

Clinical Image Evaluation for Mammography Technologists

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Categories

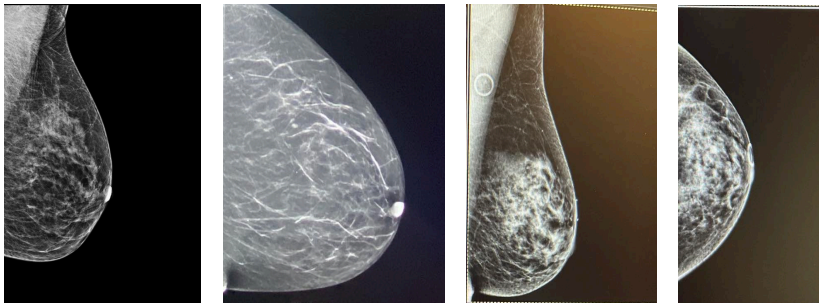
- Positioning
- Compression
- Exposure level
- Contrast
- Sharpness
- Noise
- Artifacts
- Exam ID



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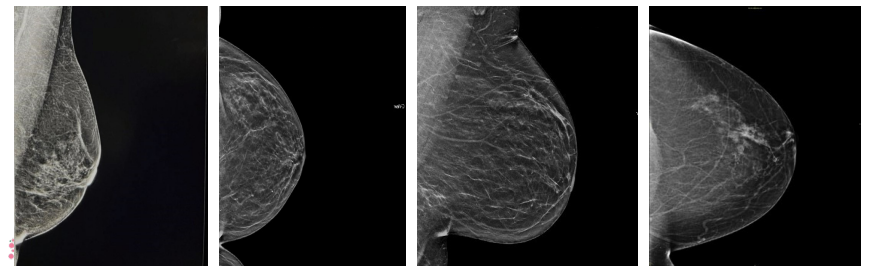
Positioning... Positioning... Positioning



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Positioning... Positioning... Positioning



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Meeting the Criteria

- Images for ACR accreditation
- Images that meet image quality criteria



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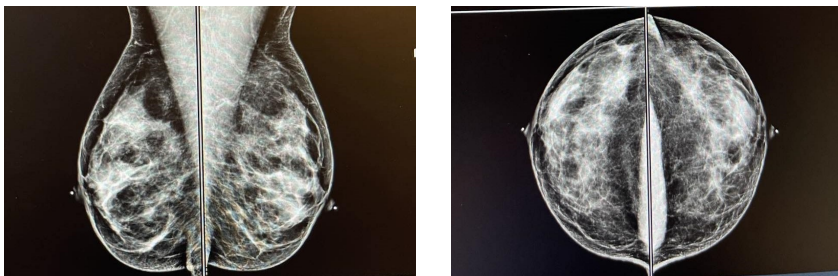
Images for ACR Accreditation

Needs to be a representation of your BEST work... In other words, almost perfect.



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Meeting Image Quality Standards*

- Positioning deficiencies do not impede diagnosis.
- Images that meet basic quality standards
 - Adequate PNL measurement
 - Nipple in profile in one of two views
 - Length of muscle on MLO
 - Minimal IMF (can have folds)

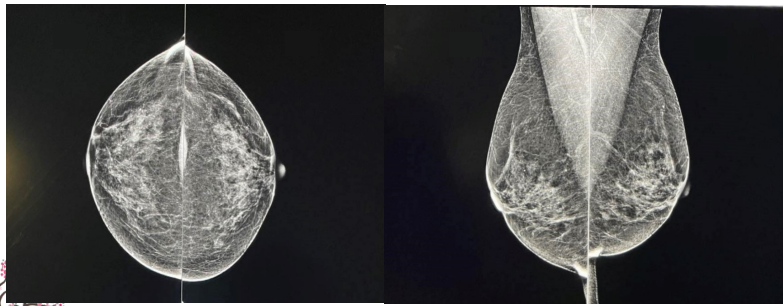


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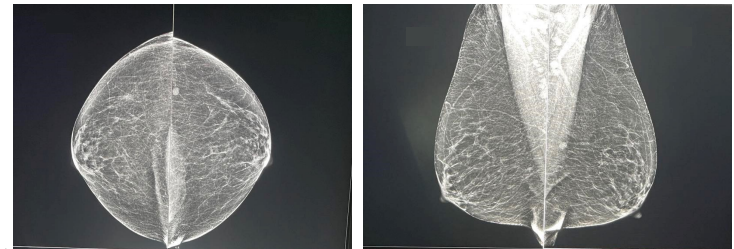
*Unless patient circumstances do not allow for adequate imaging *which must be documented!*

Meets Imaging Quality Standards



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Meets Imaging Quality Standards



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Reasonable Expectations

Even after technologists received the most up to date standardized positioning techniques, approximately 1/3 of all patients did not meet acceptable image criteria.



Source: American Journal of Roentgenology, 209, December 2017

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Variables That May Compromise Image Quality

- Patient weight and height
- Breast size, shape, mobility, tenderness
- Lack of patient cooperation
- Mobility/stability issues
- Developmentally disabled
- Congenital abnormalities
- Limited ROM
- Dementia/Alzheimer's
- Elderly/infirm
- Body habitus

Should be noted by technologist and dictated into report.



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Reasonable Expectations for the MLO

MLO View	Positioning Criteria	FFDM	DBT	Bassett
	Visualization of Pec Muscle to PNL	86%	87%	81%
Concave Pec	36%	28%	-	
Straight Pec	41%	46%	-	
Convex Pec	23%	26%	-	
Wide Margin at Top of Pec	95%	93%	-	
No Motion	98%	97%	99%	
Posterior Glandular Tissue Included	90%	94%	77%	
Nipple in Profile	89%	92%	88%	
Skin or fat folds	53%	62%	15%	
Upper Location	25%	27%	-	
Lower Location	35%	45%	-	
Visualization of Inframammary Fold	81%	85%	49%	
Requires More Than One View	13%	17%	-	



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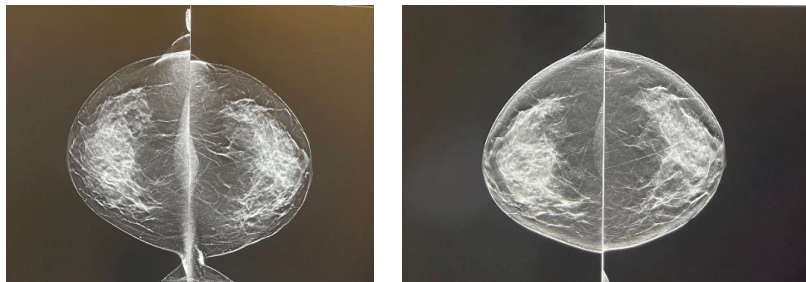
Reasonable Expectations for the CC

CC View	Positioning Criteria	FFDM	DBT	Bassett
	Pec Muscle Visualized	48%	50%	32%
No Motion	100%	98%	-	
Lateral Glandular Tissue Included	73%	81%	37%	
Nipple in Profile	83%	85%	89%	
Skin or fat folds	39%	47%	10%	
Medial Location	16%	23%	-	
Lateral Location	29%	32%	-	
Visualization of Cleavage	41%	34%	-	
Requires More Than One View	5%	7%	-	



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Meet, Beat, Repeat



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Critical Factors

- Positioning techniques used by technologists are not standardized or consistent so image quality can be widely variable especially when comparing images to previous studies
- While technologists can identify imaging deficiencies, they are often unable to identify specific corrective actions needed to improve the image



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There are only **2** factors that cause positioning problems that result in insufficient images*...

1. **Equipment:** the way the machine is set-up: height of the IR, angle and compression paddle size
2. **Patient:** the way the patient is “set-up”: both feet, hips and shoulders facing forward (for all views except the XCCL)



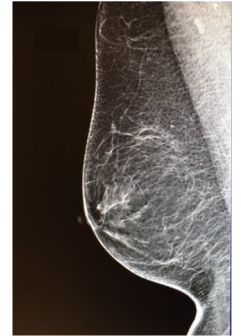
*Excluding patient limitations described previously

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The MLO View

- Inclusion of all breast tissue within perimeter
- Pectoral muscle fully visualized
- Tissue well separated
- Tissue visualized back to retromammary fat space
- IMF



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The MLO View

Visualization of the pectoral muscle:

- The pectoralis muscle is not really part of the breast
- However, it serves as an important anatomical landmark for positioning and image evaluation

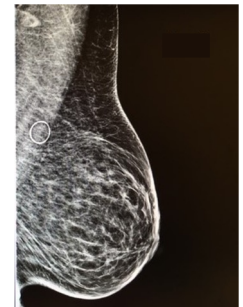


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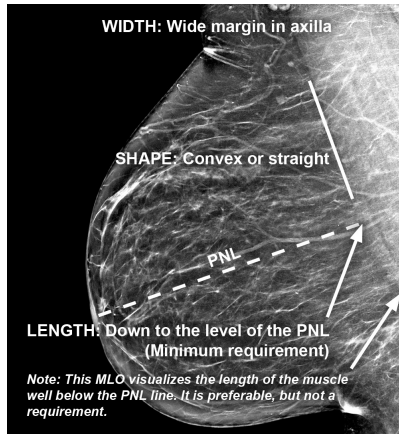
The MLO View

- **Width:** wide margin at the top (axilla)
- **Length:** down to the level of the PNL
- **Shape:** Convex/straight



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Width of the Muscle

There should be a wide margin of the pectoralis muscle at the top of the image (in the axilla).



Width of the Muscle – Equipment

- Related to the placement of the IR in the axilla
- The back corner of the IR should be placed just anterior to the latissimus dorsi



Width of the Muscle – Patient

- Related to the position of the patient
- Patient must be turned into the machine with feet, hips and shoulder as far forward as possible, with their shoulder down, relaxed and pulled forward and can be held in position by the technologist (if possible)



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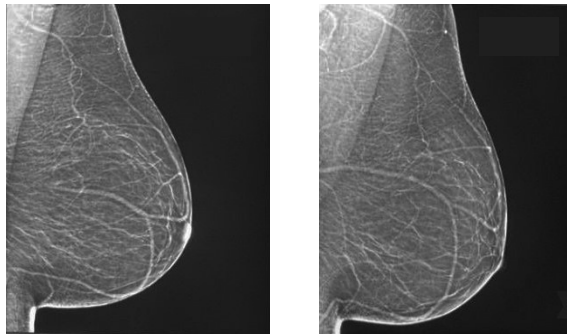
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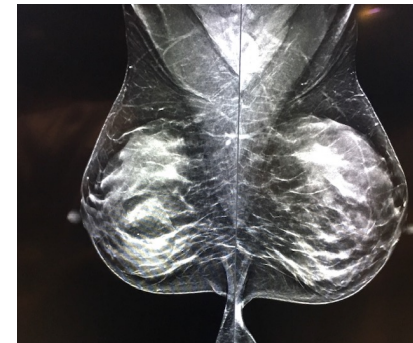
Width of the Muscle



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Visualization of the Lat Dorsi

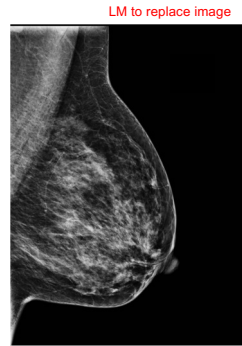


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Length of the Muscle

Should be visualized down to the level of the PNL.



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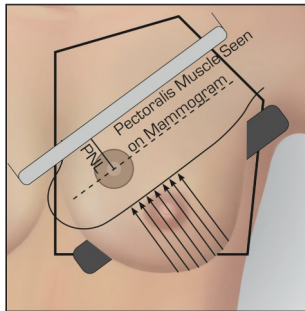
Angle for the MLO

- Angle to the free margin of the pectoralis muscle
- Keep angulation consistent
- Steeper angle for patients with longer thoraxes and small breast
- Lesser angles for shorter thoraxes and larger breasts

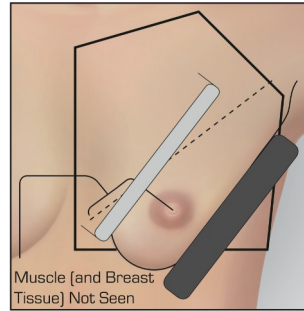


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Proper degree of angulation.



Angle too steep.



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Recommended Angulation for MLO

- Depends on body habitus
- Maintain consistency from year to year



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Keep Angles Consistent

- 40 degrees for shorter, heavier patients with large breasts
- 45 degrees for average patients
- 50 degrees for tall, thinner patients with smaller breasts

*Note: 35 degrees for patients who have undergone reduction



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Keep Angles Consistent

- Use variations of 5-degree increments
- No more 47, 42, 48, 53 etc.



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Keep Angles Consistent

- I am **not** saying to NEVER use 35 or 55, but try to keep it consistent, so comparison is easier from year to year
- An MLO angled at 56-degrees one year will look markedly different than an MLO angled at 42-degrees the next year



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Length of the Muscle – Patient

- Related to the position of the patient
- The patient must be turned into the machine with both feet, hips and shoulders as far forward as possible, as not to impede progress of the compression paddle



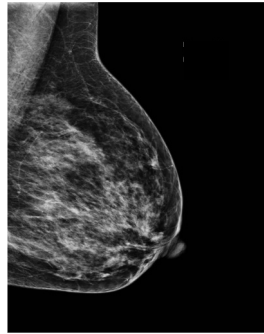
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Proper degree of angulation



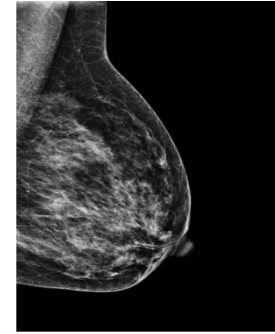
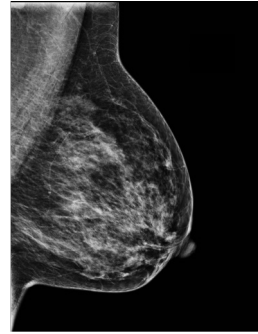
Angle too steep



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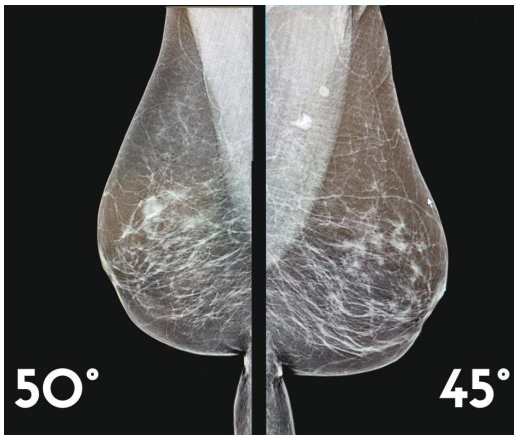
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OR... Patient is not facing the machine properly.



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Shape and Opacity of the Muscle

The muscle should be convex or straight.



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Shape and Opacity of Muscle – Equipment

- Related to the height of the IR
- Top of IR should be positioned at the height of the sternoclavicular joint, or halfway between the top of the shoulder and the axillary crease



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Shape and Opacity of Muscle – Patient

- Related to relaxation of pectoralis muscle
- Patient's shoulder, arm and hand must be relaxed with the elbow bent and relaxed behind the image receptor



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Problems with the MLO

- No visualization of the IMF
- Folds in the IMF
- Breast drooping
- Breast not centered



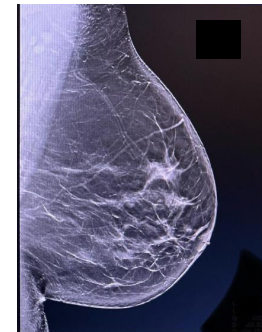
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No IMF



IMF



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The position of the patient related to the bottom front corner of the IR is critical.

- Patient must be facing forward with both feet
- Lower front corner of the IR should be directly below the plane of the patient's nipple or half between her ASIS and umbilicus
- This requires the patient taking a "side step" towards the technologist

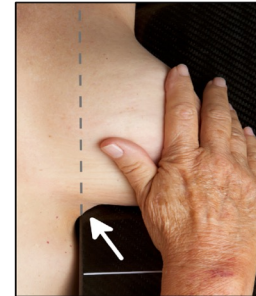


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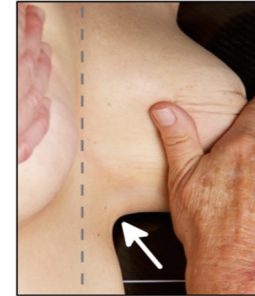
Improper

Edge of IR in front of IMF



Proper

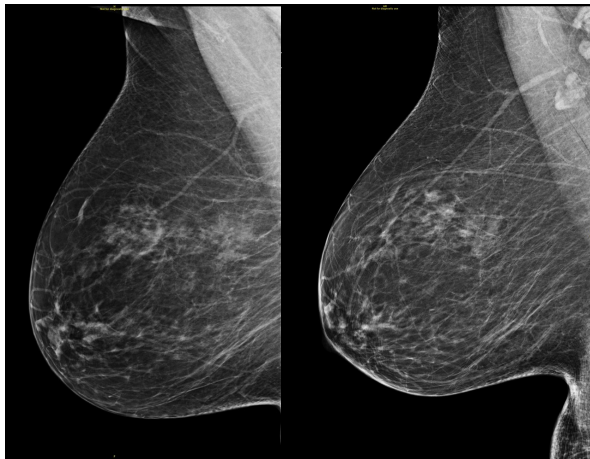
Edge of IR in behind IMF



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Top edge of IR indicated by vertical dotted line

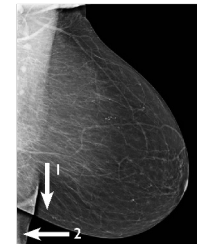
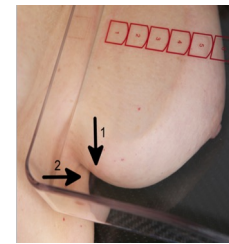
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Folds in the IMF



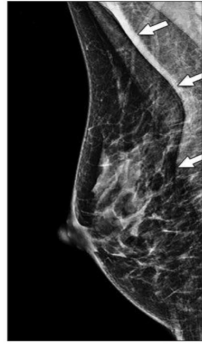
1. Horizontal fold is in the medial breast
2. Vertical fold is in the lateral breast



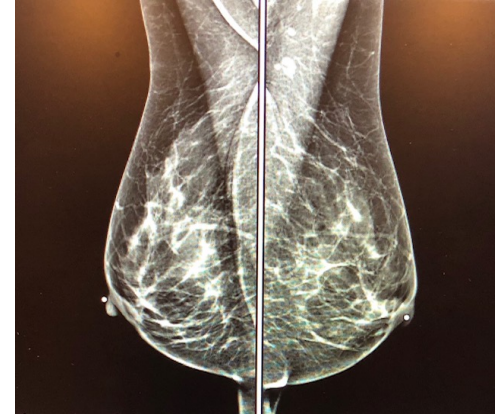
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Vertical Folds in the Lateral Breast



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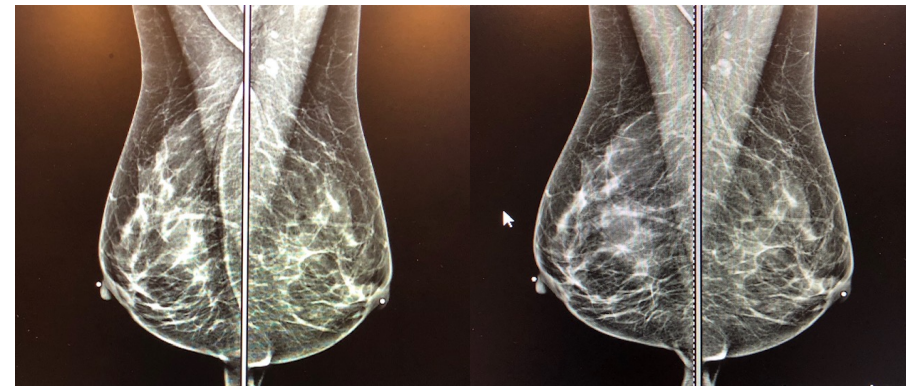


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The Technologist's Hand Must Slide Down the Lateral Side of the Breast



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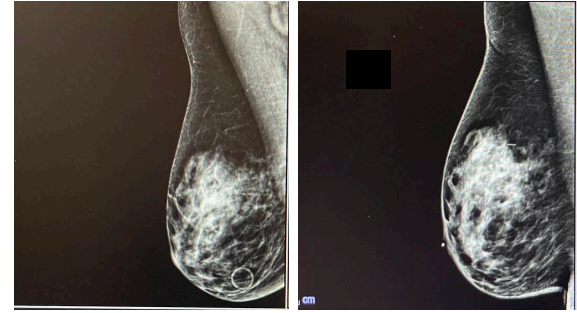
The “Sagging Breast”



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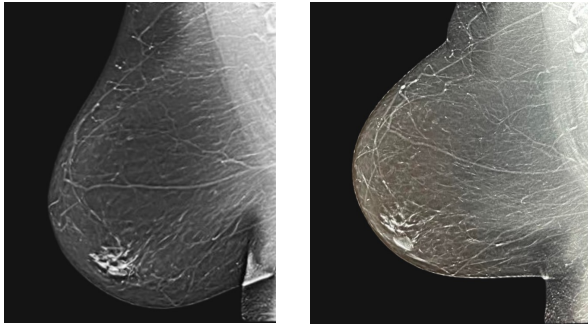
The “Sagging Breast”



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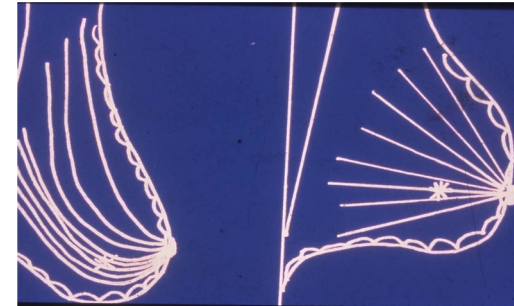
The “Sagging Breast”



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The “Sagging Breast”



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Image Courtesy: Stephen Feig, MD

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Position of the Breast

- Breast held in the “up and out” position to bring the breast back to its ‘normal’ position (nipple perpendicular to the chest wall)
- Maintained by adequate compression
- Have the patient lift and flatten the contralateral breast



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Maintain the Breast in the “Up and Out” Position*

- Keep the nipple as close as possible to perpendicular to the chest wall.
- Don't let go of the breast until compression is **complete**.

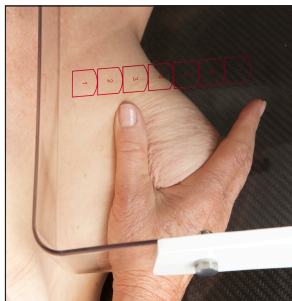
**This will help eliminate the “sagging breast”*



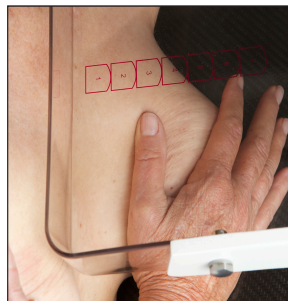
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Solution for the “Sagging Breast”



Hold the breast in the up and out position.



Compress.



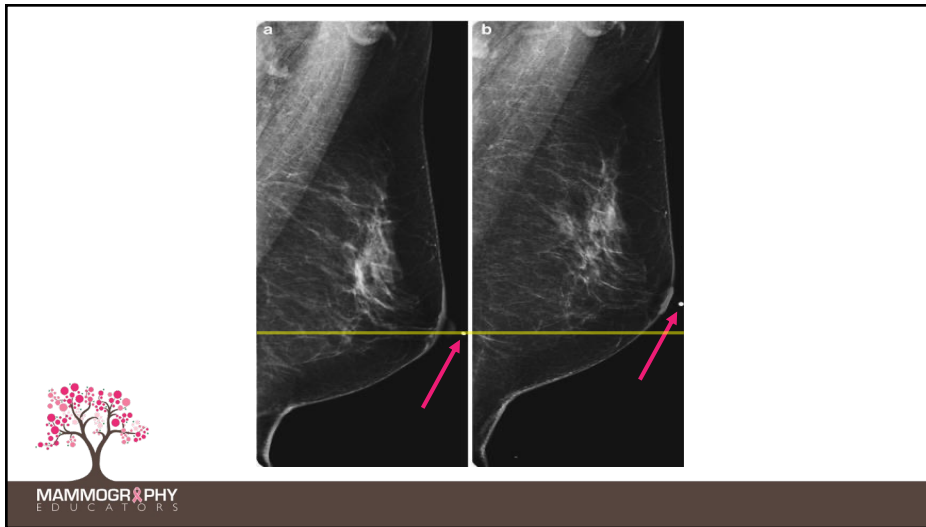
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Solution for Breast Not Centered

- Large compression paddle is needed for the CC due to the width of the breast
- If the patient has a short thorax, the compression paddle should be changed to the small size for the MLO*
- Paddle size should be consistent for the same view of each breast

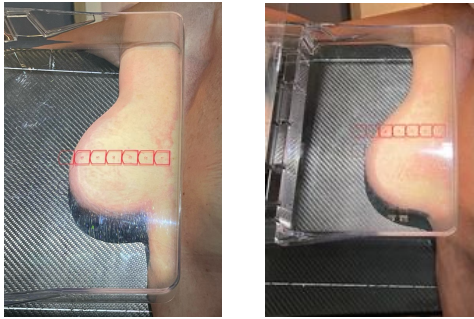
*There is no published literature that states that changing the compression paddles between views is *not* recommended.

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Solution for Breast Not Centered

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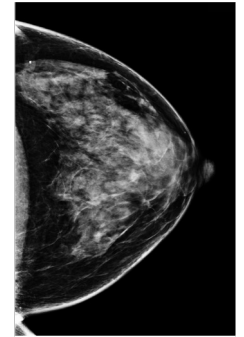
Solution for Breast Not Centered



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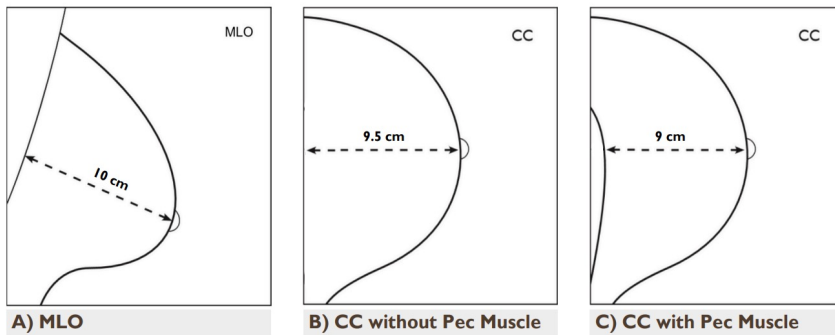
The CC

- Include maximum amount of breast tissue in the axial/transverse plane
- Visualization of medial breast tissue (cleavage) if possible
- Visualization of pectoralis muscle on approximately 50% of all CCs
- PNL within 1cm of PNL measurement on the MLO



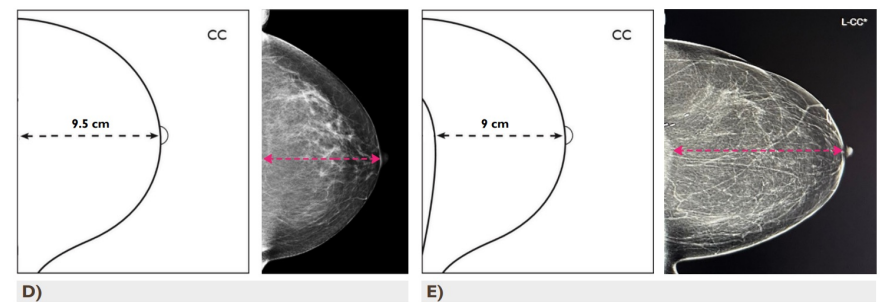
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How to Measure the PNL



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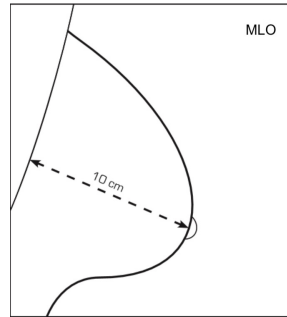
How to Measure the PNL



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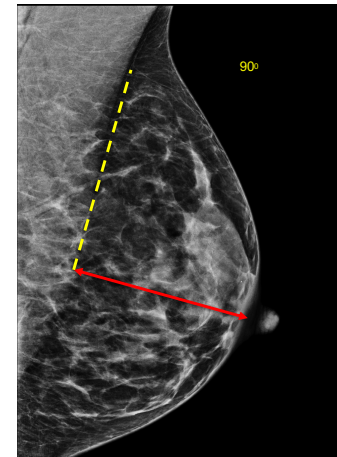
Measurement of the MLO

Measure from the base of the nipple to the anterior margin of the pectoralis muscle where the intersection can be measured as a 90-degree angle.



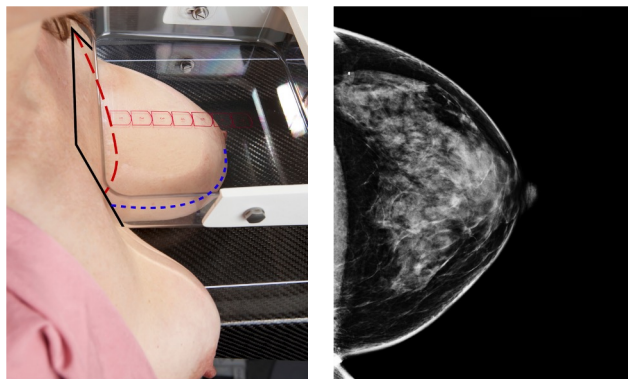
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Is it the Equipment or the Patient?

Equipment:

- IR too high or too low
- Compression paddle size

Patient:

- Facing towards the machine with both feet, hips and shoulders forward



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Due to lack of anatomical landmarks,
positioning techniques are extremely important!!



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Due to lack of anatomical landmarks,
positioning techniques are extremely important!!



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The CC

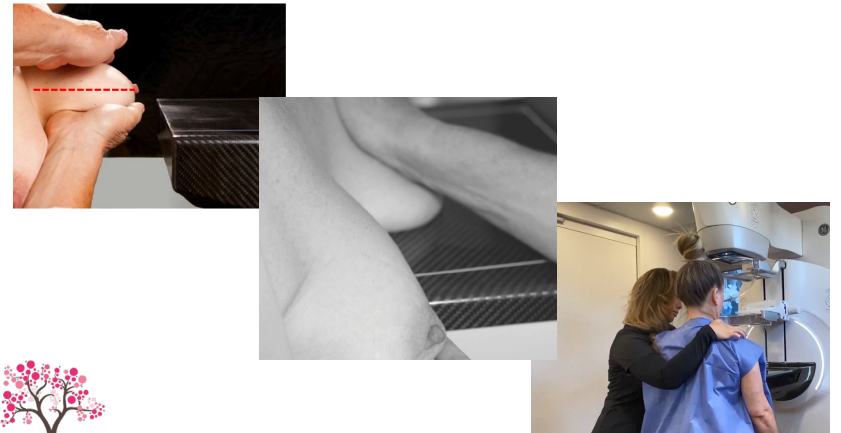
Common problems:

- Short CC (PNL measurement on CC is less than 1 cm of PNL measurement on the MLO)
- No pec muscle (remember the 50% rule!)
- No visualization of deep medial breast tissue (cleavage)

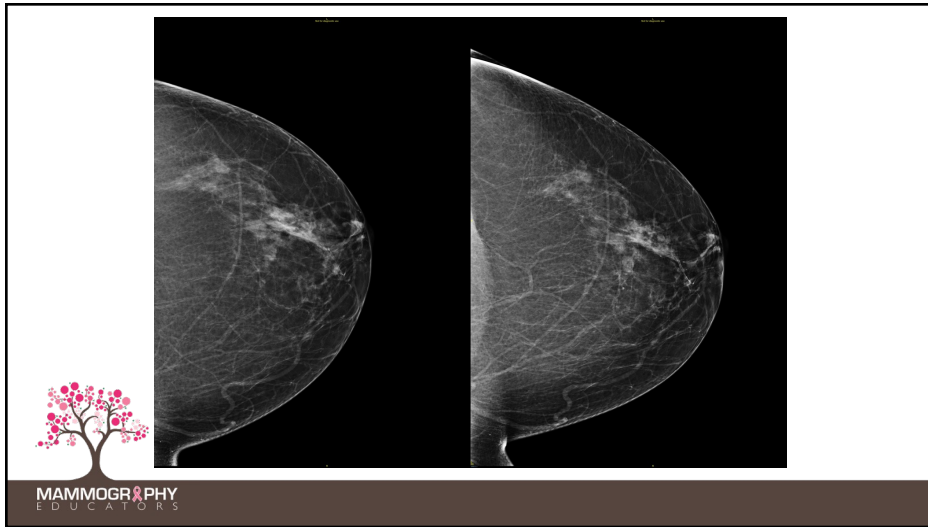
All are most often related to *positioning technique*,
vs. equipment and patient position. (Although they are
still important!)



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What my 35+ years of experience tell me...

If the tech has the machine set up properly and uses standardized positioning techniques it is almost always the position of the patient that causes the deficiency.

You need data! The recommendations made in this lecture are based on scientifically proven techniques.



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Mammography Positioning Standards in the Digital Era: Is the Status Quo Acceptable?

Ashley I. Huppe¹
Kelly L. Overman²
Jason B. Gatewood¹
Jacqueline D. Hill¹
Louise C. Miller²
Marc F. Inciardi¹

OBJECTIVE. The objective of our study was to evaluate positioning of full-field digital mammography (FFDM) and digital breast tomosynthesis (DBT) compared with film-screen (FS) mammography positioning standards.

MATERIALS AND METHODS. A retrospective study was conducted of consecutive patients who underwent screening FFDM in 2010–2012 and DBT in 2012–2013 at an academic institution. Examinations were performed by five experienced technologists who underwent updated standardized positioning training. Positioning criteria were assessed by consensus reads among three breast radiologists and compared with FS mammography data from a 1993 study by Bassett and colleagues.

RESULTS. One hundred seventy patients ($n = 340$ examinations) were analyzed, showing significant differences between FFDM and DBT examinations ($p < 0.05$) for medial or inferior skin folds (FFDM vs DBT: craniocaudal [CC] view, 16% [$n = 56$] vs 23% [$n = 77$]; mediolateral oblique [MLO] view, 35% [$n = 118$] vs 45% [$n = 154$]), inclusion of lateral glandular tissue on CC view (FFDM vs DBT, 73% [$n = 247$] vs 81% [$n = 274$]), and concave pectoralis muscle shape (FFDM vs DBT, 36% [$n = 121$] vs 28% [$n = 95$]). In comparison with Bassett et al. data, all positioning criteria for both FFDM and DBT examinations were significantly different ($p < 0.05$). The largest differences were found in visualization of the pectoralis muscle on CC views and the inframammary fold on MLO views, inclusion of posterior or lateral glandular tissue, and inclusion of skin folds, with DBT and FFDM more frequently exhibiting all criteria than originally reported Bassett et al. findings.

CONCLUSION. DBT and FFDM mammograms more frequently include posterior or lateral tissue, the inframammary fold on MLO views, the pectoralis muscle on CC views, and skin folds than FS mammograms. Inclusion of more breast tissue with newer technologies suggests traditional positioning standards, in conjunction with updated standardized positioning training, are still applicable at the expense of including more skin folds.

Source: American Journal of Roentgenology; 209, December 2017



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FREE RESOURCES AND VIDEOS

www.mammographyeducators.com




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Our Resources

Below are resources to support mammography technologists and their breast imaging departments. Find information on mammography accreditation, positioning techniques and problem-solving, regulatory requirements, breast cancer support and much more.



Mammography Positioning Free Downloads Tips And Tricks

MQA And EQUIP Breast Cancer Screening Additional Resources

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Mammography Positioning



FREE POSITIONING VIDEOS

- Positioning for the CC and MLO Views**
by Louise C. Miller, RTRM
- Positioning for Implant Displacement Views**
by Louise C. Miller, RTRM
- Positioning for the 90 Degree Lateral View**
by Louise C. Miller, RTRM

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A Technologist's Perspective of the FDA Report 'Poor Positioning Responsible for Most Clinical Image Deficiencies, Failures – SBI Newsletter
by Louise C. Miller, RTRM, FSBI

How to Help Your Technologist Part 1 – Common Problems with the Mediolateral Oblique – The Inframammary Fold: How to Improve Visualization and Reduce Skin/Fat Folds in the Inframammary Fold – SBI Newsletter
Series by Louise C. Miller, RTRM, FSBI: Part 1 of 3

How to Help Your Technologist Part 2: Common Problems with the Mediolateral Oblique – Not Enough Pectoralis and the Sagging Breast – SBI Newsletter
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How to Help Your Technologist Part 3: Common Problems with the Craniocaudal View – SBI Newsletter
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Picture Perfect: Training Helps Mammography Techs Improve Imaging
Source: Billings Gazette covers Montana's Billings Clinic Breast Center's experience with the Train-the-Trainer Program and the importance of standardized mammography positioning.

Most Commonly Used Additional Views, Part 1: Variations of the Craniocaudal View – SBI Newsletter
by Dawn Dierenburger, RTRM & Robyn Hadley, RTRM

Most Commonly Used Additional Views, Part 2: Minimizing Superimposition and Identifying Location
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Most Commonly Used Additional Views, Part 3: Defining Structures and Clarifying Presence of Abnormalities
by Dawn Dierenburger, RTRM & Robyn Hadley, RTRM

Mammographic Positioning: Evaluation from the View Box
Source: Radiology 1993; 188:803-806

Mammography Positioning Standards in the Digital Era: Is the Status Quo Acceptable?
by Ashley I. Huppe, Kelly L. Overman, Jason B. Gatewood, Jacqueline D. Hill, Louise C. Miller, and Marc F. Inciardi

Poor Positioning Responsible for Most Clinical Image Deficiencies and Failures – FDA
U.S. Department of Health and Human Services, Food and Drug Administration (FDA)

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Technologists' Characteristics and Quality of Positioning in Daily Practice in a Canadian Breast Cancer Screening Program
This study evaluates to what extent technologists' experience, training or practice in mammography are associated with screening mammography positioning quality.

Technology Changes: Positioning Challenges – SBI Newsletter
by Louise C. Miller, RTRM, FSBI

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The Cost of Poor Positioning: Avoiding Workplace Injuries by Using Proper Positioning Techniques
by Louise C. Miller, RTRM, FSBI

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Tips & Tricks for Mammographers

31 Daily Tips for Breast Cancer Awareness Month
by Louise C. Miller, RT(R)(MARRT), CRT(M), FSBI, FNGCC

A Team Approach to Thriving in the Face of Workforce Shortages
by Steven-Hay Shirley, PhD, MEd, MPH, Sarah Jacobs, RT(R)(MGRIT) and Robyn Hadley, RT(R)(M)

Advanced Skin Marking in Breast Tomosynthesis and MRI
A self-guided CE Activity approved by the ASRT for 1 Category A continuing education credit, completion of *Book by Medical*.

Aiming for Quality: Tips for Achieving Optimal Imaging in a Suboptimal World – SBI Newsletter
by Dawn Deenbrugger, RT(RM) & Robyn Hadley, RT(RM)

Breast Biopsy Marker Migration: Significance and Potential Solutions
by Sarah Jacobs, BS, RT(R)(MGRIT) and Robyn Hadley, RT(R)(M)

Dear Breast Imaging Professionals: What If...
by Sarah Jacobs, BS, RT(R)(MGRIT)

Enhancing Wellness: The Importance of Effective Feedback
by Sarah Jacobs, BS, RT(R)(MGRIT)

Gratitude: The Key to Personal and Professional Well-Being
by Sarah Jacobs, BS, RT(R)(MGRIT)

Patient History Details, Documentation and Delivery – SBI Newsletter
by Dawn Deenbrugger, RT(RM) & Robyn Hadley, RT(RM)

Portrait of COVID-19 Pandemic: A Technologists Perspective – SBI Newsletter
by Robyn Hadley, RT(RM)

The Connection Between Mental Health and Workplace Injury
by Sarah Jacobs, BS, RT(R)(MGRIT)

Staff Shortages in Breast Imaging: Where Do We Go From Here?
by Sarah Jacobs, BS, RT(R)(MGRIT) and Robyn Hadley, RT(R)(M)

Sustaining Relationships in the Remote Imaging Environment
by Sarah Jacobs, BS, RT(R)(MGRIT)


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by Louise C. Miller, RT(RM), FSB

The Medical Outcomes Audit: A Team Approach to Understanding the Data and Sharing Results
by Sarah Jacobs, BS, RT(R)(MGRIT) and Robyn Hadley, RT(R)(M)

Technologist Engagement, Part 1: Creating Positive Patient Interactions With Effective Communication
by Sarah Jacobs, BS, RT(R)(MGRIT) and Robyn Hadley, RT(R)(M)

Technologist Engagement Part 2: Enhancing the Radiologist-Technologist Partnership
by Sarah Jacobs, BS, RT(R)(MGRIT) and Robyn Hadley, RT(R)(M)

What Every Mammography Technologist Would Like Their Radiologist To Know About: The Role of the Technologist – SBI Newsletter
by Louise C. Miller, RT(RM), FSB



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Free Downloads

CC and MLO Quick Steps and Image Criteria Checklists
Handouts for *The Miller Method™* steps for the CC and MLO along with self-evaluation image checklists

Reasonable Expectations for the CC and MLO
Source: *American Journal of Roentgenology*; 200, December 2017

How to Properly Measure the PNL
by Louise C. Miller, RT(RM), FSB

Tips for Scripts
The following are suggested responses as mentioned in our online course: *Tips and Tricks for Mammographers*. Communications tips were provided by Elizabeth Green, PhD, who is a licensed clinical psychologist whose specialty, among others, is the development and application of effective and appropriate communication skills.

MQSA / EQUIP

Contact the MQSA Program
The MQSA Hotline 1-800-838-7750 can answer specific questions regarding MQSA compliance or issues related to your facility's inspection or individual situation. They are very prompt in returning calls and VERY helpful!


Mammography Quality Standards Act (MQSA) – Important information about the Enhancing Quality Using the Inspection Program (EQUIP) Initiative
U.S. Department of Health and Human Services, Food and Drug Administration (FDA)

The MQSA Final Rule 2023: What Exactly Changed and What Do I Do Next?
by Robyn Hadley, RT(RM)

Tips For EQUIP: A Practical Guide for Technologists and Radiologists
by Louise C. Miller, RT(RM), FSB and Christine Pucillo, RT(RM), BS

How Mammography Programs Can Prepare for 2017 Regulation
Three new questions added to annual inspections that Radiology administrators should be aware of.

Validation Cycles: Mammography (Revised 02-22-2023)
American College of Radiology



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Miller, Louise C. (2020) *Meeting EQUIP Standards: Image Quality & Positioning Problem-Solving For Breast Imagers*. San Diego, CA.

Miller, Louise C. (2024) *Mammographic Imaging of Challenging Patients*. San Diego, CA.



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