

SPECIAL ISSUES IN BREAST CANCER
**BI-RADS: WHAT DO WE NEED TO KNOW?
ADVANTAGES AND LIMITATIONS**

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ABSTRACT • BI-RADS (Breast Imaging and Reporting Data System) is meant to transform breast imaging language to a universal one by defining the related descriptive terms, the statistical definitions, and providing recommendations for radiological reports and data archiving system. The latest version covers three imaging modalities i.e. mammography, ultrasound and MRI. It cannot replace personal experience, good knowledge of the literature and continuous medical education.

Despite its limits, it has proven to be a useful tool for communication between physicians of different specialties and researchers. The knowledge of its basic elements is necessary for all physicians who deal with breast diseases and breast cancer screening.

RÉSUMÉ • BI-RADS (Breast Imaging and Reporting Data System) vise à rendre universel le langage utilisé en imagerie du sein en définissant les termes descriptifs, les définitions statistiques et en donnant des recommandations pour la rédaction des comptes-rendus et le stockage des données informatiques. La version la plus récente porte sur trois modalités d'imagerie : la mammographie, l'échographie et l'IRM. Elle ne peut remplacer l'expérience personnelle, une bonne connaissance de la littérature et la formation médicale continue.

Malgré ses limites, il s'est révélé être un outil utile pour la communication entre médecins de différentes spécialités et chercheurs. La connaissance de ses principes de base est nécessaire pour tout médecin confronté aux maladies du sein et au dépistage du cancer du sein.

INTRODUCTION

BI-RADS (Breast Imaging and Reporting Data System) was first published in the United States in 1993 to unify the mammography language including the coding, the terms used to describe lesions, the statistics and data archiving. Its goal was to obtain a better communication between different physicians in charge of the patient and to facilitate comparison between the research studies.

It concerned mammography in the first place (version 1, version 2, version 3 and version 4 published in 2003) and was extended later to include ultrasound (version 1) and MRI (version 1) in 2003 [1-3].

BI-RADS in mammography is the main and largest of the three volumes. It consists of six chapters (Table I). Chapter 1, the *lexicon*, defines the terms to be used for description of a normal mammography or lesion. This section will be further detailed in this article for all three modalities: mammography, ultrasound and MRI. Chapter 2 is about *reporting* and it is practically identical for the three techniques. The most important feature is the notorious evaluation categories (BI-RADS 0 to 6) which will be developed later. In Chapter 3, *follow-up on results and audit*, the interesting elements are definitions of statistical terms "true positive", "false positive", "true negative" and "false negative" and will be detailed later in the text. Chapter 4 contains *practical advices*, including

recommendations for follow-up of category 3. Chapter 5 & 6, *data collection* and *appendices*, contain sample forms and provide practical information such as recommended abbreviations, forms for cancer classification and an important dictionary for database explaining how to structure information fields in a database, useful for research or audit. The last section contains *illustrated cases*.

We will first tackle the lexicons in mammography, ultrasound and MRI summarized in an appendix that can be accessed on the online version of this paper. This appendix contains all descriptive terms in two languages, French and English, helping in a better communication between radiologists, physicians and surgeons and even between French and English-speaking doctors. Then, we will consider the other sections common for the three techniques.

BI-RADS TERMINOLOGY

Mammography lexicon

It contains definitions, descriptive schemes and radiological images of the following items.

– A *mass* is a space-occupying lesion with a convex border and visible on two orthogonal views; it needs to be differentiated from focal asymmetric density which lacks the conspicuity of a mass, especially the convex border.

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TABLE I
SECTIONS OF BI-RADS ATLAS OF MAMMOGRAPHY

1. LEXICON	Defines the terms used for description of a normal or abnormal mammography.
2. REPORTING	Describes the structure of a report including type of breast density and evaluation categories.
3. FOLLOW-UP ON RESULTS AND AUDIT	This section includes also statistical definitions.
4. PRACTICAL ADVICES	This section includes also recommendations for follow-up of category 3.
5 & 6. DATA COLLECTION & APPENDICES	Contain sample forms for data collection, a list of recommended abbreviations and an important dictionary for the terms to be used in an electronic database.
ILLUSTRATED CASES	Examples of cases including different modalities with their reports.

– The *characteristics* of a *mass* should be defined: shape (round, oval, lobular, irregular), margin (circumscribed, microlobulated, obscured, ill-defined, spiculated), density (higher, isodense or lower than the surrounding glandular tissue, presence of fat component).

– *Calcifications*: divided into three categories according to the level of suspicion:

- Typically benign: skin calcifications, vascular, radiolucent center, coarse, rod-like, round, eggshell, milk of calcium, dystrophic, suture calcifications.
- Intermediate concern: amorphous or indistinct, coarse heterogeneous calcifications.
- Highly suspicious: pleomorphic, fine linear or linear branching calcifications.
- Distribution: Diffuse/scattered, regional, segmental, linear or clustered.

– *Architectural distortion*.

– *Associated findings*: skin or nipple retraction, skin or trabecular thickening, axillary lymphadenopathy, architectural distortion, calcifications.

– *Special cases*: solitary dilated duct, intra-mammary lymph node, focal/global asymmetry.

– *Location* of a lesion: according to a clock with some special locations (retro-areolar, central, axillary); depth (anterior, middle, posterior 1/3), lesion-nipple or lesion-skin distance.

This rigid terminology is supposed to create a universal language between radiologists but does not solve the problem of subjectivity in reporting mammograms. Thus, Berg et al. [4] found a substantial inter-observer variability in feature analysis with kappa values varying between 0.28 and 0.75 (kappa value > 0.61 corresponds to substantial or almost perfect agreement). Some of the obtained kappa values of some features were • mass shape: 0.28 • microcalcifications morphology: 0.36 • mass density: 0.40 • mass borders: 0.4 • breast density: 0.43 • microcalcifications distribution: 0.47 • special cases: 0.56 • lesion type: 0.75.

If BI-RADS does not eliminate the subjectivity in describing mammographic findings, it, nevertheless, permits a better communication between different specialists (radiologists, physicians and surgeons) provided that they know this terminology otherwise it will become a source of confusion. Therefore, many radiologists choose a progressive introduction of these terms into their reports

with enough descriptive details to avoid confusion. After all, the management will be based primarily on the radiologist's assessment expressed in the report under a BI-RADS category.

Ultrasound lexicon

This terminology was developed in a way similar to that of mammography.

The background echotexture of the breast is noted: homogeneous fatty breast constitutes a low contrast environment and may reduce the sensitivity, homogeneous fibroglandular and heterogeneous.

In case of a *mass*, the following characteristics should be determined:

– *Shape*: round, oval, irregular, three lobulations or fewer are accepted in the oval shape, if more than three lobulations, then the shape will be considered irregular.

– *Orientation*: parallel or not to the skin plane.

– *Margin*: circumscribed (clear transition with the adjacent tissue) versus non-circumscribed (indistinct, angulated, microlobulated, spiculated).

– *Boundary*: an echogenic rim of a variable thickness is sometimes present at the interface between the mass and adjacent tissue and may be seen in certain cancers and abscesses.

– *Echogenicity*: compared to that of fat.

– *Posterior acoustic features*: absent, enhancement, shadowing, combined. Many cancers present no posterior change and sometimes posterior enhancement.

– *Surrounding tissues*: mass effect, dilated or branching ducts, thickened Cooper's ligaments, edema, architectural distortion, skin thickening/retraction.

– *Vascularization*: present or absent, present adjacent to the lesion, increased vascularity in surrounding tissues.

MRI lexicon

First published in the latest version of BI-RADS in 2003, this section reviews breast MRI with the same methodology and objectives as the previous sections.

The breast composition is noted: almost entirely fatty, heterogeneously fatty, heterogeneously fibroglandular, almost entirely fibroglandular.

Abnormal enhancement is defined as an enhancement of higher signal intensity compared to normal glandular

tissue. This characteristic should be evaluated on the first phase of a high resolution dynamic study, showing best the difference in enhancement.

Morphological and kinetic features of abnormal enhancement are classified as follows:

A. *Mass-related enhancement*

- Shape: round, oval, irregular.
- Margins: smooth, irregular, spiculated.
- Enhancement pattern: homogenous, heterogeneous (ring or central).
- Internal septations: enhancing or non-enhancing.

B. *Non mass-like enhancement*

B1. Focus/foci: a special entity consisting of a tiny spot of enhancement (< 5 mm), non specific and too small to be characterized morphologically.

[The spatial distribution and enhancement pattern have to be assessed as follows.]

B2. Spatial distribution

- Focal area: less < 25% of a quadrant volume and consists of mixed fat and normal glandular tissue.
- Linear: linear enhancement not related to a duct.
- Ductal: linear enhancement along duct (pointing toward the nipple or branching).
- Segmental: triangular shape with the apex pointing toward the nipple, suggestive of a duct and its branches.
- Regional: in a large volume, not corresponding to ductal distribution.
- Multiple regional: at least two areas separated by normal tissue.
- Diffuse: largely scattered, regular distribution.
- Symmetric or asymmetric.

B3. Enhancement characteristics

- Homogeneous.
- Heterogeneous.
- Punctuate, stippled: round, tiny spots.
- Micronodular: wine grape like, beaded.
- Reticular.

C. *Associated findings*

- Nipple retraction or inversion.
- High signal in the duct before contrast injection.
- Skin retraction, thickening or invasion.
- Edema.
- Adenopathy.
- Invasion of the pectoralis muscle.
- Invasion of the chest wall.
- Blood.
- Abnormal signal void (due to artefact).
- Cyst.

D. *Dynamic aspect of the enhancement*

The area of most intense enhancement should be selected and the region of interest should be larger than three pixels. If the time-intensity curves of multiple regions are displayed, then the most suspicious one should be considered.

The initial phase of enhancement (first two minutes)

may show slow, medium or rapid increase. Three patterns are seen in the late phase:

- Progressive: continuous enhancement increasing with time.
- Plateau: after reaching a peak after 2 to 3 minutes, the signal intensity remains constant.
- Washout: decrease of signal intensity after reaching a peak in first 2 to 3 minutes.

Morphological and kinetic features suggestive of benignity:

- Round or oval mass with smooth margins, not enhancing or homogeneously enhancing without washout.
- Non mass-related stippled enhancement, regional or diffuse symmetric enhancement.

Morphological and kinetic features suggestive of malignancy:

- Irregular mass with spiculated margins, heterogeneous (ring) enhancement with rapid initial phase followed by washout. A plateau aspect may be observed in invasive carcinomas.
- Micronodular enhancement with ductal or segmental spatial distribution.

BREAST COMPOSITION

Breast composition that influences mammography accuracy is divided in four types (Table II). Type 1 is the fatty breast (glandular tissue < 25%), type 2 is heterogeneously fatty (glandular tissue 25-50%), type 3 is heterogeneously dense (glandular tissue 51-75%) and type 4 is homogeneously dense (glandular tissue > 75%).

TABLE II
TYPE OF BREAST DENSITY ACCORDING TO BI-RADS

TYPE 1	ENTIRELY FAT (< 25% of fibroglandular tissue)
TYPE 2	SCATTERED FIBROGLANDULAR DENSITIES (25-50% of fibroglandular tissue)
TYPE 3	HETEROGENEOUSLY DENSE (51-75% of fibroglandular tissue)
TYPE 4	EXTREMELY DENSE (> 75% of fibroglandular tissue)

EVALUATION CATEGORIES

This part is well known to the referring physicians and general radiologists. It consists of seven categories (Table III). Categories from 1 to 5 grade the risk of malignancy.

The overlap between *category 1* (normal study) and *category 2* (benign finding) is tolerated. Thus, typically benign eggshell calcifications could be classified BI-RADS 2 or BI-RADS 1 if the radiologist deems it too trivial to be mentioned; the management is the same, usual screening mammogram in one year.

TABLE III
BI-RADS EVALUATION CATEGORIES AND USUAL RECOMMENDATIONS

CATEGORY	Significance	Usual Recommendation
0	Incomplete evaluation	Need for an additional evaluation
1	Normal findings	Normal screening interval
2	Benign findings	Normal screening interval
3	Probably benign findings (Probability of malignancy < 2%)	Short interval follow-up is recommended
4	Suspicious findings (Probability of malignancy 2% to 94%)	A biopsy should be considered
5	Highly suggestive findings of malignancy (Probability of malignancy ≥ 95%)	Biopsy or surgery should be performed
6	Already pathologically proven malignancy. Imaging performed for staging or after chemotherapy treatment.	Category 6 should not be used after completion of treatment

Category 3 is reserved for probably benign findings with a malignancy risk < 2%. The classical example is a non-palpable, circumscribed, oval, solid mass without calcifications. In this case, the recommendation is follow-up study in six months, repeated after another six months then yearly. After a period of two or three years without change (it is up to the radiologist to decide this interval time), the lesion can be reclassified BI-RADS 2 (Figure 1).

Most of the studies demonstrating the safety of this approach were based on non-palpable masses. Hence, a palpable mass having these characteristics should be considered BI-RADS 4a. Some calcifications can also be classified BI-RADS 3.

Category 4 includes lesions with a malignancy risk between 2% and 94%. In general, a biopsy is recommend-

ed. This large group was subsequently divided into 3 sub-groups: 4a, 4b and 4c corresponding to low, medium and high probability of malignancy. A solid, palpable, partially circumscribed mass suggestive of fibroadenoma on ultrasound can be classified 4a. A radiological follow-up in six months after a negative biopsy will be realized.

A radiologic-pathologic correlation is necessary in category 4b to decide of the management; a partially circumscribed or indistinct mass with a biopsy showing a fibroadenoma will be followed in six months, in case the biopsy shows a papillary lesion then surgery should be proposed.

The category 4c consists of suspicious lesions but not typically malignant.

Category 5 is reserved for lesions with high probability of malignancy ≥ 95%.

The **categories 0 and 6** are somehow special. The category 0 includes cases when the radiologist deems that additional information, additional views or another study are necessary before giving the final conclusion. This information may be simply an old study for comparison, supplementary view like spot compression and/or magnification, or complementary study such as ultrasound or MRI if the ultrasound was not conclusive.

The category 6 is reserved for cases where the pathological diagnosis of malignancy was already made. Imaging is made for preoperative staging or monitoring post neoadjuvant treatment. It should not be used after completion of the treatment.

Usually, the BI-RADS in a report corresponds to the most pejorative lesion or to the one requiring immediate action. For example, BI-RADS 4 prevails over categories 2 and 3. On the other hand, BI-RADS 0 and 4 are more important than BI-RADS 6 because they require immediate actions, complementary study and biopsy respectively. However, the radiologist can mention in his report different categories for different lesions to help the physician in planning his treatment e.g. right upper outer mass (BI-RADS 3) and upper inner mass (BI-RADS 4).

The final assessment should take into consideration the previous radiological studies. Thus, the BI-RADS of MRI study should also be based on the findings of previous ultrasounds and mammograms.

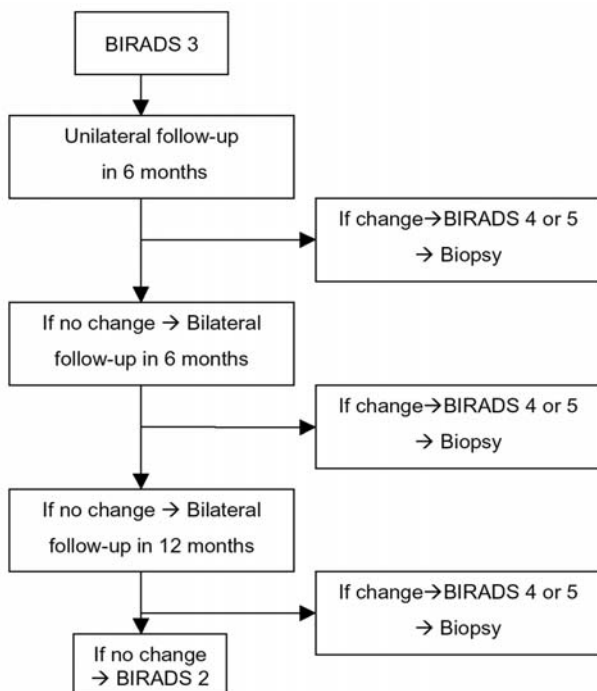


FIGURE 1

Classical follow-up of an examination classified BI-RADS 3.

STATISTICS

Definitions of some important statistical terms are specified.

There are two purposes for the mammogram, screening and diagnostic. A screening study is realized to an asymptomatic woman. A diagnostic study is realized to a woman having symptoms or clinical signs suggestive of breast cancer, or after a screening examination demonstrating an anomaly and classified BI-RADS 0. The category BI-RADS 3 should not be used in screening studies. If the radiologist detects a finding suggestive of category 3 on a screening mammogram, appropriate evaluation (spot compression/magnified view, ultrasound, etc.) should be performed to confirm his initial judgment and the screening study become a diagnostic one.

Knowledge of the definitions of the terms 'true positive', 'true negative', 'false positive' and 'false negative' as specified in BI-RADS is essential to understand the related articles.

A diagnostic study is considered *true negative* if it was classified BI-RADS 1, 2 or 3 and no proven cancer was discovered during the following year.

A diagnostic study is considered *false negative* if it was classified BI-RADS 1, 2 or 3 and a cancer was proven by cytology or histology during the following year.

A diagnostic study is considered *true positive* if it was classified BI-RADS 4 or BI-RADS 5 and a cancer was proven by cytology or histology in the following year.

A diagnostic study is considered *false positive* if it was classified BI-RADS 4 or BI-RADS 5 and no proven cancer was discovered in the following year.

For screening studies, the definitions differ. Category 3 is not used as specified above and a positive examination is classified 0, 4 or 5.

Attention! Regarding the histological proof of cancer, it is the date of the biopsy that counts. For example, if the initial study was classified negative (BI-RADS 1 or 2) and a cancer detected on a mammogram performed three days before the year end but the biopsy done on day 1 after the year end, then the initial study is classified as true negative. On the other hand, if the biopsy is done on day 1 before the year end, then the initial study is considered false negative. Therefore, many centers refuse to do the yearly mammogram before one year in order to improve their statistics.

LIMITATIONS OF BI-RADS

1. Despite the precise descriptive terms of BI-RADS, it did not solve the well-known inter- and intra-observers variability reported in breast imaging [4].
2. BI-RADS does not explicitly relate a radiological feature or group of features to the final assessment categories. Some recommendations are cited but do not cover all possibilities and combinations encountered in real-life practice. The radiologist should rely on the published studies and his personal experience.

For example, Liberman et al. assessed the positive

predictive value (PPV) of mammographic features of biopsied masses and calcifications. They found that spiculated margins, irregular shape of masses and linear morphology, segmental and linear distribution of calcifications had the highest PPV warranting a classification in category 5 [5]. However, information may be missing in the literature and even sometimes discrepancies are found. For example, the French Haute Autorité de Santé gave recommendations for the classifications of the radiologic abnormalities into 6 categories derived from the BI-RADS classification [6]. The main difference between these classifications is the management of clusters of amorphous calcifications, considered category 3 by the French and of intermediate risk, subsequently category 4 by the Americans. The French choice tends towards a higher specificity by reducing the false positive biopsies [7].

3. Factors other than the lesion features might influence the radiologist's decision (personal or familial risk factors, multiple lesions, patient or radiologist's anxiety, etc.).

A lesion considered category BI-RADS 3 is usually monitored but it may be biopsied if the patient is too anxious or if regular follow-up is not possible (travel, etc.). Furthermore, a radiologist who recently had a false negative case will tend to increase the false positives by lowering the threshold to biopsy.

Overall, different articles reported a substantial inter- and intra-observer variability in feature analysis and final assessment, especially between categories 3 and 4 [4, 6, 8].

CONCLUSION

BI-RADS has been an important asset for breast imaging by pushing the radiologists to have more standardized reports and to give a final recommendation.

It has improved the communication of information between various healthcare providers (radiologists, physicians, surgeons) provided that they have a good knowledge of the language in use and its limitations. It does not replace the personal experience or personal investment in case study.

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An **Appendix**, in French and in English, that summarizes **BI-RADS lexicons** in mammography, ultrasound and MRI, as well as recommendations for the report is available **online** : <http://www.lebanesemedicaljournal.org/articles/57-2/doc4.pdf>
A sample (Mammography lexicon), in English and French, is presented below.

BI-RADS TERMINOLOGY • Mammography lexicon

	<i>Term</i>	<i>Description</i>	
Mass	Mass		
	<i>Shape</i>	Round	spherical, ball-shaped, circular or globular shape
		Oval	elliptical or egg-shaped
		Lobular	contours with undulations
		Irregular	cannot be characterized
	<i>Margins</i>	Circumscribed	well-defined or sharply-defined, abrupt transition between the mass and surrounding tissue
		Microlobulated	small undulations
		Obscured	hidden by superimposed or adjacent normal tissue
		Indistinct	poor definition of the margin, may indicate infiltration by the lesion
		Spiculated	lines radiating from the margin of the mass
	<i>Density</i>	High density	> density fibro-glandular breast tissue
		Isodense	= density fibro-glandular breast tissue
		Low density	< density fibro-glandular breast tissue
Fat-containing		i.e. oil cyst, lipoma, galactocele, hamartoma, fibroadenolipoma	

	<i>Morphology</i>		
Calcifications	<i>Typically benign</i>	Skin calcifications	typical lucent-center
		Vascular	parallel tracks or linear tubular associated with blood vessels
		Coarse or popcorn-like	produced by fibroadenoma
		Large rod-like	found in secretory disease "plasma cell mastitis" and duct ectasia. More than 1 mm, occasionally branching
		Round	benign if scattered. < 1 mm in the acini. If grouped and < 0.5mm: punctate, they necessitate close follow-up
		Lucent-centered	round or oval, wall is thicker than "eggshell". Include fat necrosis, calcified debris
		"Eggshell" or "rim"	very thin, < 1 mm in thickness. Fat necrosis and calcifications in the cyst wall
		Milk of calcium	sedimented calcifications in cyst. On CC: fuzzy, round, amorphous; on 90° lateral: semi-lunar, crescent-shape, curvilinear
		Suture calcifications	calcium deposit on suture material
		Dystrophic calcifications	irregular, > 0.5mm, lucent center. Seen in irradiated breast or after trauma
	<i>Intermediate concern calcifications</i>	Amorphous or indistinct	round or flake-shaped. Small or hazy
		Coarse heterogeneous	irregular, > 0.5 mm, variable in size and shape. Of intermediate concern. If multiple bilateral, benign: fibrosis, fibroadenoma. If isolated cluster: small but significant likelihood of malignancy.
	<i>Higher probability of malignancy</i>	Pleomorphic or heterogenous calcifications	more conspicuous than amorphic calcifications. Usually vary in size and shape, < 0.5 mm.
		Fine linear or fine linear branching calcifications	thin, linear, irregular, discontinuous and < 0.5mm. Suggest filling of the duct lumen involved by breast cancer
		<i>Distribution</i>	
		Diffuse/Scattered	distributed randomly throughout the breast e.g. amorphic and punctate benign calcifications
		Regional	calcifications scattered in a large volume of breast tissue (> 2 cc) not conform to duct distribution
		Grouped or clustered	more than 5 calcifications grouped in a small volume (< 1cc)
		Linear	calcifications arrayed in a line that may have branch points
		Segmental	deposits in duct and its branches, suspicious of multifocal cancer in a lobe or segment. benign calcifications may have segmental distribution

Architectural distortion	the normal architecture is distorted with no definite mass. Includes: spiculations, focal retraction or distortion of the parenchyma. In the absence of history of trauma or surgery a biopsy is recommended
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Special cases	Tubular density / Solitary dilated duct	tubular or branching density representing dilated duct
	Intramammary lymph node	reniform, has radiolucent notch due to fat in hilum, usually < 1 cm
	Asymmetric breast tissue	relative to the contralateral breast, includes: greater volume or density. No mass, architectural distortion or suspicious calcifications. It is usually a normal variant, except if associated with palpable asymmetry.
	Focal asymmetric density	Asymmetry of tissue with similar shape on 2 views, with no evidence of borders or definite mass. It could represent an island of normal breast.

Associated findings	Skin retraction	skin is pulled
	Nipple retraction	nipple is pulled-in or inverted. This finding is often bilateral and does not indicate malignancy if old and stable.
	Skin thickening	focal or diffuse
	Trabecular thickening	thickening of fibrous septa
	Axillary adenopathy	enlarged > 2 cm, non-fatty hilum should be commented.
	Architectural distortion	as associated finding, in conjunction with a finding
Calcifications	as associated finding, in conjunction with a finding	

Lesion location	Side	R L	
	Classic localisation		
	Quadrant + Clockface	UOQ, UIQ, LOQ, LIQ 1 o'clock to 12 o'clock	
	Depth	1/3 anterior	
		1/3 middle	
		1/3 posterior	
	Special localisation		
	Central		along the same axis of the nipple on 2 views
	Retro-areolar		
	Axillary tail		

Mammography lexicon 1/5

TERMINOLOGIE BI-RADS Lexique des termes mammographiques

	Terme	Description	
Masse	Masse	lésion occupant un espace, vue sur deux incidences différentes. Les bords externes sont convexes.	
	Forme	Ronde	sphérique, en forme de boule, circulaire ou globuleuse
		Ovale	ellipsoïde ou ovoïde
		Lobulée	contour ondulé
		Irrégulière	forme qui ne correspond à aucune des précédentes
	Contour	Circonscrit	contour (au moins 75%) nettement délimité avec une transition brusque entre la lésion et le tissu environnant
		Microlobulé	de courtes dentelures du contour créent de petites ondulations
		Masqué	masse probablement circonscrite bien que le contour soit caché par le tissu normal adjacent ou superposé
		Indistinct	mauvaise définition du contour ou d'une portion du contour ; peut indiquer un infiltration
		Spiculé	lignes rayonnant depuis le contour d'une masse
	Densité	Haute	> densité du tissu mammaire fibro-glandulaire
		Moyenne	= densité du tissu mammaire fibro-glandulaire
		Faible	< densité du tissu mammaire fibro-glandulaire
		Contenant de la graisse radiotransparente	lésions bénignes i.e. hamartome, kyste huileux, galactocèle...

Morphologie		
Typiquement bénignes	Cutanées (dermiques)	petits dépôts calciques à centre clair (localisation cutanée démontrée par cliché tangentiel en cas de doute)
	Vasculaires	en rail ou linéaires, clairement associées à des structures tubulaires
	Grossières ou "coralliformes" (popcorn-like)	de grande taille, > 2-3 mm de diamètre, dégénérescence de fibroadénome
	Grandes en bâtonnets	sécrétoires suivant une distribution canalaire en direction du mamelon, bâtonnets à bords lisses, parfois discontinus ou ramifiés, à centre clair ou plein selon si le dépôt calcique se fait dans la paroi ou remplit la lumière du canal
	Rondes	bénignes si éparses. Un groupement isolé de calcifications punctiformes, < 0,5mm, nécessite une surveillance étroite voire une biopsie
	A centre clair	dépôts calciques, ronds ou ovales, à surface et à centre clair. Paroi plus épaisse que celle des calcifications "en coquille d'œuf".
	En coquille d'œuf ou pariétale	très fine, généralement moins de 1 mm, ayant l'apparence d'un dépôt calcique sur la surface d'une sphère. Calcifications des parois des kystes et cystostéatocécrose.
	Lait calcique	sédimentation intra-kystique de produits de sécrétion calcifiés. Incidence CC: dépôts arrondis, amorphes, à limites floues. Profil strict: nettes, en croissant, semi-lunaire.
	Fils de suture calcifiés	linéaires ou tubulaires et des nœuds sont fréquemment visibles.
	Dystrophiques	irrégulière, grossière et généralement > 0,5mm, le centre est souvent clair (sein irradié ou après traumatisme)
Niveau d'inquiétude intermédiaire, Calcifications suspectes	Amorphes ou indistinctes	Anciennement poussiéreuses. Trop fines ou insuffisamment nettes pour qu'une classification morphologique plus précise soit déterminable.
	Grossières hétérogènes	irrégulières qui se voient de façon évidente, généralement de taille > 0,5 mm. tendent à être coalescentes sans pour autant atteindre la taille des calcifications irrégulières dystrophiques. Elles peuvent être associées à un processus malin ou bénin (fibrose, fibroadénome, post-trauma)
Plus forte probabilité de malignité	Fines calcifications polymorphes (pleiomorphic)	elles sont mieux visibles que les microcalcifications amorphes précédentes. Elles sont de taille et de forme variable, mesurant généralement < 0,5 mm.
	Fines linéaires ou fines linéaires ramifiées	fines calcifications linéaires ou curvilignes irrégulières, possiblement discontinues, de moins de 0,5 mm de large. Cet aspect suggère le comblement de la lumière d'un canal irrégulièrement envahi par le cancer du sein.
Distribution		
	Diffuses/Éparses	La distribution est aléatoire dans l'ensemble du sein. Les calcifications amorphes et punctiformes ayant cette distribution sont généralement bénignes et bilatérales.
	Régionale	Calcifications éparses dans un grand volume (> 2 cc de tissu mammaire) n'ayant pas une distribution canalaire.
	Groupées en amas	Présence d'au moins 5 calcifications groupées dans un petit volume tissulaire (< 1 cc)
	Linéaire	Calcifications disposées en ligne. Cette calcification qui évoque des dépôts calciques dans un galactophore augmente la suspicion de malignité.
	Segmentaire	Suggère des dépôts calciques dans un canal ou des canaux et leurs branches évoquant la possibilité d'un cancer mammaire étendu ou multifocal dans un lobe ou un segment. Les calcifications bénignes peuvent avoir aussi une distribution segmentaire.

Distorsion architecturale	L'architecture normale est rompue sans masse précise visible. Ceci inclut les fines lignes ou spicules irradiant (rayonnant) à partir d'un point et la rétraction focale ou distorsion du bord du parenchyme. En l'absence d'antécédent de traumatisme ou de chirurgie, une biopsie est appropriée.
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Cas spéciaux	Structure tubulaire asymétrique/Canal dilaté solitaire	Structure tubulaire ou ramifiée qui représente vraisemblablement un canal dilaté ou hypertrophié.
	Ganglion intramammaire	Réniforme ou présente une encoche radiotransparente due à la présence de graisse dans le hile et mesure généralement < 1 cm
	Asymétrie globale	Une asymétrie du tissu mammaire est appréciée par comparaison avec la zone correspondante du sein controlatéral et représente un volume plus important de tissu mammaire dans une portion significative du sein. Pas de masse, de distorsion architecturale ou de calcifications suspectes. Une telle asymétrie représente généralement une variante de la normale mais peut être significative si elle correspond à une anomalie palpable.
	Asymétrie focale	Asymétrie localisée de forme similaire sur deux incidences, mais complètement dépourvue de contours et de l'évidence d'une véritable masse. Elle pourrait représenter un îlot de tissu mammaire normal, en particulier quand elle est parsemée de graisse mais une évaluation complémentaire peut être nécessaire.

Résultats associés	Rétraction cutanée	la peau est anormalement attirée vers l'intérieur du sein
	Rétraction du mamelon	le mamelon est rétracté ou ombiliqué. Ce signe est souvent bilatéral et n'évoque pas la malignité quand il est stable et chronique.
	Épaississement cutané	il peut être focal ou diffus et supérieur à 2 mm.
	Épaississement du stroma	il s'agit d'un épaississement des septa fibreux du sein.
	Adénopathie axillaire	Adénomégalie > 2 cm sans involution graisseuse peut justifier un commentaire, une corrélation clinique et une évaluation additionnelle lorsqu'elle est nouvelle.
	Distorsion architecturale	peut être utilisée en tant que résultat associé en conjonction d'un signe
	Calcifications	peuvent être utilisées en tant que résultat associé en conjonction d'un signe

Localisation de la lésion	Côté	D G
	Localisation classique	
	Cadran + Rayon horaire	QSE, QSI, QIE, QUI 1h à 12h
	Profondeur	1/3 antérieur
		1/3 médian
		1/3 postérieur
	Localisations spéciales	
	Centrale	directement dans l'axe du mamelon sur 2 incidences
	Rétro-aréolaire	en arrière de l'aréole
	Prolongement axillaire	