Breast Imaging

youropenhouse.us
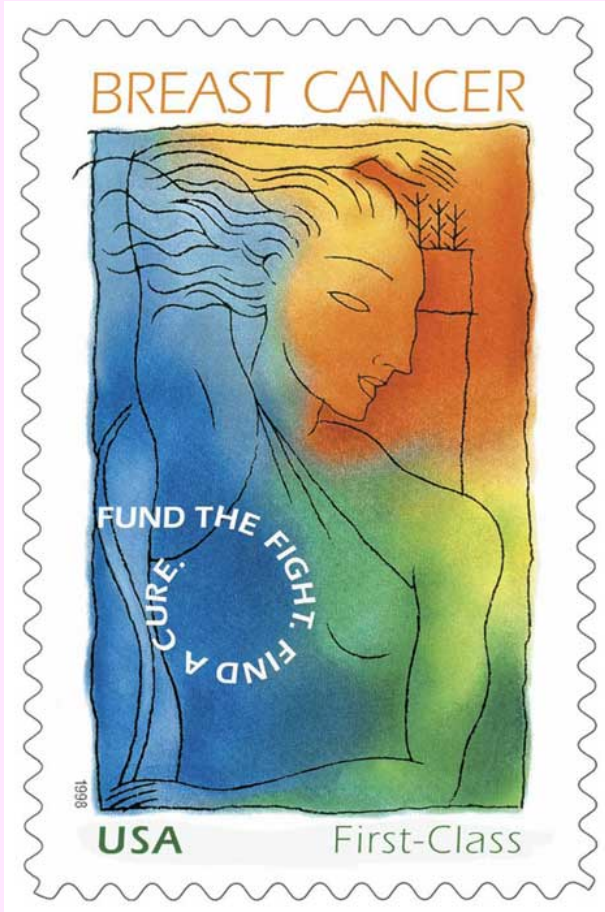
Kathleen Ruchalski, HMS IV
Gillian Lieberman, MD
BIDMC Radiology

Agenda

ajcarver.org

- Introduce our patient
- Mammography
- Breast MRI
- Breast ultrasound
- Radiological evaluation for metastasis
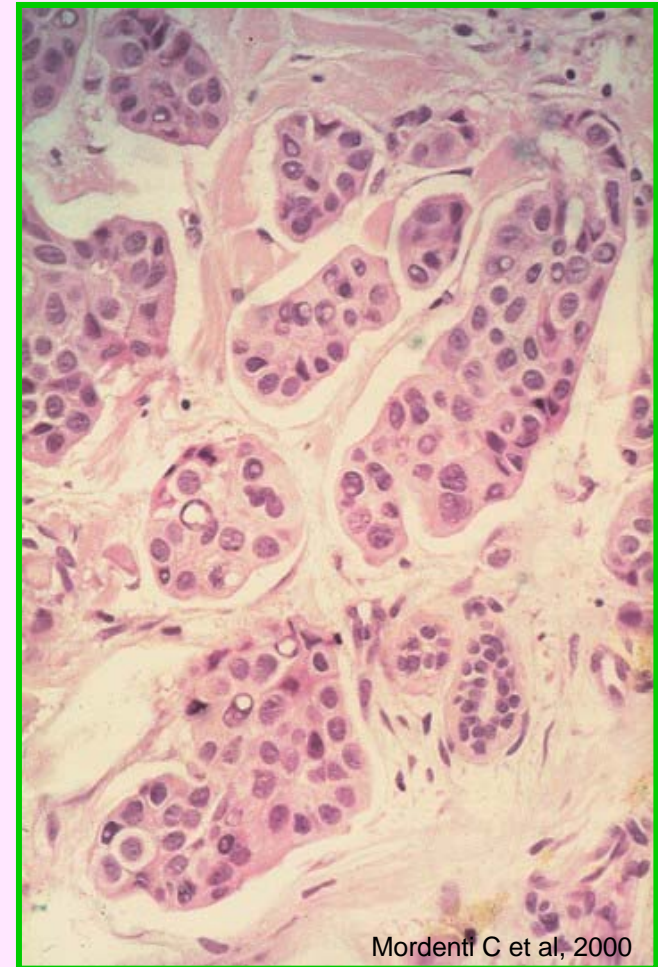- Breast cancer facts
- Summary

Our patient: Presentation

- MG is a 71 year old woman who presented to her dermatologist with an itchy right inframammary fold skin lesion

- Last screening mammogram in 2004
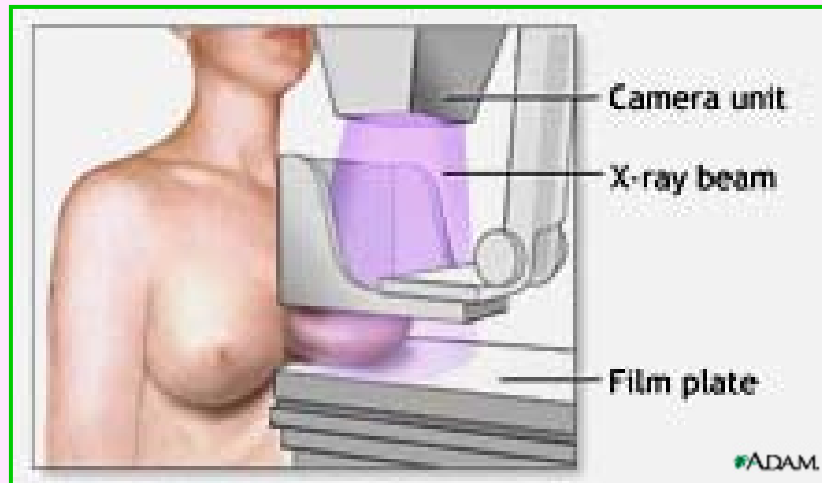
- Underwent a punch biopsy
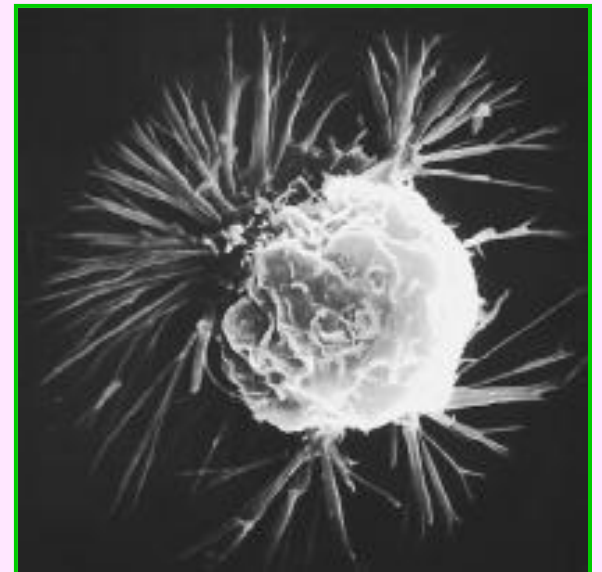
Our patient: cutaneous punch biopsy

- Pathology: metastatic adenocarcinoma of unknown primary site

- Pathologist suspects breast cancer
  - Breast cancer commonly forms islands of gland-like neoplastic cells within the dermal layer of skin.

Mordenti C et al, 2000

Introduction to Mammography

RadiologyInfo.org

- Mammography is a breast radiograph
- Standard method to evaluate breast
- Can be used for:
  - Cancer screening
  - Diagnostic evaluation

Camera unit

X-ray beam

Film plate

ADAM.
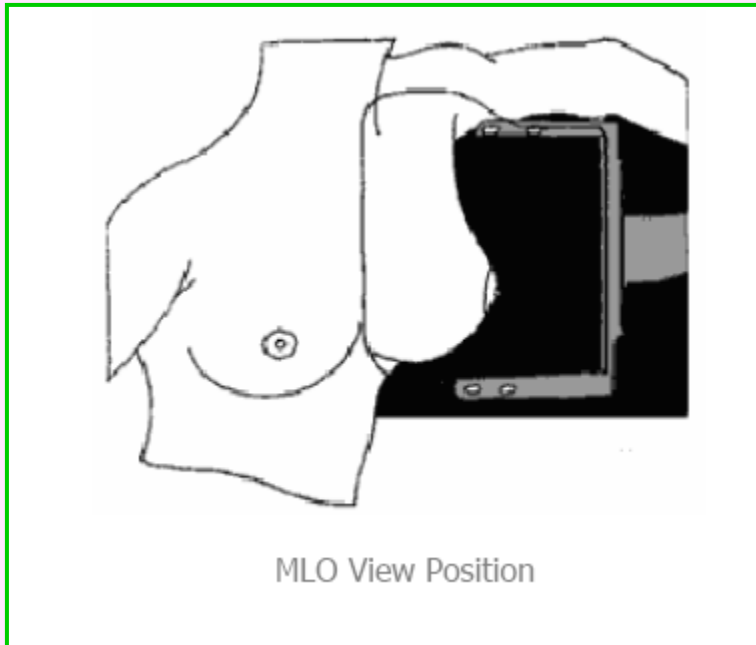
Screening Mammography

herspacebreast.com

Indications

- Annual exam: starting at age 40
- High risk: age 30 or 10 years earlier than at age mother's breast cancer was detected
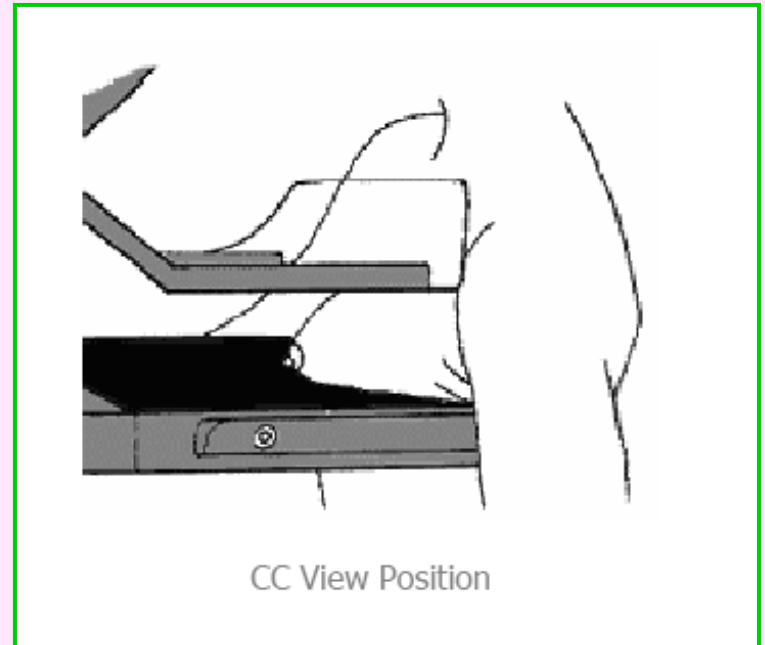
Screening Mammogram Views

Mediolateral oblique

MLO View Position

☓ The MLO view estimates the location of a mass either superior or inferior to the nipple with slight variation due to the obliquity (angle).
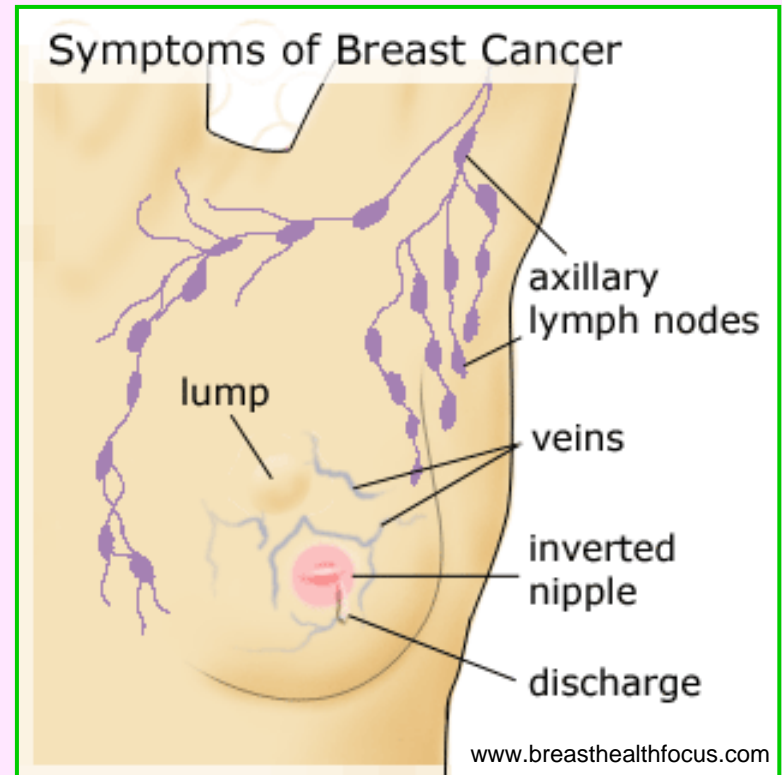
Craniocaudal

CC View Position

☓ The CC view describes the location of a mass either medial or lateral to the nipple.

Diagnostic Mammography

Indications

- Mass(es): palpable or detected on screening mammography
- Microcalcifications
- Architectural distortion
- Parenchymal asymmetry
- Palpable abnormality
- Focal tenderness
- Spontaneous nipple discharge

Symptoms of Breast Cancer

axillary lymph nodes

lump

veins

inverted nipple

discharge

www.breasthealthfocus.com

Mammographic signs of malignancy

– Breast asymmetry

– Masses

– Architectural distortion

– Skin thickening

– Nipple retraction

– Suspicious calcifications

- Linear or branching
- Clusters
- Punctate

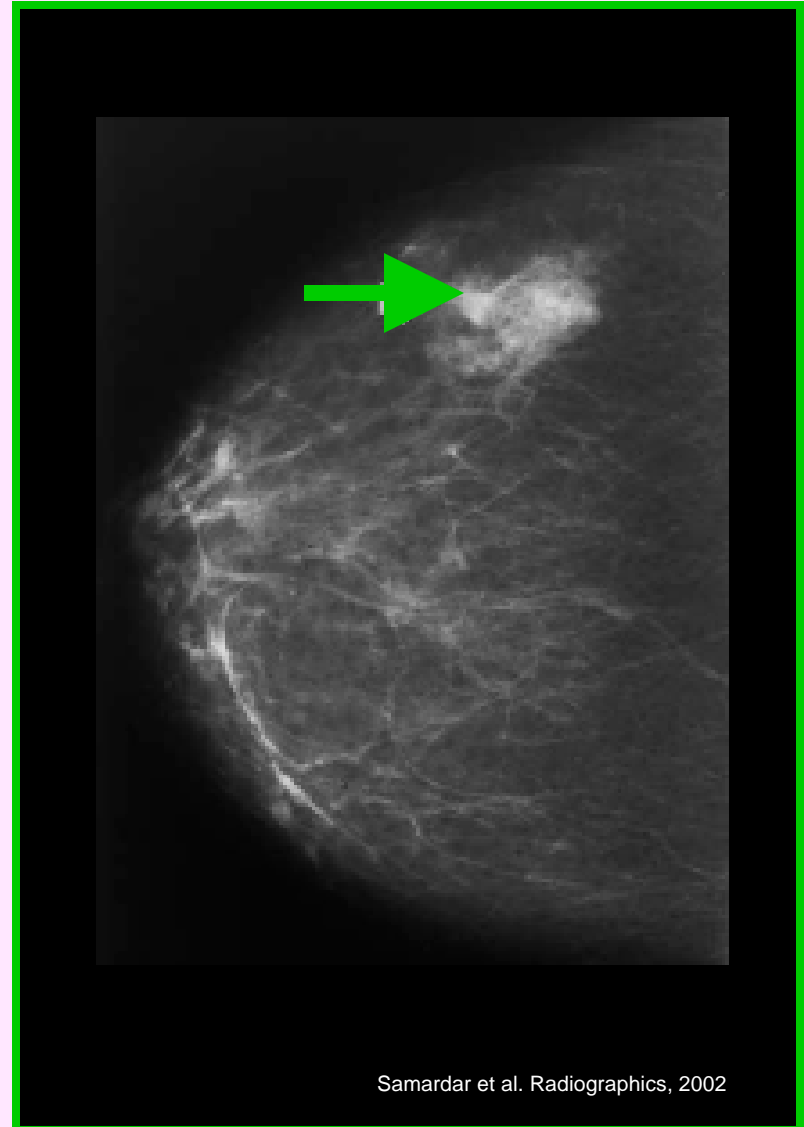sprojects.mmi.mcgill.ca/mammography/asymmetry.htm

Mammographic signs of malignancy

- Breast asymmetry
- Masses
- Architectural distortion
- Skin thickening
- Nipple retraction
- Suspicious calcifications
  - Linear or branching
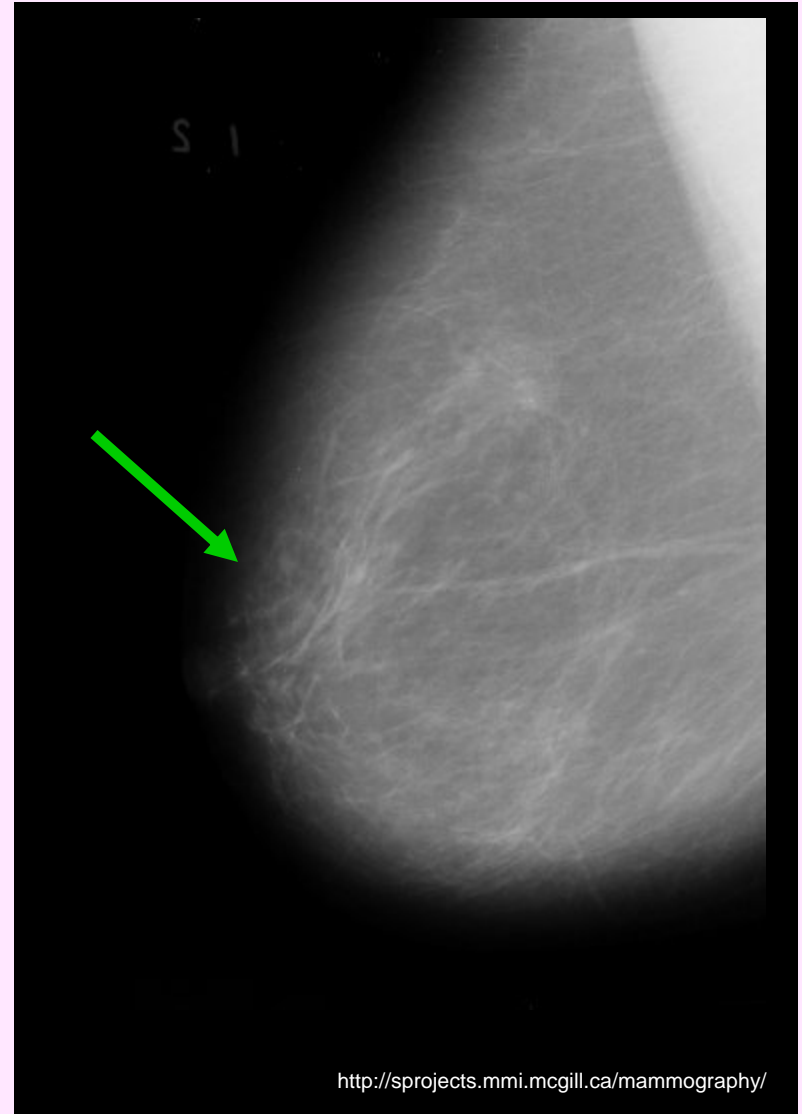 - Clusters
  - Punctate

Samardar et al. Radiographics, 2002

Mammographic signs of malignancy

– Breast asymmetry

– Masses

– Architectural distortion

– Skin thickening

– Nipple retraction

– Suspicious calcifications

 • Linear or branching

 • Clusters

 • Punctate

http://sprojects.mmi.mcgill.ca/mammography/

Mammographic signs of malignancy

– Breast asymmetry

– Masses

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– Skin thickening

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– Suspicious calcifications

  • Linear or branching

  • Clusters

  • Punctate

www.radiographicceu.com/article31.html

Mammographic signs of malignancy

– Breast asymmetry

– Masses

– Architectural distortion

– Skin thickening

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– Suspicious calcifications
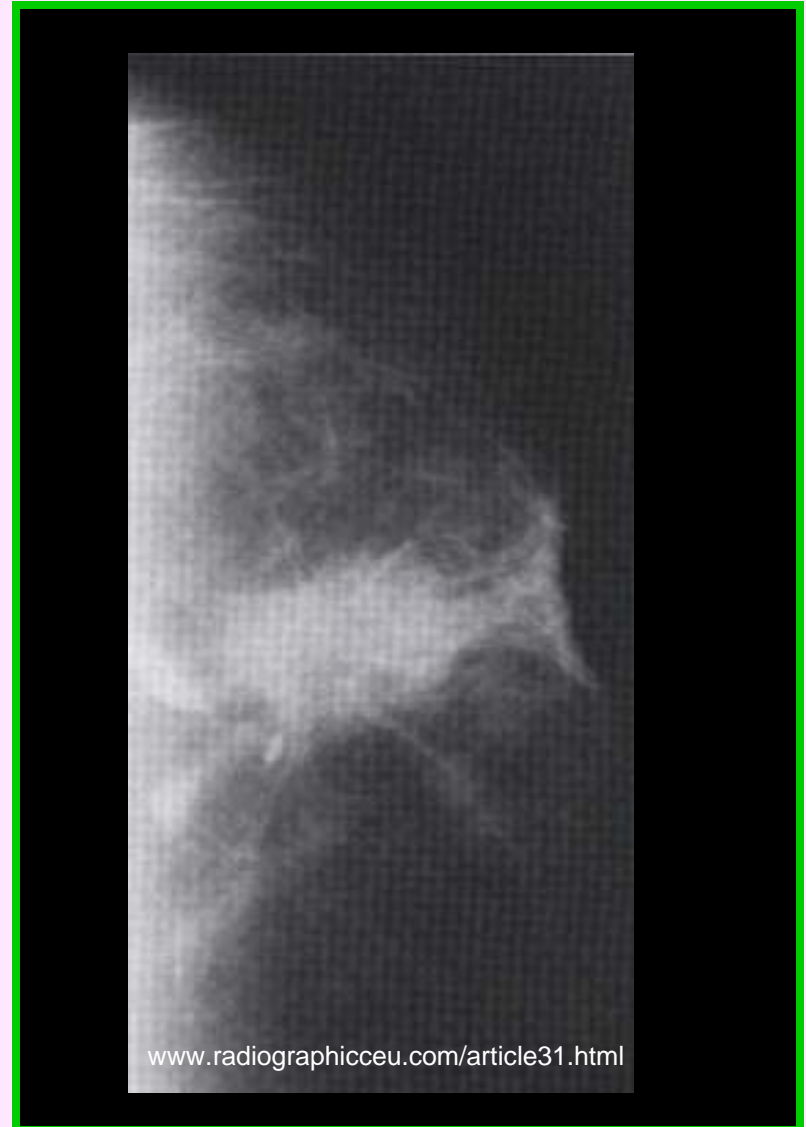
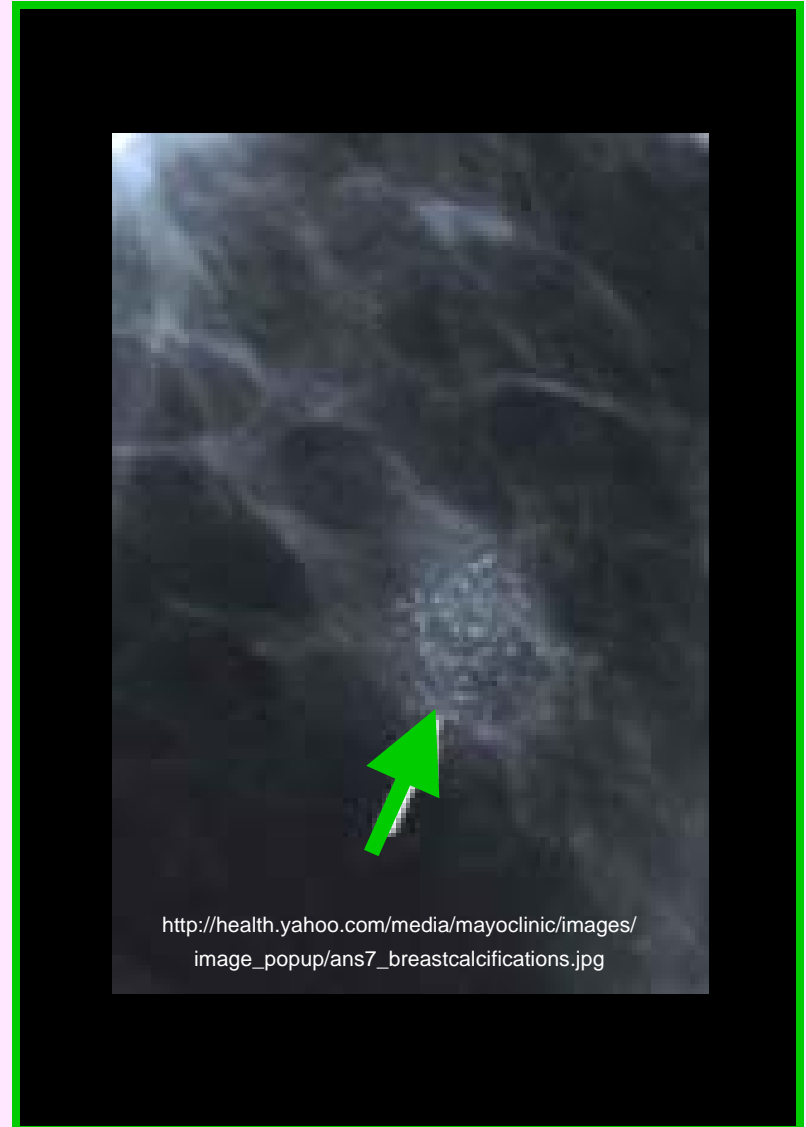- Linear or branching

- Clusters

- Punctate

http://health.yahoo.com/media/mayoclinic/images/
image_popup/ans7_breastcalcifications.jpg

Breast Imaging Reporting and Data System (BI-RADS)

Category 0: Need additional imaging
- Spot compression and magnification
- Ultrasonography

Category 1: Negative

Category 2: Benign finding

Category 3: Probably benign finding
- Short term interval follow-up
- <2% risk of malignancy
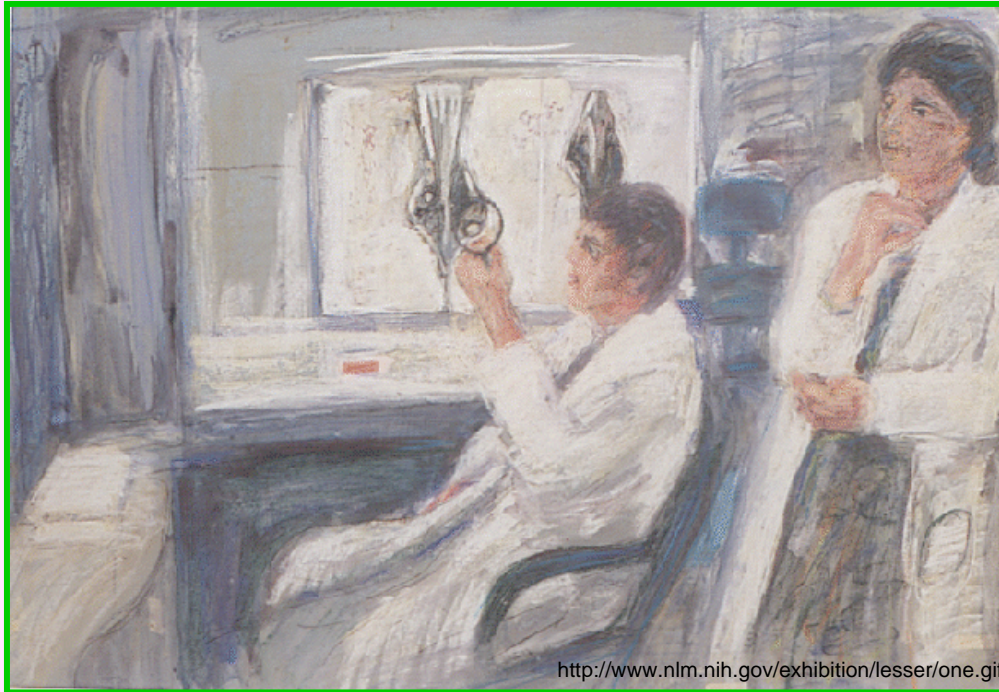
Category 4: Suspicious abnormality
- Consider biopsy
- 25-50% risk of malignancy

Category 5: Highly suggestive of malignancy
- Appropriate action should be taken
- 75-99% risk of malignancy

Category 6: Biopsy proven malignancy

Our patient: mammography results

http://www.nlm.nih.gov/exhibition/lesser/one.gif
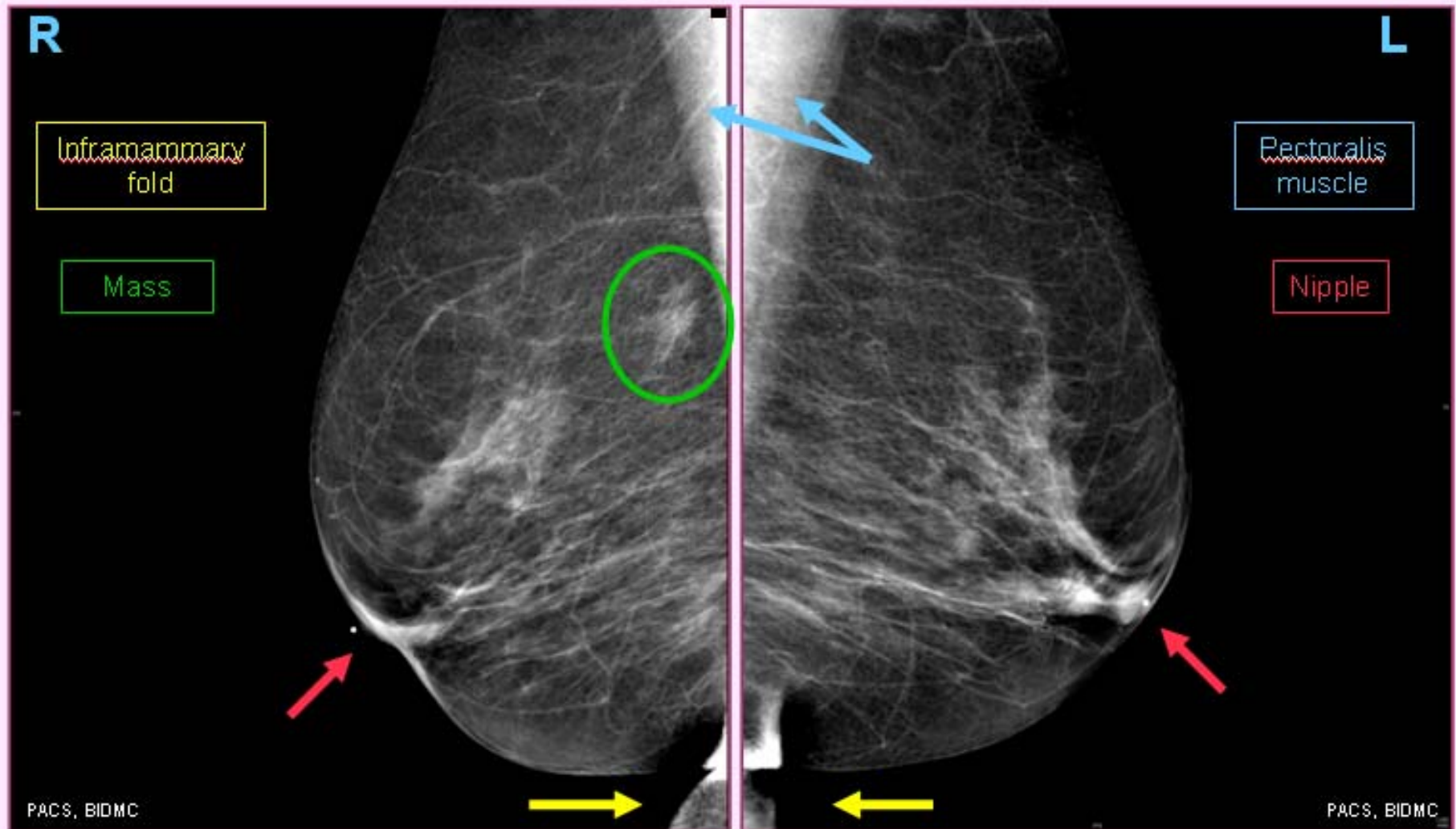
CC & MLO markers delineated a mass
posteriorly in the upper outer quadrant

Our patient: Cranio-Caudal (CC) view of diagnostic mammogram
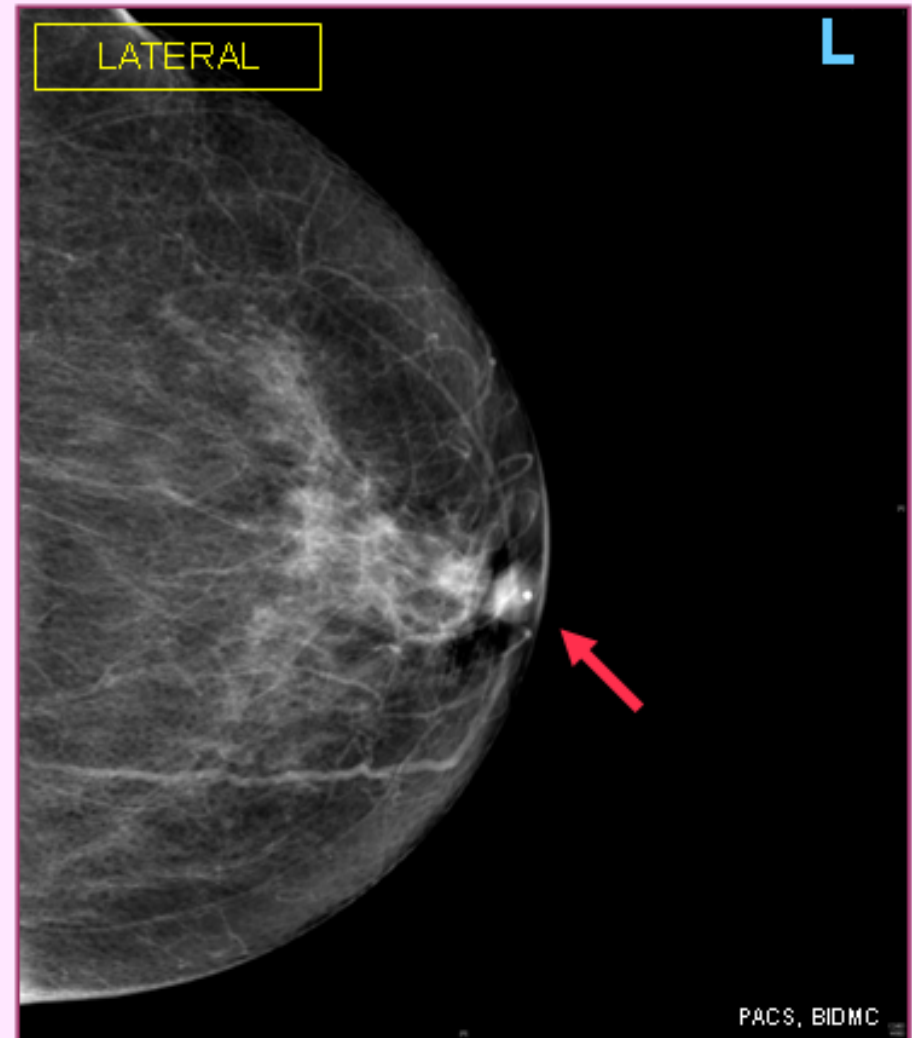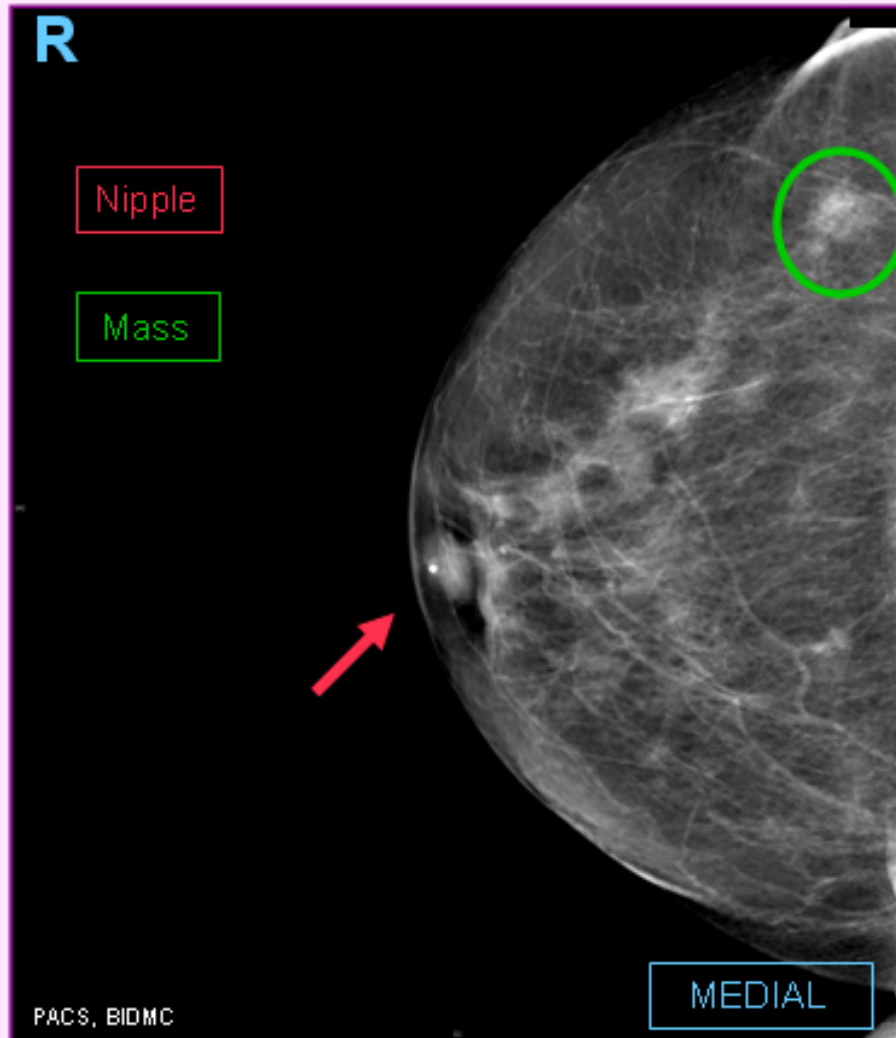
Our patient: Mediolateral-oblique (MLO) view of diagnostic mammogram

Our Patient:

- Recommended to undergo a breast MRI to better evaluate findings & assist in cancer staging

www.uwhealth.org/.../5939_figure_1(1).jpg
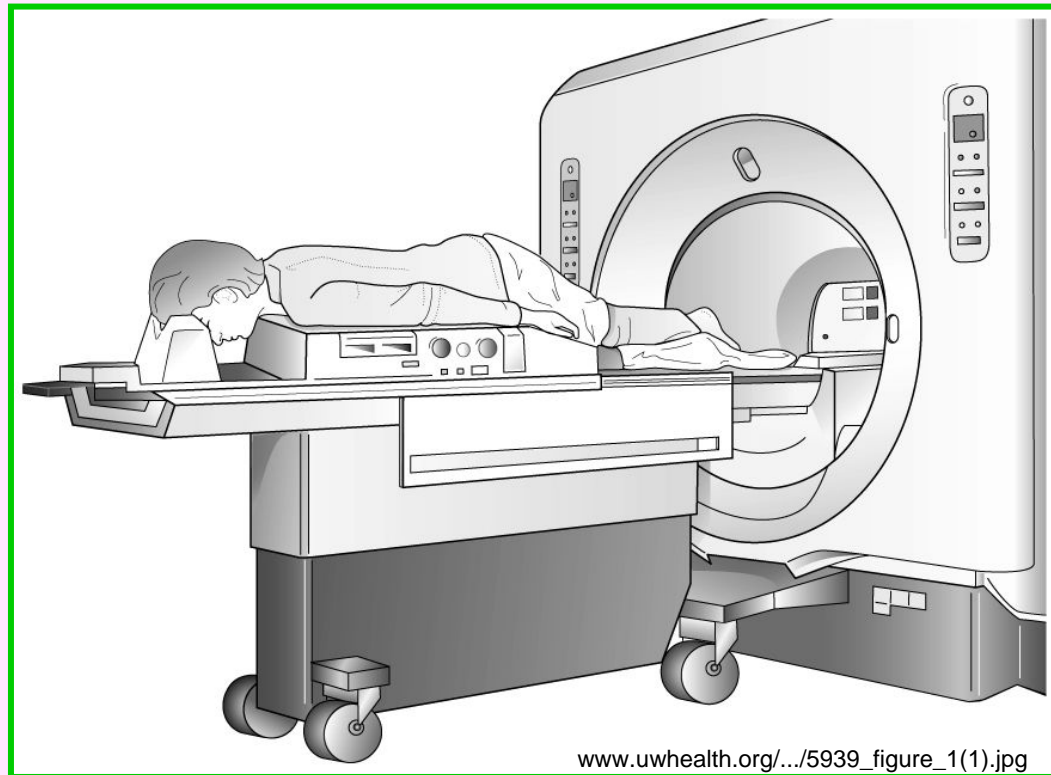
Breast MRI

- Adjunct to mammography & sonography
- Not for populations with low prevalence of breast cancer
  - High sensitivity
  - Low specificity: unnecessary workups

- False positive enhancement:
  - fibroadenomas, fat necrosis, radial scars, lymph nodes, mastitis, atypical hyperplasia

- MRI guided breast biopsies

Cancer-genetics.com

Breast MRI Indications

www.imaginis.com/breasthealth/mri.asp

- Identifying clinically/ mammographically occult primary tumor

- Staging and treatment planning

- Evaluating response to chemotherapy

- Detecting recurrent cancer in postreatment breast

- Evaluating breast implants: rupture and masses

- Screening high-risk women (BRCA positive)

www.medicalimagingmag.com

Breast MRI Kinetics

- Evaluation of lesions after contrast injection

- Enhancement rate (Wash-in)
  - Amount of increased intensity at area of concern
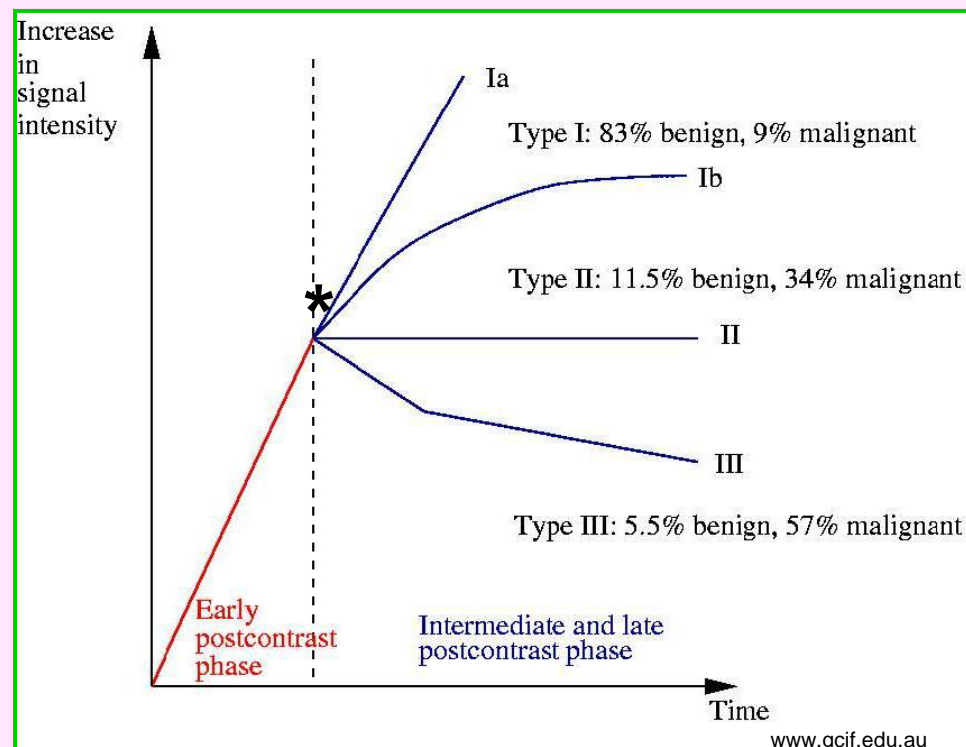 - Measured 1 minute after injection of contrast

Bronson, www.medicalimagingmag.com

Breast MRI Kinetics

Time-signal intensity curve (Delayed phase)

– <u>Type 1: Persistent curve</u> continuous enhancement increasing in intensity

– <u>Type 2: Plateau curve</u> peak enhancement 2- 3 min after contrast; then staying constant at this intensity

– <u>Type 3: Washout</u>
decrease in signal intensity after peak enhancement

* 2-3 min peak enhancement

Increase in signal intensity

Ia

Type I: 83% benign, 9% malignant

Ib

Type II: 11.5% benign, 34% malignant

*

II

III

Type III: 5.5% benign, 57% malignant

Early postcontrast phase

Intermediate and late postcontrast phase

Time

www.qcif.edu.au

MRI signs of breast malignancy:

- Morphology
  - Spiculated margin
  - Heterogeneous enhancement
  - Irregular shape of mass

- Kinetics
  - Wash in: fast enhancement velocities
  - Delayed phase: Plateau (type II) and Washout (type III)

www.hsc.wvu.edu/som/radio/cai/MRI.asp

www.radiologyregional.com
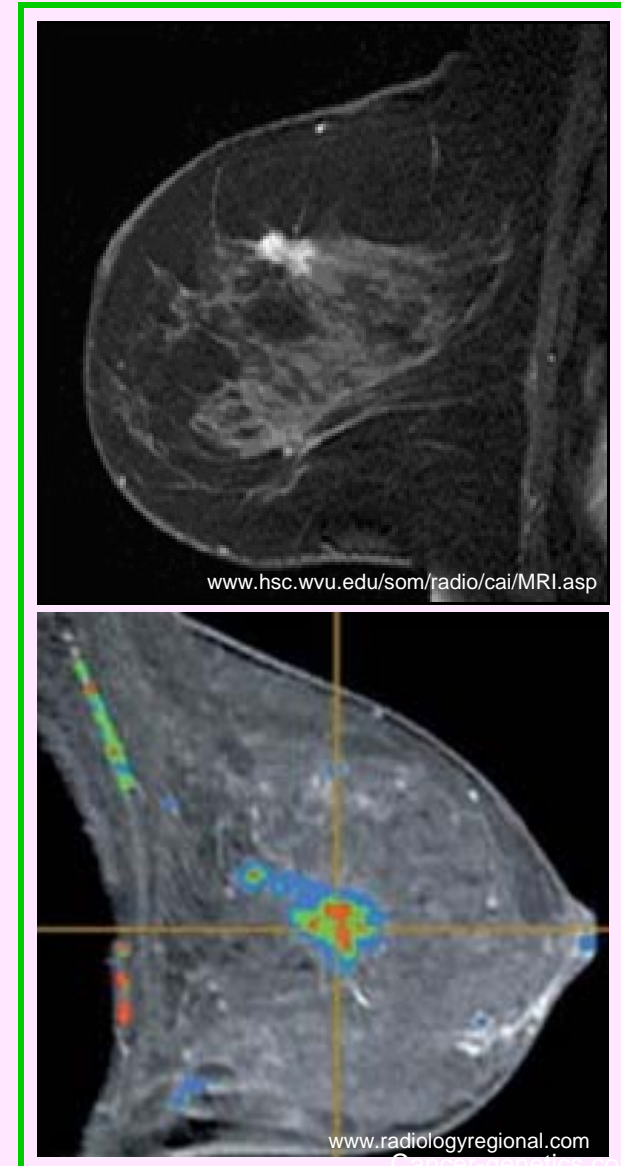
Our Patient: Breast MRI
T1 weighted with fat suppression

Breast Mass

Pre-contrast

Post-contrast

Delayed

Subtraction

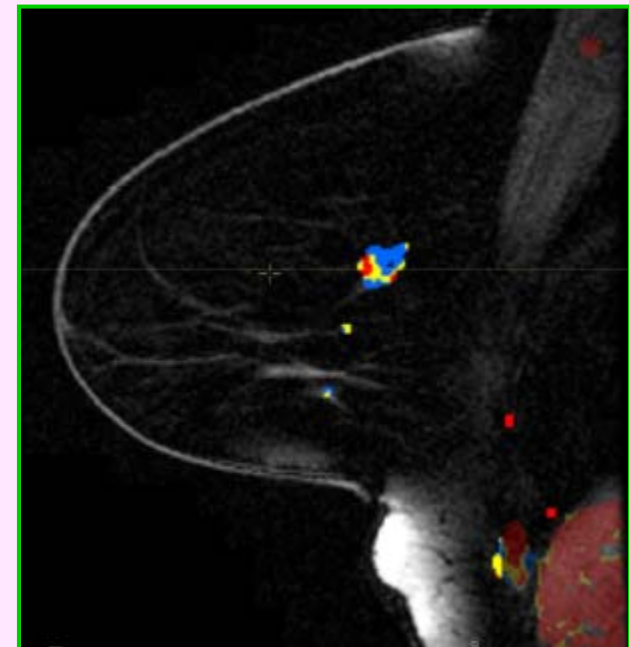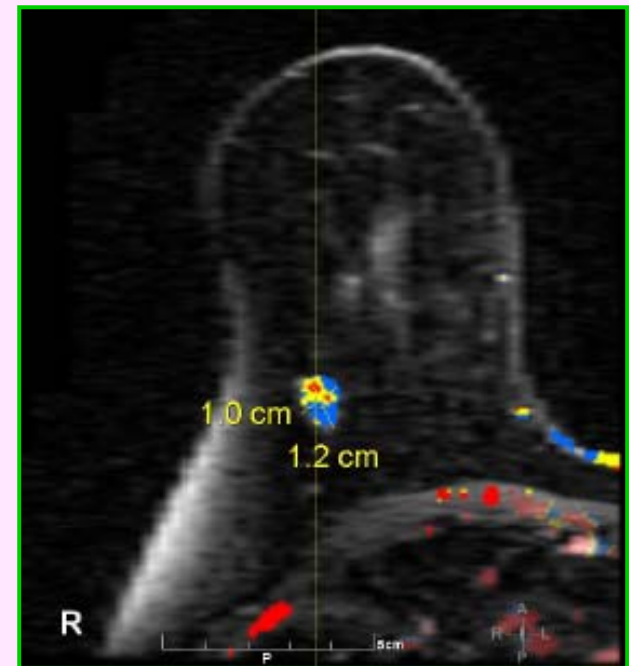*Courtesy of Dr. Venkataraman*

Our Patient: MRI Kinetics

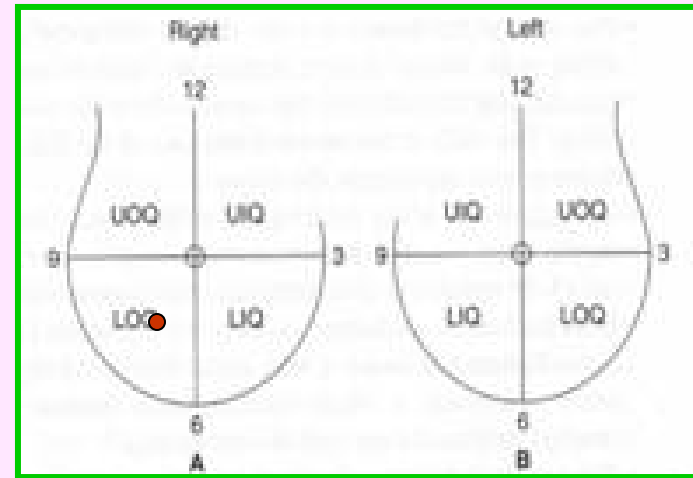Breast mass contains all 3 curves
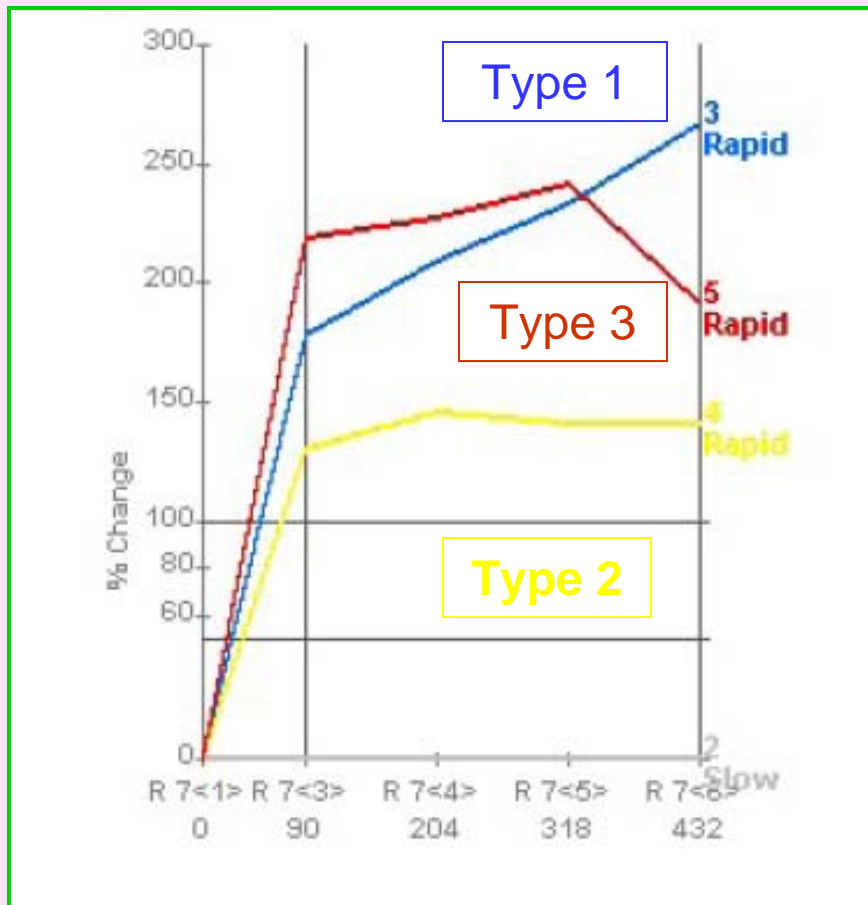
Courtesy of Dr. Venkataraman

Our patient: Summary

- Mammogram
  - Suspicious mass at 9 o'clock

www.radiographicceu.com

- MRI
  - Morphology: ill-defined, spiculated, heterogeneously enhancing
  - Kinetics: with Type III (rapid wash out) curve

- An ultrasound guided breast biopsy was recommended

Breast Ultrasound Indications

- Cystic vs. solid masses

- Characterization of solid masses
  - Benign vs. malignant

- Further evaluation of mammographic densities

- Evaluate palpable masses in women who are pregnant, lactating, < 30 years old

- Guide interventional procedures

US characteristics of malignancy

- Hypoechogenicity
- Spiculation
- Growth out of normal tissue planes
  - Mass that is taller than wider
- Angular margins
- Shadowing
- Microlobulation
- Duct extension
- Calcifications
  - high specular echoes within mass
- Branch pattern

Houssami et al; Australian Family Physician 2005

Roubidoux et al; Radiology 2004
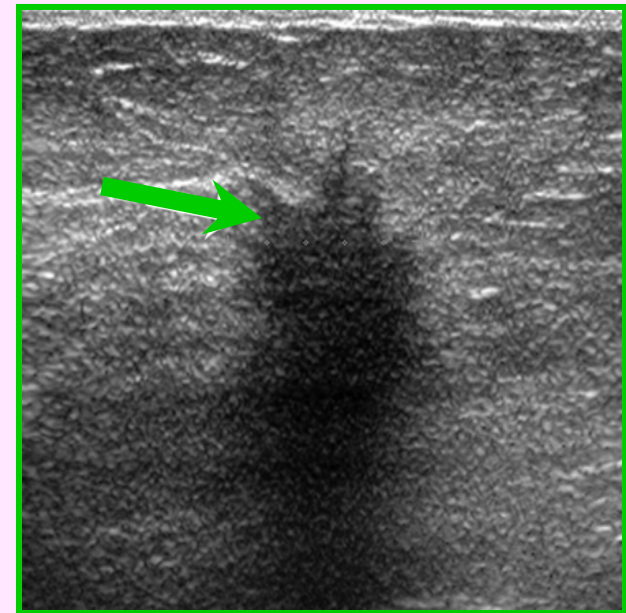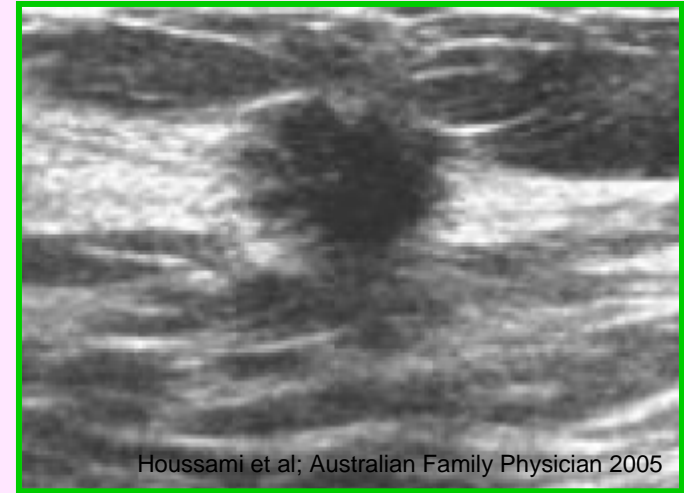
Our patient: Breast ultrasound

Mass:

- Hypoechoic
- Ill-defined borders
- Vertical growth

Our Patient:
Ultrasound guided Breast Biopsy

Our patient: Ultrasound-guided breast biopsy

BX 1` 2 3 4 5   CLIP   3.5·

PACS, BIDMC   Rt Breast   9:00   9CM   Trans

Our patient: Ultrasound-guided breast biopsy

NEEDLE

BX 1` 2 3 4 5 CLIP

PACS, BIDMC

Rt Breast 9:00 9CM Trans

3.5·
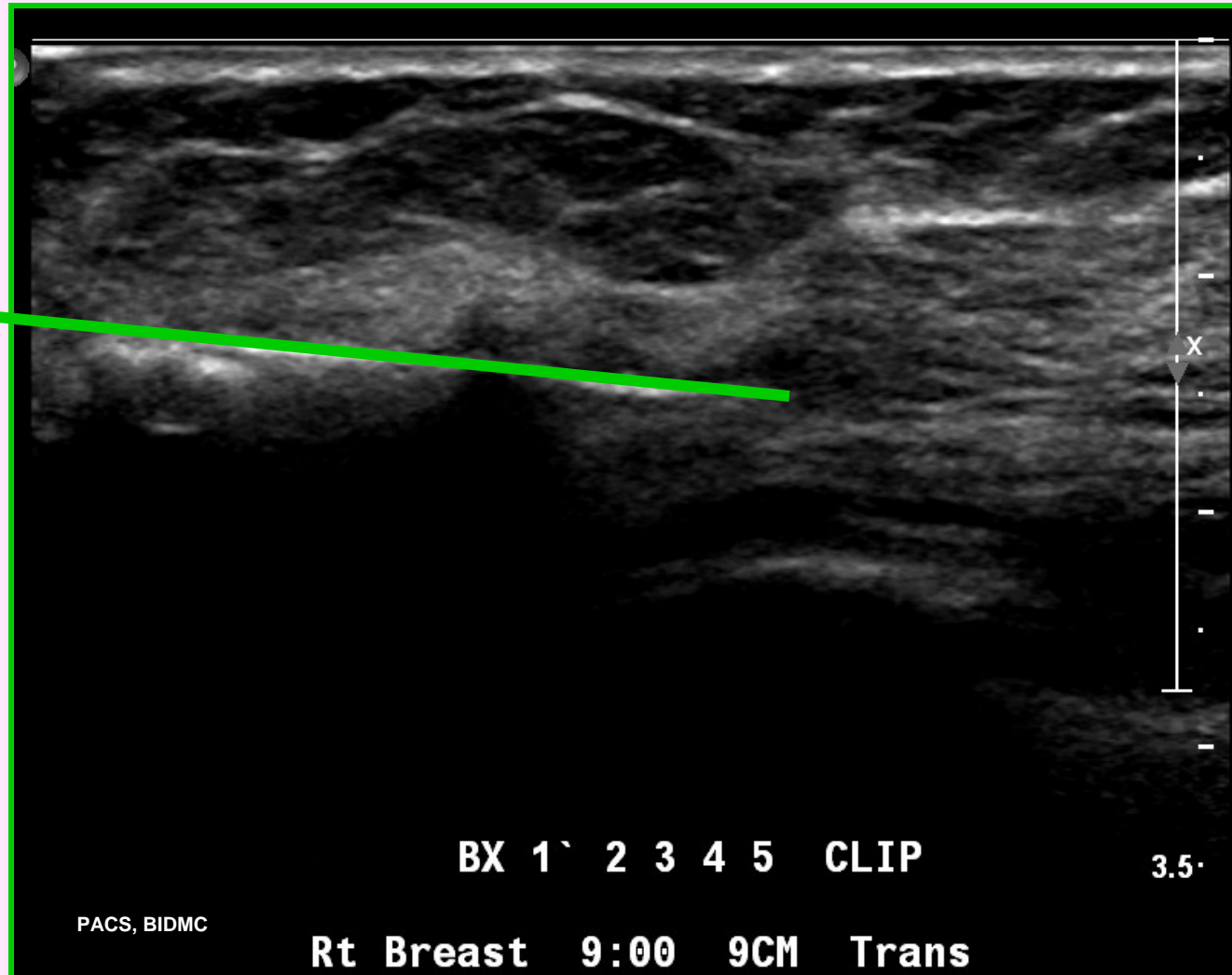
Our Patient: ultrasound biopsy results

www.health.state.ny.us/nysdoh/breast_cancer
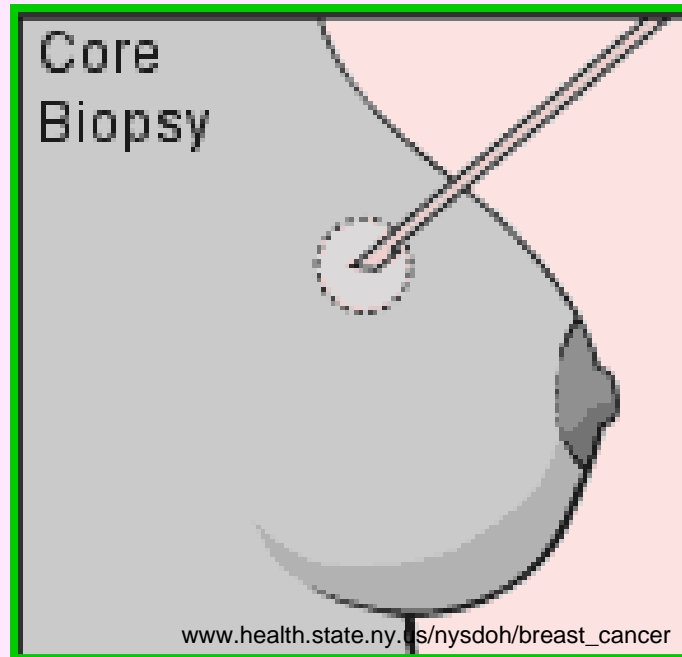
Infiltrating ductal carcinoma

Breast Cancer Staging (TNM)

Primary tumor: size in greatest dimension

- T1: < 2cm
- T2: >2cm and < 5cm
- T3: > 5cm
- T4: any size with extension
  - T4a: chest wall
  - T4b: breast skin edema/ulceration; skin nodules
  - T4c: T4a & T4b
  - T4d: inflammatory carcinoma

Stage 1
Early disease: tumour confined to the breast (node-negative)

Stage 2
Early disease: tumour spread to movable ipsilateral axillary node(s) (node-positive)
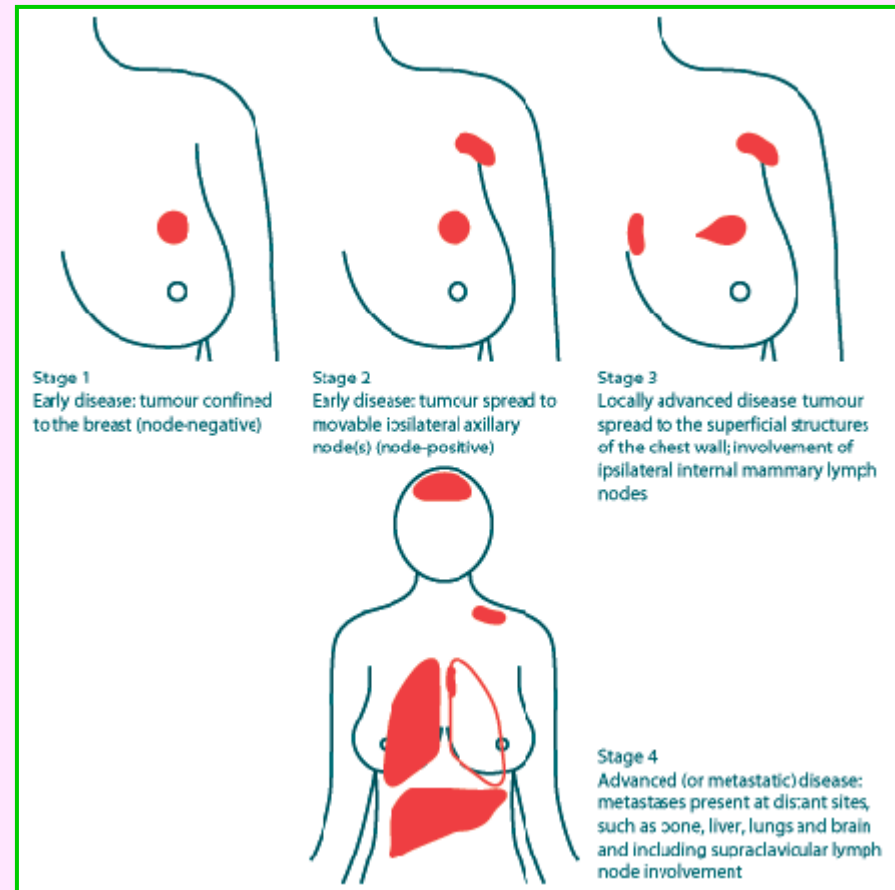
Stage 3
Locally advanced disease tumour spread to the superficial structures of the chest wall; involvement of ipsilateral internal mammary lymph nodes

Stage 4
Advanced (or metastatic) disease: metastases present at distant sites, such as bone, liver, lungs and brain and including supraclavicular lymph node involvement

www.breastcancersource.com

Staging: Our patient

Primary tumor: size in greatest dimension
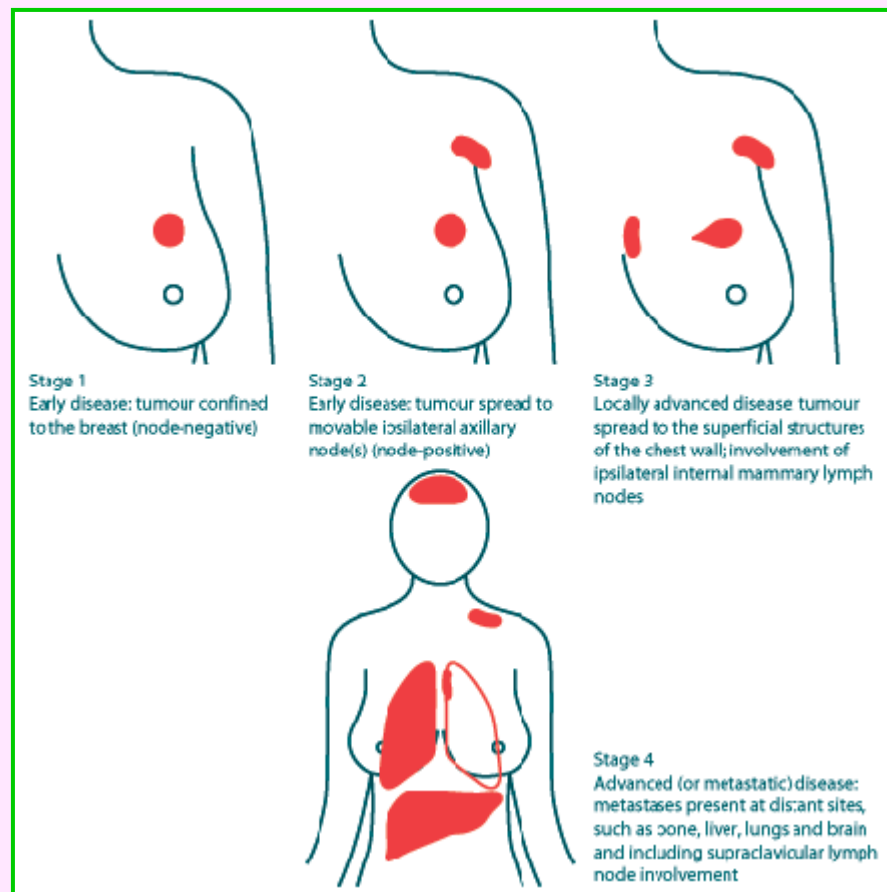
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  - T4c: T4a & T4b
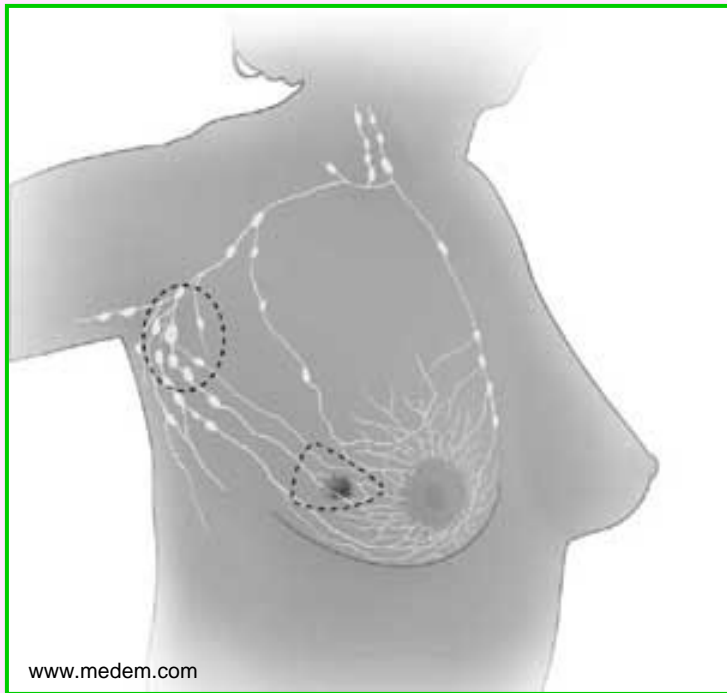 - T4d: inflammatory carcinoma

Stage 1
Early disease: tumour confined to the breast (node-negative)

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Early disease: tumour spread to movable ipsilateral axillary node(s) (node-positive)

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Locally advanced disease tumour spread to the superficial structures of the chest wall; involvement of ipsilateral internal mammary lymph nodes

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www.breastcancersource.com

Breast Cancer Staging (TNM)
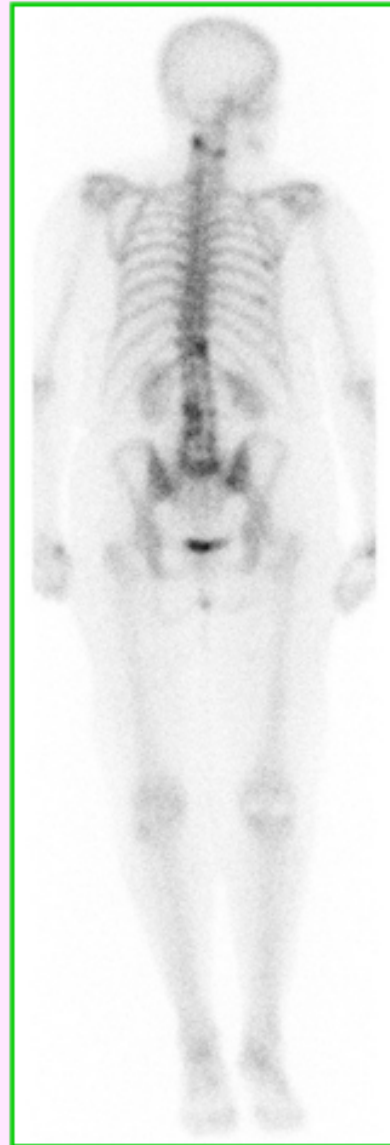

www.medem.com

- Lymph nodes
  - N1: ipsilateral movable lymph nodal involvement
  - N2: fixed axillary nodes
  - N3: ipsilateral internal mammary nodal involvement
- Metastasis
  - M0: no distant metastasis
  - M1: distant metastasis

Our patient : staging thoracic CT with contrast

Breast mass
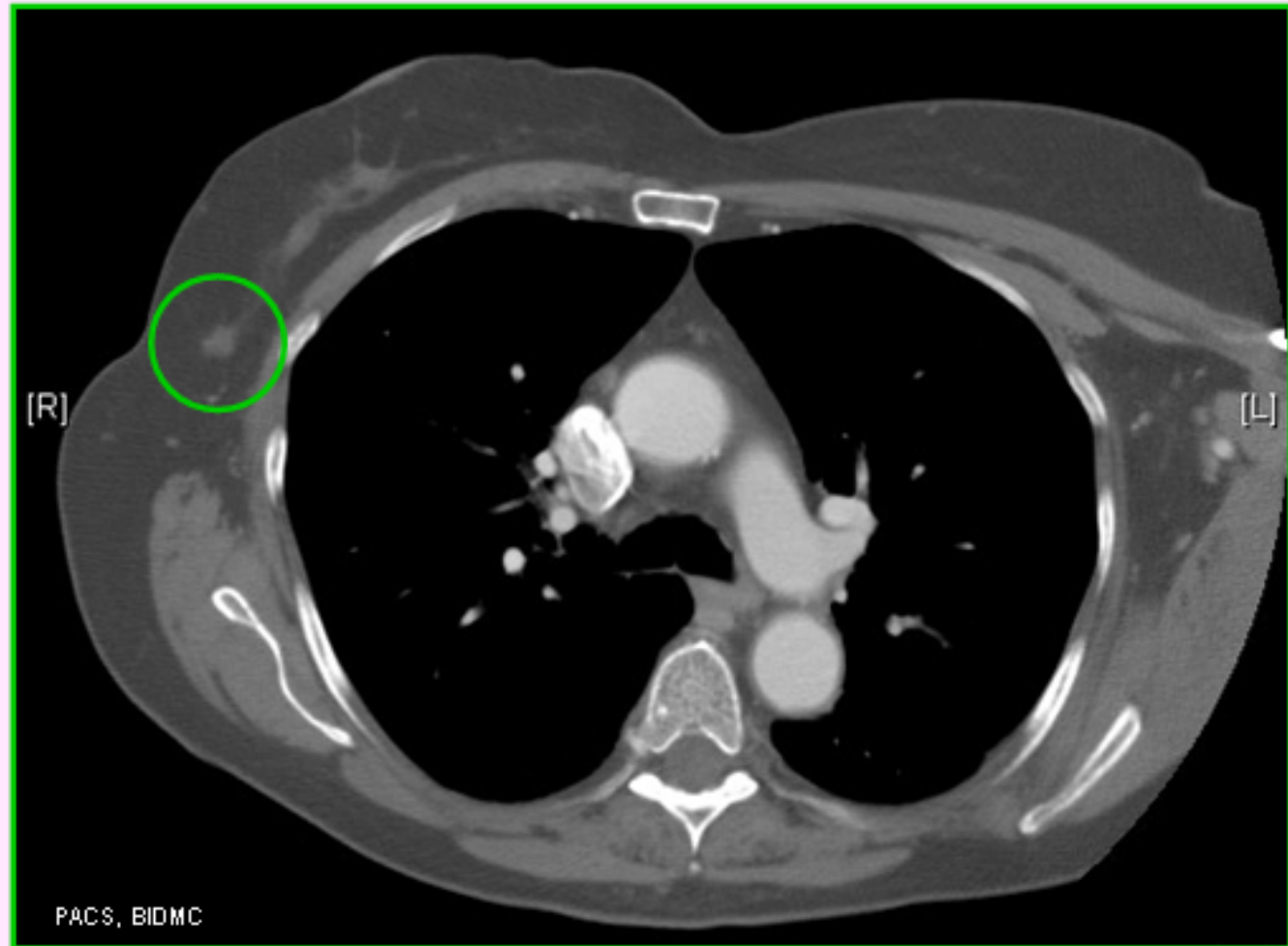
Our Patient: staging bone scan
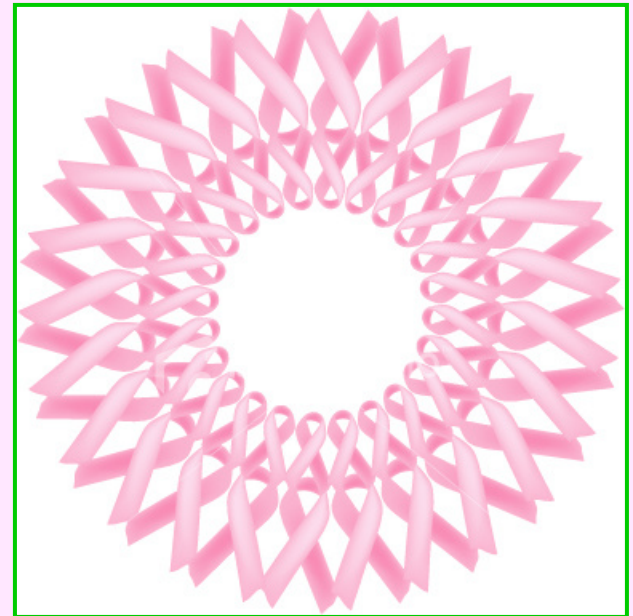
Our Patient: staging bone scan

Careful! These are old rib fractures!

**No signs of metastasis**

PACS, BIDMC

Our Patient: Summary

- Diagnosis: Infiltrating ductal carcinoma
- Our patient is scheduled to be seen at BreastCare Center for further evaluation and treatment planning

Why breast imaging?
Breast Cancer Statistics

- Most common nonskin cancer in women

- Leading cause of cancer death in women worldwide

- 13% American women will be diagnosed with breast cancer in their lifetime

www.breastthermography.com
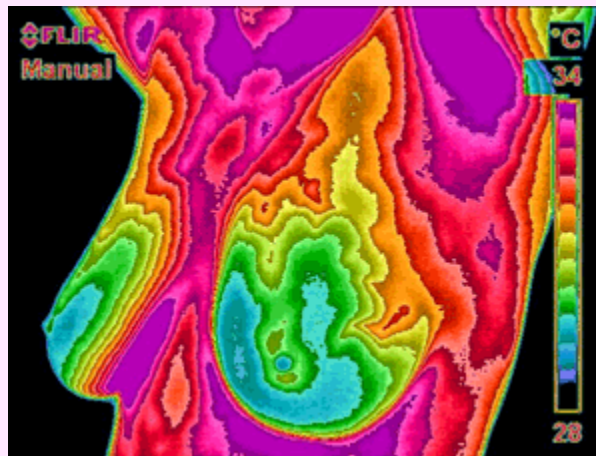
Why breast imaging?
Breast Cancer Risk Factors

- Female
- Increased age
- 30 years or older at birth of first child
- DCIS or LCIS on prior biopsy
- Atypical hyperplasia
- Early menarche and late menopause
- Hormone therapy
- Family history
- Genetic predisposition

Summary

- Mammography
  - Screening
  - Diagnostic
  - BI-RADS
- Breast MRI
- Breast Ultrasound
- Staging: CT & Bone scan

www.medical.siemens.com

- Dr. Lieberman
- Dr. Fein-Zachary
- Dr. Venkataraman
- Dr. Dialani
- Dr. Iuanow
- Nancy Littlehale, NP
- Staff at Breast Imaging Center

www.inspiringteachers.com

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- Mordenti C, Peris K, et al. (2000). Cutaneous metastatic breast carcinoma. *Dermatovenerologica* , 9(4).