Complex radiologic evaluation of breast diseases

Endre Szabó
1 thing to remember:

• Do not touch the breast before the period!
Lactiferous sinus

Duct orifices

Lobe (segment): Duct orifice, multiple ducts and TDLUs

Main duct
Development
• Clinical examination
  – palpable lump
  – nipple discharge
  – skin change
  – pain

• Screening
  – László Tabár
Diagnostic tools

- X-ray mammography
- ultrasound
- MRI
- CT
- isotope
- PET
- alternatives
Minimum criteria:

- high frequency generator
- Automatic Exposition Control (AEC)
- 0.4 mm nominal focal spot, Mo rotating anode
- adjustable compression plate
- 18x24 and 24x30 cm cassette holder with Bucky table
- spot compression views
- accessories for X-ray guided biopsy
- high definition screen-film system
- forced development /35 °C, 180/90 s/
- high power /5000 lux/m²/ viewing box, magnification
- QC devices /breast phantom, mammographic sensitodensitometer/
2002 Physician Insurers Association of America

- breast cancer has the highest incidence
- second highest fees claimed at court
- radiologist is the most frequently sued speciality
Analogue mammography

**high quality:**
- 18-20 lp/mm resolution
- high contrast resolution

**disadvantages:**
- non-linear density curve
- low contrast at the high density areas
- no post-processing
- only one copy exists

**advantages:**
- best price for high quality
DIGITAL MAMMOGRAPHY

1) storage phosphor plate resolution: 50µ

IDC + EIC (1999)

FDA
Full Field Direct Digital Mammography (FFDM)

The Center for Devices and Radiological Health (CDRH) of the Food and Drug Administration (FDA) has completed its review of your premarket approval application (PMA) for the Senographe 2000 D Full Field Digital Mammography System. This device is indicated for generating mammographic images that can be used for screening and diagnosis of breast cancer. The Senographe 2000 D is intended to be used in the same clinical applications as traditional mammographic film-screen systems. We are pleased to inform you that the PMA is approved subject to the conditions described below and in the “Conditions of Approval” (enclosed). You may begin commercial distribution of the device upon receipt of this letter.

The sale, distribution, and use of this device are restricted to prescription use in accordance with 21 CFR 801.109 within the meaning of section 516(h) of the Federal Food, Drug, and Cosmetic Act (the act) under the authority of section 515 of the act. Until such time as an FDA approved accreditation process for full-field digital mammography has been developed, the Senographe 2000 D Full Field Digital Mammography System must only be sold to screen-film accredited/certified facilities. FDA has also determined that, to ensure the safe and effective use of the device, the device is further restricted within the meaning of section 515(h) under the authority of section 515(k) of the act as the labeling specify the requirements that apply to the training of practitioners who may use the device as approved in this order and (2) insofar as the labeling specify the requirements that apply to the training of practitioners who may use the device as approved in this order and (2) insofar as the labeling specify the requirements that apply to the training of practitioners who may use the device as approved in this order and (2) insofar as the labeling specify the requirements that apply to the training of practitioners who may use the device as approved in this order and (2) insofar as the labeling specify the requirements that apply to the training of practitioners who may use the device as approved in this order and (2) insofar as the labeling specify the requirements that apply to the training of practitioners who may use the device as approved in this order and (2) insofar as the labeling specify the requirements that apply to the training of practitioners who may use the device as approved in this order and (2) insofar as the labeling specify the requirements that apply to the training of practitioners who may use the device as approved in this order and (2) insofar as the labeling specify the requirements that apply to the training of practitioners who may use the device as approved in this order and (2) insofar as the labeling specify the requirements that apply to the training of practitioners who may use the device as approved in this order and (2) insofar as the labeling specify the requirements that apply to the training of practitioners who may use the device as approved in this order and (2) insofar as the labeling
Postprocessing
CAD=Computer Aided Diagnosis
Digital mammography

**advantages:**
- better imaging of dense breasts
- postprocessing
- simple storage, reproduction
- copies
- CAD
- telemammography, teleconsultation
- experimental applications

**disadvantages:**
- price
Workup

- extra views (latero-lateral, spot-compression), invasive examinations (galactography, pneumocystography)
US mammography

Technical requirements:

- high definition device
- high frequency (10-17 MHz), linear, 40 mm transducer
- shallow focusing (0-4 cm)
- image storage
US mammography

advantages:

• dense breasts (cystic – solid)
• paramammary regions
• US guided interventions (FNAC, CB, drainage, preoperative localisation)
• simple, cheap, quick
US mammography

disadvantages:

- aspecyfic symptoms (scar– tu – chr. inflammation – granuloma)
- limited resolution (microcalcs – DCIS)
Cooper’s ligament
glandular tissue
abscess
drainage
hematoma
calcified FA
benign LN
malignant LN
Sampling

- exfoliative (smear)
- aspiration cytology
- core biopsy
- vacuum core
- cyst drainage (pneumocystography)
- preoperative localisation
- galactography

- UH / X-ray/ MRI guidance
Biopsy

Guidance

• **ultrasound**: if visible on ultrasound
  – cyst, nodule, axillary lymph node, (ducts)

• **stereotactic**: visible ONLY on mammography
  – nodule, microcalc, distortion
Biopsy

Sampling

• Cytology:
  – 23, 21, 19 Gauge

• Core biopsy (automated gun):
  – 14 G (2.1mm)

• Vacuum core biopsy (Mammotome):
  – 11 or 8 G

• ABBI:
  – 10-20 mm
Core Bx indications

• PREOPERATIVE HISTOLOGY: THERAPY PLANNING
  – *to avoid*: „diagnostic” surgery, frozen sections, 2nd sitting
  – choose type of operation (oncologic, psychic and legal factors)
  – preop. chemo-radiotherapy (mastitis carcinomatosa)

• after surgery: recurrence? scar? fat necrosis? granuloma?

• after inadequate cytology:

• RADIOLOGICALLY:
  – solid nodule
  – architectural distortion
  – microcalc
  – mastitis carcinomatosa

*To rule out malignancy (FIBROADENOMA)*
Core Bx is not indicated

- if its result will not change treatment
- technical problems
  (non-complying patient, localisation, ill defined, badly visualized lesions)
- unequivocally benign finding
  (intramammary LN, macrocalc)
Core Bx needle

- diameter 14G (2.1 mm)
- notch: 15-22 mm

"...comparison of samples obtained with 14-, 16, and 18 gauge..."

Nath ME, Robinson TM, Tobon H et al.
Dept. of Pathology, University of Pittsburgh
RADIOLOGY, 1995 Dec, 197:3,739-42

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<th>18 G</th>
<th>16 G</th>
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<td>Rate</td>
<td>65%</td>
<td>92%</td>
<td>100%</td>
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Vacuum core biopsy

- bigger samples
  - almost complete removal before final breast conservation surgery
Core Bx
Sztereo tactic Vacuum Core Biopsy (Mammotome)
Breast MRI

- coil (uni- or bilateral)
- compression
Breast MRI

• **Best** indications
  – implant rupture
  – occult primary
  – family screening of high risk patients
  – multifocality, tumor size exact measurement
  – to rule out invasive tumor and recurrence

• **Good** indications
• "problem solving"
• monitoring chemotherapy

• **Bad indications**
  – lesion can be Bx-ed (**microcalc**, etc)
  – lesion can be diagnosed only pathologically (radial scar)
  – VIP, aversions for X-ray mammo, axillae…
Diagnostic criteria

• kinetics

• I: steady
• II: plateau
• III: washout

CUP

Schelfout et al. Eur Radiol. 2003
Post-processing
Maximum Intensity Projection, MIP
Intracapsular rupture

„Keyhole sign”

„Inverted teardrop sign”
Extracapsular rupture

- fluid collection outside the fibrous capsule

Malignant
Ablation

- Focused US
- Cryo
- Radiofrequency
- Microwave
- Laser
Tomosynthesis
Preoperative marking of non-palpable breast lesions

- skin scratch
- wire
- staining/ductography
- isotope
Galactography
Bracketing
Izotóp – ROLL, SNOLL

Radio guided Occult Lesion Localisation

Sentinel Node plus Occult Lesion Localisation