Breast mass imaging: Role and limitations

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Overview

*Breast mass imaging*

- **Role**
  - Detection : Screening program
  - Characterisation - BIRADS
  - Histologic Correlation

- **Limitations**
  - Missed breast cancer
  - Overdiagnosis
Part 1 : Radiologist’s role

- To perform a complete diagnostic imaging evaluation before doing an assessment
- To recognize lesions requiring biopsy
- Good interpretation of imaging should:
  - Respect the descriptive guidelines of the BIRADS
  - Include the various imaging techniques
  - Summarize the diagnostic strategy for clinicians

*Standardized diagnosis and reporting of breast cancer. Diagnostic and Interventional Imaging*, Thomassin N, 2014
Role

Screening mammography

- Early detection of breast cancer reduces mortality from breast cancer
  - 24% reduction of breast cancer mortality among those invited to mammography screening

- Early diagnosis offers more treatment options and less aggressive treatment
  - Less mastectomy
  - Less chemotherapy

Breast cancer screening with mammography, Lancet 1993
Mammography = gold standard screening examination

Cranio-caudal (CC)  Mediolateral Oblique (MLO)
Role

**BIRADS : classification**

- Terminology developed by the American College of radiography
  - Lexicon used worldwide
  - Classification based on the *positive predictive value of malignancy*

- Describe lesions detected by the different breast-imaging techniques: mammography, ultrasound, MRI

- Role
  - To standardize reports
  - To adapt patient management and follow-up
Role

BIRADS: when to do a biopsy?

- ACR 4: 3 < PPV < 94 %
- ACR 5: PPV > 94 %
- ACR 3: PPV < 3 %

To adapt strategy:
- Invasive carcinoma ⇒ axillary lymph node exploration
- Multifocal cancer ⇒ conservative vs mastectomy

To confirm homo or controlateral breast cancer
Genetic mutation
Risk of non-compliance

ACR BI-RADS atlas: breast imaging reporting and data system (5th ed.) (2013)
Role

Mass: Definition

- A mass is defined by a space-occupying lesion that is visible on two different views.
- If a potential mass is seen on one view only, it should be reported as an “asymmetry”.
- Masses are characterized according to strict criteria.

ACR BI-RADS atlas: breast imaging reporting and data system (5th ed.) (2013)
### Role

**Mass: Characterization**

<table>
<thead>
<tr>
<th>Masses</th>
<th>Shape</th>
<th>Margin</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oval</td>
<td>Circumscribed</td>
<td>High density</td>
</tr>
<tr>
<td></td>
<td>Round</td>
<td>Obscured</td>
<td>Equal density</td>
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<tr>
<td></td>
<td>Irregular</td>
<td>Microlobulated</td>
<td>Low density</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Indistinct</td>
<td>Fat-containing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spiculated</td>
<td></td>
</tr>
</tbody>
</table>

**Margin** = this criteria has the highest positive predictive value for malignancy
Role

Mass: Characterization

- How to better assess the margins?
  - spot compression views
Role

Mass: **Characterization**

- How to better assess the margins?
  - *Ultrasound (US)*: description of the shape, margin, orientation compared to the skin, echo pattern, vascularisation

*ACR BI-RADS atlas: breast imaging reporting and data system (5th ed.) (2013)*
Role

Mass: **Characterization**

- How to better assess the margins?
  - *Tomosynthesis*: significantly decreases convergence phenomena due to glandular overlay
**Role**

**Mass : localisation**

- **In US :**
  - Distance to the nipple
  - Clock radius

- **Triangulation principle**
  - From the oblique and CC views - by aligning the nipples - it is possible to locate the lesion on the profile view (upper or lower)
Case 1

- 55-year-old patient
- No medical history
- Screening mammography
Do you see anything?
Do you see anything?

⇒ A small lesion at the bottom of the axillary area
You are the radiologist: what is your next step?

1. Nothing. It is a benign axillary lymph node
2. Proceed with spot compression
3. Ask for profil view
4. Compare with previous exams
You are the radiologist: what is your next step?

1. Nothing. It is a benign axillary lymph node

2. Proceed with spot compression - to assess the margin

3. Ask for profil view - to locate the lesion

4. Compare with previous exams
Where is the mass located?

In the upper external quadrant

⇒ In the upper external quadrant
Lesion visible since 2014. What do you do?
What do you do?

- Classify ACR 5: spiculated margin
- Add US examination
- Perform a biopsy

A spiculated mass is suspect even if it’s stable for years +++
Core biopsy US-guided:
NST grade I

Mass, irregular margins
=> ACR5
Role

Pathological-imaging correlations

- The anatomopathological classification used to evaluate breast tissue specimens from biopsy is the *European classification* 
  \[(B1 \Leftrightarrow B5)\]

- After the biopsy, the radiologist has to check if there is correlation between imaging anomalies and histological results
ACR 3 - ACR 4 a ⇒ B2

- Round mass smooth margin or lobulated
- Complicated or complex cyst

Biopsy validated ⇒ Follow up

ACR 3 - ACR 4 a ⇒ B1

RCP Follow-up or new biopsy
Causes of discordance

• Targeting errors
  Small lesions < 5mm (use of a clip during the biopsy)
  Breast fibrosis
  Deep lesions

• Poor visibility of the target and the needle
  Patient’s movement
  Hematoma
Pitfalls in diagnosis

- ACR5 or ACR4b ACR4c $\Rightarrow$ B1 or B2
  - Risk of FN +++ : failed biopsy
    - New core biopsy or surgical excision

- Benign lesions present themselves as malignant
  - Radial breast scare
  - Sclerosing adenosis
  - Fibroadenoma: with irregular boundaries, infarction, hyalinization or stromal proliferation
Part 2 : Limitations

• Missed breast cancer

• Controversial impact of the mammography
  ◦ X- Ray exposure
  ◦ Overdiagnosis
Limitations

Missed breast cancer

• Detection errors:
  = Presence of a mass but overlooked
    • lack of attention or experience
    • Poor technical application
    • Up to 1/3 of interval cancers

• Misleading interpretation:
  = Cancers mimicking pseudobenign lesions or with slow evolution.

Thurfjell EL. Benefit of independent double reading in a population-based mammography screening program. Radiology 1994
Limitations

Detection errors

Missed cancers are often in the glandular border or in the deeper part of the breast

Not 1 ... but 2 lesions

Poor technical application
Limitations

Detection errors

- Multifocal cancers
  - 20% of cancers (lobular)
  - Bilateral in 10% of cases

- «Satisfaction of search»
  - After the identification of a first lesion, the radiologist misses additional lesions

Therapeutic implications: surgery of multifocal cancers is monobloc
Conservative surgery versus mastectomy

Liberman L et al. MR imaging findings in the controlateral breast of women with recently diagnosed breast cancer. AJR 2003
Case 2

- Patient coming for pre-operative localization of a triple negative grade III cancer of left breast
- Conservative surgery planned
Where is the ACR6 lesion located?
Do you see anything else?

Lésion ACR6
Do you see anything else?
Additional lesion in another part of the breast

Biopsy = NST grade II

Conservative surgery ⇒ MASTECTOMY
Limitations

**Pseudobenign lesions**

- **Slow evolution:** low Ki, tubular
- **Round cancer**
  - First screening of a BRCA patient, well limited mass ⇒ ACR 3.
  - Follow up after 4 month: increase in size ⇒ biopsy
Limitations

Mammography controversial impact

- No decrease in mortality

- Radiation risk

- Overdiagnosis
Limitations

Overdiagnosis

• Indolent cancer would not have produced symptoms or premature death

• ≠ false positives (10%):
  ◦ initial screening suggests a pejorative lesion but follow up and/or biopsy reveal benign lesion
    • Anxiety
    • Unnecessary biopsies
    • Overtreatment such as surgical excision

⇒ Over a 20-year-period of screening, 1woman/5 will have a FP diagnosis

Benefits and Harms of Breast Cancer Screening: A Systematic Review, Jama 2015
Kargan Arleo et al, cancer 2017
Conclusion

**Take home message**

- **ROLE**
  - Detection
  - Characterization
  - Biopsy
  - Histologic correlation

- **LIMITATIONS**
  - Missed breast cancer
  - Overdiagnosis
  - Xray radiation
  - Effect on mortality rate
Future?

Artificial intelligence for breast cancer screening: Opportunity or hype?

Nehmat Houssami a,*, Christoph I. Lee b, Diana S.M. Buist c, Dacheng Tao d

- AI technologies could be used
  - To increase the accuracy of mammography screening?
  - To distinguish lesions that require excision and those that could be followed up?

- Extremely large data-sets of imaging examinations linked to clinical factors and cancer outcomes are needed to train and validate models
Thank you for your attention

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