Helping Your Technologists: Tips for Troubleshooting Mammographic Positioning, Part 1

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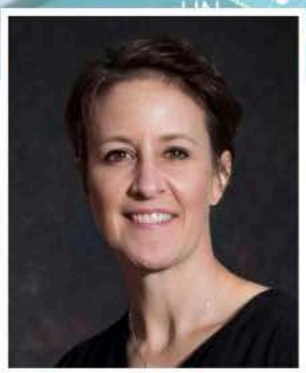

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Quality imaging is a top priority of each member of the imaging team. Various challenges that are routinely presented throughout a technologist's workday pose limitations for acquiring quality images. Understanding these challenges and how to troubleshoot them can be difficult for the technologist and the interpreting radiologist. We recommend simplifying the troubleshooting process with your technologists by using the data-driven scientific principles outlined in this article. This article, the first of a two-part series, focuses on tips that radiologists can share with their mammography technologists to correct common positioning problems. The second part will offer ideas for providing image quality feedback to technologists while collaboratively assessing corrective action and amplifying high-level communication skills.

A study by Huppe et al established realistic expectations for specific imaging criteria for the craniocaudal (CC) and mediolateral oblique (MLO) views.[1] Because of variations in patients' physical limitations, body habitus, breast size and shape, mobility, compression tolerance, cognitive abilities, and other unique conditions, achieving all imaging criteria 100% of the time is unrealistic. A study by Salkowski et al found that positioning is the predominant factor in technical recalls. Patient recalls for additional imaging due to technical factors are often related to positioning. Positioning problems account for 47% of full-field digital mammography recalls and 81% of digital breast tomosynthesis recalls.[2]

The criteria for positioning and image quality assessment have remained unchanged since the publication of the 1999 ACR *Mammography Quality Control Manual*, which includes a section on clinical image quality. However, this version was developed for use with film-screen mammography and has not been updated to allow for the changes and challenges that technologists encounter with full-field digital mammography and digital breast tomosynthesis, including an increase in the length, width, and thickness of the image receptor (IR). This situation complicates how technologists are taught to position patients for mammograms and can also account for the wide variation in clinical image quality that radiologists encounter, especially from technologist to technologist and from year to year. More importantly, resources for and understanding of how to effectively troubleshoot positioning challenges and work with patient limitations that impact image quality are lacking. Troubleshooting image quality should be based on a solid understanding of correlative anatomy and standardized positioning techniques. Each step in the positioning process has an effect on a specific image quality criterion. Remember two sources of error when positioning and troubleshooting mammographic images: how the patient is positioned and how the machine is set up or positioned (ie, the angle and height of the IR and the compression paddle size).

Understanding key foundational principles can improve image quality. The following are tips for common positioning challenges with the CC and MLO views.[3]

Troubleshooting the CC View

Poor Visualization of Posterior Tissue

- Ensuring appropriate height of the IR is critical. An IR that is too low will exclude posterior, superior breast tissue. An IR that is too high will exclude posterior, inferior breast tissue. Elevate the breast until the posterior nipple line is perpendicular to the chest wall. Raise the IR to the level of the elevated inframammary fold.
- Optimize posterior tissue visualization by pulling the breast onto the IR with both hands (Figure 1).
- Anchor the breast with the base of the thumb at the 12-o'clock position and continue to pull the breast forward upon compression.

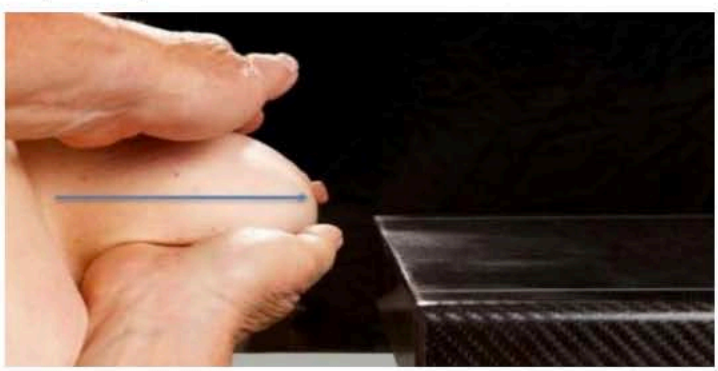

Figure 1. Posterior nipple line perpendicular to chest wall and breast pulled onto IR with both hands. Image courtesy of Mammography Educators.

Poor Visualization of Medial Tissue

- Once the breast is pulled onto the IR, lift the contralateral breast up and over onto the corner of the IR.
- Ensure that the patient's feet, hips, and shoulders are facing forward. This position will help maximize visualization of deep medial breast tissue.

Troubleshooting the MLO View

Visualization of Inframammary Fold

- Do not ask the patient to lean forward while moving the hips and buttocks backward; this position removes the inframammary fold from the field of view.
- To ensure the inframammary fold is in front of the IR and visualized on the image, be certain the patient's feet, hips, and shoulders are facing forward. The patient must sidestep toward the technologist to ensure the bottom corner of the IR is positioned halfway between the patient's umbilicus and anterior superior iliac spine.

Amount of Pectoralis Muscle

- The length of the pectoralis muscle should extend down to the level of the posterior nipple line with a wide margin in the axilla.
- The angle of the machine should be parallel to the free margin of the pectoralis muscle with the patient facing forward to achieve adequate length of the muscle. If the angle is too steep or the patient is turned away from the machine and not facing forward, the pectoralis muscle will be shortened.
- To obtain a wide margin of muscle in the axilla, place the corner of the IR just anterior to the latissimus dorsi while the patient's shoulder is directed forward and down and remains relaxed.

Shape of Pectoralis Muscle

- The pectoralis muscle should appear convex or straight. This shape indicates that optimal posterior tissue is visualized, with the breast adequately pulled away from the chest wall. A relaxed muscle allows optimal taut compression and separation of breast structures without undue discomfort.
- Asking the patient to rest or drape her arm over the side of the IR is often well received. Be mindful not to overuse the word *relax*. It may also be helpful to ask the patient to soften her shoulders to effectively relax the pectoralis muscle.
- Proper height of the IR is also essential to ensure optimal pectoralis muscle shape. Correct height for the MLO view is achieved when the top corner of the IR is at the level of the sternoclavicular joint, halfway between the top of the shoulder and the axillary crease (Figure 2).

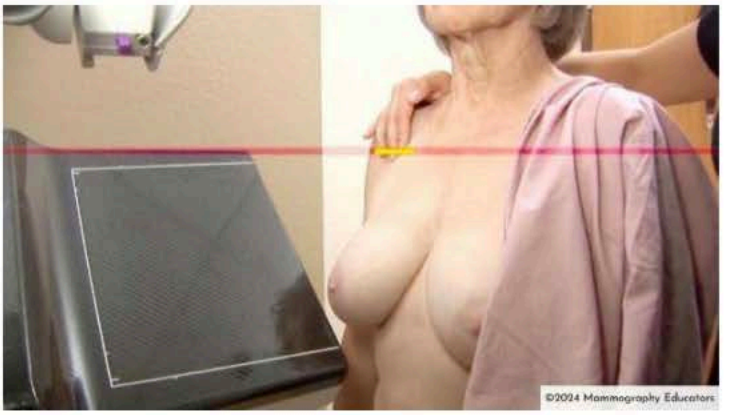

Figure 2. Proper height of IR for MLO view with top corner of IR at the level of the sternoclavicular joint, halfway between the top of the shoulder and the axillary crease. Image courtesy of Mammography Educators and Volpara Health.

Paddle Size

The same paddle size should be used for both CC views and the same paddle size should be used for both MLO views. Depending on the patient's body and breast size or shape, using one paddle size for the CC views and a different paddle size for the MLO views may be necessary. Using the appropriate paddle size allows all breast tissue to be imaged within the perimeter and ensures optimal image centering.

- Patients with a breast shape that is wide and not long may require the large paddle for the CC view. However, the same patient may require the small paddle for the MLO view to effectively include all superior and inferior tissue and achieve proper image centering without including excess abdominal tissue inferiorly.
- Patients with small breasts and a long thorax require the small paddle for the CC view and the large paddle for the MLO view.
- Using the half paddle, if available, may be beneficial for male patients, patients with very small breasts, implant-displaced views, and patients with extremely thin breasts. This paddle provides more space for the technologist's hand, allowing adequate anchoring of the breast to ensure optimal visualization of posterior tissue and compression without having the hand caught between the breast and compression paddle.

Patient Limitations

Technologists face a number of patient limitations that affect the ability to produce images of optimal quality. Producing quality images of all four standard views is often not achievable with patients who have specific limitations or challenges. Including a supplemental view is not only beneficial but may also be necessary to adequately image all breast tissue.[4]

Continued on page 18>

- Patients in wheelchairs: For the CC view, place foam blocks or pillows behind the patient to help hold the patient forward. For the MLO view, place the wheelchair at a 45° angle and remove armrests and footrests if possible (Figure 3).

Figure 3. Wheelchair with armrests removed, positioned at a 45° angle to the machine for the MLO view. Images courtesy of Mammography Educators.

- Patients with cognitive compromise: Allow a caregiver or family member to be in the examination room to calm the patient if necessary.

- Patients with physical limitations such as kyphosis, scoliosis, pectus carinatum, or pectus excavatum: Patients with kyphosis can have effective imaging for the CC view if they are seated (Figure 4). Angling patients with scoliosis differently for each MLO view may be necessary depending on the degree of curvature of the spine. Patients with pectus carinatum may require two CC views, one to adequately include the lateral aspect of the breast and one to include the medial aspect. Adding a supplemental lateromedial (LM) view can be helpful for visualizing inferior, posterior tissue (Figure 5).

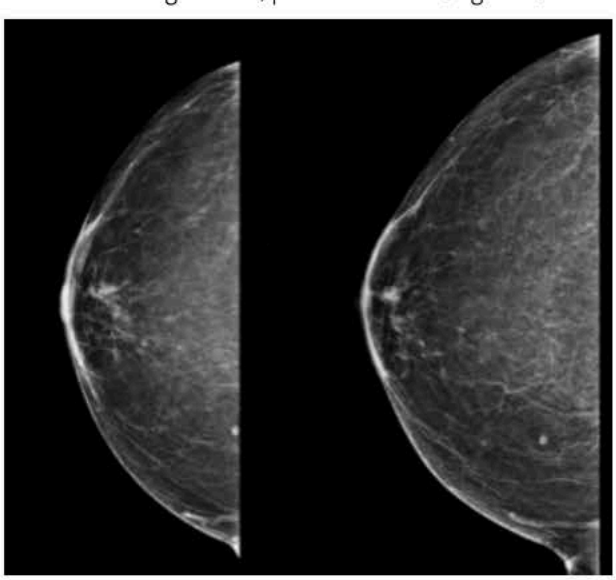

Figure 4. Images obtained from a patient with kyphosis. Left, CC view obtained with patient standing. Right, CC view obtained with patient seated. Images courtesy of Robyn Hadley.

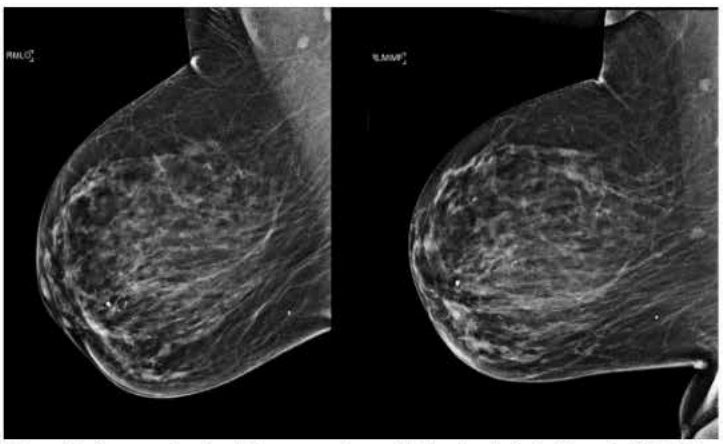

Figure 5. Images obtained from a patient with kyphosis. Left, Standard MLO view. Right, supplemental lateromedial view to include posterior inferior tissue. Images courtesy of Robyn Hadley.

- Height difference: When the patient and technologist are of significantly different heights, it may be beneficial for the patient or technologist to be seated during the examination while obtaining the CC views to ensure sound ergonomics for the technologist (Figure 6).

Figure 6. Left, Short technologist performing an examination on a tall patient. Right, Tall technologist performing examination on a short patient. Images courtesy of Mammography Educators.

- Patients with limited range of motion (shoulder, neck, or back): Exercise care not to force patient movement. Patients should feel comfortable discussing their limitations with the technologist during positioning.

- Patients with implanted medical devices: Patients with devices such as pacemakers, defibrillators, ports, shunts, or loop recorders may require two views to accomplish an adequate screening view. For example, the MLO view may require one view with minimal compression to include the posterior tissue (with the device) and an additional anterior compression view with full compression to include anterior breast tissue (Figure 7).

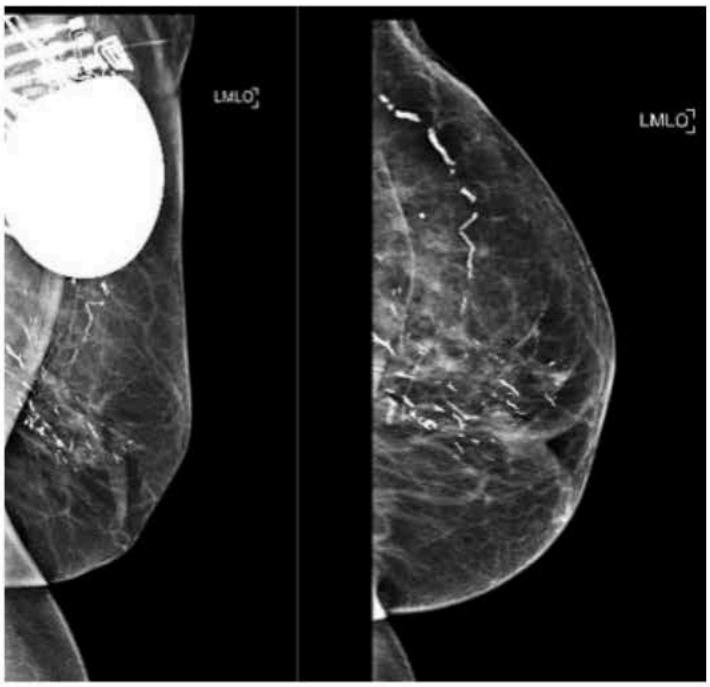

Figure 7. Patient with implanted medical device. Left, MLO view with minimal compression to visualize posterior tissue. Right, Anterior compression view with adequate compression to visualize glandular tissue. Images courtesy of Robyn Hadley.

- Patients with chronic illnesses: Encourage technologists to do their best and enlist the help of other technologists, staff members accompanying the patient, or the patient's family. Doing so can help achieve quality imaging while keeping the patient as calm and comfortable as possible.

Despite the numerous challenges technologists and radiologists face in their imaging departments, effective troubleshooting during mammographic positioning can help overcome some of the most common positioning challenges. Knowing what actions to take and when to take them can lead to a positive patient experience and improve image quality.

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What's New in the News: New Breast Cancer Screening Recommendations From the USPSTF

(continued from page 13)

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