Biopsy Procedures and Margin Assessment: The role of imaging during breast cancer diagnosis and surgery

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For every 1,000 women who have a screening mammogram:

- 100* out of the 1,000 will return for additional mammogram and/or ultrasound due to something seen in the initial mammogram.
- 61 out of the 1,000 will have the additional imaging and find nothing is wrong.
- 20* out of the 1,000 will find what was seen in the imaging is likely not cancer and return in 6 months to keep watch on the finding.
- 19 out of the 1,000 will have a minimally invasive needle biopsy.
- 5 out of the 1,000 will be diagnosed with breast cancer.

When breast cancer is found this way, the cure rate is very high.

To learn more about the benefits and risks of annual mammography, visit MammographySavesLives.org.

*This will be lower for women who have had prior mammograms and higher for women who are having their first mammogram.
Biopsy imaging guidance
- X-ray guidance (stereo/DBT)
- US
- MRI
- Excisional biopsy

Breast-conserving surgery
- Staging: MRI (size of involvement)
- Localization
- Specimen imaging
Breast biopsy ~ 1990

Image-based target localization in the breast becomes available
  - enables use of a biopsy gun for breast biopsy

-> stereotactic breast biopsy
Imaging during the biopsy procedure

- Pre-procedure mammogram
Lesion is targeted in DBT scout.
DBT/Stereo image guidance

DBT Scout

Pre-fire Stereo

Post-fire Stereo
DBT/Stereo image guidance

DBT Scout

DBT Post-marker
DBT image guidance (DBT pre/postfire)
DBT image guidance (DBT pre/postfire)
Biopsy imaging guidance:
Verification of core specimen samples

Calcifications must be seen in tissue samples to confirm successful biopsy
Biopsy imaging guidance

- Stereotactic biopsy most common (52%) for non-palpable tumors
- Reasons for excisional biopsy (2006):
  - Too faint, too superficial, to posterior (5%)
  - Patient preference (5%)
  - Small (<1cm) or superficial, easier to excise (4%)
# of patients

1000

100

20

5

Screening mammography

Diagnostic mammography

Needle-core biopsy

Positive biopsy (cancer)

Biopsy imaging guidance
- X-ray guidance (stereo/DBT)
- US
- MRI
- Excisional biopsy

Surgery

Breast-conserving surgery
- Staging: MRI (size of involvement)
- Localization
- Specimen imaging
Breast cancer surgery

• Breast-conserving surgery (BCS):
  • Preferred method of treatment for early stage and uni-focal breast cancer *
  • The goal of breast-conserving surgery (BCS) is to excise the tumor with negative margins while achieving satisfactory cosmesis *

• Breast-conserving treatment (BCT):
  • BCS + radiation therapy

Pre-and intra-operative imaging

Tumor staging (lesion size)
  • MRI

Lesion localization
  • Needle (wire) localization
  • Radioactive seed localization

Determining whether localization and excision were successful
  • Lumpectomy specimen imaging
MRI staging: Tumor extent, multi-focality
Wire localization: Procedure

“Kopans needle”

Lesions identified in alphanumeric grid

Needles placed adjacent to biopsy clips using grid coordinates

Adequate positioning verified on orthogonal mammogram

Spring wire is deployed

Review on orthogonal mammogram
Radioactive seed localization

• Performed under ultrasound guidance
Orthogonal digital specimen radiography:
- Verification that clips and wires are within specimen
- Margin verification
Seed vs. wire localizations

• Several studies performed, no difference in margin status between both procedures


Lumpectomy specimen margins

Conservation of healthy breast tissue, improved cosmetic outcome

Removal of all cancer, minimize chance for recurrence

Re-excision required if positive margins are found at final pathology

Goal: 10% (American Society of Breast Surgeons)

Reported re-excision rates: 10-50%

Margin assessment - can we do better?

- Improved margin assessment with intra-operative 3D imaging
- Active area of research, novel devices are coming to market


Summary

• Imaging plays an important role during work-up of breast imaging findings
  • Biopsy guidance
  • Localization for surgical excision
  • Margin assessment of lumpectomy specimen

• Novel imaging systems are being developed to enable margin assessment in the operating suite during surgery