



Carolina Radiology
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Mammography Handbook

Version 7 (October 2024)



Version Updates

Version 7 Update Summary October 2024

- Updated the look and format of the document
- Added Version updates (page 2)
- Transwomen section updated (page 6)
- Diagnostic Eval-Screening Callback-Only scan the axilla if the radiologist is going to biopsy the lesion (BR 4/5 lesions) (page 6)
- Diagnostic Eval-Palpable Lump & Breast Pain-Additional views added (page 9-10)
- Biopsy criteria for fibroadenoma updated (page 9)
- Additional mammographic views added for nipple discharge (page 11)



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SCREENING

SCREENING GUIDELINES

- To be performed yearly *on all females 40 and over* for routine screening.
- To be performed on females under 40 with high lifetime risk of breast cancer according to ACR and ACS guidelines:
 - First degree relative (maternal or paternal) with premenopausal breast cancer: may begin screening 10 years prior to the age of diagnosis of youngest relative but not before age 30.
 - BRCA-1 carrier: to begin by age 30, but not before 25, in conjunction with MRI screening.
 - BRCA-2 carrier: to begin at age 30 in conjunction with MRI screening.
 - Known genetic predisposition such as Li-Fraumeni, Cowden, Peutz-Jegher etc. or as otherwise recommended by a genetics counselor, to begin at age 30 in conjunction with MRI screening.
 - History of mantle radiation age 10-30: may begin as early as 8 years after radiation exposure or age 25, whichever is greater, in conjunction with MRI screening.
 - Tissue diagnosis of invasive breast cancer, in-situ ductal cancer, atypical ductal or lobular hyperplasia or LCIS to begin at age of diagnosis.
- **If a patient presents for diagnostic mammogram within 3 months prior to her annual screening, proceed with bilateral diagnostic mammogram.**

MAMMOGRAPHY

- Screening exams will be reviewed by the technologist for technical adequacy before the patient leaves the department.
- Repeat standard views will be obtained for posterior nipple line (PNL) not within 1 cm on the CC and MLO views, inadequate pectoralis muscle, if any part of the breast is cut off, or if there is motion/artifact.
- XCCL views should be obtained if lateral breast tissue on a standard CC view is not obtained. Nipple in profile view should be obtained if the nipple is not in profile on at least one of the standard views per side.
- Implant displaced views will be performed for patients with implants on screening mammography. 2D will be performed with implant views (CC and MLO), and digital breast tomosynthesis will be performed for the implant displaced views (CC and MLO).



- If a study is inappropriately requested (e.g., screening study for symptomatic patient) the study should not be performed as ordered. If a radiologist is available when the patient is in the department, the exam will be entered and performed as a diagnostic exam. If a radiologist is not available, the patient will be rescheduled for a diagnostic appointment.
- Screening Views:
 - Bilateral - CC/MLO views.
 - Unilateral – CC/MLO Same problem solving as above.

ULTRASOUND

- ABUS where available.
- May be performed on females who are heterogeneously dense or extremely dense as supplementation for routine screening mammography, however insurance coverage varies and may require pre-authorization. Patients should be advised to check with their provider prior to the study being performed.
- If patient refuses mammogram, proceed with screening ultrasound. Document patient refusal and education if provided.

SCREENING BREAST MRI

- To be performed on High-Risk females (>20% lifetime risk of breast cancer) after consultation with order from referring provider.
- Bilateral – Protocol to include dynamic postcontrast sequences, subtraction images, subtraction MIP.

SPECIAL SCREENING SITUATIONS

- **Pregnancy/Breastfeeding**
 - Breast cancer screening is recommended for pregnant or breastfeeding females 40 or older who are at average risk of breast cancer.
 - Routine breast cancer screening is recommended throughout pregnancy if 40 or older.
 - Please note that lead aprons can increase scatter and therefore increase radiation to the patient. Lead aprons are no longer routinely recommended. However, a lead apron can be provided if patient desires despite education.
- **Mastectomy**
 - Routine screening of the contralateral breast applies with CC and MLO views.
 - Screening of the mastectomy side generally is not indicated.
 - A screening exam, however, may be performed at the discretion of the referring clinician and is appropriate in the setting of flap reconstruction and/or significant residual tissue.
 - A diagnostic mammogram and/or targeted ultrasound may be performed on the mastectomy side in the setting of palpable lump.



- **Male Patient**

- **Protocol for Screening Imaging of Male Patients:**

- While conditions exist that place a male at increased risk for breast cancer, screening mammography is not typically performed in an asymptomatic male patient.
 - Conditions for which screening may be considered include: Klinefelter's syndrome, prior history of breast cancer, BRCA-1, and BRCA-2 carriers.
 - Screening mammography may be offered beginning at age 50 and performed annually.
 - There is no data to support a mortality benefit over physical exam.
 - Screening breast MRI is not indicated in this patient population.
 - Screening study should include bilateral CC and MLO views.
 - All men should be a diagnostic mammogram for their screens if screening is indicated.

- **Transgender Patient**

- **Protocol for Transmen (Female- to-Male) Screening:**

- The need to offer screening mammography is dependent on whether breast amputation surgery has occurred and whether residual breast tissue remains.
 - The effect of hormone therapy with testosterone is unclear.
 - Screening should therefore be offered to transmen as follows regardless of hormone therapy:
 - No breast tissue remains - screening not indicated.
 - Breast tissue remains - screening should be offered as per natal females.

- **Protocol for Transwomen (Male- to-Female) Screening:**

- The use of specific regimens of exogenous hormone therapy may be an indication for screening mammography, especially in the setting of additional risk factors.
 - Screening not indicated:
 - No hormone use or less than 5 years of use.
 - Screening to begin at age 40 and annually thereafter:
 - Cycling hormones (≥ 5 years).
 - BRCA mutation carrier or other genetic disorder on hormones (may begin screening earlier (<40 yo) as high-risk protocol). (If not on hormones, may screen as for natal males annually at age 50).
 - MRI screening is indicated for the high-risk patients in this category.



DIAGNOSTIC EVALUATION

- All diagnostic exams should come with an ultrasound order unless the workup is for calcifications.
- **If a patient presents for diagnostic mammogram within 3 months of her annual screening, proceed with bilateral diagnostic mammogram.**
- **If a patient presents for diagnostic evaluation within 2 months after her negative screening mammogram, you may proceed with diagnostic ultrasound after review of the screening mammogram.**
- Main categories of diagnostic evaluation:
 - Screening Callback
 - BIRADS 3 follow-up
 - Palpable Lump
 - Focal Breast Pain/Tenderness
 - Nipple Discharge/Change in Nipple Appearance
 - History of Breast Cancer (within 3 years of partial mastectomy)
- Radiologist should mark and screenshot what is being called back on screening mammograms.
 - UWL- create key image (spacebar if it is assigned).
 - Mcleod- make key image by using space bar.
 - Parkway- make key image by clicking on camera button on bottom of screen.
 - Conway- make mark on image and it should be automatically saving it when the study is final.

SCREENING CALLBACK

- Obscured/Microlobulated/Indistinct/Spiculated Masses, Asymmetry, Focal Asymmetry, or Architectural Distortion:
 - Perform diagnostic mammogram on **all** findings.
 - Basic Views: ML/LM, CC, Spot Compression Views.
 - Additional views should be done in spot compression 3D with reconstructed C-Views regardless of how the study is ordered.
 - If finding does not persist, can stop workup and BIRADS 1 or 2.
 - If finding persists, then pursue ultrasound.
 - Can be limited ultrasound if finding is BIRADS 1 or 2. If the finding is BIRADS 4 or 5, then add radian/axillary scan (scan axilla if biopsy is going to be performed).
- Well circumscribed mass (>80% of margins well defined on both views)
 - May proceed directly to limited US as defined above, BR 4 or 5 add radian/axillary scan (Scan the axilla if biopsy is going to be performed).



- Calcifications
 - Perform diagnostic mammogram with whole breast 3D ML/LM views and 2D spot magnification CC and ML/LM views of calcifications.
 - If BIRADS 1, 2 or 3 then can stop here.
 - If BIRADS 4 or 5, then ultrasound can be performed at interpreting radiologists' discretion.
 - Use tangential views for possible skin calcifications.

BIRADS 3 FOLLOW-UP

Follow up done at 6-month, 1-year from original diagnostic, 2-years from original diagnostic.

- Mammogram 6-month follow-up of calcifications:
 - Perform 3D CC and ML views of the whole breast.
 - 2D spot magnification CC and ML views of calcifications.
- Mammogram 6-month follow-up of asymmetry or mass:
 - Perform 3D CC and MLO views.
 - Spot 3D CC and MLO views.
 - Possible targeted ultrasound depending on findings.
- Ultrasound of 6-month follow-up:
 - limited ultrasound if finding remains BIRADS 1, 2, or 3.
 - Convert to complete breast ultrasound if BIRADS changes to 4 or 5 - add radian/axillary scan.
 - If changes to BIRADS 5 – add sub pec and supraclavicular scan.
- If patient missed BR 3 follow up and presents for screening within 3 years of initial diagnostic exam, perform diagnostic mammogram. If presenting after 3 years of initial diagnostic mammogram, proceed with screening.

USE OF BIRADS 3

- A finding using this category should have a $\leq 2\%$ likelihood of malignancy but greater than the essentially 0% likelihood of malignancy of a characteristically benign finding.
- Use should be limited to specific findings after an appropriate diagnostic workup:
 - **Mammography**
 - Non-calcified circumscribed solid mass on baseline exam.
 - Focal asymmetry without calcification or architectural distortion on baseline exam.
 - Solitary group of punctate or round calcifications on baseline exam.
 - Calcifications suggestive of early fat necrosis in a patient who has undergone biopsy or trauma.
 - Calcifications that are suspected to be vascular.



- **US**
 - Classic appearing fibroadenomas.
 - Isolated complicated cysts or cluster of microcysts.
 - Suspected fat necrosis/ hematomas.

- **MRI (evolving)**
 - Incidental round/oval mass with circumscribed margins and hyperintense T2 signal which has either homogenous enhancement or dark internal septations on a baseline exam. (i.e., classic MRI findings of fibroadenoma.)
 - Focus with washout kinetics on baseline exam.
 - Homogenous NME with a focal, regional, or multiple regions of distribution on baseline exam.

BIOPSY CRITERIA

- **Fibroadenomas**
 - Biopsy may be considered for suspected fibroadenomas greater than 3 cm in size at the radiologist's discretion.
 - >20% increase in size (over 1 year).
 - Change in appearance.
 - Poorly circumscribed or immobile.
 - Any new mass that is a suspected fibroadenoma. (Baseline screener can be BIRADS 3 if smooth/circumscribed etc.).
 - Age >35 when presenting as baseline diagnostic should be considered although not hard criteria.

PALPABLE LUMP

- **Female under 30**
 - Limited ultrasound of area of concern (for BIRADS 1, 2 or 3).
 - Unilateral if one side, bilateral if both sides.
 - A limited ultrasound should include the clock position of the palpable lump and one clock position before and after the target.
 - (a lump at 9:00 would include imaging from 8-10:00) with representative imaging of the anterior, middle, and posterior thirds of the breast labelled with clock face position and cm from nipple
 - If finding is concerning and will consider biopsy (BIRADS 4 or 5), then do radian ultrasound scan with axilla.
 - Mammogram at discretion of performing radiologist.



- **Female 30 years old and older**
 - Bilateral Diagnostic Mammogram (if not performed in that year or if patient is due for annual mammogram within 3 months).
 - To include CC/MLO views bilaterally.
 - ML view of side of concern.
 - CC/MLO spot views of area of concern.
 - Spot tangential views.
 - Use triangle skin marker to mark palpable lump on breast.
 - Workup of any other incidental findings per interpreting radiologist.
 - To be followed with targeted ultrasound of the palpable area of concern depending on mammographic findings.
 - Other areas of ultrasound as per interpreting radiologist.

- **Male under 25**
 - Targeted ultrasound area of concern.
 - Mammogram at interpreting radiologists' discretion.

- **Male over 25**
 - Bilateral Diagnostic Mammogram.
 - Targeted ultrasound of area of concern as needed.

- **Male of any age with physical exam findings suspicious for breast cancer**
 - Bilateral Diagnostic Mammogram.
 - Ultrasound of area of concern as needed.

BREAST PAIN

Two categories of breast pain: **clinically significant** or **clinically insignificant**

- Clinically significant breast pain is defined as focal (one quadrant) and noncyclical.
- Clinically insignificant breast pain is defined as non-focal (greater than one quadrant), diffuse, or cyclical.

- **Female under 30 (clinically significant)**
 - Limited ultrasound to area of concern if findings are BIRADS 1, 2 or 3.
 - If BIRADS 4 or 5, then scan radian and axilla.

- **Female 30 years old and older**
 - Bilateral Diagnostic Mammogram to include ML of side of concern and CC/MLO spot compression views of area of concern.
 - Spot tangential views.
 - Use triangle skin marker to mark area of concern on breast.
 - This will be followed by limited ultrasound of area of concern if findings are BIRADS 1, 2 or 3
 - If BIRADS 4 or 5, then radian scan with axilla.



NIPPLE DISCHARGE

Two categories of nipple discharge: **Physiologic** or **Pathologic**

- Physiologic is bilateral, white, green, or yellow in color, multi-orifice on the nipple surface.
- Pathologic is unilateral, spontaneous, and serous or blood-stained and single orifice or with a trigger point on physical exam.
- There is no indication for evaluation of physiologic nipple discharge for females of any age.

The following guidelines are for **pathologic** nipple discharge:

- **Female under 30**
 - Complete breast ultrasound of symptomatic side.
 - Consider mammogram if ultrasound shows a suspicious finding or the patient is high risk.
 - If negative work-up and pathologic nipple discharge, recommend surgical consultation and consider MRI.
- **Female 30 years old and older**
 - bilateral diagnostic mammogram with limited breast US of the subareolar region.
 - **Include CC and ML magnification views of the subareolar region.**
 - If negative work-up and pathologic nipple discharge, recommend surgical consult and consider MRI.
- **Male**
 - Bilateral Diagnostic Mammogram.
 - Complete Breast ultrasound of side in question.
 - If mammogram and US negative, consider MRI.

HISTORY OF BREAST CANCER

- Patients with a history of breast cancer surgery must be a diagnostic mammogram for a minimum of two years to reestablish a baseline.
- Restart screening as diagnostic mammogram over a two-year period to begin 6 months post radiation therapy. Check to see when her last bilateral mammogram was to figure out whether to start with unilateral or bilateral. Follow up alternating unilateral treatment breast/bilateral every 6 months for 2 years.
- Diagnostic views include CC/MLO/ML views of the postsurgical side. CC/MLO views of the non-affected side.
 - Magnification views of the lumpectomy bed on first diagnostic follow up.
- If patient has a history of mastectomy, routine screen contralateral side with CC/MLO views
 - Screening of the mastectomy side, even with reconstruction, is not usually appropriate according to ACR appropriateness criteria.
- After two years, the patient may return to screening examination with bilateral two view study if not otherwise specified by referring physician.



SPECIAL DIAGNOSTIC SITUATIONS

○ Lactation

- Usually, these patients are seen for diagnostic purposes such as a palpable mass, bloody nipple discharge or other focal finding.
- Imaging evaluation should not be delayed.
- **Lactating patients who present with clinical signs or symptoms (pain, lump, thickening, suspicious unilateral nipple discharge should follow the imaging protocol outlined above starting with diagnostic mammography if the patient is > or equal to 30 yrs of age.**
- Patients should breast feed or pump within 30 min prior to imaging.
- Consider screening during lactation dependent on age, underlying risk, and expected duration of lactation.
- There is no contraindication to mammography during lactation.
- Screening breast MRI is not the initial screening tool of choice but may be considered in lactating females with a high lifetime risk of breast cancer.
 - There is no sizable risk to breastfeeding the infant after the scan (no need to pump and dump) as <1% of the contrast agent enters the breastmilk and <1% of the contrast agent is absorbed by the infant in the breastmilk. However, if the patient is extra cautious and wants absolutely no contrast agents in the breastmilk, she can discard breastmilk for 24 hours.

○ Protocol for Diagnostic Imaging of Male Patients

- Imaging is not recommended for the initial presentation of a male patient of any age with symptoms of gynecomastia and physical exam consistent with gynecomastia or pseudogynecomastia.
- However, for those patients who are referred for workup of suspected gynecomastia and over 25 years old, start with bilateral mammogram.
- If under 25 years old, start with whole breast ultrasound.
- For a male <25 with palpable breast mass, targeted breast ultrasound first.
- Mammogram at radiologist's discretion.
- For a male > 25 years old with palpable lump, bilateral diagnostic mammogram.
- Limited ultrasound area of interest if mammogram is not conclusive.
- Add radian/axillary scan for BIRADS 4 or 5.
- Male of any age with physical exam signs suspicious for breast cancer, bilateral diagnostic mammogram. Limited ultrasound area of concern, add radian/axillary scan for BIRADS 4 or 5.
- For a male of any age with nipple discharge, bilateral diagnostic mammogram, and complete breast ultrasound.



○ High Risk Lesions

- Biopsy proven high risk lesions should be referred for surgical consultation.
- These lesions include (but are not limited to) papillomas, atypical ductal hyperplasia, atypical lobular hyperplasia, lobular carcinoma in situ, and radial scar.
 - In some cases, the patient and breast surgeon may opt for imaging surveillance rather than surgical excision. In these cases, a BIRADS 2 should be given at imaging follow-up.
 - Literature is evolving in that papillomas and radial scar without atypia may be followed with diagnostic evaluation over a period of two years. Must be confident in amount of tissue sampled.
- However, the interpreting radiologist should state that continued imaging surveillance should be performed if surgical excision is not performed.

○ Breast Abscess

- Initial diagnostic workup should start with focused breast ultrasound.
- Diagnostic mammogram at radiologist's discretion (is most useful in females over 30, in the setting of abscess with prolonged clinical course).
- Categorize suspected nonpuerperal abscess as BIRADS 4.
- Proceed to ultrasound guided aspiration and biopsy of any inconclusive solid component.
- A biopsy clip should be used any time a solid specimen is obtained, or fluid is sent for cytology.
- If biopsy confirmed abscess- short term 4-week targeted ultrasound follow-up to document resolution
- If biopsy confirmed abscess has not resolved, repeat aspiration/biopsy with short term 4-week targeted ultrasound follow-up as needed.
- If biopsy confirmed abscess has resolved, BIRADS 2.



PROTOCOLS

- **Breast MRI Indications**
- **Obtaining Prior Images and Reports**
- **Biopsy Guidelines**

BREAST MRI INDICATIONS

- High risk screen as an adjunct to screening mammography.
- Presurgical planning.
- Determination of stage and extent of disease in a patient with newly diagnosed breast cancer – strongly indicated when patient desires breast conservation in the setting of invasive lobular carcinoma.
- Positive surgical margins post lumpectomy.
 - Performed between 35-42 days after surgery to decrease the number of false positives as normal postsurgical granulation tissue can enhance.
- Post neoadjuvant.
- Silicone implant integrity evaluation.
- Suspicious Nipple discharge with negative initial work up.
- Evaluation of unknown primary tumor after negative initial diagnostic workup.
- MRI should not be performed prior to conventional work up.

OBTAINING PRIOR IMAGES AND REPORTS

- The initial inquiry for prior mammograms, breast ultrasound, and breast MRI examinations should be made by the referring clinician at the time of exam order. The patient will be asked to fill out an authorization for release of breast images form.
- The scheduling staff will encourage the patient to retrieve and bring with her any old studies at the time of examination.
- On the date of the exam, the technologist will also inquire about prior films. If the patient has not signed a release in the clinician's office, the technologist will assist the patient in filling out the authorization for release of breast images form.
- If the patient does not know where or when previous studies were performed, the technologist will encourage the patient to check her records and with her referring physician for this information. The technologist or scheduling staff will provide a film release form for the patient's use when films are located.



- For further evaluation of an abnormality recently seen within 6 months on an outside study, the patient **MUST** bring the prior study and a copy of the report at the time of diagnostic evaluation. Patients should be informed of the need to re-schedule if the prior study is unavailable for review with any current study to be performed.
- For diagnostic workup of patients with findings from an outside institution, the radiologist will have a low threshold to repeat the mammographic and/or ultrasound studies in the setting of unavailable/incomplete/ or unclear findings.
- Diagnostic imaging must have previous mammograms for comparison, allowances may be made for extenuating circumstances.
- If patient presents for diagnostic mammogram for pain/palpable and no priors available, dictate as you would if baseline study and state an addendum will be made once priors are made available.

BIOPSY/LOCALIZATION GUIDELINES

Needle type, gauge of device, and number of passes performed is per radiologist's discretion.

US or mammographic guided biopsy of MRI findings should always have post clip T1 MRI sequence performed to ensure the MRI finding was in fact biopsied.

Needle localizations/seed localizations always need to have post CC and ML views to be reviewed by the radiologist before the patient leaves the department.

- **Clip Placement**

- Clips should be placed for all biopsies when a specimen is sent to pathology/cytology. This includes cysts aspirated and sent for cytology.
- If the radiologist, however, chooses to not send fluid for cytology during the aspiration of a classically benign cyst, then no clip needs to be placed.
- Clips should be placed for all axillary lymph node biopsies as new research being performed may obviate the need for sentinel node dissection in breast cancer patients undergoing neoadjuvant therapy.
- ***Always obtain a post clip mammogram***
 - ***CC and ML views to be reviewed by the radiologist before the patient leaves the department.***

- **Specimen Radiographs**

- Dictations of specimen radiographs should include visualization of the clip, mass/calcs, wire/seed (if applicable).
- If the specimen margin is < 1 cm from the finding, this should be documented and communicated directly to the surgeon if the study is being read in real time.