INTRODUCTION

The American College of Radiology (ACR) Breast Imaging Reporting and Data System (BI-RADS) has undergone revision. The main objectives of the new BI-RADS edition remain the same: to diminish confusion in the interpretation of imaging findings, to standardize reporting, and to simplify outcome monitoring.1 The overall changes made to the ACR BI-RADS have been designed to give more flexibility for situations where the previous edition of BI-RADS in the past had given much confusion.2

The new edition of BI-RADS has made changes to its 3 components, the BI-RADS breast imaging lexicon, the standardized reporting language, and the medical audit and outcome monitoring. The mammography, ultrasound, and magnetic resonance imaging (MRI) lexicons have been made more compatible with each other by using the same descriptors for a lesion across whenever possible all 3 imaging modalities. An increase number of mammography images have been added to the new edition replacing many of the feature illustrations in the previous edition. Also added in this new edition is an increase in number of reference citations, which provides evidence-based justification to the lexicon and management recommendations.3

BREAST IMAGING LEXICON

Several changes to the mammography, ultrasound, and MRI lexicon terminology have been made in the new edition.2 Inconsistencies in some descriptive terms have been addressed, and terms have been deleted, added, or revised in an effort to enhance clarification of appropriate usage.

Mammography Lexicon

Various descriptors in the mammography lexicon were changed to improve clarification of terminology. The previous BI-RADS mammography lexicon used the terms “grouped or clustered” for calcifications less than 1 cc in volume, and the term “regional” for calcifications greater than 2 cc. These terms did not address the group of calcifications measuring 1 cc to 2 cc in volume. The new edition has resolved this inconsistency by expanding the definition of “grouped” to a volume extending up to 2 cc. In addition, the terms “group or clustered”, which could be used interchangeably with the previous BI-RADS edition, are being phased out and have been changed to the term “grouped (historically clustered) with the intention of ultimately changing it to “grouped” in a later revision.2

Increased simplification has led to some terms in the new edition to be consolidated, such as the descriptors “lucent-centered”, “egg-shell,” and “rim” used to describe types of benign calcifications. These are now under one single descriptive term, “rim” (Fig. 1). Another term that has been eliminated is the descriptor for mass shape “lobular”, which has been replaced by the term
“oval” to standardize descriptors across imaging modalities. These changes have been summarized in Box 1. Other terms such as “intermediate concern”, used for amorphous and coarse heterogeneous calcifications and the term “higher probability of malignancy” used for fine pleomorphic, fine linear, and fine-linear branching calcifications have also been deleted from the mammography lexicon. New published evidence suggests that some of the descriptive terms used to characterize calcifications may not impart the level of suspicion previously believed, and therefore the revised BI-RADS has changed to only using descriptors for lesion characterization.4

There are some descriptive terms in the updated BI-RADS that have been expanded, such as the terms that describe an “asymmetry” often represents summation artifact. In addition, a new term “developing asymmetry”, which describes a focal asymmetry that is new, growing, or more conspicuous, has been added to the existing types of asymmetries in the mammography lexicon. Increased clarification has been provided as to the different management recommendations for the 4 types of asymmetries (Box 2).

**Ultrasound Lexicon**

The terminology in the ultrasound lexicon has been expanded in the new BI-RADS edition. Descriptors for tissue composition as characterized on ultrasound have been revised to correlate to the mammographic breast densities. These are “homogeneous-fat”, “homogeneous-fibroglandular”, and “heterogeneous” tissue composition. As in the previous edition, there are primary descriptors to characterize the shape and margin of masses imaged on ultrasound. Similar to the mammography and MRI lexicon, the ultrasound descriptors were updated to maintain consistency among the 3 modalities. There will be certain terms that will be defined such as that for a complicated cyst, which is defined as a circumscribed, oval, mass parallel orientation containing low-level echoes throughout (Fig. 2).

Along with descriptors for the additional section, which include “echo pattern” and “posterior acoustic features”, there is a new subsection titled “Associated Features”, which will include descriptors for architectural distortion, vascularity, and elastography (tissue stiffness). The descriptive terms for elastography are new and include “soft”, “intermediate”, and “hard”. It is emphasized that the features of elastography do not trump the primary features of morphology, shape, margin, and orientation. 3 These changes have been summarized in Box 3.

**Magnetic Resonance Imaging Lexicon**

Several changes were also introduced into the MRI lexicon. Although previously introduced as a

---

**Box 1**

Summary of changes to the BI-RADS mammography lexicon

<table>
<thead>
<tr>
<th>Lexicon Terminology</th>
<th>Updated BI-RADS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grouped–historically clustered</td>
<td>Replaces “grouped” or</td>
</tr>
<tr>
<td>Rim</td>
<td>“clustered”</td>
</tr>
<tr>
<td>Oval</td>
<td>Replaces “lucent-</td>
</tr>
<tr>
<td></td>
<td>centered”, “egg-shell”</td>
</tr>
<tr>
<td>Developing asymmetry</td>
<td>Replaces “lobular”</td>
</tr>
</tbody>
</table>

**Box 2**

Descriptors for types of asymmetry in the mammography lexicon and appropriate assessment category

<table>
<thead>
<tr>
<th>Types of Asymmetry</th>
<th>Assessment Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymmetry</td>
<td>BI-RADS 1</td>
</tr>
<tr>
<td>Global asymmetry</td>
<td>BI-RADS 2</td>
</tr>
<tr>
<td>Focal asymmetry</td>
<td>BI-RADS 3</td>
</tr>
<tr>
<td>Developing asymmetry</td>
<td>BI-RADS 4</td>
</tr>
</tbody>
</table>
concept, background parenchymal enhancement (BPE) has been officially added to the new BI-RADS MRI lexicon and the MRI report. There are 4 terms that describe the amount of BPE: “minimal”, “mild”, “moderate”, and “marked”. It is important to recognize that the amount of BPE does not directly correlate with the amount of fibroglandular tissue seen on mammography. However, the amount of BPE depends on the amount of fibroglandular tissue present, and inclusion of terminology that characterizes the amount of fibroglandular tissue as assessed on the noncontrast, nonsubtracted T1 sequence has been added to the BI-RADS revision. These terms are meant to correlate with the amount of fibroglandular parenchyma seen on mammography. The descriptors to describe fibroglandular parenchymal tissue on MRI are “almost entirely fat”, “scattered fibroglandular tissue”, “heterogeneous fibroglandular tissue”, and “extreme fibroglandular tissue”. Several descriptors have also been changed or deleted from the MRI lexicon to increase simplification. Terms used to describe mass shape “round”, “oval”, and “irregular” remain. However, the descriptor “lobular” for mass shape, has been deleted and incorporated in the term “oval” (Fig. 3). Mass margin descriptors have also been revised. The term “circumscribed” has replaced “smooth”, and the term “irregular” is now a descriptor of mass shape and margin. In addition, terms used to describe the internal enhancement of a mass, “central enhancement”, and “enhancing internal septations”, have been removed from the lexicon due to lack of usage. Similarly, descriptors used for nonmass enhancement, “reticular” and “dendritic”, have also been removed from the lexicon for underutilization. Another descriptor eliminated from the MRI lexicon is “ductal”, which has been consolidated under the term “linear” (Fig. 4). Other terms “multiple foci” and “stippled”, descriptors for nonmass enhancement have been removed from the lexicon as it is now recognized that they represent normal enhancement of fibroglandular tissue and will be described as part of BPE. These changes have been summarized in Box 4.

A new term to describe nonmass enhancement has been introduced into the MRI Lexicon, “clustered ring enhancement”. This finding, although not often seen, has been shown to have a high positive predictive value (PPV) for ductal carcinoma in situ. Another new imaging feature introduced into the lexicon describes the characteristics of masses and nonmass enhancement on the T2 noncontrast sequence. This feature assesses the T2 signal intensity of lesions, as increased T2 signal intensity has been mostly associated with benign lesion such as cysts and fibroadenomas, and much less with malignant lesions such as mucinous carcinoma. In addition to the changes regarding the morphologic descriptors for mass and nonmass enhancement, the revised edition includes a section on kinetic descriptors, new sections listing nonenhancing findings, and associated findings as well as a new implants section.

**REPORTING SYSTEM**

The new BI-RADS edition has made several changes to the standardized reporting language as well. As in the Breast Imaging Lexicon, some terms have been deleted, added, or clarified. The new edition has eliminated the percent ranges for the breast density categories found in the mammography lexicon. These had been introduced in previous editions in an attempt to provide an equal distribution of breast density assignments throughout all studies performed. However, they were not found to be helpful and were deleted.
The new BI-RADS also provides clarification of terms used to describe lesion location on mammography. Previously, in cases where a lesion was located in the central breast or at the 12:00 location, a specific quadrant could not be assigned. The new BI-RADS has expanded the terminology for lesion location by adding terms such as “upper/lower/outer/inner central”. This terminology has been added to the mammography lexicon and allows for direct correlation of lesion location on ultrasound and MRI. Increased clarification has also been provided to describe the use of subcategories for the BI-RADS assessment Category 4. The new BI-RADS provides specific PPV cut-off points for BI-RADS 4A/4B/4C, which match certain specific imaging findings. The use of these cut-off points remains optional in the new edition but is strongly encouraged.4

One of the major changes in the new BI-RADS edition has been the separation of assessment categories and management recommendations that had been “linked” in the previous edition. In most cases, the assessment and management have been paired up appropriately. However, there are some instances where the management recommendations did not go along with the BI-RADS assessment. This is the case in the BI-RADS Category 3/follow-up at 1-year management recommendation given at the third follow-up recommendation for a probably benign finding. The new edition provides flexibility for discrepancies between the assessment and the management. It also includes situations where a benign finding may require an intervention or surgical management: when a patient presents with a palpable mass without imaging findings still requiring surgical management, or cases of therapeutic cyst aspirations due to patient discomfort. The new BI-RADS edition addresses these discrepancies.

Other specific situations leading to discrepancies that have been addressed include cases of ruptured silicone implants, abscesses, new hematoma, and unexplained edema. In these situations, the imaging findings are benign appearing and lead to a benign recommendation but with

Fig. 3. Revised MRI lexicon terminology for mass shape. Axial post-contrast T1-weighted (A) and sagittal post-contrast subtracted T1-weighted (B) images show an oval enhancing mass in the central right breast. The descriptor for mass shape “lobular” has been deleted and replaced with the term “oval”.

Fig. 4. Updated MRI lexicon terminology for nonmass enhancement. Axial post-contrast T1-weighted (A) and sagittal post-contrast subtracted T1-weighted (B) images demonstrate linear enhancement in the inferior lateral right breast. The term “ductal” has been eliminated from the lexicon and replaced with the descriptor for nonmass enhancement “linear”.

Mercado 484
surgical/clinical management required. By unlinking the assessment from the management, the BI-RADS assessment category then appropriately reflects the imaging finding providing a concordant management recommendation for the assessment. This is then followed by the addition of a separate sentence that explains the discordance and provides the additional management.

AUDITING

The auditing section has also been expanded in the new BI-RADS edition. New and updated performance benchmarks based on more recent published literature have been incorporated in the new edition, as the previous ones were outdated. One of the benchmarks that has been updated is the recall rate. Half of all radiologists do not meet the 10% benchmark for recall rate, and therefore it has been changed to a more realistic number of 12% as more than 75% of radiologists are able to meet it.¹¹,¹²

The definition for “screening interval” has been re-evaluated in the new edition. The revised BI-RADS edition recognizes that the screening interval may differ from country to country and in some countries it may be 1 year or 2- to 3-year intervals. As the definition of “cancer” for purpose of outcome monitoring is cancer diagnosis within the screening interval, the importance of defining the exact length of the screening interval is apparent. A longer screening interval results in a larger number of false negatives as cancers are allowed to grow for a longer period of time before they are discovered.

The new edition also addresses the difference between the 2 types of cyst aspirations: diagnostic versus therapeutic. A diagnostic cyst aspiration is performed to evaluate if a lesion is a cyst and should be accompanied by a suspicious assessment with a recommendation for tissue diagnosis. A therapeutic cyst aspiration is performed on a simple cyst for symptomatic relief and should be accompanied by a benign assessment (Category 2) with an additional phrase added to the recommendation stating why it was performed. Therapeutic cyst aspirations should not be included as biopsies when auditing the practice.²

ASSESSMENT CATEGORIES

Changes have been made to the BI-RADS management terminology, which include explanations for each BI-RADS assessment category on its usage. Added explanations provide guidance on how each assessment category should be used and for which specific circumstance. The BI-RADS assessment Category 0 (Incomplete) is used when additional imaging workup is required to make a final assessment, primarily from screening examinations and rarely from a diagnostic study. It can also be used in cases when one is awaiting prior studies for comparison. It states that when used in this situation, re-assessment needs to be performed within 30 days as to avoid delay in reporting. BI-RADS Category 1 (Negative) should be used only when the mammography report describes no specific benign finding, and BI-RADS Category 2 (Benign finding) should only be used when the mammography report describes a benign finding. For both categories, the recommendation remains routine screening.

For BI-RADS Category 3 (Probably benign finding), an explanation is provided on when the assessment category should be used, that is, for lesions that have a less than 2% likelihood of malignancy. A recommendation of short-interval follow-up should be given for lesions assessed as Category 3. The revised BI-RADS edition provides additional guidance as to which particular lexicon descriptor leads to a concordant assessment Category 3 as supported in the literature; these include a group of tiny round/oval calcifications, a noncalcified circumscribed solid mass, and a focal asymmetry.¹³,¹⁴ A Category 3 assessment should be given only after a full diagnostic imaging evaluation has been performed, almost never if previous examinations are available for comparison, and never from a screening study.

The terminology for recommendations associated with the BI-RADS assessment categories 4, 5, and 6 have changed in the new edition. For Categories 4 and 5, the recommendations have

---

Box 4
Summary of changes to BI-RADS MRI lexicon

<table>
<thead>
<tr>
<th>Lexicon Terminology</th>
<th>Updated BI-RADS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPE</td>
<td>New</td>
</tr>
<tr>
<td>Amount of fibroglandular tissue</td>
<td>New</td>
</tr>
<tr>
<td>Central enhancement</td>
<td>Deleted</td>
</tr>
<tr>
<td>Enhancing internal septations</td>
<td>Replaces &quot;ductal&quot;</td>
</tr>
<tr>
<td>Linear, linear branching</td>
<td>New</td>
</tr>
<tr>
<td>Multiple foci</td>
<td>Deleted</td>
</tr>
<tr>
<td>Stippled</td>
<td>Deleted</td>
</tr>
<tr>
<td>Reticular</td>
<td>Deleted</td>
</tr>
<tr>
<td>Dendritic</td>
<td>Deleted</td>
</tr>
<tr>
<td>Clustered ring</td>
<td>New</td>
</tr>
<tr>
<td>Nonenhancing lesion section</td>
<td>New</td>
</tr>
<tr>
<td>Implant section</td>
<td>New</td>
</tr>
</tbody>
</table>
changed to “tissue diagnosis” with a directive that states “Biopsy should be performed in the absence of clinical contraindication”. The recommendation “appropriate action should be taken” for Category 6 has also been changed to “Surgical excision when clinically appropriate”. The changes to the wording reflect the importance of conveying the appropriate management recommendation when tissue diagnosis is required.

The BI-RADS assessment Category 4 (Suspicious abnormality) is assigned to all findings that are between Category 3 (>2% risk of malignancy) and Category 5 (≥95% risk of malignancy). Most recommendations for tissue diagnosis are Category 4, ranging from aspiration of new complicated cysts to biopsy of very suspicious pleomorphic calcifications. The subdivisions of Category 4 (4A/4B/4C) have been better delineated in the new edition with well-defined cut-off points (Box 5). The terminology for Category 4B has changed from “intermediate ” to “moderate” and for Category 4C has changed from “moderate” to “high” to reflect new evidence from more recent published literature.

The assessment Category 5 (Highly suggestive of malignancy) is assigned to findings that are almost always malignant with more than 95% risk of cancer. It has been recognized that not one single imaging feature can impart such a high risk of malignancy, but rather a combination of findings is required to lead to the assessment Category 5. BI-RADS Category 6 (Known biopsy – proven malignancy) is given when the findings have already been confirmed as malignant by biopsy, and the imaging has been performed before surgical excision. Category 6 lesions should be excluded from the medical audit, as they would inappropriately inflate the cancer detection rate and PPVs.

**SUMMARY**

The new edition of BI-RADS provides increased clarification of the lexicon terminology by introducing new terms and deleting others when appropriate. It also leads to improved standardization of the reporting language and improved image interpretation. The revision also provides increased guidance in the usage of the BI-RADS management terminology, providing explanations on how the assessment categories should be used and in which specific circumstances. Overall, the changes made in the new BI-RADS give increased uniformity of terminology across the mammography, ultrasound, and MRI lexicons; add compatibility across the lexicons; and promote usage of the same descriptors across all 3 modalities ultimately leading to improved patient diagnosis and patient care.

**ADDENDUM**


**REFERENCES**


