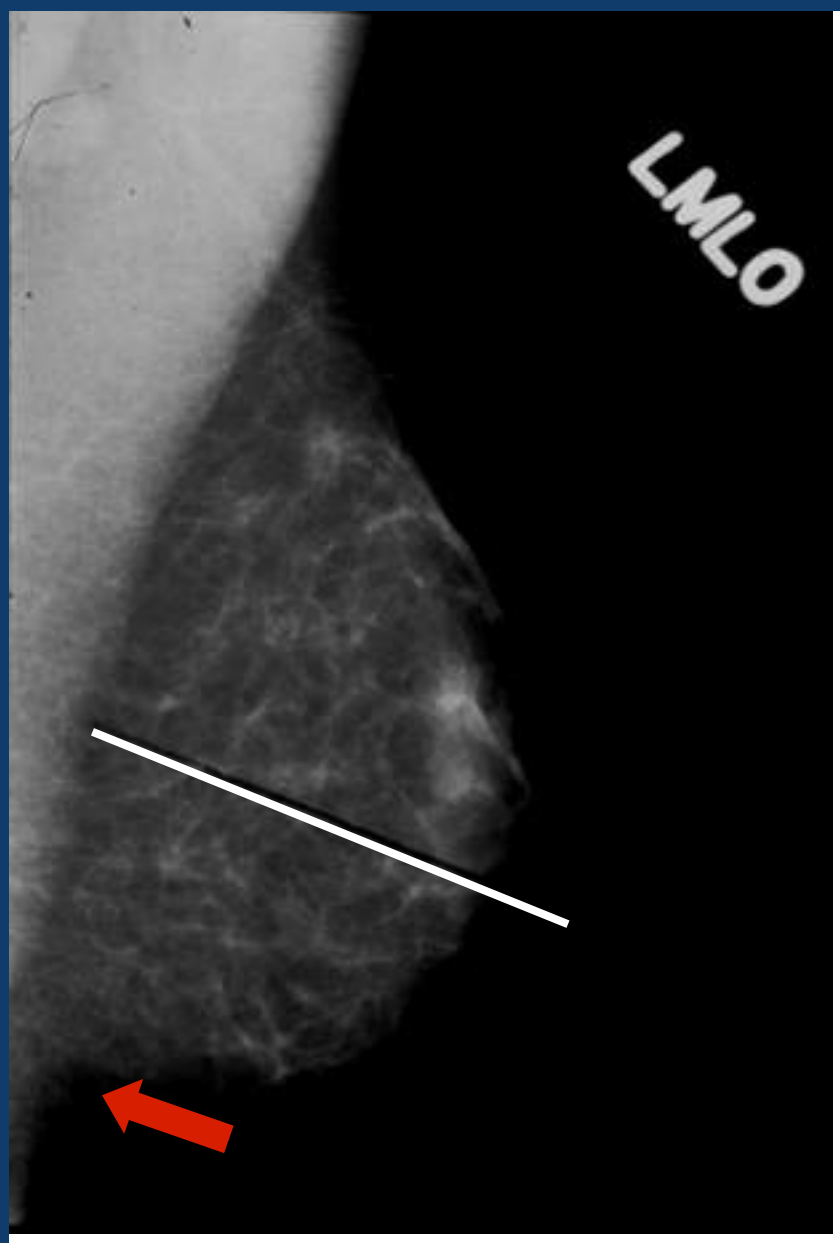
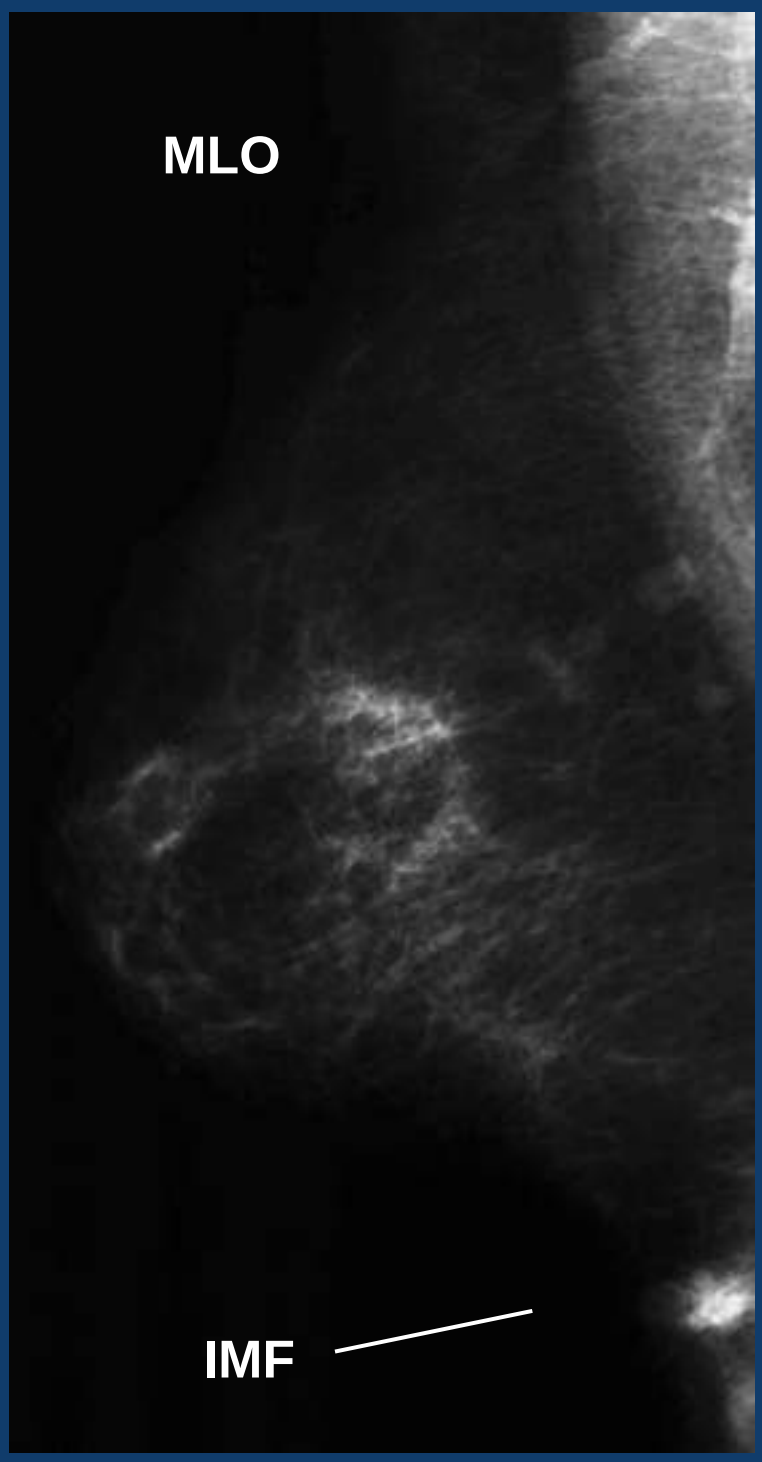
Open IMF



Score = 4

Open Inframammary Fold

- Skin overlying abdomen in front of edge of receptor
- Free of skin folds



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Positioning Criteria: CC

- Inclusion of medial tissue
- Nipple centered on film
  - No excessive exaggeration
  - Exaggeration may cause loss of medial or lateral posterior tissue
  - Inclusion of posterior tissue
- Free of skin folds

Positioning: CC Most Common Deficiencies

Deficiency	Frequency (%)
Poor visualization of posterior tissue on CC	32
Posterior nipple line on CC not within 1 cm of MLO	30
Excessive lateral/medial exaggeration on CC	20
Skin folds overlying breast tissue	18

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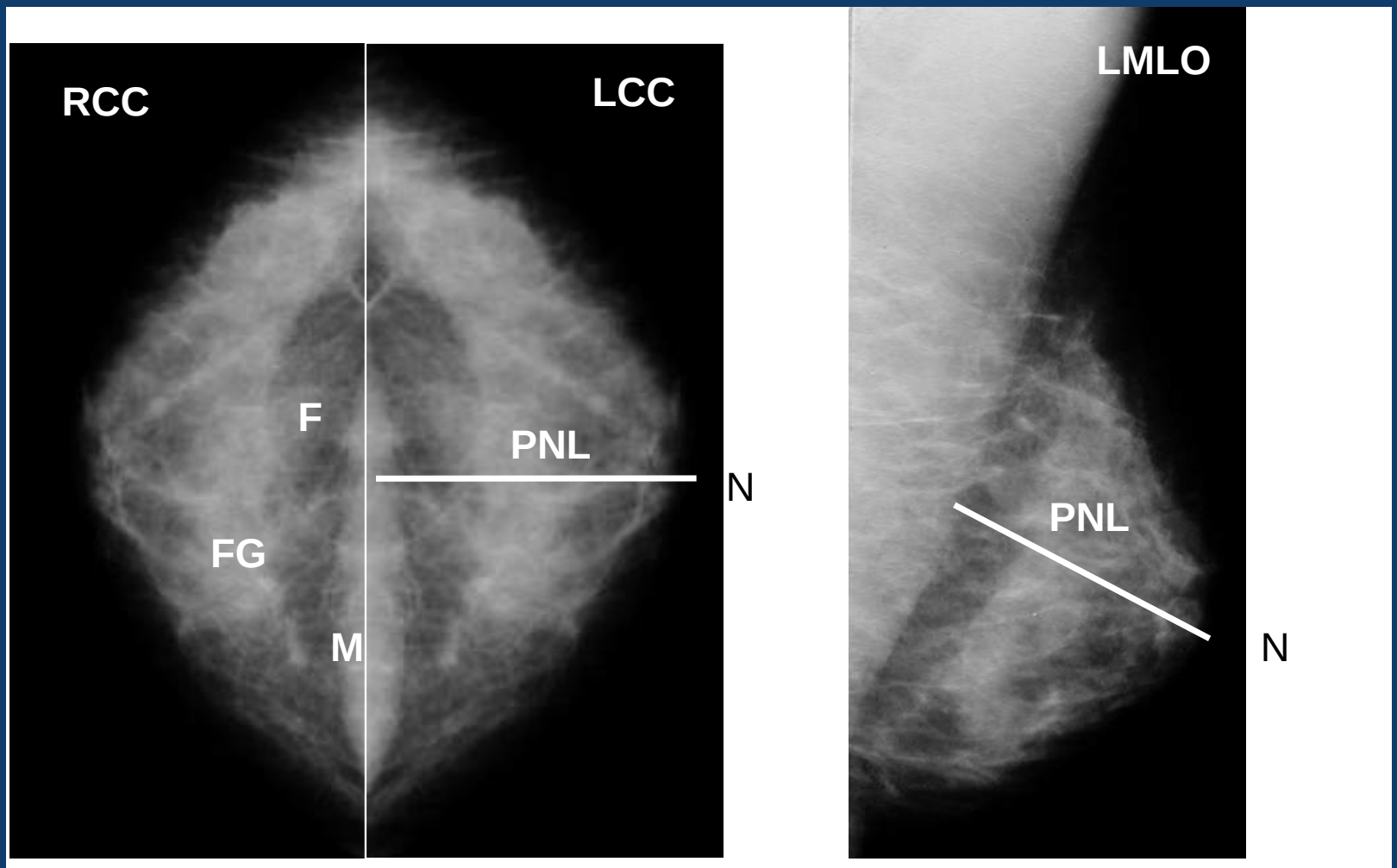
Visualization of Posterior Breast on CC

- PNL should measure within 1 cm of MLO
  - Depends on a well positioned MLO
- Pectoral muscle can be seen in 30% of women
- Requires proper positioning of CC:
  - Elevate inferior breast (freely movable tissue)
  - Pull superior and inferior tissue onto receptor
  - Lean patient's head forward to the side of tube
- Pectoral muscle in central and medial breast
  - Improper positioning if central and lateral



PNL (Posterior Nipple Line) on CC should be within 1cm of MLO

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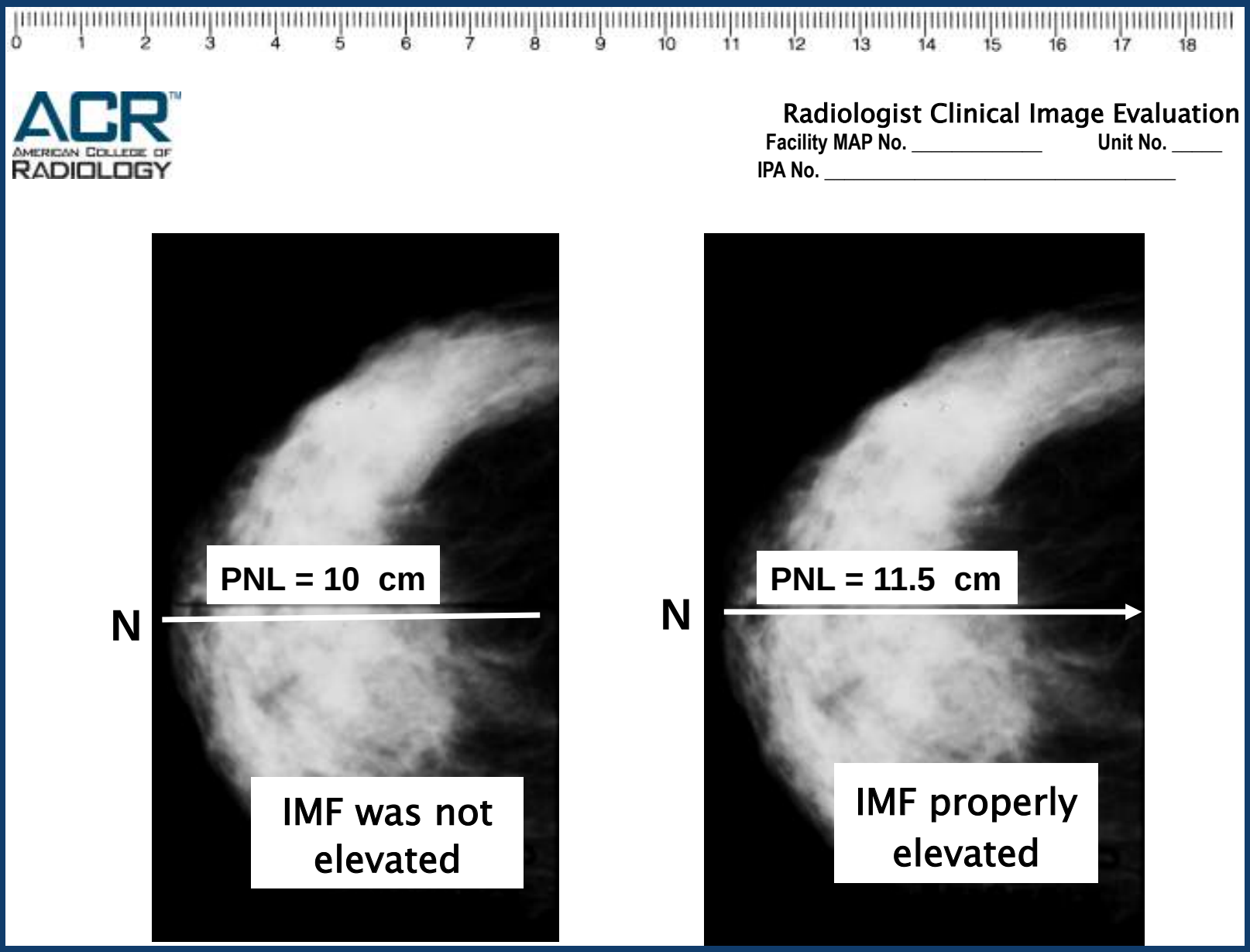
Visualization of Posterior Breast on CC



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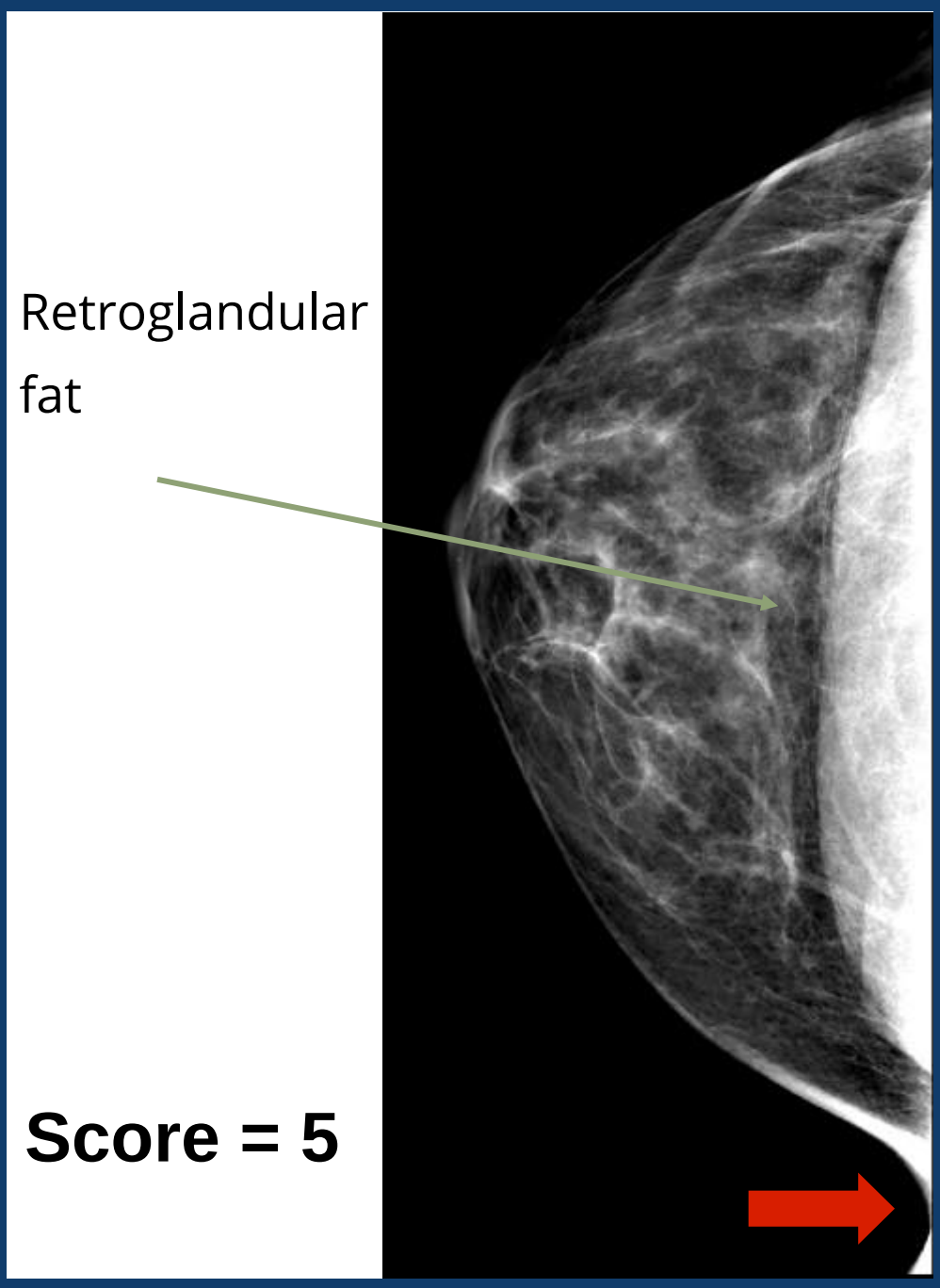
Inclusion of Medial Tissue

- Skin reflection of cleavage visualized
- Retroglandular fat
  - Sternum flush with bucky
  - Contralateral breast draped
- Free of skin folds
  - IMF properly elevated
  - Check for gap
  - Must look from medial side



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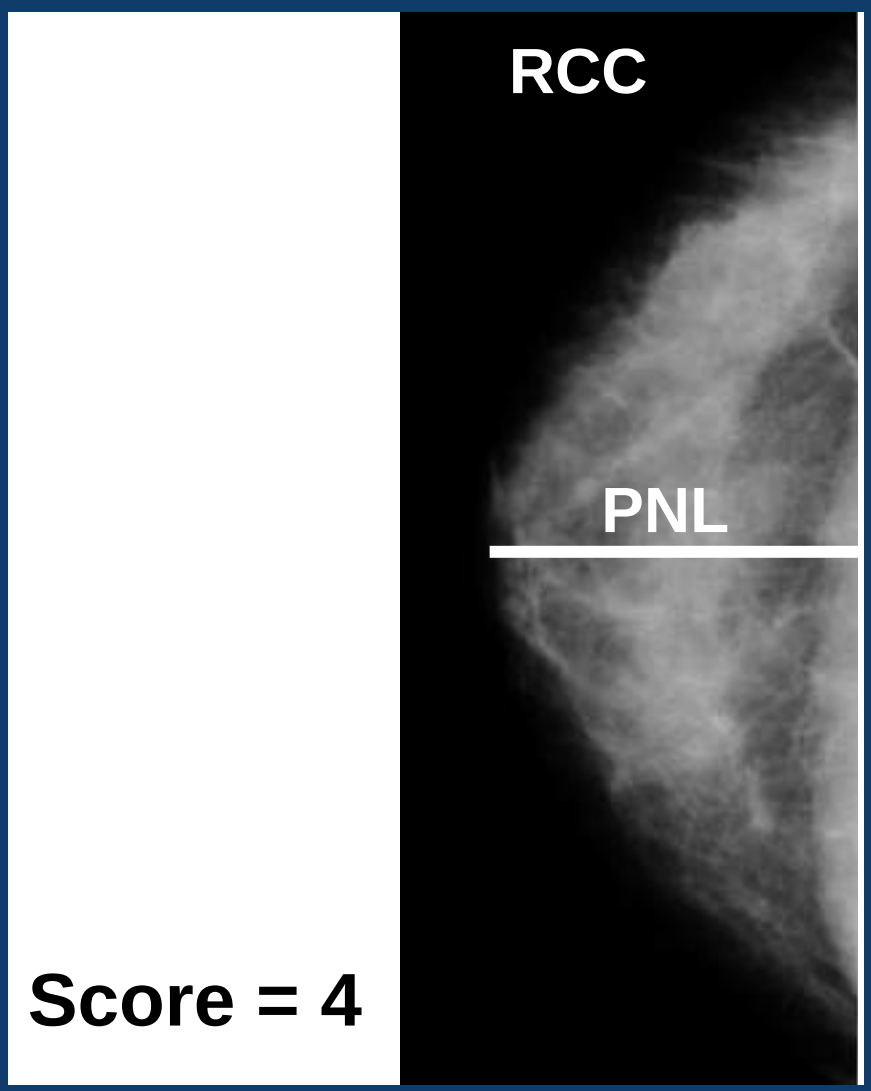
Nipple Centered on Film

- No excessive exaggeration
- Otherwise, nipple will point to the missing tissue
  - If points laterally RT should lift and pull out lateral tissue
  - If points medially RT should rotate to place sternum flush with bucky



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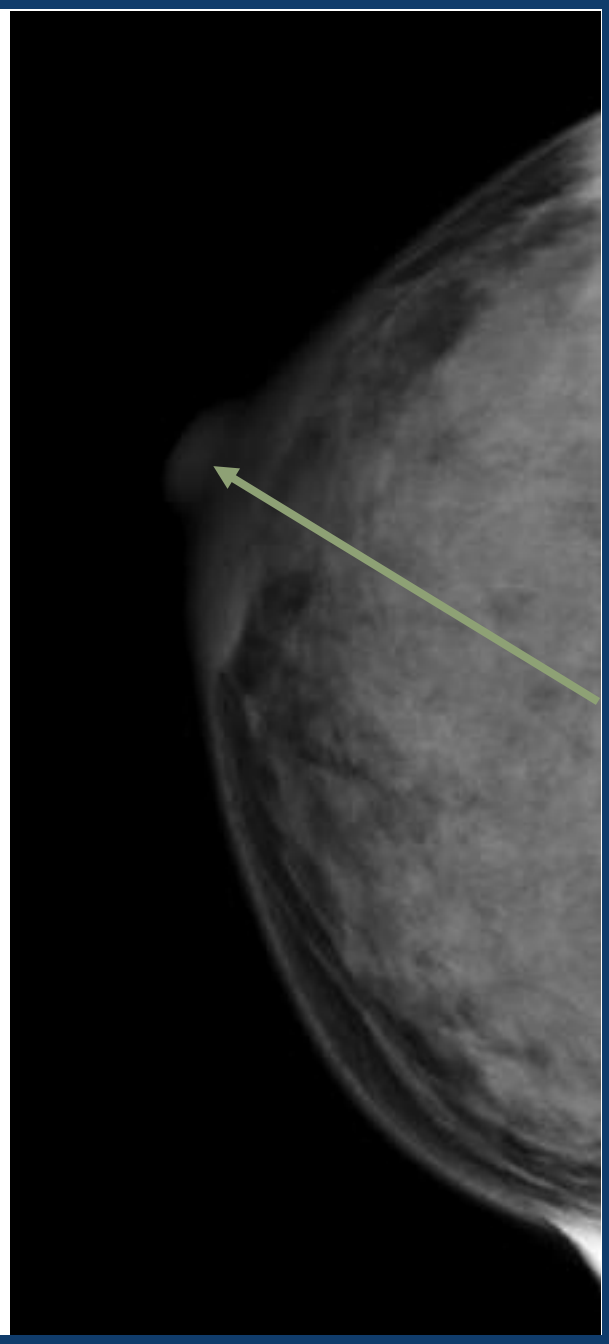
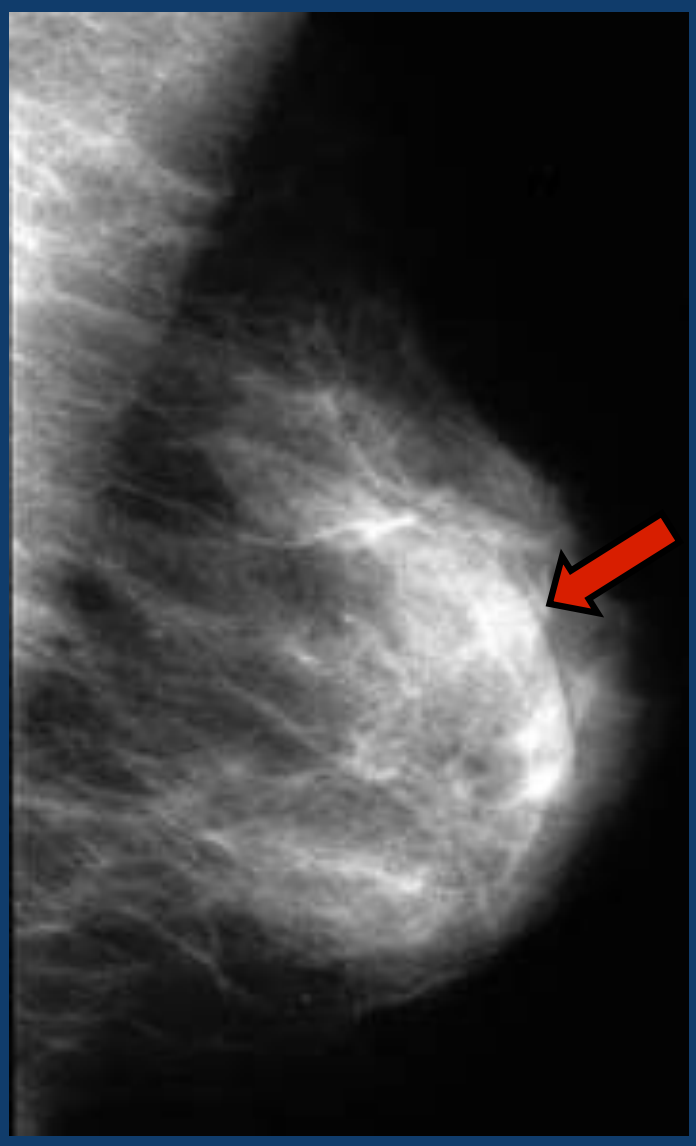
Excessive Exaggeration

- Nipple will point to the laterality of missing tissue
  - If it points laterally, lift and pull out lateral tissue
  - If points medially, rotate to place sternum flush with bucky

Score = 3

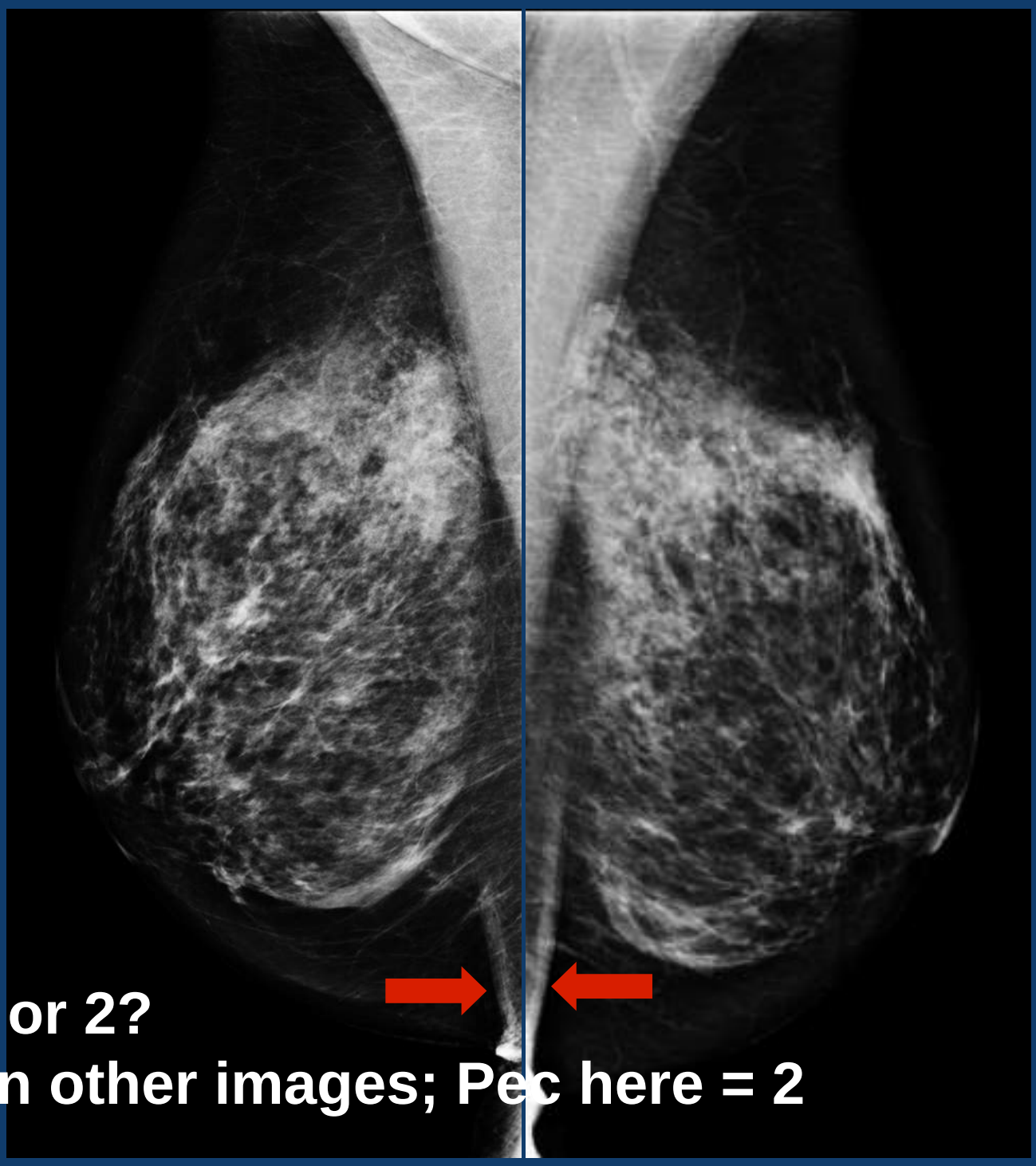


Skin Folds Overlying Breast



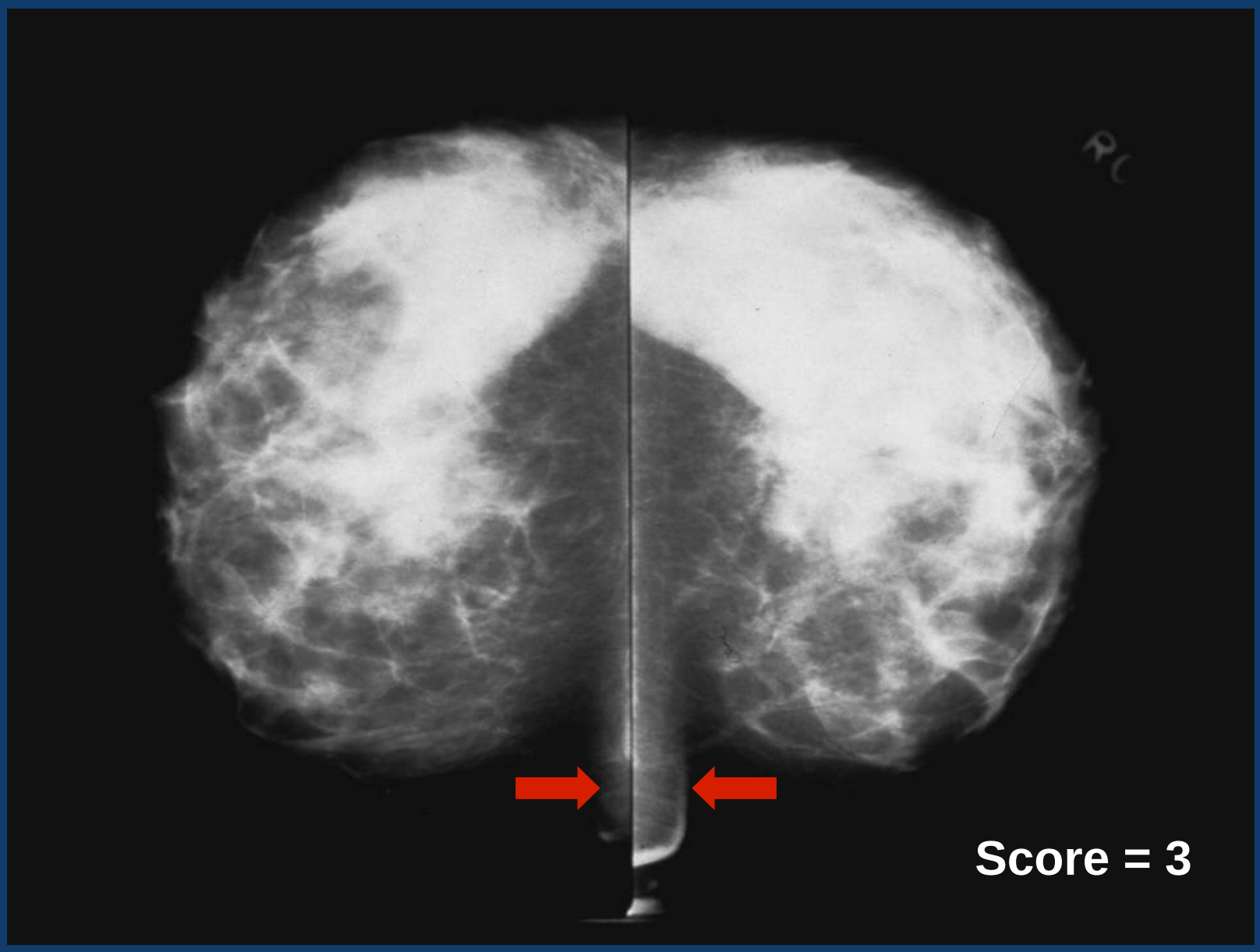
Score = 2

Inframammary skin folds



Score = 3 or 2?
Depend on other images; Pec here = 2

Medial skin folds on CC



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Compression

- Affects sharpness
  - Compression decreases unsharpness (blur) due to reduced time and motion
- Affects contrast
  - Good compression increases contrast due to less scattered radiation
- Affects exposure level
  - Compression increases exposure level due to reduced breast thickness

Compression: Most Common Deficiencies

Deficiency	Frequency (%)
Poor separation of fibroglandular tissues	65
Non-uniform exposure of fibroglandular tissues	19
Patient motion	16

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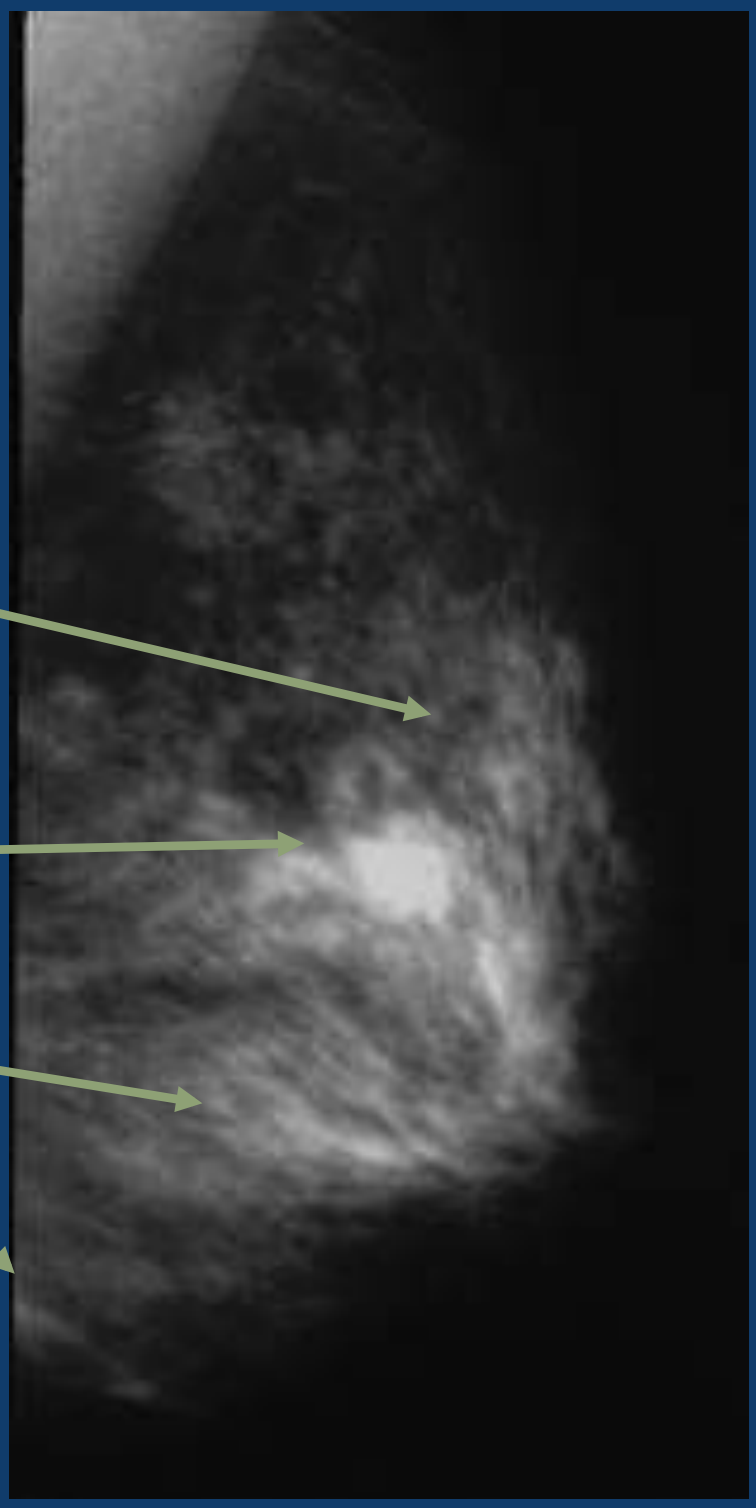
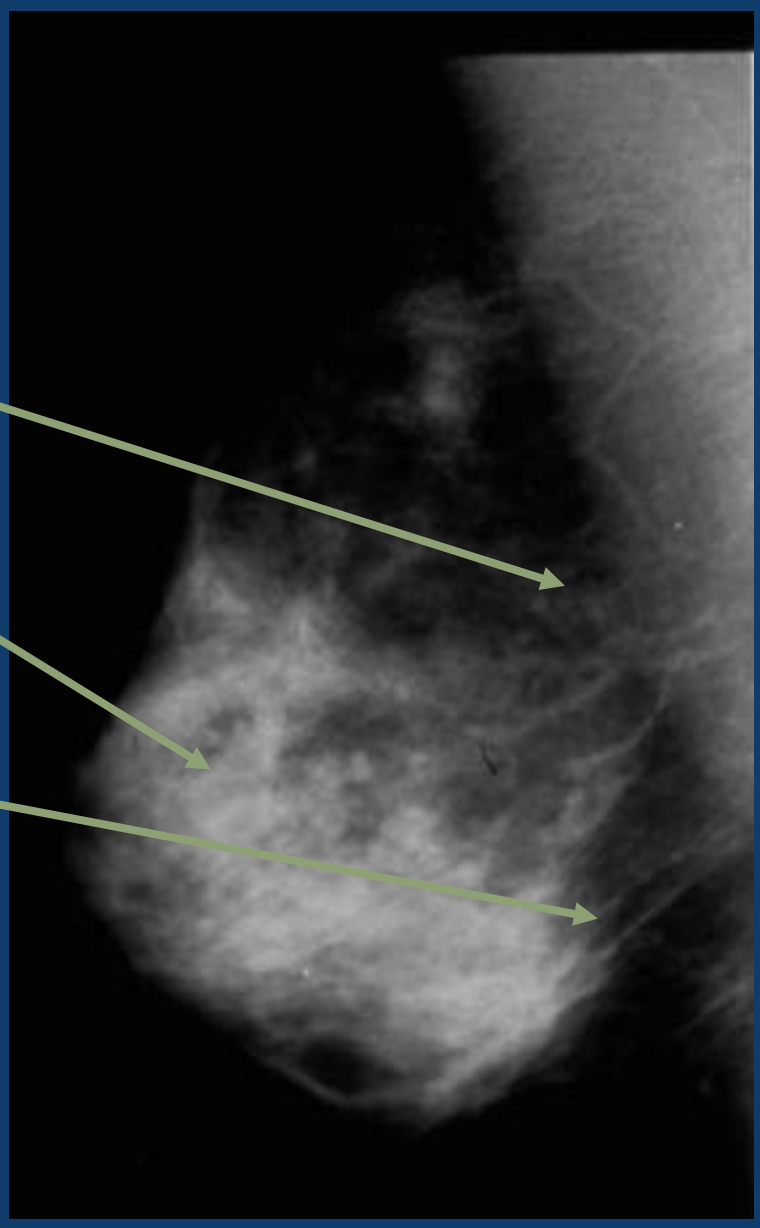
Inadequate Compression

- Poor separation of fibroglandular tissues
- Unequal exposure of fibroglandular tissues
- Motion unsharpness



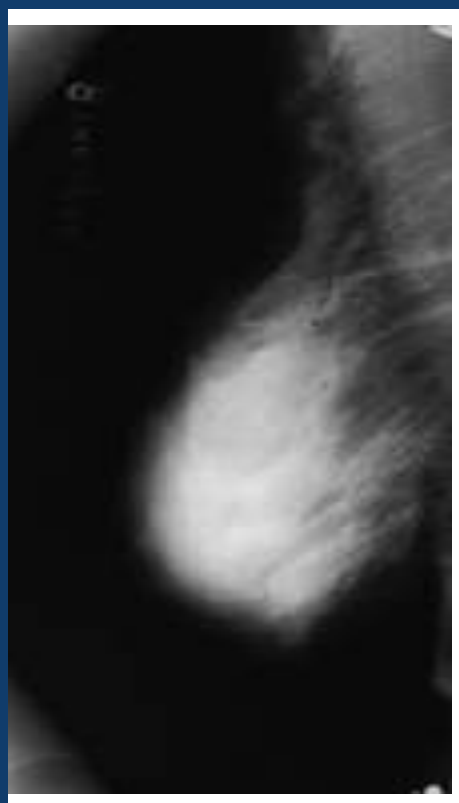
Assessing Sharpness on the MLO

- Anterior edge of pectoral muscle (blurred?)
- Subareolar area
- Inferior breast
  - Edges of vessels, calcifications, and Cooper's ligaments

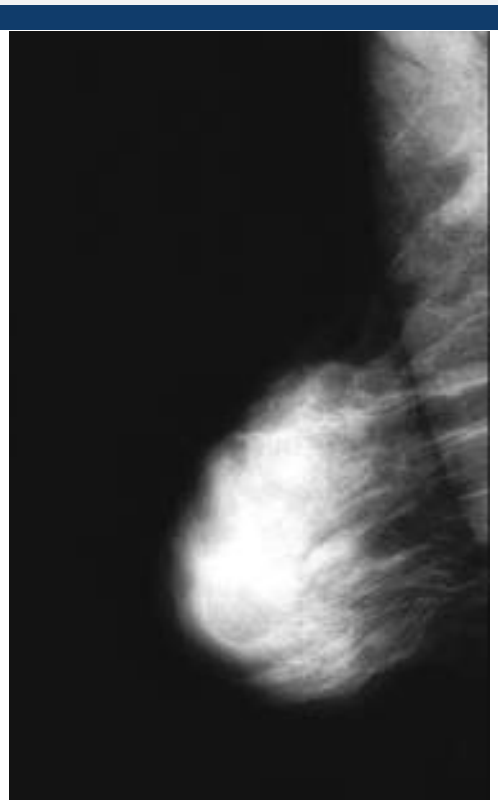


Score = 2

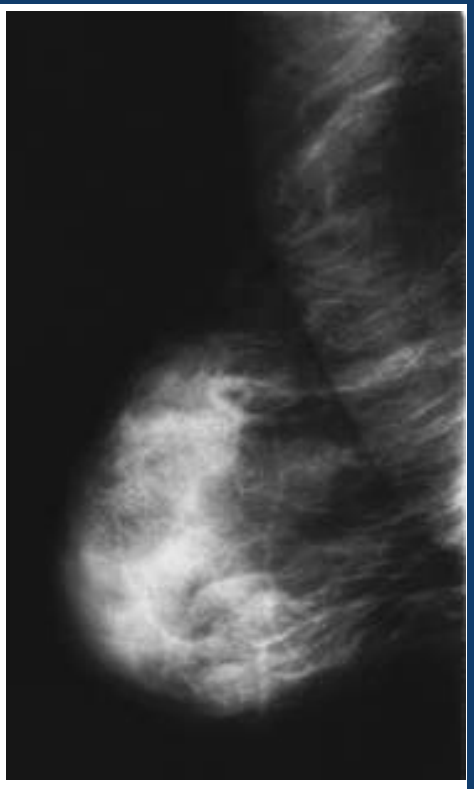
Compression



Year 1
Score = 2



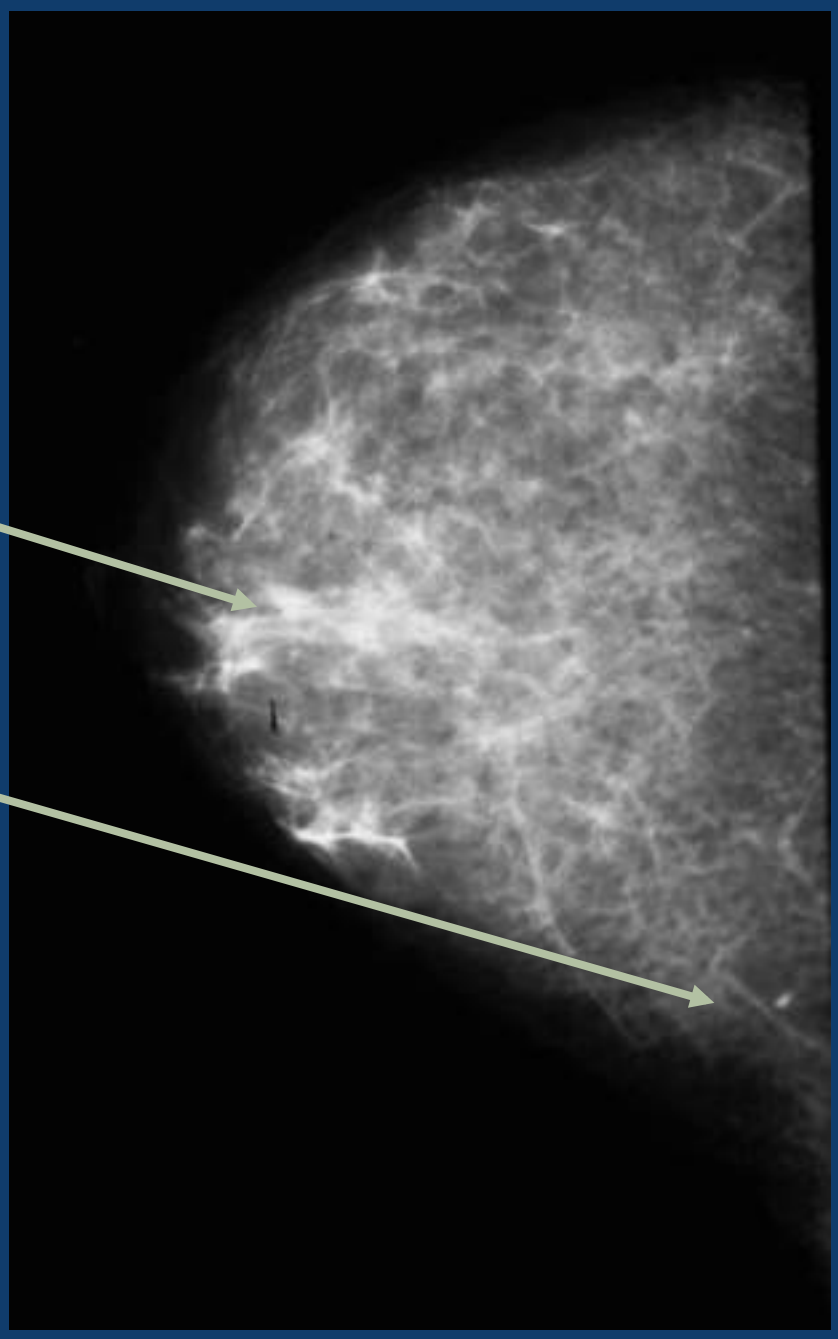
Year 2
Score = 2-3



Year 3
Score = 4

Assessing Sharpness on CC

- Subareolar area
- Medial breast
  - Edges of vessels, calcification, ligaments



Assessing Sharpness on CC

- Minimum average optical density (OD) in fibroglandular tissue should be 1.0 when measured with a spot densitometer
- Fibroglandular tissue should be a shade of gray
- Pectoral muscle may have OD under 1.0; however, must be able to see underlying tissue
- Uniformly washed out look indicates under- exposure on screen film images

Exposure Level: Most Common Deficiencies

Deficiency	Frequency (%)	
Generalized underexposure	56	(80)
Inadequate exposure of dense tissues	24	
Generalized overexposure	18	(20)
Overexposure of radiolucent tissues	2	

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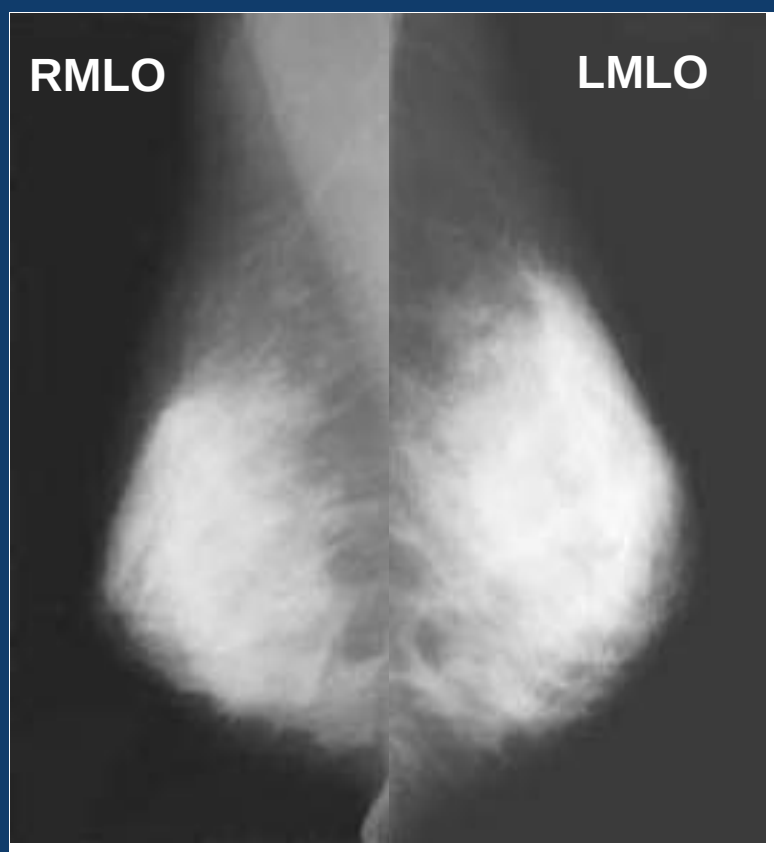
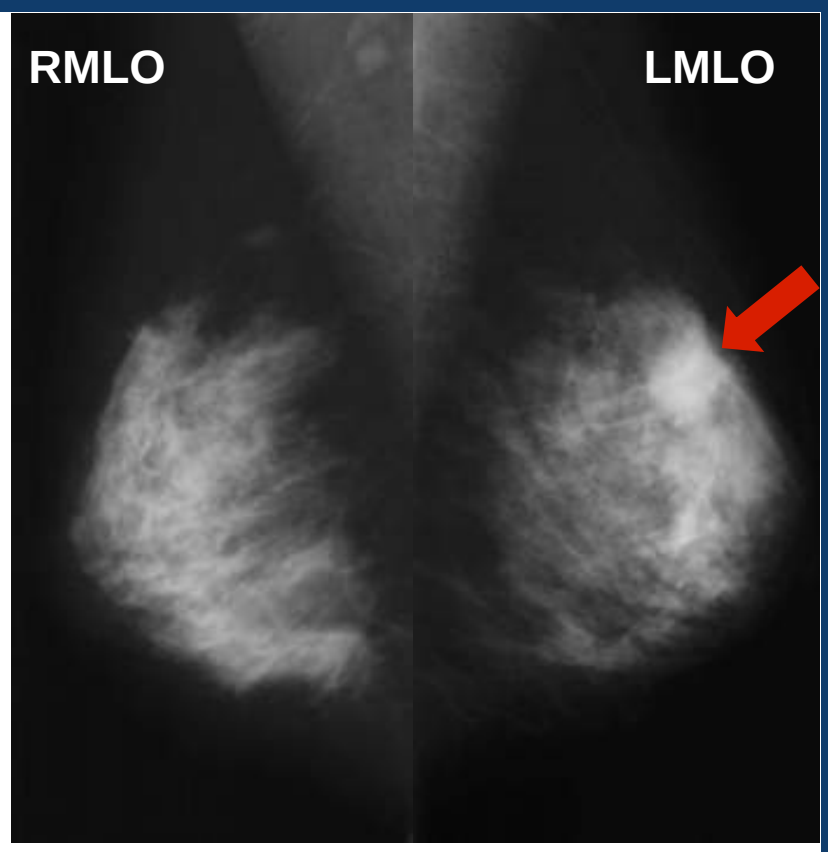
Exposure Level: Most Common Deficiencies



Initial Exam
Score = 2, possible 1



6 Months Later
Score = 4

Contrast

Differences in optical densities between different tissues. Fat should have high optical density (blacker) and fibro-glandular tissue should have much lower optical density (whiter).

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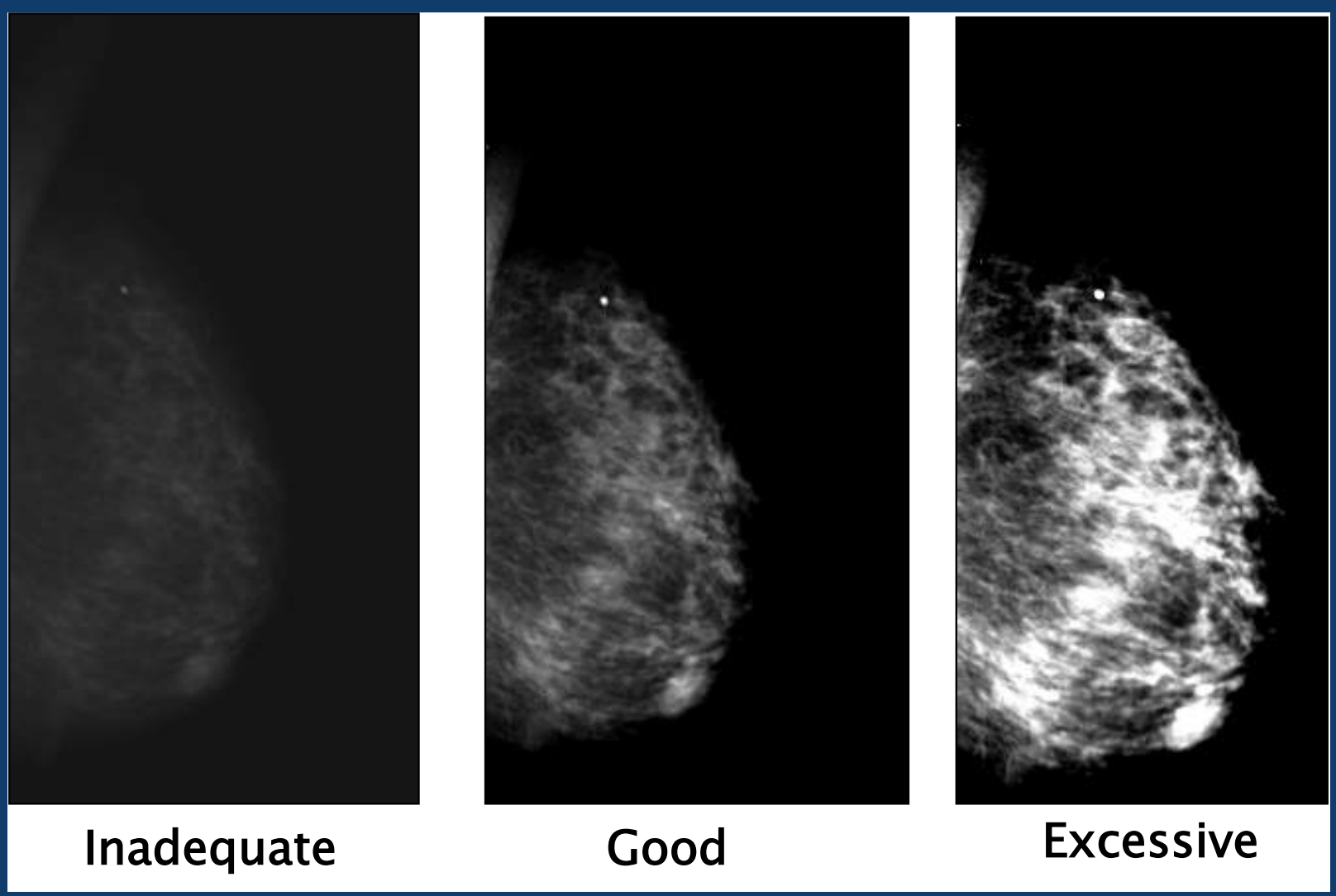
Contrast: Most Common Deficiencies

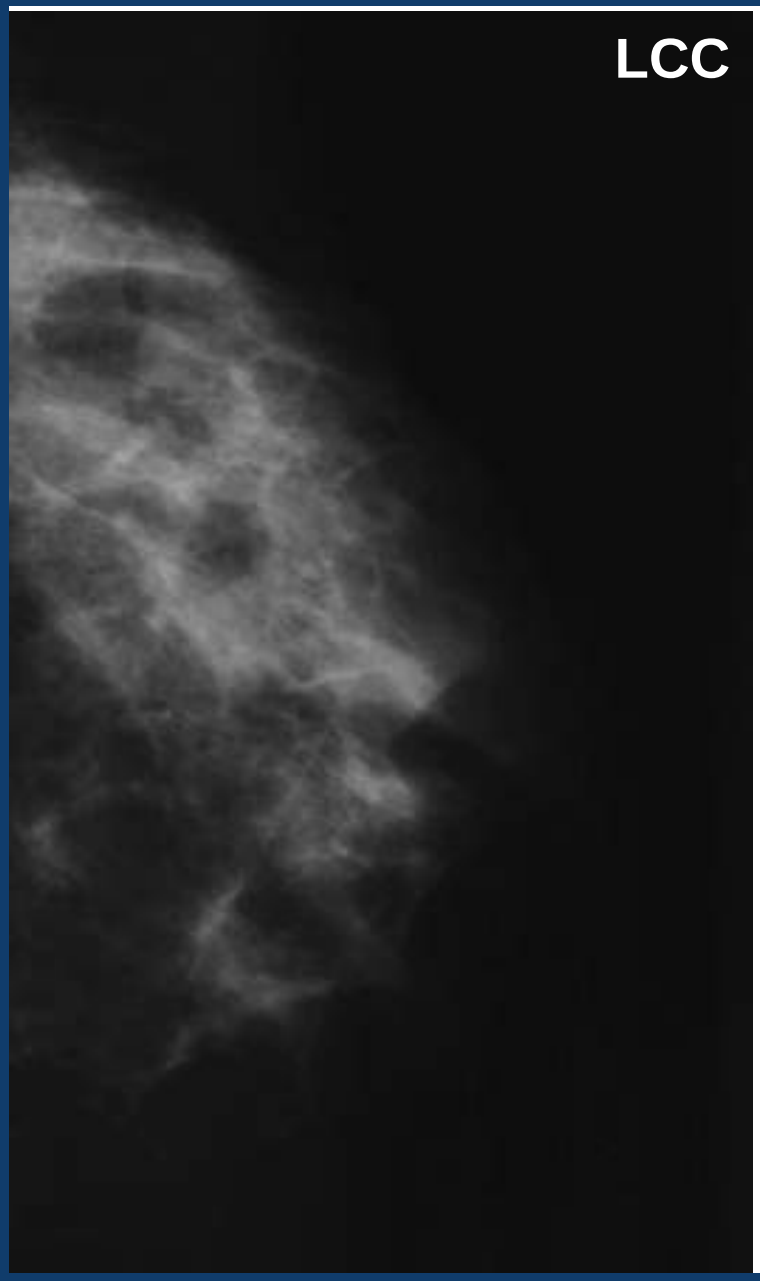
Deficiency	Frequency (%)
Inadequate contrast	90
Excessive contrast	10

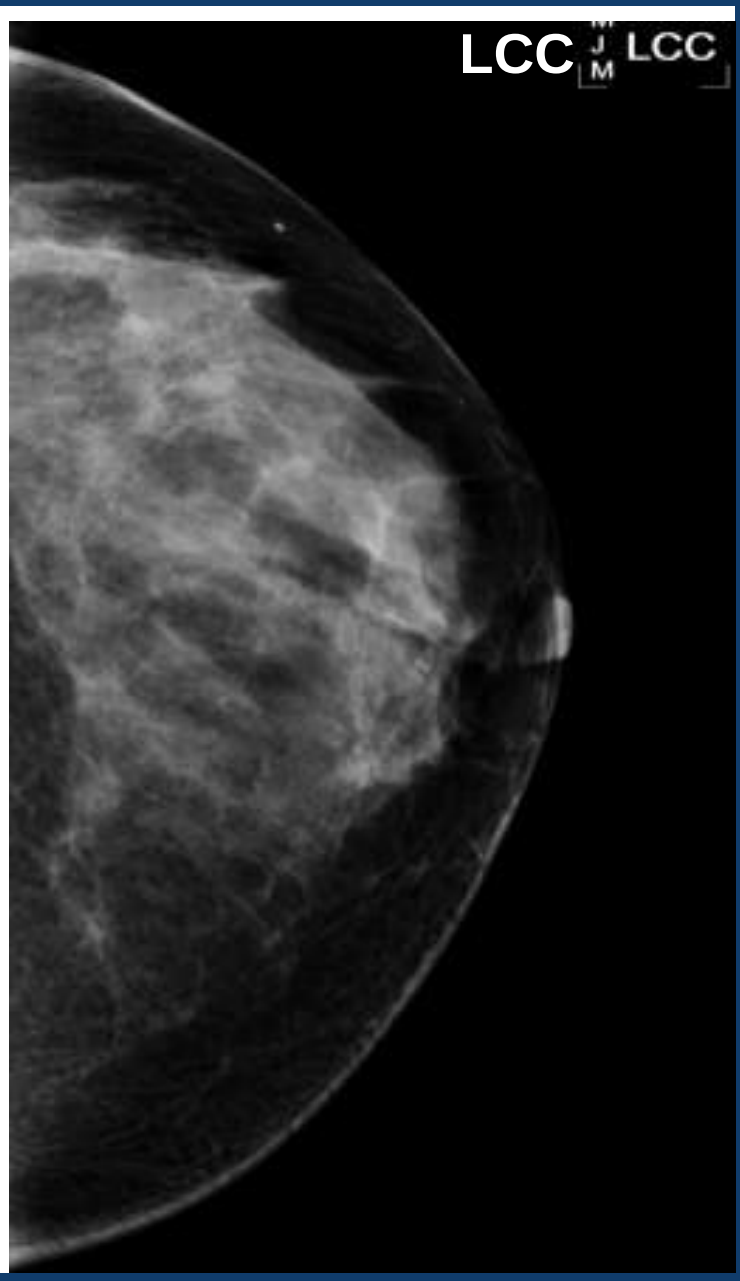
Contrast



Inadequate Good Excessive

Good Contrast Film-Screen and Digital: Same Patient





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Sharpness

- Unsharpness (often referred to as “blur” by medical physicists)
- Blurring of margins of vessels and Cooper’s ligaments
- Unclear margins of masses
- Unsharpness of calcifications

Assessing Sharpness on the MLO

- Inferior third of the breast
- Subareolar area
- Anterior edge of pectoral muscle
- Edges of vessels, calcification, and Cooper’s ligaments

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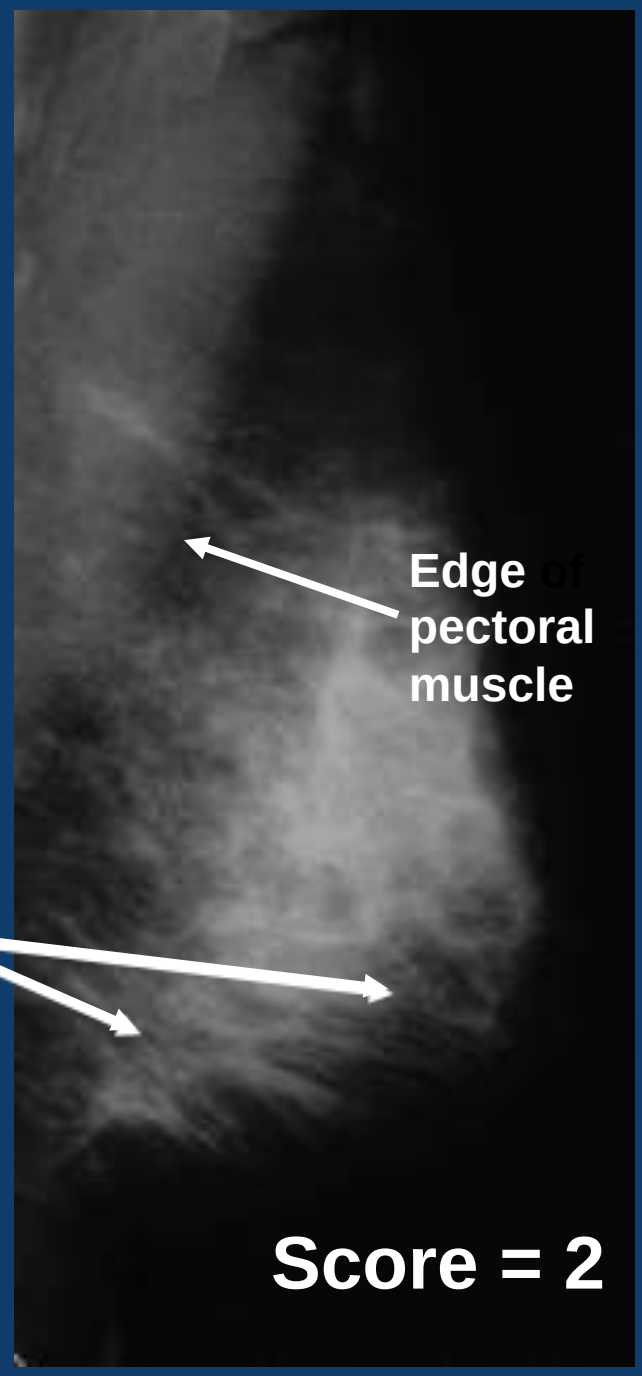
Inadequate Compression

- Motion unsharpness seen as poor delineation of linear structures
- This is usually most evident in inferior and subareolar aspect of MLO
- Also look at the edge of the pectoral muscle



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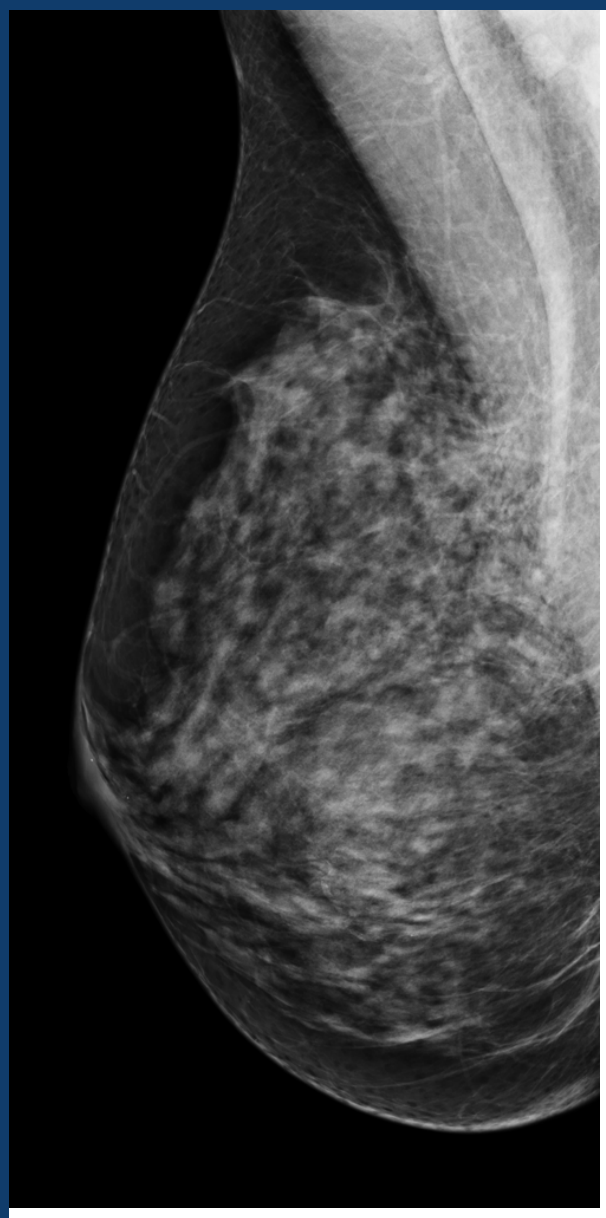
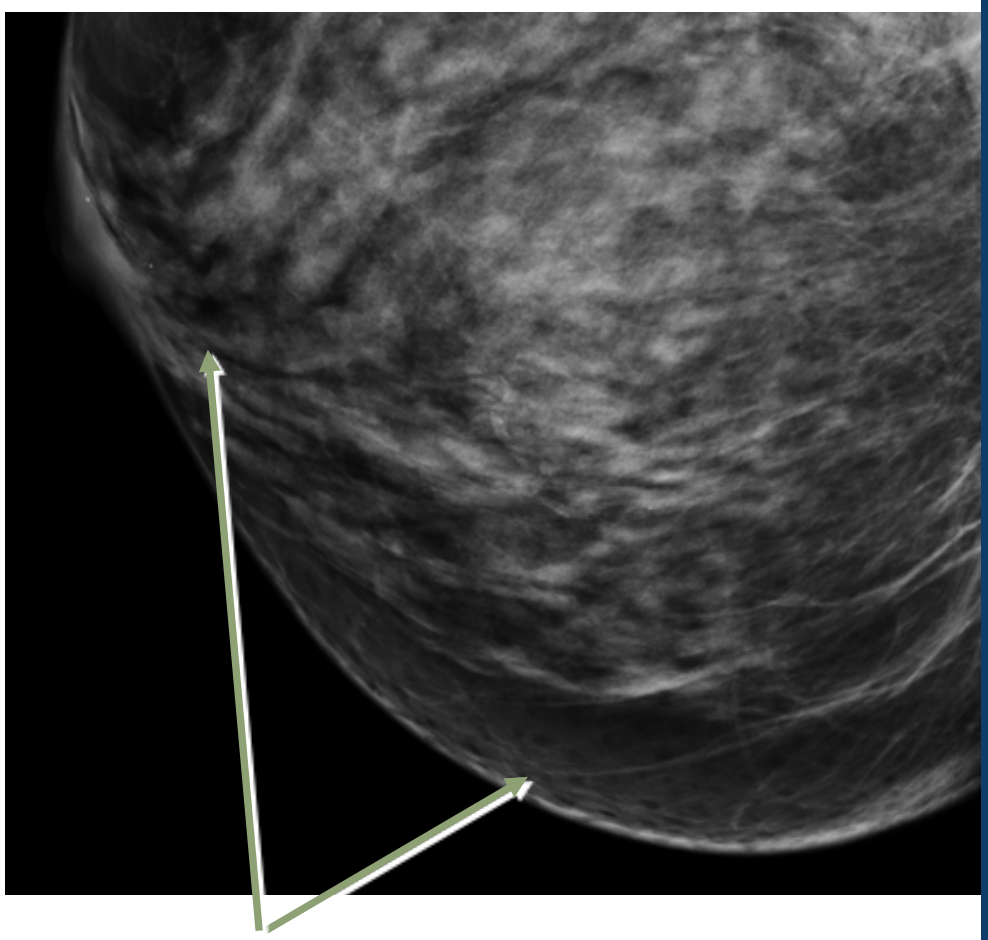
Inadequate Compression





Motion unsharpness

Score = 3

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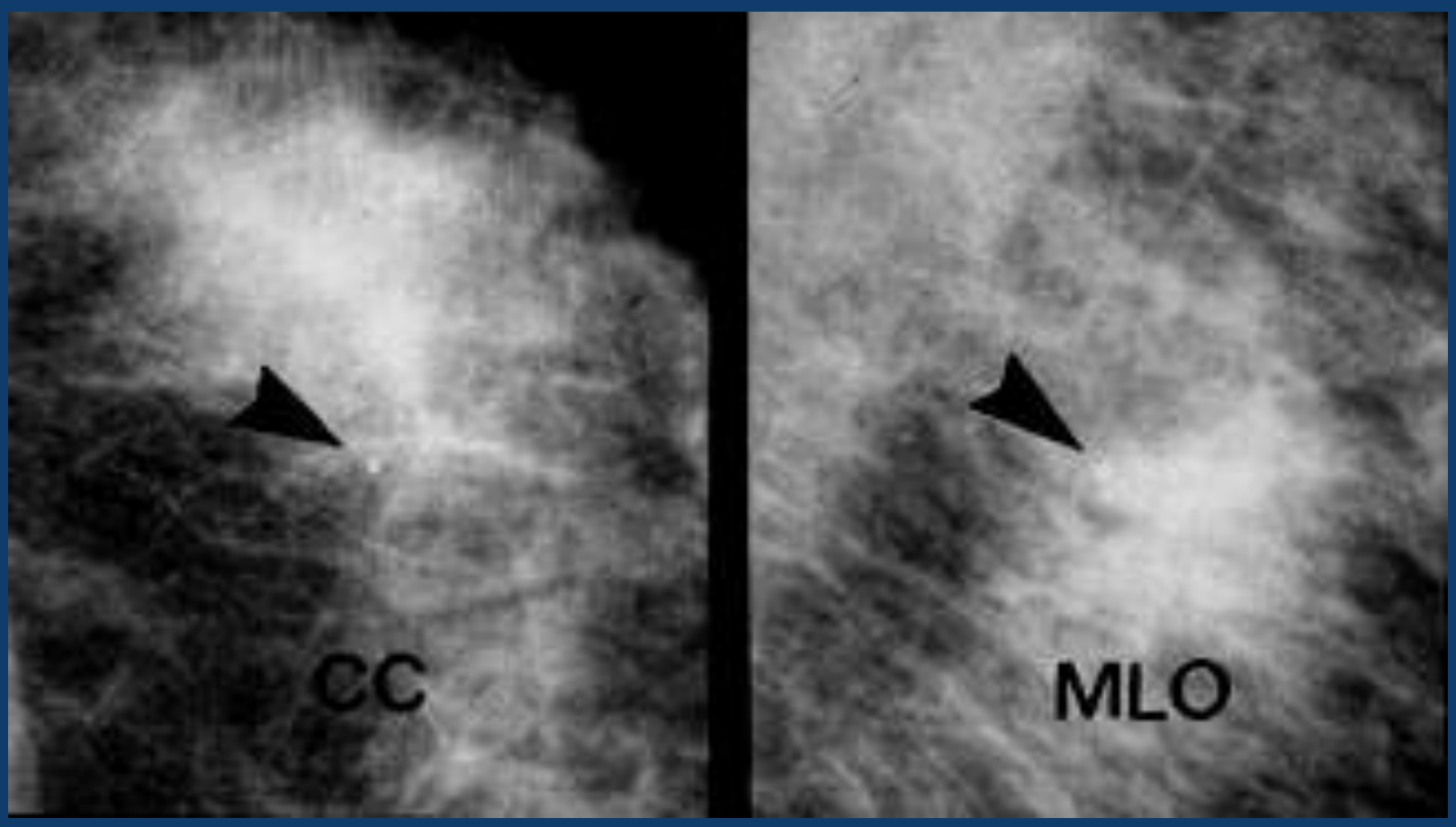
Assessing Sharpness on the CC

- Medial aspect of the breast
- Subareolar area
- Edges of vessels, calcifications, Cooper's ligament

Assessing Sharpness on the CC



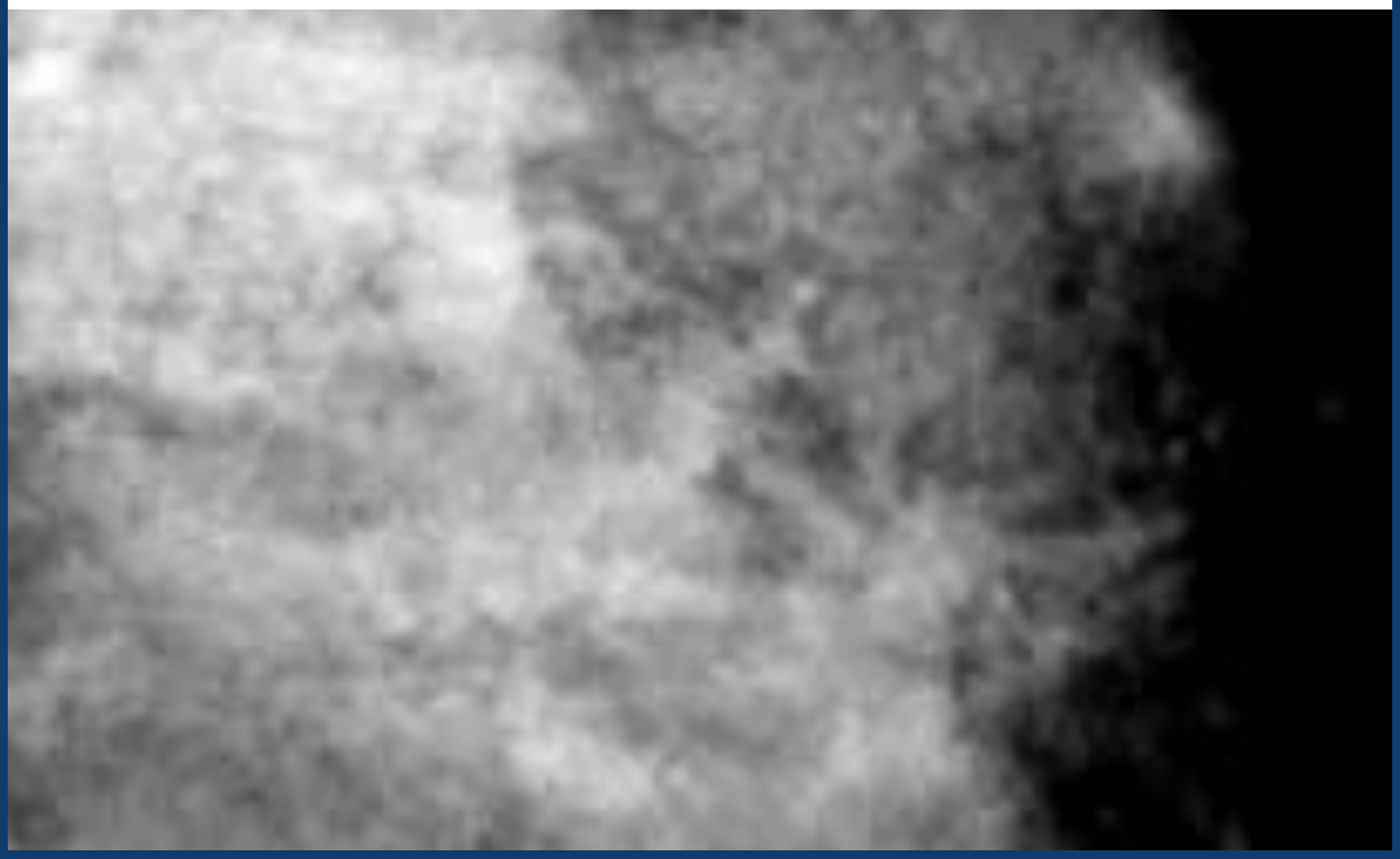
- Unsharpness related to inadequate compression and motion more likely to occur on MLO
- If question about sharpness, compare CC to MLO

Noise

- Mottled pattern of areas of relatively equal tissue density
- Noise limits visualization of details in the image

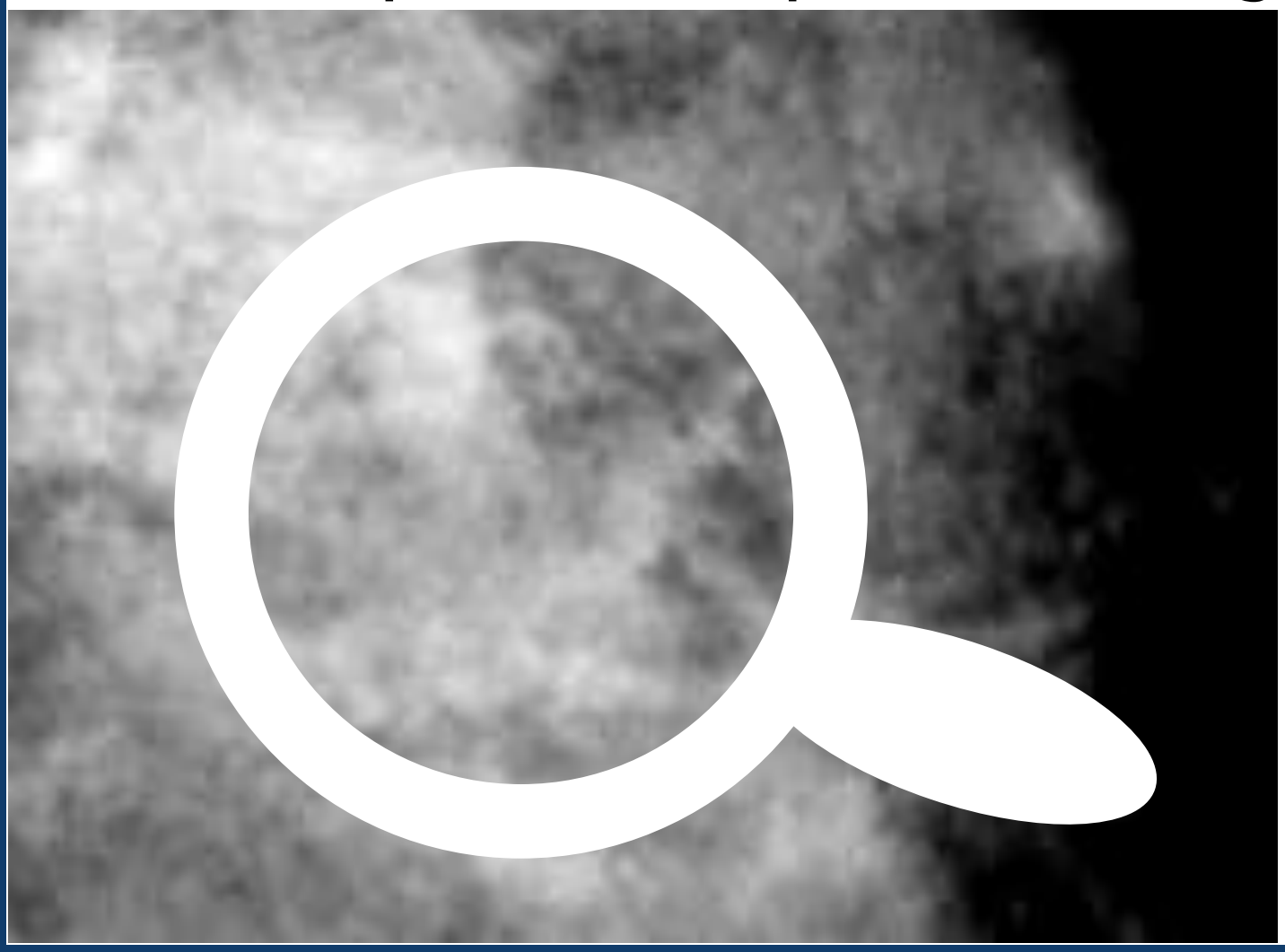
Noise

Mottled pattern of areas of relatively equal tissue density



Noise

If noise suspected, it helps to use a mag lens



Noise

Mottled pattern makes it difficult to see fine details in the images

Scoring: 1-5

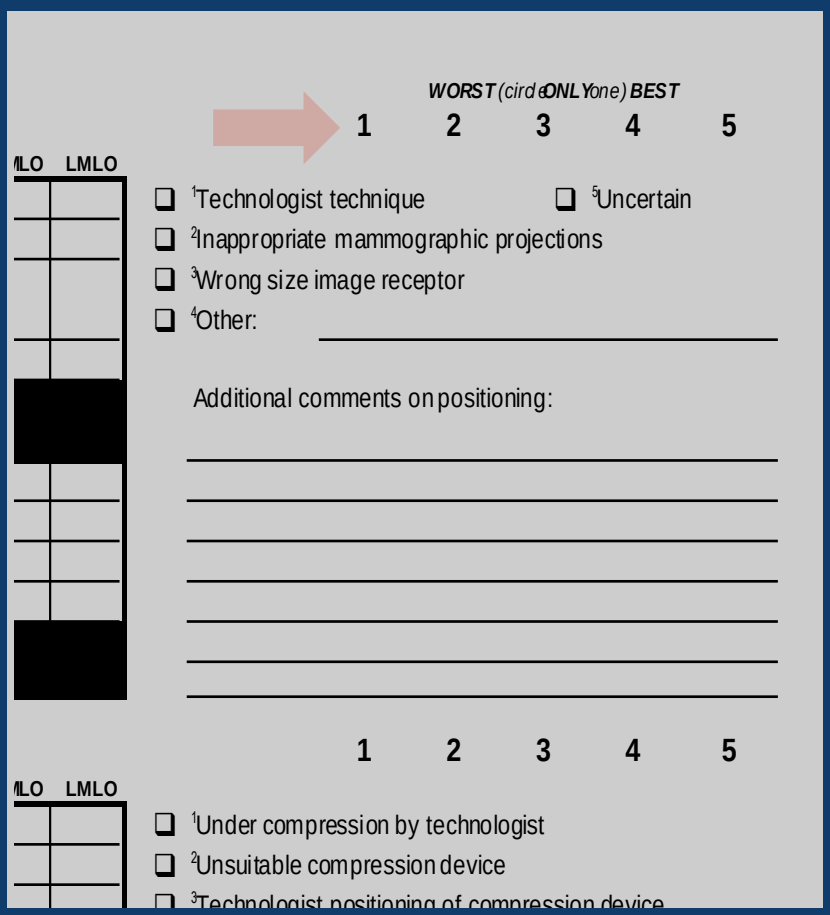
5 = Excellent/Outstanding

4 = Good

3 = Mildly deficient or just within the acceptable range (fair)

2 = Significant image defects, improvement needed

1 = Reserved for the most serious problems, totally unacceptable



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Scoring Categories

Any score 3 or below - reviewer must indicate:

- Deficiency(s)
- Possible cause(s)
- And provide comments, if possible

*Justify any score of 1, 2 or 3. A score of 1 should **only** be used for the most serious problems and may require a review of additional images.*

Deficiencies	*Breast/ View* RCC	LCC	RMLO	LMLO
A. POSITIONING				
❑ [1] Poor visualization of posterior tissues				
❑ [2] Sagging breast				
❑ [3] Inadequate amount of pectoral muscle shown on image				
❑ [13] Inadequate inframammary fold (IMF)				
❑ [4] Poor visualization of posterior tissues				
❑ [5] Excessive exaggeration				
❑ [6] Portion of breast cut off				
❑ [7] Skin folds				
❑ [8] Other body parts projected over breast				
❑ [12] Breast positioned too high on image receptor				
❑ [11] Posterior nipple line (PNL) on CC *not* within 1 cm of MLO PNL				

Possible Causes

❑ [1] Technologist technique ❑ [5] Uncertain
❑ [2] Inappropriate mammographic projections
❑ [3] Wrong size image receptor
❑ [4] Other: _____

Additional comments on positioning:

Score

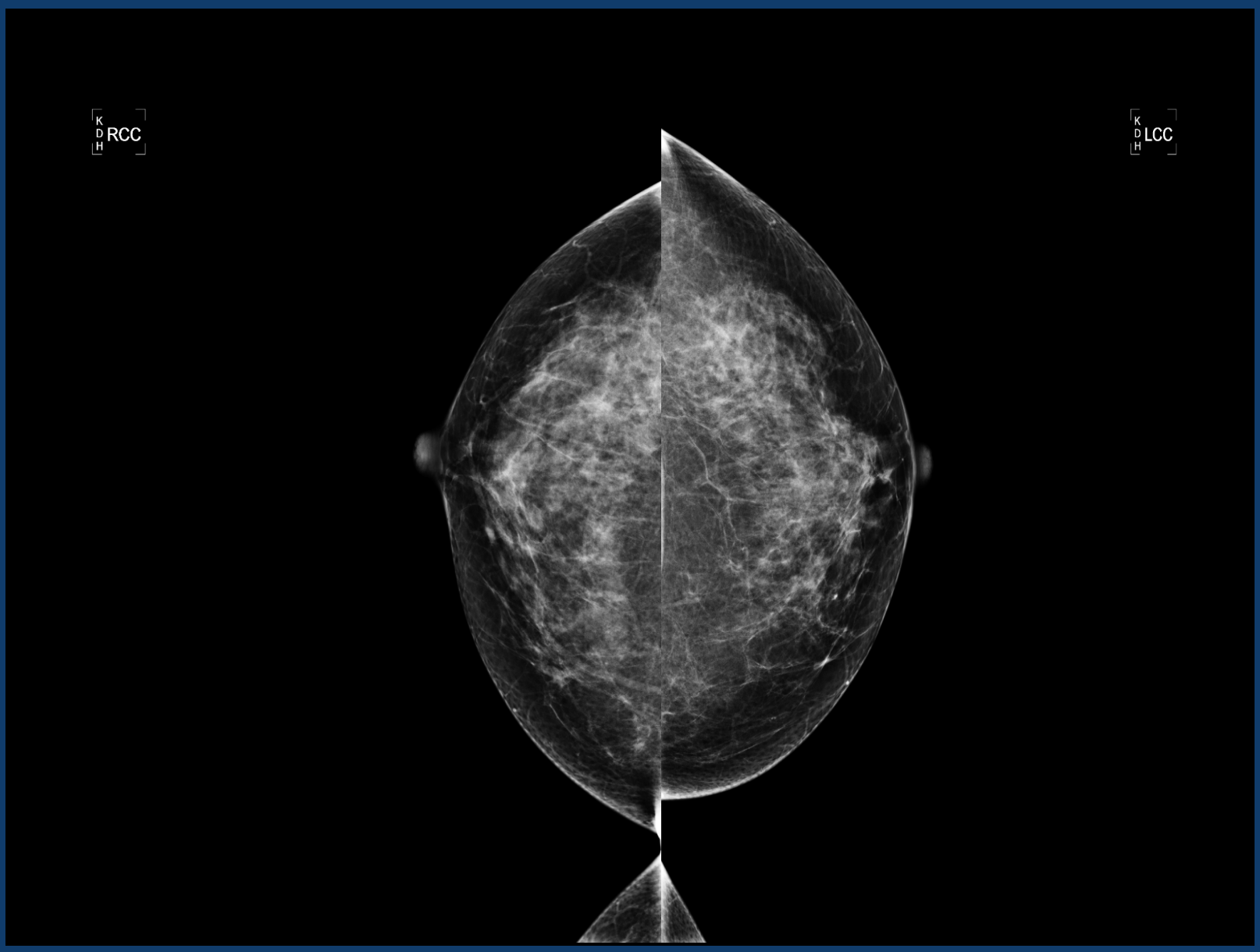
WORST *(circle* ***ONLY*** *one)* ***BEST***

1 2 3 4 5

Failing Score

- Score of 1 or 2 in any category
- 3 (or more) scores of 3 in categories (A – G)
  - Does *not* include category H (Exam ID)
- Do *NOT* fail for minor artifacts (G)
  - Artifacts should be prominent to earn a score of 3
  - Artifacts should be severe to earn a score of 2 or 1
- *Do* fail H (exam ID) even with a score of 2 (the patient's name, patient ID or R/L are missing)
  - Do *NOT* fail for other minor exam ID deficiencies

Case 1



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