Updates in Mammography

Dr. Yang Faridah A. Aziz
Department of Biomedical Imaging
University Malaya Medical Centre
Updates in Breast Imaging

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Department of Biomedical Imaging
University Malaya Medical Centre
Updates in Breast Imaging

- Digital Mammography including CAD
- Tomosynthesis
- Contrast-enhanced Mammography
- MR breast imaging
Breast Disease

- Breast carcinoma is the commonest cancer in Malaysian women in every race
- 3738 new cases every year
- A woman in Malaysia has a 1 in 20 chance of developing breast cancer in her lifetime

*National Cancer Registry Malaysia report 2003*
Breast Disease

Charts from http://www.radiologymalaysia.org/breasthealth/About/FactsNStats.htm
Mammography through the years

- Mammography is shown to be effective in reducing breast cancer mortality through early detection\(^1\)
- Breast imaging started in 1913 by Albert Salomon
- Mammography started in the 1960s\(^2\)
- In 1969, the first x-ray units dedicated to breast imaging were available\(^2\)
- By 1976, mammography as a screening device became standard practice and its value in the diagnosis of breast carcinoma was recognised

Mammography through the years

- Screen-film mammography (SFM) is the technology of choice
- Personnel involved are well-trained in this method
- Low cost and high spatial resolution

Mammography through the years

- In general radiology, transition to digital technology began two decades ago.
- Digital mammography was first introduced in stereotactic biopsy.
- Digital mammography was slow due to difficulty to produce full-field digital detectors.
- In 2005, the first digital mammography was approved.

Digital vs SFM

- Detection of breast lesion
- Workflow processes
- Image quality including image post-processing
- Image archival and retrieval
Digital vs SFM

- Detection of breast lesion
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Detection of breast lesion

• Breast is a difficult organ to imaged
• Breast density ranges from dense (75% or more of breast compose of glandular tissue) to fatty
• Sensitivity of detection of carcinoma is 62.9% in dense breast compared to 87% in fatty breast

Image quality

Fatty background
Image quality

Dense breast
Lesion detection vs breast density

- Women with dense tissue have a **four to six times** higher risk of breast cancer compared to women with little or no dense tissue.
- Masking of existing lesion by overlying breast tissue.

Digital vs SFM

- Overall diagnostic accuracy of digital and film mammography for breast cancer detection is similar
- Digital is more accurate in:
  - Women under 50
  - Women with dense breast
  - Premenopausal or perimenopausal women
- Due to wide dynamic range of digital, able to display contrasting regions without compromising resolution

Detection of breast lesion: calcification

- SFM boasts a high spatial resolution – good for detection of microcalcification
- DM is limited by pixel size
- However the high contrast resolution of DM
  - shows more calcification compared to SFM
  - increases the ability to characterize calcification better

Clustered microcalcification

**Biopsy:**
Ductal carcinoma in situ
Detection of breast lesion

- DM also allows for use of software such as computer-aided detection
- CAD serves as a ‘second reader’ in a screening mammogram programme
Computer aided diagnosis

• Diagnosis made by a radiologist taking into account the computer output as a ‘second opinion’
• Causes of missed cancers
  • Poor image quality → training of radiographers and QA
  • Misinterpretation → training of radiologists
  • Oversight → second reader/CAD
• Used mainly in screening mammography
Digital vs SFM

- Detection of breast lesion
- **Workflow processes**
- Image quality including image post-processing
- Image archival and retrieval
Digital vs SFM

Reliance on personnel

Problems with film processing e.g. artifacts

DARKROOM
DO NOT ENTER
Digital vs SFM
Workflow processes

• A 45% reduction in the time taken to perform and process images using DM compared to SFM
• DM is also useful in stereotactic biopsy and hookwire localisation
• Hard-copy images of DM is consistent without presence of artifacts

Use of digital system during biopsy decreases the overall time of procedure as images do not need to be processed for needle placement.
Digital vs SFM

- Detection of breast lesion
- Workflow processes
- **Image quality including image post-processing**
- Image archival and retrieval
Digital vs SFM – Image quality

- DM is able to manipulate digital information
- Repeat rate with DM is low
- DM can change image contrast, zoom and magnify
- Delineates subcutaneous skin better than SFM
- However no amount of image manipulation could compensate for a badly taken mammogram!
Mammogram mass

benign  Sebaceous cyst
HPE – invasive ductal carcinoma
Biopsy:
Mucinous carcinoma
Mammogram - mass

Carcinoma
Digital vs SFM

- Detection of breast lesion
- Workflow processes
- Image quality including image post-processing
- Image archival and retrieval
Digital vs SFM
Limitation of space
Workflow in a Radiology department with SFM

Limited storage
Missing films
Labour intensive
Degradation of films

RADIOLOGY DEPARTMENT, WARDS, CLINIC, OTHER HOSPITALS
Workflow in a Radiology department with Digital
# Digital Mammography: in summary

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<td><strong>Image quality</strong></td>
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Breast Tomosynthesis

- Acquisition of multiple images during Tomo scan
- Displays the breast in slices
- Reduces tissue overlap
- Reduction in compression pressure
- Dose? Similar to one view mammogram

Courtesy of Siemens
Breast Tomosynthesis

Courtesy of Hologic
Contrast-enhanced Mammography

- A pre-contrast mammogram is performed
- An iodine-based contrast media is injected
- Post-contrasted images are then acquired
- These images (pre-contrast and contrasted) are subtracted
Contrast – enhanced Mammography

Breast MR

- Has a high sensitivity in detecting breast lesion
- Has a high negative predictive value
- No radiation
Breast MR: Drawbacks

- Picks up benign lesion as well
- Gives rise to higher number of unnecessary biopsies
- Cost
Breast MR

- Not used for general population screening
- Reserved for young women with high risk of breast carcinoma
- Performed also in women with suspected multiple breast carcinomas
Breast MR

- Static T1WI, T2WI, STIR
- Contrast-enhanced
- Dynamic contrast-enhanced
- Spectroscopy
Breast MR

Courtesy of GE
Breast MR

Courtesy of GE
Breast MR

Courtesy of GE
Figure 1 (a) T1 pre contrasted (b) Contrast-enhanced T1-WT FLASH 3D showing an ill defined lesion with irregular margin, features typical of a carcinoma (c) Fat suppressed MRI image revealed a smaller satellite lesion (arrow) close to it. (c) The enhancement curve was Type III with an early peak and delayed phase rapid washout. Histology revealed multifocal invasive ductal carcinoma.
Conclusion

• Exiting developments in breast imaging mainly due to digital technology
• Multiple approach to image the breast
• Do not forget that NOTHING can compensate for an examination that is done badly
• Perform the best that you can every time!
THANK YOU