Breast Imaging

Conundrums:

Case based approach to breast cancer detection

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Disclosures

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Christine Wilson, BC Cancer Agency • Dr Paula Gordon, BC Women’s Hosp
Outline

Part I: To elucidate the diagnostic imaging pathway for:
The routine screen detected abnormalities
The clinically detected abnormalities
The imaging occult abnormalities

Part II:
Introduction to male breast diseases
Imaging recommendations
BC Screen vs Clinically detected abnormalities

Screening: Asymptomatic
Biannual screening offered to asymptomatic women $\geq 40$ yo
Annual screening offered to women with higher risk: 1st degree family history, genetic mutation carrier, prior chest radiation

Clinically detected: Symptomatic
Palpable abnormality, nipple discharge, nipple changes
Pain is not a typical indication
## Screening Mammography Program

### Program Overview

| Target Population | Women age 50-69 years  
|                  | Service also available to women age 40-49 & 70-74 and older |
| Screening Test   | Two-view screening mammograms |

### Abnormal recall rate

<table>
<thead>
<tr>
<th>Abnormal recall rate</th>
<th>2012</th>
<th>National target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial screen</td>
<td>17.3%</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>Subsequent screens</td>
<td>6.3%</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>Overall</td>
<td>6.9%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Screening Mammography Program 2015 Annual report
Screening Program Flow

- Screening Mammography
  - Abnormal
    - Additional views
      - Abnormal
      - Biopsy
    - Normal / Benign
      - Imaging surveillance
      - Screening program
      - Normal / Benign

Screening Mammogram: Case 1

54 F

L CC

L MLO
Screening Mammogram: Case 1

54 F

L CC

L MLO
Screen Detected: Abnormal or Suspicious

- Abnormal
- Additional views
  - Normal / benign
  - Biopsy
  - Imaging surveillance
- Screening mammography
- Normal / Benign
- Screening program
Screen Detected: Additional Views

L Mag CC

L Mag MLO
Screen Detected: Abnormal or Suspicious

- Abnormal
  - Additional views
    - Abnormal
      - Biopsy
    - Normal / benign
      - Imaging surveillance
      - Screening program
      - Normal / Benign
      - Screening Mammography
Screen Detected: BIRADS 4 Image guided Biopsy
Screen Detected: Biopsy showed IDC. Fine wire localization and excision.
High Risk Screening Program Flow

- **Screen**
  - Abnormal
  - Additional views
    - Abnormal
      - Biopsy
      - Imaging surveillance
    - Normal / benign
      - Normal / Benign
      - Screening program

Breast exam Q6 mon
Mammography Q12 mon ≥ 30yr
MRI Q12 mon 25-65 yr
High Risk MRI Screen: Case 2

49 F
BRCA1

Series: Collection MIP - SUB *PEAK* - Index: 10

133.8mm
Collection MIP - SUB *PEAK*
10 / 45

4-8-15

FOV: 53.3x41.8 cm
584x458
323.4Thk

Zoom 88%
W 554  L 277

5cm
High Risk Patient Program Flow

Breast exam Q6 mon
Mammography Q12 mon ≥ 30yr
MRI Q12 mon 25-65 yr
US: as advised

Screen

Abnormal

Additional views

Normal / Benign

Screening program

Abnormal

Biopsy

Imaging surveillance

Normal / benign
High Risk Screen: Additional views
High Risk Screen: Additional views
High Risk Screen: Additional views
High Risk Patient Program Flow

Screen

- Breast exam Q6 mon
- Mammography Q12 mon ≥ 30 yr
- MRI Q12 mon 25-65 yr
- US: as advised

Normal / Benign
Screening program

Abnormal

Additional views

Abnormal

Biopsy

Imaging surveillance

Normal / benign
High Risk Screen: Image guided biopsy showed IDC.
Pathway for clinically detected Abnormality

The most common presenting clinical finding is of a palpable abnormality, discharge, new nipple inversion, nipple changes

The initial diagnostic pathway is always physical examination

<table>
<thead>
<tr>
<th>Mass</th>
<th>Nipple discharge</th>
<th>Nipple changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical examination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnostic work up</td>
<td>Spontaneous, Single duct, Bloody or clear</td>
<td>If no mass, SMP if not up to date</td>
</tr>
<tr>
<td></td>
<td>Diagnostic work up</td>
<td>Suspicious: diagnostic work up</td>
</tr>
<tr>
<td></td>
<td>Cytology</td>
<td>+ surgical consult</td>
</tr>
<tr>
<td></td>
<td>galactogram</td>
<td></td>
</tr>
</tbody>
</table>
Clinically detected Abnormality

Mammography and ultrasound are often used concurrently for palpable breast masses. A negative diagnostic exam (BIRADS 1 or 2) has an estimated cancer rate and a negative predictive value of 0.3% and 99.7% respectively.\(^3\)

Dennis et al suggests that breast biopsy may be avoided in women with palpable abnormalities when both the ultrasound and mammography depict normal tissue at the lump site.\(^4\)

Clinical followup is recommended following a negative imaging exam since an MRI or palpation guided biopsy is reserved for those with persistent high clinical suspicion.
Clinically detected Abnormality: Case 3

31 F with enlarging mass and pinching sensation to chest wall
Palpable mass: Diagnostic Targeted US

Solid papillary carcinoma
Galactography: Case 4

Ductal carcinoma is the most common cause of bloody discharge. When discovered, surgical excision is recommended to:
- 60% upgrade to carcinoma
- 10% upgrade to a high risk lesion as DIN1B
15-30% of breast cancers are not detectable by standard screening mammography. This has been shown to be higher in <50 years and in those with dense breast (BIRADS C or D).

The primary limitation of full field digital mammography is overlapping dense fibro glandular tissue.

Dense breast is an independent risk factor for breast cancer.

This can be overcome in part by the advent of digital breast tomosynthesis when used in a screening setting in combination with US.
Aging and clinically occult breast cancer

A study of 27,825 asymptomatic women (1995 – 2000) with combined screening mammography, ultrasound (US), and physical exam found breast density was the most significant predictor of mammographic sensitivity and hormonal status. ** 15% of cancers detected only with US.

### Sensitivity of screening modalities for cancer detection in women of varying densities

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammography</td>
<td>98.0</td>
<td>82.0</td>
<td>64.4</td>
<td>47.8</td>
</tr>
<tr>
<td>US</td>
<td>NP</td>
<td>65.9</td>
<td>81.4</td>
<td>76.1</td>
</tr>
<tr>
<td>Physical exam*</td>
<td>22.0</td>
<td>31.7</td>
<td>28.8</td>
<td>34.78</td>
</tr>
</tbody>
</table>

* Breast density can not be determined by physical examination
Mammography alone detects 4–5 cancers/1,000 women screened each year\textsuperscript{14}

Addition of screening ultrasound in women with mammographically normal but dense breasts improves breast cancer detection by finding an additional 2.3 cancers per 1,000 women screened and 3.8 cancers/high-risk lesions per 1,000 women screened\textsuperscript{15}

To date, unlike some US States, there is no existing legislation in Canada to inform women of their breast density or to provide coverage of supplemental screening US to women with dense breast
Mammographically occult: Case 4

35 F

L CC

L MLO
Mammographically occult: Case 4

Biopsy proven Invasive ductal carcinoma

1.7 x 1.1 cm
Male breast disease

Male breast cancer comprises 1% of all male cancers and 0.6% of all breast cancers\(^1\)

<table>
<thead>
<tr>
<th>Category</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Cases</td>
<td>200</td>
<td>23,800</td>
</tr>
<tr>
<td>Incidence (per 100,000)</td>
<td>1</td>
<td>99</td>
</tr>
<tr>
<td>Deaths</td>
<td>60</td>
<td>5,000</td>
</tr>
<tr>
<td>Death rate (per 100,000)</td>
<td>0.3</td>
<td>19</td>
</tr>
<tr>
<td>5 yr survival (2006-8)</td>
<td>80%</td>
<td>88%</td>
</tr>
</tbody>
</table>

2015 Screening BC\(^4\)
Normal Male Breast

Breast tissue of both sexes are identical at birth and remains quiescent until hormonal stimulation at puberty.

- Estrogen: Temporary proliferation of ducts and stroma
- Testosterone: Involution of ducts
- No Progesterone: No development of terminal lobular units (unless exposed to increased level of estrogen.)
Normal Male Breast

Contains ductal and connective tissue. No suspensory ligaments of Cooper

Male: scattered ducts without lobules

Female: organized ducts and lobules
Male Breast Imaging

Male breast disease is too few to justify screening mammography

When mammography yields suspicious findings not characteristic of gynecomastia, sonography is effective

The small breast size facilitates optimal ultrasound penetration allowing assessment of deep regions
Nova Scotia experience

Review of 1466 male patient encounters over a 13 year period

Gynecomatia is very common and can often be difficult to differentiate from malignancy by imaging particularly on ultrasound which does not add to diagnostic accuracy and can decrease specificity

Found that false positives were more likely to occur when US was also used compared to mammography alone (23.7%, 83/350 vs 7.3%, 60/818)

A final diagnosis of gynecomastia very commonly resulted in a false positive imaging test (22 out of 45 pathology proven cases of gynecomastia receiving a BI-RADS of 3 or higher)

<table>
<thead>
<tr>
<th></th>
<th>PPV</th>
<th>NPV</th>
<th>+LR</th>
<th>Sens</th>
<th>Spec</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mx</td>
<td>10.4%</td>
<td>100%</td>
<td>13.5</td>
<td>100%</td>
<td>92.6%</td>
<td>60.6%</td>
</tr>
<tr>
<td>US +/- Mx</td>
<td>2.4%</td>
<td>100%</td>
<td>4.2</td>
<td>100%</td>
<td>76.1%</td>
<td>58.6%</td>
</tr>
</tbody>
</table>

Greenlaw, Yen et al. 2011
Male Breast disease: Gynecomastia

The abnormal increase in the stromal and ductal component of the male breast which is in response to increased estrogen : testosterone ratio

Most common male breast pathology. Found in up to 55% of male breasts in one autopsy series

Pathologically, gynecomastia progresses through several stages

There are many recognized causes with non-hormonal causes frequently associated with unilateral gynecomastia

<table>
<thead>
<tr>
<th>Cause</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idiopathic</td>
<td>25%</td>
</tr>
<tr>
<td>Cirrhosis</td>
<td>8%</td>
</tr>
<tr>
<td>Puberty</td>
<td>25%</td>
</tr>
<tr>
<td>Drugs</td>
<td>10-20%</td>
</tr>
</tbody>
</table>
Gynecomastia

Nodular

Dendritic

Diffuse

Yen et al.
Male Breast Cancer

Past studies have suggested an increased incidence of male breast malignancy from 0.85 to 1.3 per 100,000 between 1973 and 2000.

Mean age: 67 (only less than 6% of cancer in < 40 yo)

Current principles of management are based on female breast cancer trials

Reported to present at a more advanced stage even though cancer behavior and aggressivity are considered equivalent to that of postmenopausal female breast cancer

Reported risk Factors:

<table>
<thead>
<tr>
<th>Genetic</th>
<th>Lifestyle</th>
<th>Work</th>
<th>Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRCA2</td>
<td>Obesity</td>
<td>High ambient temp</td>
<td>Testicular damage</td>
</tr>
<tr>
<td>Klinefelter</td>
<td>Alcohol</td>
<td>Exhaust emission</td>
<td>Liver damage</td>
</tr>
<tr>
<td></td>
<td>Estrogen</td>
<td></td>
<td>Chest radiotherapy</td>
</tr>
</tbody>
</table>

**Gynecomastia is NOT a risk factor**
Male Breast Cancer: Subtypes

All of the histological subtypes identified in the female breast have been observed in the male breast.

<table>
<thead>
<tr>
<th>Histology</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invasive Ductal</td>
<td>90%</td>
</tr>
<tr>
<td>Ductal carcinoma in situ</td>
<td>10</td>
</tr>
<tr>
<td>Invasive papillary</td>
<td>2</td>
</tr>
<tr>
<td>Medullary</td>
<td>2</td>
</tr>
<tr>
<td>Mucinous</td>
<td>1</td>
</tr>
<tr>
<td>Paget’s</td>
<td>1</td>
</tr>
<tr>
<td>Lobular</td>
<td>1</td>
</tr>
</tbody>
</table>

*Lancet 2006*
Male Breast Cancer

Invasive ductal carcinoma. 72-year-old male with a three month history of new right nipple retraction and tender retroareolar firmness.

R Mag CC
Male Breast Cancer

Paget’s disease. 80-year-old male with a firm mobile lump under the left breast.

L MLO
Male Breast Cancer

A young male presents with swelling around the L nipple for 2 weeks. Reported as BI-RADS and stereotactic biopsy was performed. Pathology showed unilateral gynecomastia, florid type.
Summary

Review of the flow of diagnostic imaging in the identification of female breast cancer
Review of the flow of diagnostic imaging in the setting of a clinical finding
Review of the limitations of mammography in the detection of breast lesions
Review of the male breast disease and the role of diagnostic imaging


References


