A Mundinger

Microcalcifications: biopsy – yes or no?
Outline

Microcalcifications: biopsy yes or no?

- Test – have a guess?
- Basic concepts of characterization
- Cases
- Test - answer
What can you do optimizing your skills in microcalcs?

Focussing on radiologic-pathologic correlation
Your guess?
Concepts of characterization
The old concept

Morphologic overlap of microcalcifications

Ductal

Intracanalicular

Lobular

(wrong wording)

Comedo Necrosis

Cribriform Type

Fibroadenoma

Sclerosing Adenosis

Original Images in Morton Lanyi, Diagnosis and Differential Diagnosis of Breast Calcifications, 1986
Lanyi M. Differentialdiagnose der Mikroverkalkungen. Röntgenbildanalyse von 60 intraductalen Carcinomen, das „Dreiecksprinzip“. Radiologe 1977; 17: 213 – 216
Pathological concepts

TDLU and intraductal spread

Distension and unfolding of the TDLU

MG: group of calcium

Extension of DCIS within ducts

MG: linear, segmental distribution of calcifications

New ducts in high grade DCIS

* Wellings and coworkers 1975
Two concepts combined
Progenitor cell model and calcifications

Intermediary glandular cells

DCIS
grade 3

Invasive breast cancer
grade 3

DCIS develops in major ducts in most cases of casting calcifications

Glandular cells

DCIS
grade 1,2,3

Invasive breast cancer
grade 1,2,3

DCIS develops in TDLU´s in most cases of punctate, amorphous and pleomorphic calcifications

László Tabár et al. The Impact of Mammography Screening on the Diagnosis and Management of Early-Phase Breast Cancer. 2013
Extensive in-situ component of T2 stage NOS
# Microcalcifications

**UK- screening classification**

<table>
<thead>
<tr>
<th></th>
<th>Benign</th>
<th>Intermediate</th>
<th>Malignant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distribution</strong></td>
<td>singular, cluster</td>
<td>cluster</td>
<td>cluster</td>
</tr>
<tr>
<td><strong>Cluster Shape</strong></td>
<td>round</td>
<td>round</td>
<td>linear, triangular</td>
</tr>
<tr>
<td><strong>Microcalc shape</strong></td>
<td>annular, popcorn-like</td>
<td>granular</td>
<td>variable</td>
</tr>
<tr>
<td><strong>Microcalc size</strong></td>
<td>uniform</td>
<td>uniform</td>
<td>variable</td>
</tr>
<tr>
<td><strong>Density</strong></td>
<td>uniform</td>
<td>uniform</td>
<td>variable</td>
</tr>
</tbody>
</table>

### Mammography

<table>
<thead>
<tr>
<th>Calcifications</th>
<th>Typically benign</th>
<th>Skin</th>
<th>Vascular</th>
<th>Coarse or “popcorn-like”</th>
<th>Large rod-like</th>
<th>Round</th>
<th>Rim</th>
<th>Dystrophic</th>
<th>Milk of calcium</th>
<th>Suture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspicious morphology</td>
<td>Amorphous</td>
<td>Coarse heterogeneous</td>
<td>Fine pleomorphic</td>
<td>Fine linear or fine-linear branching</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distribution</th>
<th>Diffuse</th>
<th>Regional</th>
<th>Grouped</th>
<th>Linear</th>
<th>Segmental</th>
</tr>
</thead>
</table>

**Note:**
- **Typically benign** refers to calcifications that are generally considered benign.
- **Suspicious morphology** indicates calcifications that may be suspicious for malignancy.
- **Distribution** refers to the pattern and arrangement of calcifications.
ACR BI-RADS® Atlas – Mammography 2013 vs. 2003

Microcalcifications

Typically benign

Suspicious morphology (BI-RADS Update 2013)

Suspicious and highly suspicious subgroups converge to a single „suspicious“ group due to only small differences in ppv

- round
- punctate = subgroup of round
- amorphous
- fine pleomorphic
- coarse
- heterogeneous
- linear and linear branching

Original Images BI-RADS Atlas
Typically benign popcorn-like rim large rod-like vascular dystrophic

Diameter > 1 mm means benign macrocalcifications

ACR BI-RADS® Breast Imaging Atlas
Typically benign

Spot magnification assesses calcifications in medio-lateral and cranio-caudal planes and separates milk of calcium from punctate, amorphous, fine pleomorphic microcalcifications!

„Tea cup“ means crescent shape (concave up)
44 years old

Benign milk of calcium calcifications

L mlo   L ml

No biopsy!
<table>
<thead>
<tr>
<th>BI-RADS Atlas 2013</th>
<th>Category</th>
<th>ppv</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse heterogeneous</td>
<td>4B</td>
<td>13%</td>
</tr>
<tr>
<td>Amorphous</td>
<td>4B</td>
<td>21%</td>
</tr>
<tr>
<td>Fine pleomorphic</td>
<td>4B</td>
<td>29%</td>
</tr>
<tr>
<td>Fine linear / - branching</td>
<td>4C</td>
<td>70%</td>
</tr>
</tbody>
</table>

Combined data from 4 studies, published 1998-2010 (E. Sickles)
Microcalcifications - pooled malignancy rate of type descriptors plotted against distribution modifiers

<table>
<thead>
<tr>
<th>ACR BI-RADS distribution modifiers</th>
<th>clustered</th>
<th>diffuse</th>
<th>regional</th>
<th>segmental</th>
<th>linear</th>
</tr>
</thead>
<tbody>
<tr>
<td>round/punctate</td>
<td>7.66 (2.49 – 21.23)</td>
<td>5.67 (0.36 – 50.05)</td>
<td>22.63 (3.27 – 71.65)</td>
<td>21.41 (8.73 – 43.72)</td>
<td>21.74 (4.33 – 63.03)</td>
</tr>
<tr>
<td>coarse heterogeneous</td>
<td>12.02 (5.22 – 25.29)</td>
<td>–</td>
<td>25 (8.34 – 89.11)</td>
<td>–</td>
<td>16.67 (0.95 – 80.64)</td>
</tr>
<tr>
<td>amorphous or indistinct</td>
<td>18 (13.7 – 23.28)</td>
<td>6.98 (0.94 – 37.16)</td>
<td>27.32 (7.09 – 64.93)</td>
<td>33.17 (21.76 – 46.98)</td>
<td>35.03 (17.99 – 56.99)</td>
</tr>
<tr>
<td>pleomorphic</td>
<td>37.12 (30.86 – 43.84)</td>
<td>28.06 (14.99 – 46.32)</td>
<td>39.44 (21.69 – 60.49)</td>
<td>57.75 (40.54 – 73.26)</td>
<td>61.36 (36.43 – 81.48)</td>
</tr>
<tr>
<td>linear or linear branching</td>
<td>57.73 (34.54 – 77.95)</td>
<td>17.61 (6.3 – 40.45)</td>
<td>51.2 (13.33 – 87.74)</td>
<td>82.71 (61.05 – 93.59)</td>
<td>80.16 (63.78 – 90.27)</td>
</tr>
</tbody>
</table>

Pooled malignancy rate based on fourteen studies (n = 3,499) in percent with 95% confidence interval in parenthesis.

Pooled malignancy risk of round/punctate microcalcifications is approximately 9%.

Rominger M, Wisgickl C, Timmesfeld N. Breast microcalcifications as type descriptors to stratify risk of malignancy: a systematic review and meta-analysis of 10665 cases with special focus on round/punctate microcalcifications. Rofo. 2012 Dec;184(12):1144-52.
Special focus on round/punctate Microcalcifications

Co-factors for risk qualify for biopsy
- History of breast cancer
- Presence of mass
- Non-exclusive round/punctate form
- Higher number
- Suspicious distribution

Exclusion of all suspicious co-factors directs to follow-up
Although punctate morphology usually prompts a benign or probably benign assessment, the segmental distribution in this case prompts a suspicious assessment instead. Core biopsy: ductal carcinoma in situ (DCIS). Previously published as Figure 6 (p. 776) in Leung JWT, Sickles EA. The probably benign assessment. Radio! Oin North Am 2007; 45(5):773-789.
Different size: punctate < 0.5 mm vs round ≥ 0.5 mm

Different risk: for an isolated group of punctate microcalcifications

1) BI-RADS 3 if
   - no previous Mx to prove stability of microcalcifications
   - baseline Mx

2) BI-RADS 4 if
   - new developing or increasing microcalcifications
   - linear or segmental distribution
   - adjacent to cancer
ACR BI-RADS® Atlas – Mammography 2013 vs 2003

Gruppe vs. Regionale Verteilung: neue Grenze 2 cm

Group (2003 1cm²) Diameter ≤ 2 cm

Regional distribution Diameter > 2cm
## PPV by Calcification Distribution

<table>
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<tr>
<th>Category</th>
<th>PPV</th>
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<tr>
<td>Regional</td>
<td>4B</td>
</tr>
<tr>
<td>Grouped</td>
<td>4B</td>
</tr>
<tr>
<td>Linear</td>
<td>4C</td>
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<tr>
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E Sickles, Combined data from 3 studies, published 1998-2010
Distribution – diffuse, scattered

- Scattered distribution
- Bilateral
- Small < 1mm
- Punctate < 0.5mm
- Typically benign

Secretory microcalcifications, cystic adenosis
# Grouped microcalcifications

## Risk of cancer (ppV)

<table>
<thead>
<tr>
<th>Type of descriptor for microcalcifications</th>
<th>ppV of cancer</th>
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<tbody>
<tr>
<td></td>
<td>Benign</td>
</tr>
<tr>
<td>Cluster shape</td>
<td></td>
</tr>
<tr>
<td>round</td>
<td>6%</td>
</tr>
<tr>
<td>irregular</td>
<td>2%</td>
</tr>
</tbody>
</table>

Sampled statistics
The diagnostic process in breast lesions focusing on assessment

Detection of lesion

First characterization using diagnostic criteria

Assessment for more detailed characterization

Final assessment category (R1-5; BI-RADS 0-6)

- Routine follow-up or clinical management
- Initial short interval follow-up
- Histology (Cytology)
- Additional projections: Spot magnification, DBT, Ultrasound, MRM
Cases
B5a, pTis pNx pMx, 13x10 mm, G2
B5a, pTis pNx pMx, 34 mm, G3

Before stereotactic VAB

After stereotactic VAB
Sclerosing lesion with ductal cancer in situ, B5a
Golden rules

Mammographic imaging of DCIS

Assess

- New or increasing group of microcalcifications
- Probably benign microcalcifications in high risk collective
- Any suspicious morphology or distribution

Problems

- Lack of change does not rule out DCIS
- Developing necrosis can reduce the variation in shape and density of microcalcifications
- Vanishing microcalcs + new mass: invasive cancer
Test cases –
Biopsy yes or no?
To biopsy or not?

BI-RADS 1 = 1
BI-RADS 2 = 2
BI-RADS 3 = 3
BI-RADS 4 = 4
BI-RADS 5 = 5
# Morphology and distribution

## Calcifications

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<td>Diffuse</td>
<td>2</td>
<td>2*</td>
<td>4</td>
</tr>
<tr>
<td>Group - round / oval</td>
<td>3*</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>- irregular</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional - segmental</td>
<td>4</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Linear - Linear branching</td>
<td>4</td>
<td>5</td>
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* Upgrade in high risk and new developing calcs

Modified according to M Müller-Schimpfle, Acta Radiologica 2005
Lipoid necrosis BI-RADS 2
To biopsy or not?

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# Morphology and distribution

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To biopsy or not?

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# Morphology and distribution

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* Upgrade in high risk and new developing calcs

Modified according to M Müller-Schimpfle, Acta Radiologica 2005
Secretory calcifications, mastopathy
Take-home-message 1
Do not biopsy

- Benign macrocalcifications > 1mm
- Skin and milk of calcium calcifications
- Bilateral and diffuse round/punctate, (amorphous or coarse heterogeneous?) calcifications
Round/punctate microcalcifications with co-factors of risk may be classified as suspicious.
Take-home-message 3

Surgical or vacuum assisted biopsy

■ Compare your classification with

ACR BI-RADS® Atlas – Mammography

2013 (version 5)
Thank you for your attention