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CAR Practice Guidelines on Breast Imaging and Interventions: Breast Ultrasound

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Abstract

This guideline presents Part III of the Canadian Association of Radiologists (CAR) Practice Guidelines on Breast Imaging and Intervention and focuses on breast ultrasound. Recommendations address the diagnostic, supplemental screening, and interventional roles of ultrasound in contemporary breast imaging practice. Topics include clinical indications, equipment and technical performance, axillary assessment, documentation, structured reporting using BI-RADS®, quality assurance, and personnel qualifications, with attention to both handheld and automated whole-breast ultrasound techniques. This guideline emphasizes the importance of multimodality correlation, timely diagnostic assessment, and appropriate integration of ultrasound into the overall breast imaging pathway. It is intended to be used in conjunction with the other components of the CAR Breast Practice Guidelines series and complements the CAR Breast Disease Imaging Referral Guidelines. While outlining consensus-based best practices and minimum standards, this guideline acknowledges that local expertise, patient characteristics, and resource availability may influence implementation, with final responsibility for interpretation and management decisions resting with the radiologist.

Résumé

La présente ligne directrice présente la partie III des Lignes directrices de pratique en matière d'imagerie et des intervention mammaires de la CAR, et porte sur l'échographie du mammaire. Les recommandations abordent les rôles diagnostique, de dépistage complémentaire et interventionnel de l'échographie dans la pratique contemporaine de l'imagerie mammaire. Les sujets traités comprennent les indications cliniques, l'équipement et le rendement de la technologie, l'évaluation axillaire, la documentation, la rédaction de rapports structurés selon le système BI-RADS®, l'assurance de la qualité et les qualifications du personnel, en tenant compte des techniques d'échographie mammaire complète manuelle et automatisée. Cette ligne directrice souligne l'importance de la corrélation multimodale, de l'évaluation diagnostique en temps opportun et de l'intégration appropriée de l'échographie dans le parcours global d'imagerie mammaire. Elle est destinée à être utilisée conjointement avec les autres composantes de la série des Lignes directrices d'imagerie mammaire de la CAR et complète les Lignes directrices relatives aux demandes d'examen pour les maladies du sein de la CAR. Tout en définissant les meilleures pratiques fondées sur un consensus et les normes minimales, cette ligne directrice reconnaît que l'expertise locale, les caractéristiques des patientes et la disponibilité des ressources peuvent influencer la mise en œuvre, la responsabilité finale en matière d'interprétation et de décisions de prise en charge incombant au radiologiste superviseur.

Keywords

practice guideline, ultrasonography, mammary, breast neoplasms, multimodal imaging, early detection of cancer

Preamble

The practice guidelines of the Canadian Association of Radiologists (CAR) are not rules, but are guidelines that attempt to define principles of practice that should generally produce radiological care. The radiologist and medical physicist may modify an existing practice guideline as determined by the individual patient and available resources. Adherence to CAR practice guidelines may not ensure a successful outcome in every situation. The practice guidelines should not be deemed inclusive of all proper methods of care or exclusive of other methods of care reasonably directed to obtaining the same results. The practice guidelines are not intended to establish a legal standard of care or conduct, and deviation from a practice guideline does not, in and of itself, indicate or

imply that such medical practice is below an acceptable level of care. The ultimate judgment regarding the propriety of any specific procedure or course of conduct must be made by the physician and medical physicist in light of all circumstances presented by the individual situation.

Introduction

The **CAR Practice Guidelines on Breast Imaging and Intervention** have been published as a comprehensive five-part series in the *Canadian Association of Radiologists Journal (CARJ)* to provide targeted, modality-specific guidance. While this section focuses on **Breast Ultrasound**, it is intended to be used in conjunction with the other 4 components of the update:

- **Part I: Mammography and Digital Breast Tomosynthesis**[1]
- **Part II: Contrast-Enhanced Mammography (CEM)**[2]
- **Part III: Breast Ultrasound**
- **Part IV: Breast Magnetic Resonance Imaging (MRI)**[3]
- **Part V: Breast Intervention and Biopsy Procedures**[4]

Together, these documents replace the previous 2016 consolidated guidelines to reflect the current evidence base and clinical landscape in Canadian breast imaging, and complement the recently published Breast Disease Imaging Referral Guidelines, which provide guidance on the most appropriate breast imaging test for a given indication or patient population.[5]

These guidelines aim to provide radiologists, technologists, and other allied staff with a consensus-based approach to performing and interpreting breast imaging. These recommendations align with those published by the Canadian and American Cancer Societies, the National Comprehensive Cancer Network, and the American College of Radiology. While the guidelines serve as an educational tool and outline best practices and minimum requirements, the Working Group acknowledges that alternative actions may be appropriate depending on available resources, patient factors, technological advances, and evolving medical knowledge.

Ultimately, the supervising radiologist is responsible for determining the most appropriate examination or intervention for each patient.

Overview: Breast Ultrasound

Breast ultrasound is an established, effective, diagnostic imaging technique which employs the use of high-frequency ultrasound waves for imaging, Doppler assessment, and elastography. Appropriate indications for breast ultrasound can be reviewed in the Canadian Association of Radiologists Breast Disease Imaging Referral Guideline.[5]

Any facility performing breast ultrasound, including screening and diagnostic examinations, must be able to perform mammography at the same facility. This ensures proper follow-up and complete evaluation of any findings.

Technical Considerations

Equipment

- Breast ultrasound should be performed with a high-resolution and real-time linear array scanner operating at a center frequency of at least 12 MHz, preferably higher, with pulsed, color and power Doppler.
- Equipment permitting electronic adjustment of focal zone(s) is required.
- In general, the highest frequency capable of adequate penetration to the depth of interest should be used. For evaluation of superficial lesions, a stand-off device or a thick layer of gel may be helpful.

Documentation

Images of all important findings should be recorded in a retrievable and reviewable image storage format. In the case of interventional procedures, this includes the relationship of the needle to the lesion. Images should also include the skin and the chest wall. The radiologist's report of the sonographic findings should be placed in the patient's medical record.

Retention of the breast sonographic images should be consistent with the policies for retention of mammograms, and in

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compliance with federal and provincial regulations, local health care facility procedures, and clinical need.

Permanent Identification Labels Should Contain

- The facility name and location
- Examination date
- Patient's first and last name
- Identification number and/or date of birth
- Sonographer and/or radiologist initials or another identifier

Image Labeling for Findings of Interest

- Anatomic location including side (left/right)
- Orientation of transducer (radial/antiradial or transverse/sagittal)
- Clock face, including distance from the nipple
- Quadrant

Reporting

Reporting for all ultrasound examinations should follow a structured format. Reporting should be in accordance with the American College of Radiology (ACR) document Breast Imaging Reporting Data Systems (BI-RADS®).[6]

Report Inclusions

- Indication for examination
- Note comparisons to previous exams or other imaging modalities
- Describe technique (eg, handheld vs automated whole breast ultrasound [AWBUS] and screening vs diagnostic) and breast composition if screening study
- Detail findings using standardized BI-RADS® descriptors
- Mention any technical limitations or artifacts affecting interpretation
- Provide overall assessment using BI-RADS® classification
- Include management recommendations

Diagnostic Breast Ultrasound

Supervision and Interpretation of Ultrasound Examinations

A radiologist must be available for consultation with the sonographer on a case-by-case basis. Ideally, the radiologist should be on site and available to participate actively in the ultrasound examination.

The geographic realities in Canada do not permit the presence of an on-site radiologist in all locations. Adequate documentation for each examination is critical. A videotape or video-clip record may be useful as an adjunct to the static images in difficult cases. Despite the geographic isolation of a community, the reports must be timely. Furthermore, the radiologist must be available by telephone for consultation with the sonographer and the referring healthcare professional. Where practical, the radiologist should visit the facility on a regular basis to provide on-site review of ultrasound procedures and sonographer supervision.

Specifications of the Examination

Lesion Characterization and Technical Factors

- Breast ultrasound should be performed with as high a resolution as is practical, allowing for the depth and echogenicity of the breast being imaged. Gain settings and focal zone selections should be optimized to obtain high quality images. It is acknowledged that mass characterization with sonography is highly dependent upon technical factors. Use of different modes and settings (tissue harmonic imaging, spatial and frequency compounding, color and power Doppler) is encouraged.
- The patient should be positioned to minimize the thickness of the portion of the breast being evaluated. The arm should be elevated and the patient position in a semi lateral decubitus position.
- Image depth should be adjusted so that the breast tissue dominates the screen and where the chest wall is seen, it should appear at the posterior margin of the image.
- The ultrasound should be correlated with any prior breast imaging, including mammographic, sonographic, and MRI studies.
- Any lesion or area of interest should be viewed and recorded in 2 orthogonal projections. One view is insufficient.
- At least one set of images of a lesion should be obtained without calipers. The maximal dimensions of a mass should be recorded in at least 2 dimensions.
- Breast mass characterization should be based on the following features: size, shape, orientation, margin, lesion boundary, echo pattern, posterior acoustic features, and surrounding tissue.
- Elastography can be performed as ancillary to other features of malignancy. The performer and interpreter should be knowledgeable in the type of elastography used: strain, shear wave, or acoustic resonance frequency impulse. The color scale representing velocity or elastography should be annotated to denote hardness or softness.

Axillary Node Characterization and Technical Factors. US features of axillary nodes are listed in BI-RADS® and include size, shape, cortical thickness, margin, and assessment of the hilum. Number of abnormal axillary nodes is also important for locoregional staging. Knowledge of axillary node anatomy is also essential. As new evidence emerges for the use of pre-operative axillary ultrasound in breast cancer staging, particularly in the setting of de-escalating axillary surgery, **it is important to work in a multidisciplinary capacity with local surgical and oncologic teams to determine how to incorporate guidelines in appropriate**

staging protocols and when to incorporate preoperative US axillary staging.

The axilla can be included as part of the breast ultrasound examination. Patients can be positioned in a supine oblique position with the ipsilateral arm raised and placed comfortably under their head to thin out the axillary tissue.

Cortical thickness and lymph node morphology are the most important factors in determining the likelihood of metastatic disease. Measurement of the maximum cortical thickness should be included. The number of pathologic nodes should be included in the report.

Whole Breast Screening Ultrasound

Handheld Ultrasound

Screening handheld whole breast ultrasound can be performed as an adjunct to mammography. It is not a stand-alone examination and is not a replacement for mammography. Screening ultrasound is not a replacement for MRI in high-risk screening populations (though can be used if MRI is contraindicated). Centers that perform whole breast ultrasound must be able to perform mammography at the same facility and be able to perform diagnostic workup (including US-guided biopsies) on their findings. Recent mammography and any other breast imaging should be available to the interpreting physician. If whole breast ultrasound has been performed previously, the current exam should be compared with prior examinations.

Handheld ultrasound screening relies heavily on the skill of the operator to identify and properly document any findings in real-time during the exam. The entire breast must be systematically scanned to ensure complete coverage. Proper training and experience of the operator is crucial. The technologist or radiologist must have the skill to optimize ultrasound settings such as gain, focal zones, and field of view, and the ability to recognize abnormalities while scanning and capture appropriate images.

Clinical Practice Recommendations: Documentation

- Minimum of each quadrant + 1 nipple image
- Images obtained for documentation should be annotated and include side, clock face notation, distance from the nipple and transducer orientation. One view in each quadrant and retroareolar plane in a single orientation is sufficient for documentation.
- For any solid or complex masses found, orthogonal (perpendicular) views with and without measurement calipers should be captured. Images must be labeled with laterality, clock face location, distance from nipple, and transducer orientation.
- A solid or complex mass identified during whole breast screening ultrasound should be characterized in the report by BI-RADS® sonographic features for masses. Axilla may be included per facility practice.
- When a screening ultrasound is interpreted asynchronously, it may be given a BI-RADS® 0, 1, 2. For any BI-RADS® 0 examination, the patient will need to be recalled for a focused diagnostic ultrasound to evaluate any findings.
- When an abnormality is identified during handheld whole breast ultrasound screening and a diagnostic US of the lesion is done synchronously to further evaluate, then the exam should be given a BI-RADS® 2, 3, 4, or 5.

Automated Whole Breast Ultrasound

Automated whole breast ultrasound (AWBUS) allows for mechanized performance and recording of ultrasound scans of the whole breast for later review by the radiologist. Images can be reconstructed in 3 dimensions. Depending on the machine used, static images or dynamic cineloops of the whole scan are obtained. Areas of interest detected on AWBUS should be recalled for focused handheld ultrasound assessment and should be done at the site with AWBUS technology. It has potential advantages over hand-held breast ultrasound, including standardized reproducible examination, dynamic cineloop of ultrasound scanning, 3D and multiplanar reconstruction capability, reduced dependence on operator skill, decoupling of acquisition and review.

AWBUS is indicated solely for supplemental screening; it is adjunctive to mammography screening. It is not a stand-alone examination and is not a replacement for mammography. AWBUS is not a replacement for MRI in high-risk screening populations. It is not a replacement for diagnostic breast ultrasound assessment of mammographic and/or MRI-detected abnormalities.[7]

Centers that perform automated whole breast ultrasound must be able to perform diagnostic handheld ultrasound and mammography at the same or an associated facility. Mammography and any other breast imaging should be available to the interpreting physician. If patient has had previous AWBUS, the current exam should be compared with the previous exam.

Limitations

- Unlike handheld ultrasound, AWBUS cannot perform a synchronous diagnostic assessment of any lesions identified, thus requiring the patient to be recalled for a hand-held diagnostic ultrasound.
- Can not assess the axilla (armpit area), vascularization, or tissue elasticity.
- May require additional views for larger breasts.
- Potential for artifacts due to poor positioning or lack of contact
- Cannot do immediate diagnostic assessment of any lesions identified; patients will need to be recalled for diagnostic handheld ultrasound.

Additional Reporting Inclusions for AWBUS

When AWBUS is performed in conjunction with mammography, a single integrated report that combines findings from both modalities should be provided rather than separate reports for each modality. This helps communicate a final assessment based on the highest likelihood of malignancy and provides appropriate management recommendations.

Quality Improvement

Procedures should be systematically monitored and evaluated as part of the overall quality improvement program of the facility. Monitoring should include evaluation of the accuracy of interpretation as well as the appropriateness of the examination.

Data should be collected in a manner which complies with the statutory and regulatory peer review procedures to protect confidentiality of the peer review data.

Personnel Requirements

Radiologist

Radiologists involved in the performance, supervision, and interpretation of breast ultrasound must have a Fellowship or Certification in Diagnostic Radiology with the Royal College of Physicians and Surgeons of Canada and/or the *Collège des médecins du Québec*. Equivalent foreign radiologist qualifications are also acceptable if the radiologist is certified by a recognized certifying body and holds a valid provincial license.

Radiologists interpreting breast ultrasound should be knowledgeable in the appropriate indication, benefits and limitations of breast ultrasound. They should understand the anatomy, physiology, and pathology of the breast and axilla. They should be competent in mammography interpretation and must be able to correlate multimodality imaging of the breast. The radiologist should be CAR MAP approved, reading a minimum of 1000 mammograms per year and meeting the CAR MAP CPD requirements.

In order to maintain competency, the radiologist should also meet the requirements set out by the ACR, of having overseen, performed, and interpreted at least 200 breast ultrasound examinations in the prior 36 months.[8]

Medical Radiation Technologist

Technologists performing breast sonography should be graduates of an accredited School of Sonography or have obtained certification from the American Registry of Diagnostic Medical Sonographers (ARDMS), the Canadian Association of Registered Diagnostic Ultrasound Professionals (CARDUP), the Medical Technology Management Institute (MTMI), or the equivalent. Mammography technologists performing breast sonography must have specific qualifications in breast ultrasound. They should also be members of their national or provincial professional organization.

Consistent with the requirements of ARDMS or CARDUP, continuing medical education and minimum volumes should be mandatory. Sonographers should perform breast ultrasounds regularly to maintain a high level of quality.

Information Systems Specialist

An Information Systems Specialist (ISS) is required by facilities performing digital imaging. This individual must be either on site or available upon request. He/she must be trained and experienced in installation, maintenance, and quality control of information technology software and hardware. The required qualifications of this individual will depend highly on the type of facility and the type of equipment.

The ISS should possess any relevant qualifications required by federal/provincial/territorial regulations and statutes and should be certified according to a recognized standard such as that of the Society of Imaging Informatics in Medicine or the PACS Administrators Registry and Certification Association. Expertise should include computer and database basics, networking concepts (such as DICOM, HL7, RIS, and HIS), security systems, medical imaging terminology, positioning and viewing characteristics, imaging characteristics of various modalities for image acquisition, transmission and storage, and facility workflow. The ISS should also be knowledgeable about federal, provincial, territorial, and institutional privacy legislation and policies, such as the *Personal Information Protection and Electronic Documents Act* (PIPEDA).

Responsibilities include ensuring patient record confidentiality, understanding facility policies and procedures, and the importance and requirements of an information systems quality assurance program. They also include communicating any changes/upgrades to staff and the resulting operational impacts.

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