جامعة المستقبل
كلية التقنيات الصحية والطبية
قسم تقنيات الاشعة

الفحوصات الشعاعية الخاصة
المرحلة الثالثة

Lecture 8

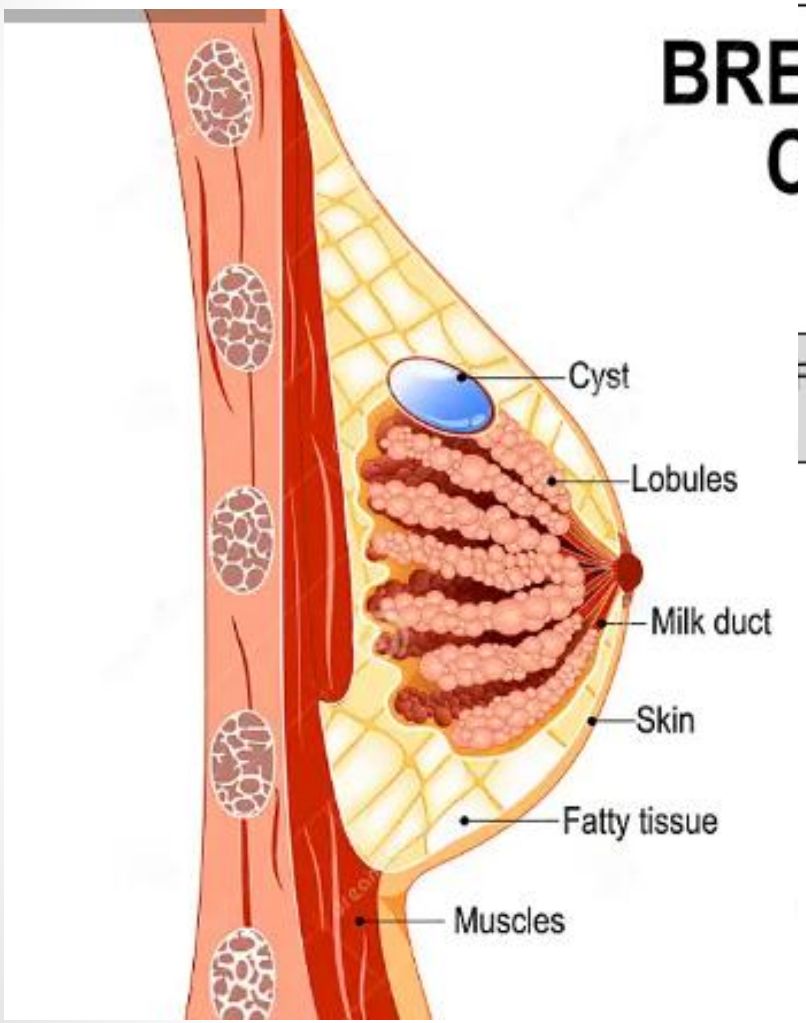
Breast imaging

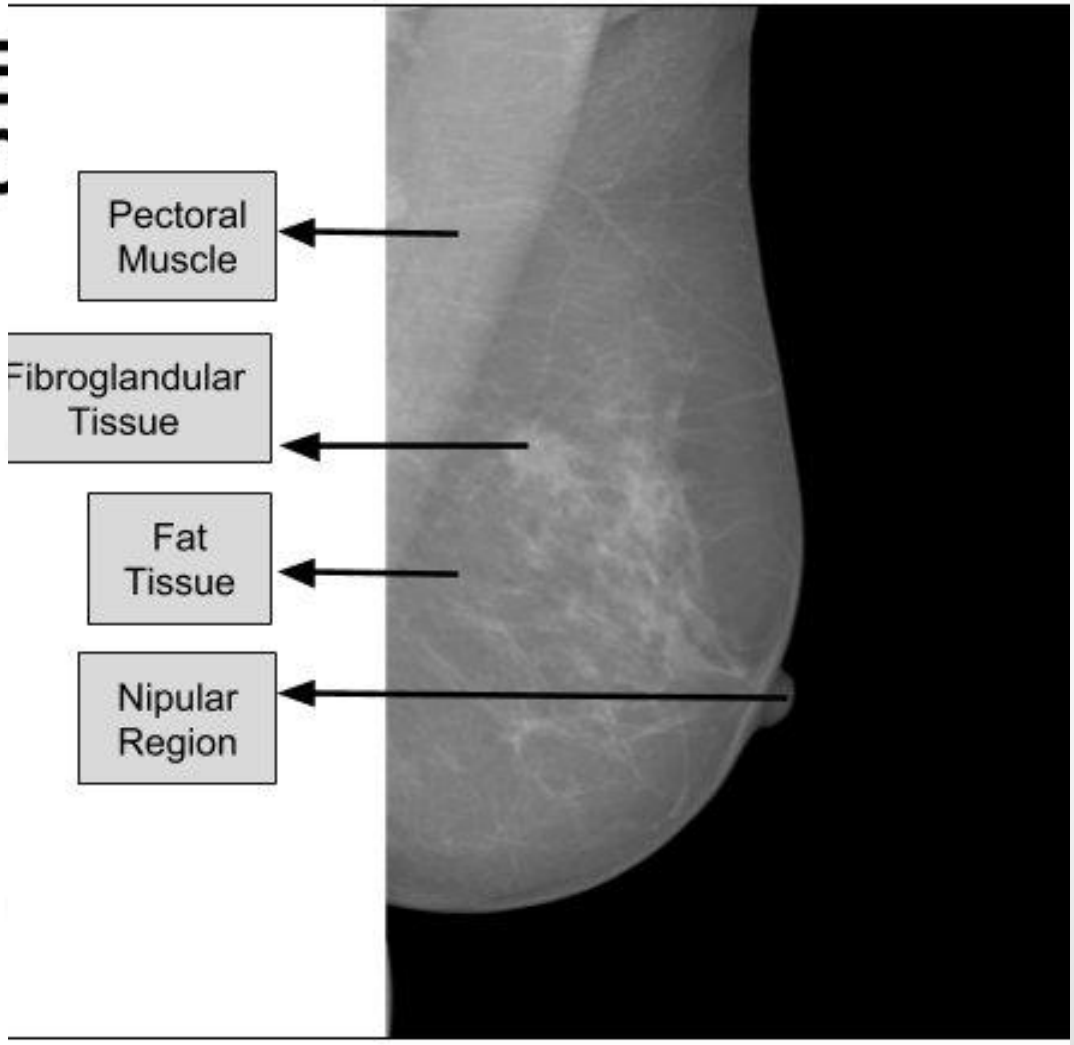
اعداد
م.م. مرتضى عبد الامير محمد

Methods of imaging the Breast

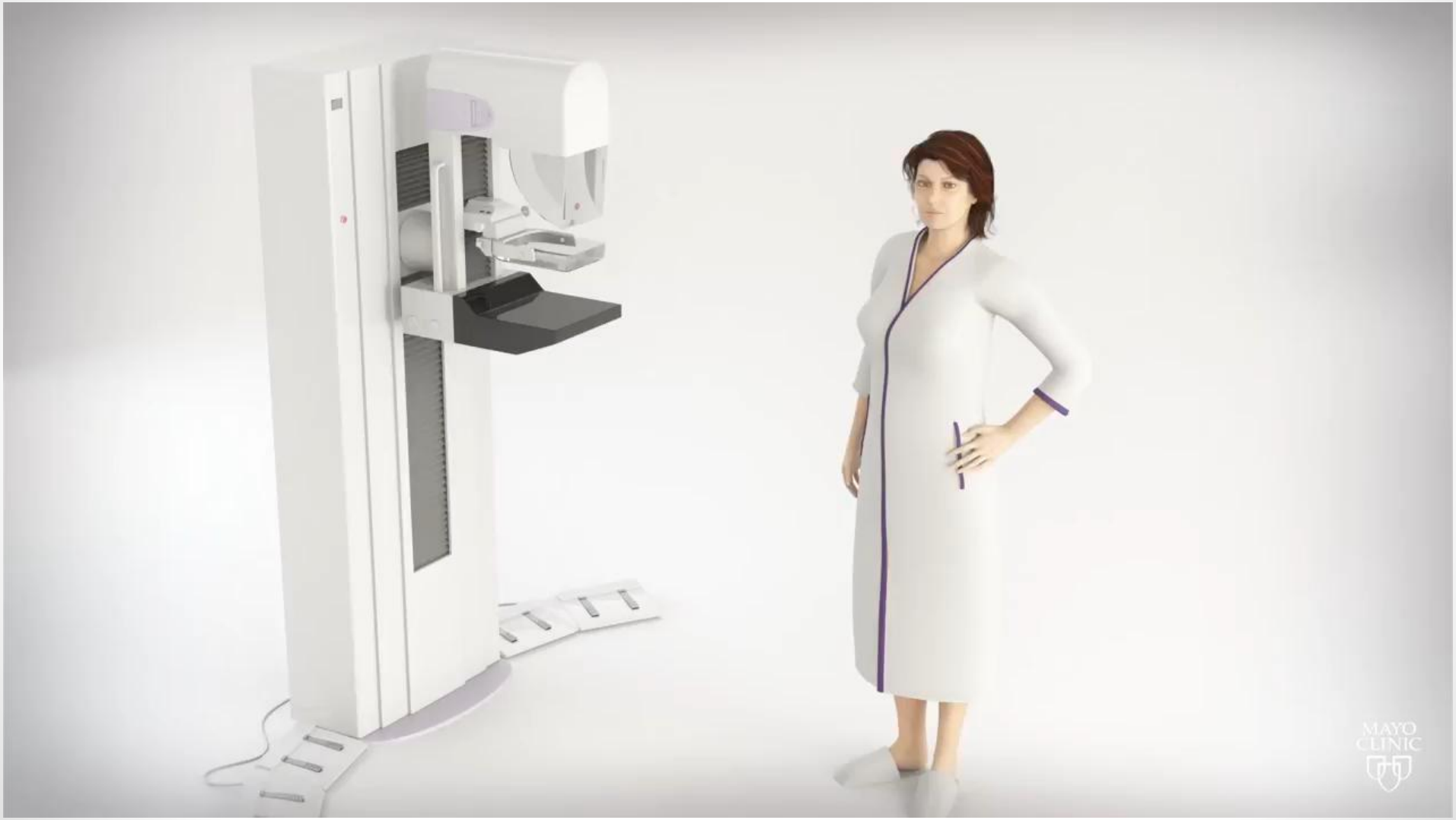
- **Mammography**
- **Ultrasonography**
- **MRI**

Anatomy of the Breast





How Mammography is Preformed



- Mammograms involve a very small amount of radiation exposure. The American Cancer Society (ACS) notes that the dose of radiation people receive during a screening mammogram is about the same amount of radiation people get from their natural surroundings (background radiation) in an average three-month period.

- Mammograms can detect changes in breast tissue up to two years before they can be felt by a woman or her physician

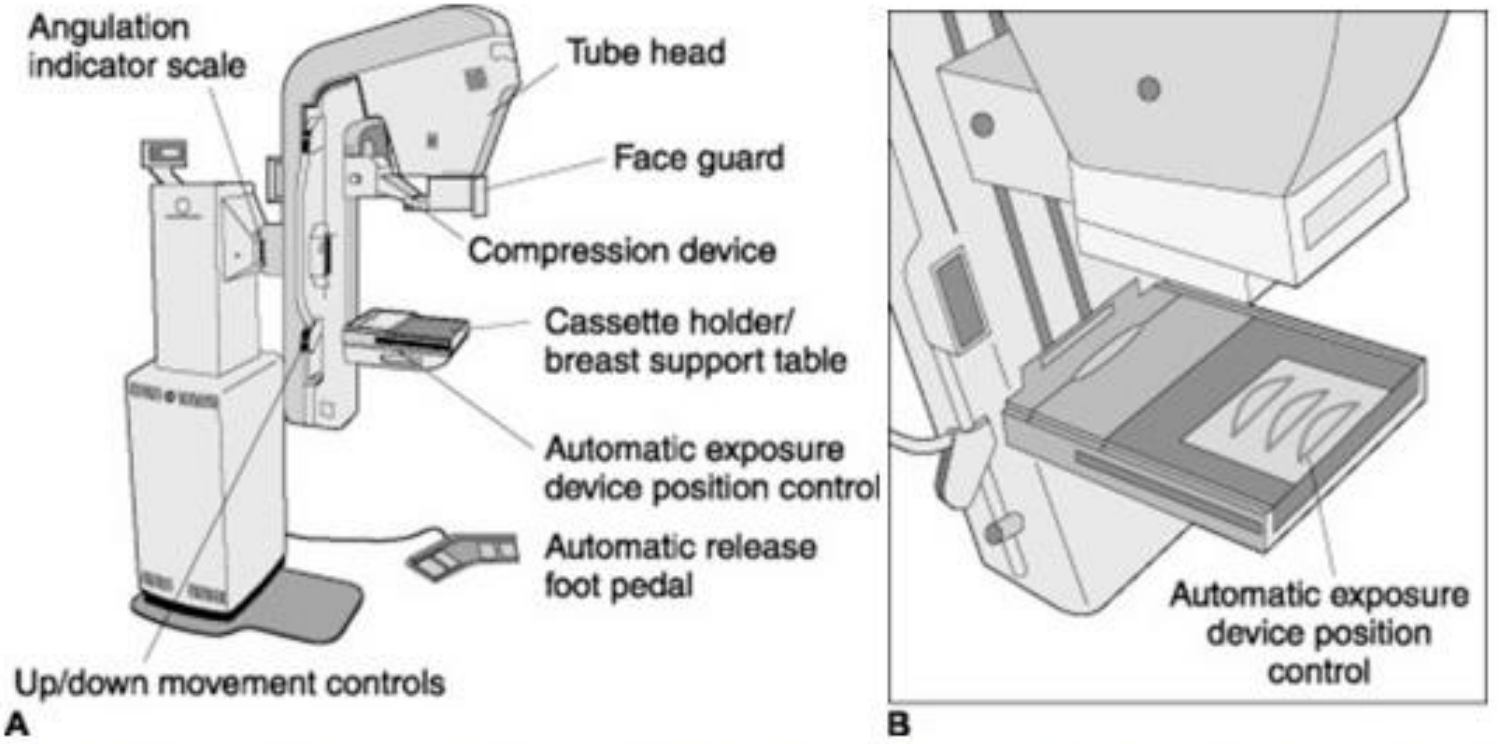
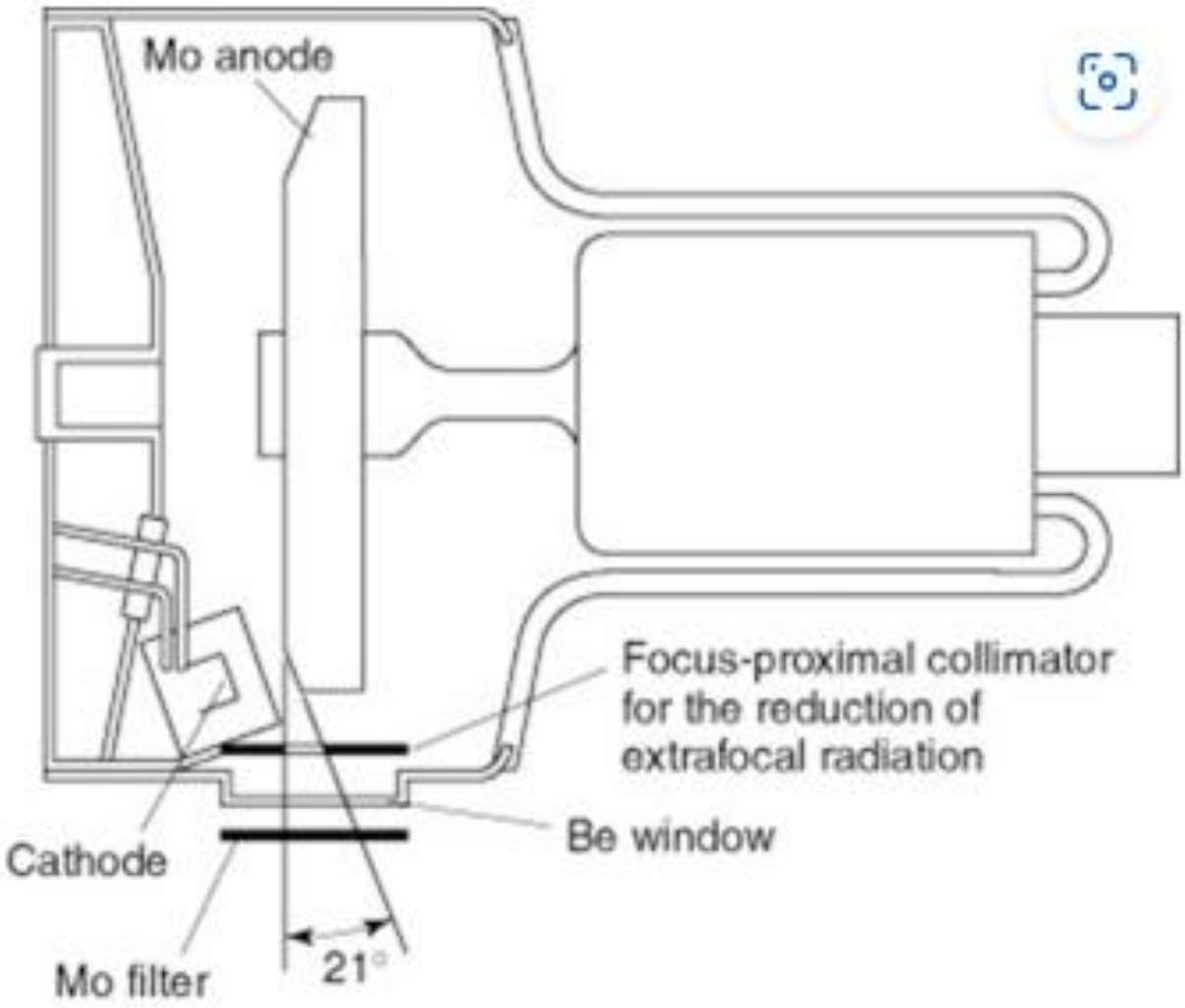


Figure 15.5 A A mammography unit. B A mammography X-ray unit showing position of automatic exposure control (AEC)

X-ray tube in mammography

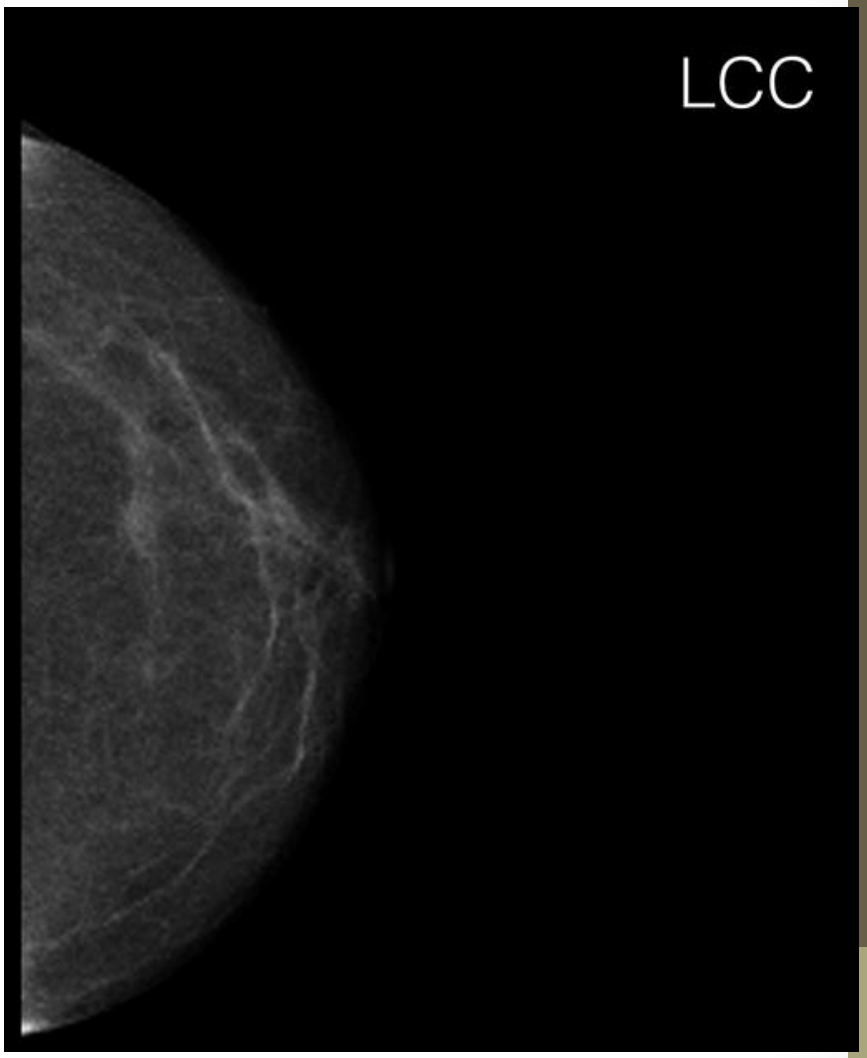


In mammography, compression of the breast is performed to reduce its thickness. By doing so, the following benefits are achieved:

improved subject contrast (by reducing scattered radiation)
improved density uniformity
improved visualization of breast tissue near chest wall (by spreading out superimposed anatomy
decreased radiation dose
decreased blurring (by reducing motion artifact)
Compression is performed using compression paddles, a component of the mammographic unit, which can vary in size and function.

Breast Projections

- **Craniocaudal (CC) View**: The X-ray beam travels from the top (cranial) to the bottom (caudal) of the breast. This view captures the anterior, central, medial, and posteromedial portions of the breast



Adequate craniocaudal (CC) views
all glandular tissue identified

nipple in profile

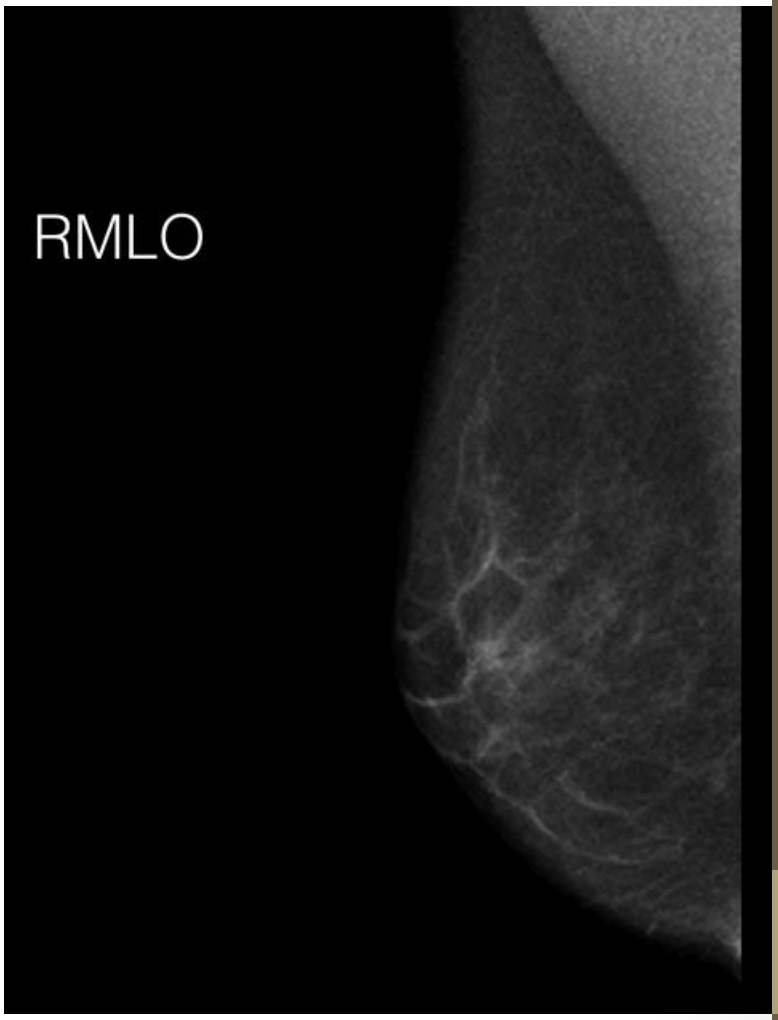
nipple in the midline of image

length of posterior nipple line (PNL) within 1 cm in size.

images symmetric

Breast Projections

- **Mediolateral Oblique (MLO)** View: The X-ray beam travels from the medial (middle) to the lateral (side) part of the breast at an angle of 30° to 60°. This view captures the posterior, upper-outer quadrant, axillary tail, and lower-inner quadrant

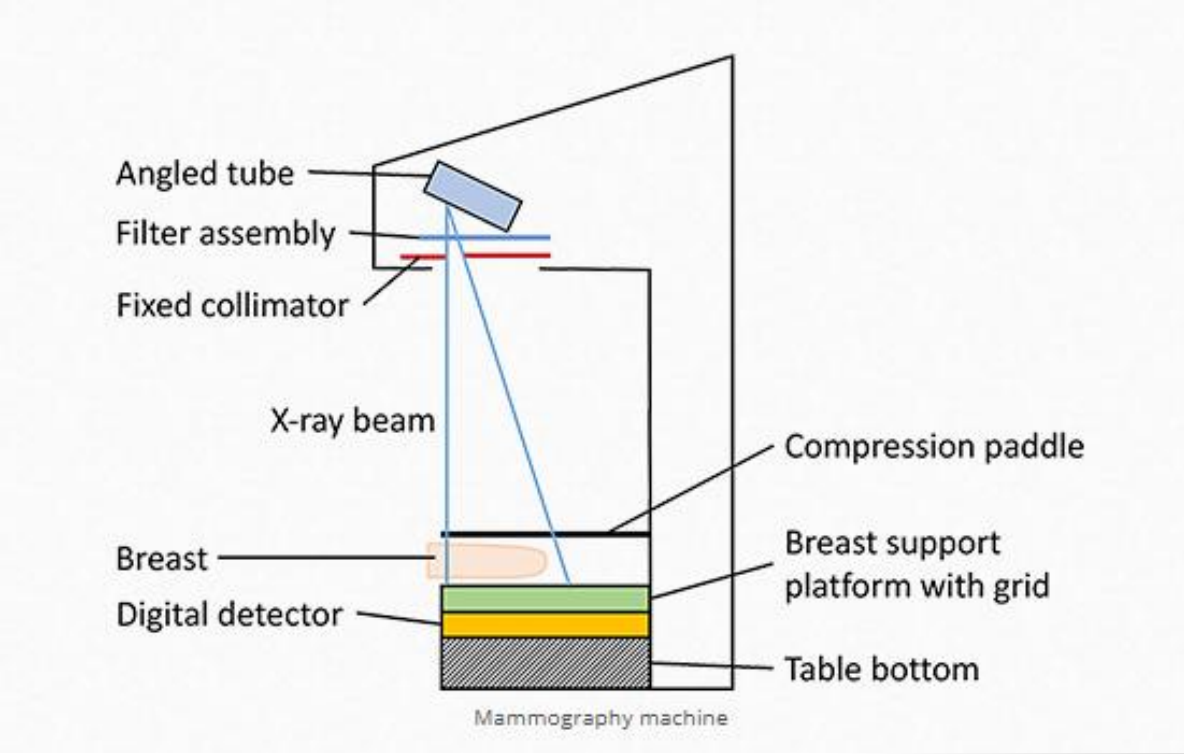


- **Adequate mediolateral oblique (MLO) views**
- pectoral shadow is seen down to the level of the nipple.
- inframammary fold is well seen
- nipple in profile
- length of posterior nipple line (PNL) within 1 cm in size (cf. PNL on CC)
- images symmetric

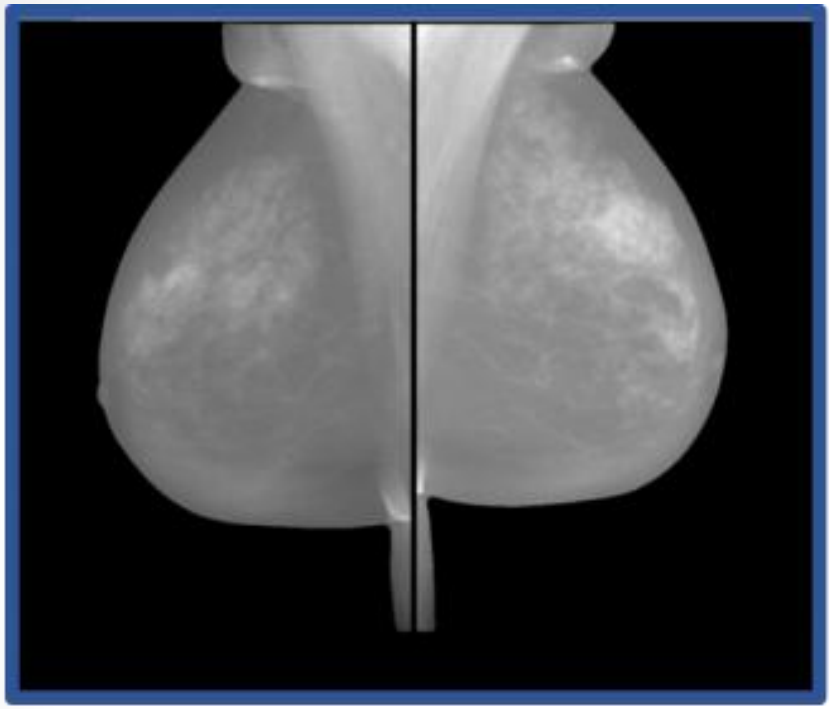
Air gap technique (mammography)

A magnification view in mammography is performed to evaluate and count microcalcifications and their extension (as well as the assessment of the borders and the tissue structures of a suspicious area or a mass) by using a magnification device which brings the breast away from the film plate and closer to the x-ray source. This allows the acquisition of magnified images (1.5x to 2x magnification) of the region of interest.

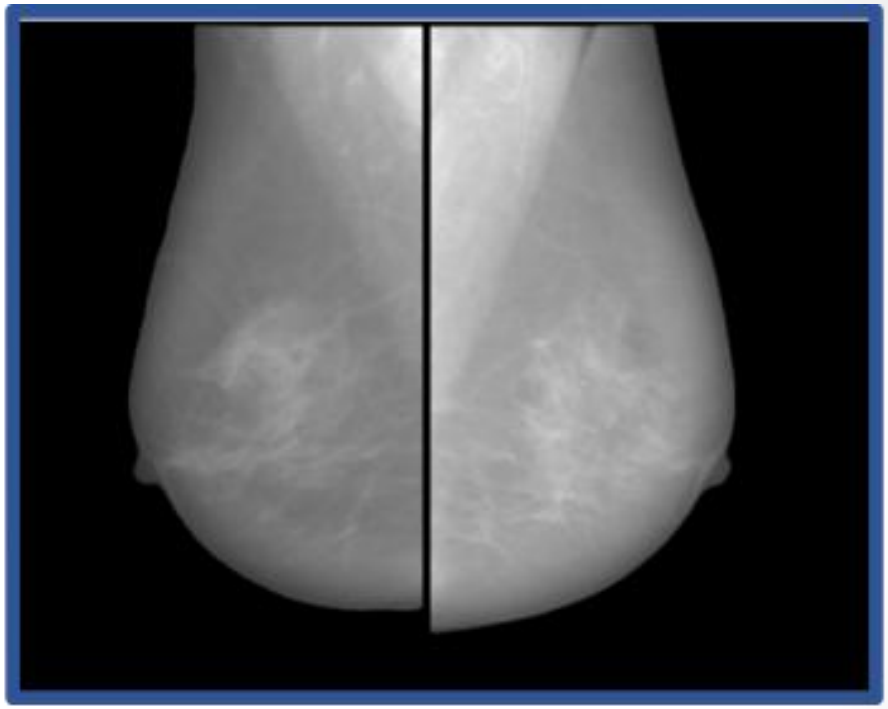
For magnification views, the breast support table is above the film to give magnification factors of around 1.8. In this case the large air gap between the breast and the film works to reduce scatter and so no grid is needed.



Inframammary fold

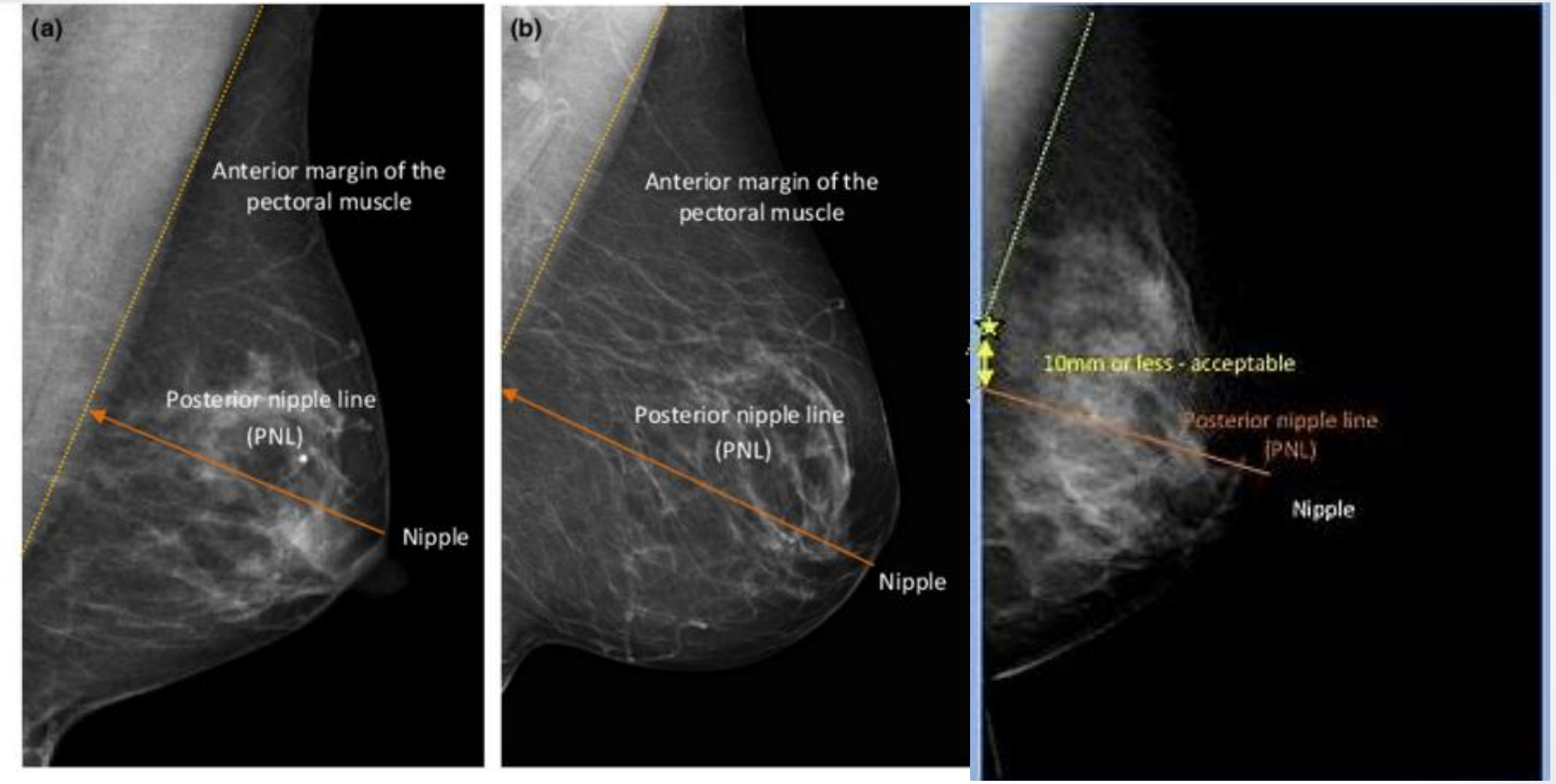


Inframammary fold obscured

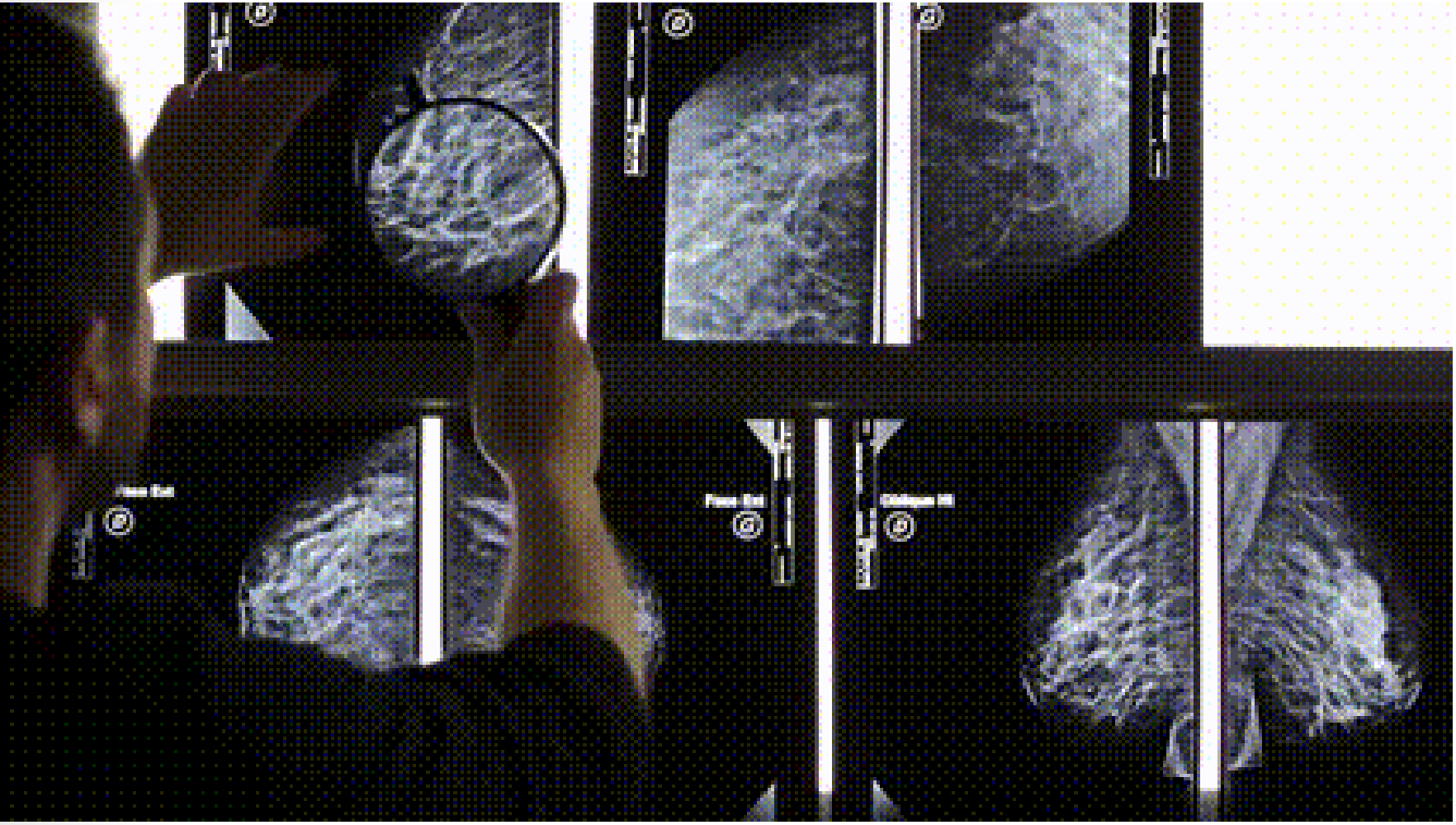


Inframammary fold not present

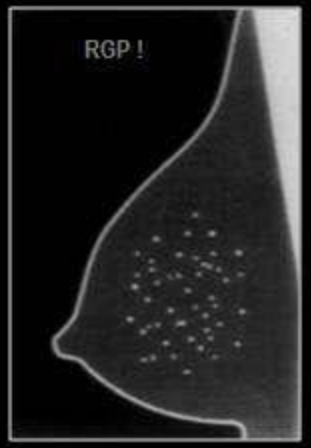
Posterior nipple line PNL



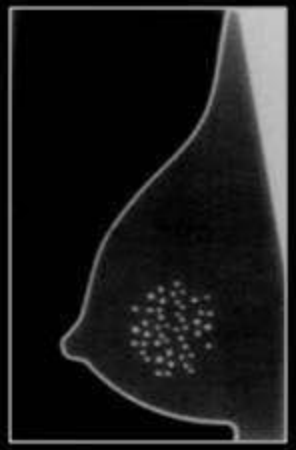
Conditions that may be identified on mammography



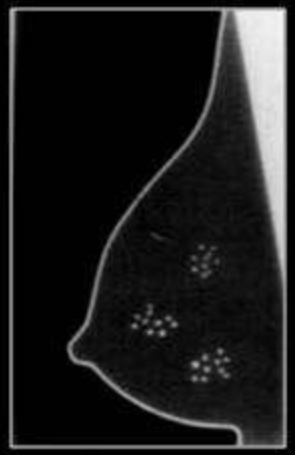
CALCIFICATION DISTRIBUTION



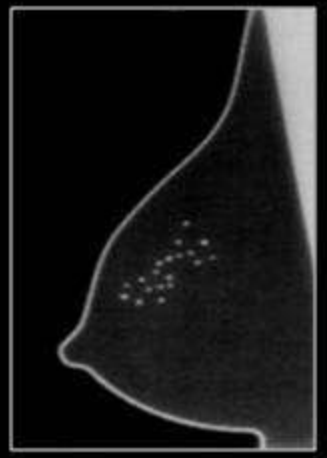
Diffuse



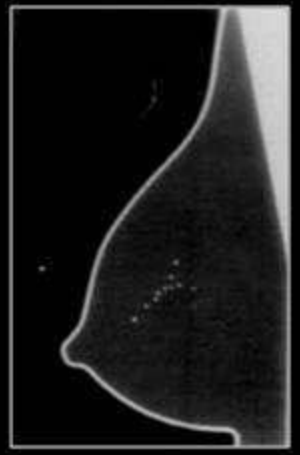
Regional



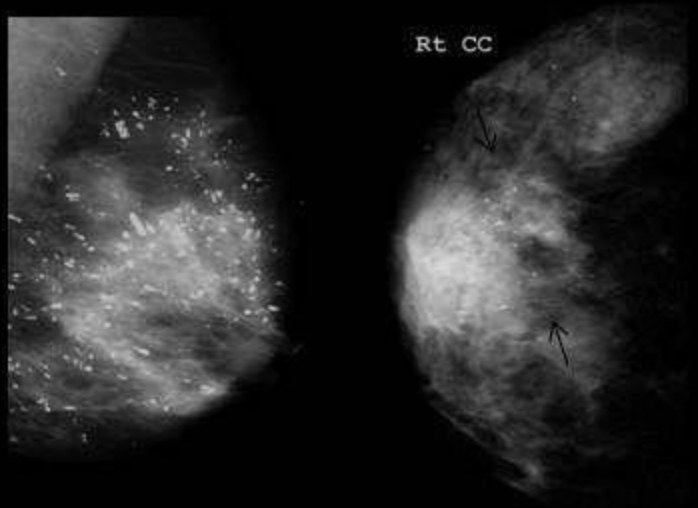
In groups

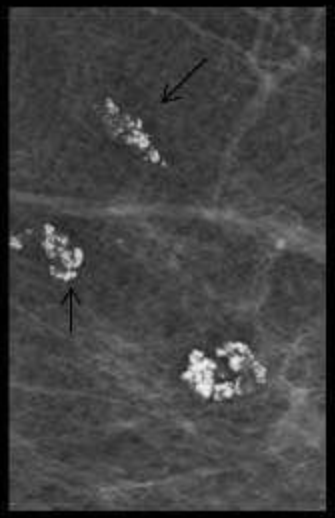


Segmentary



Linear





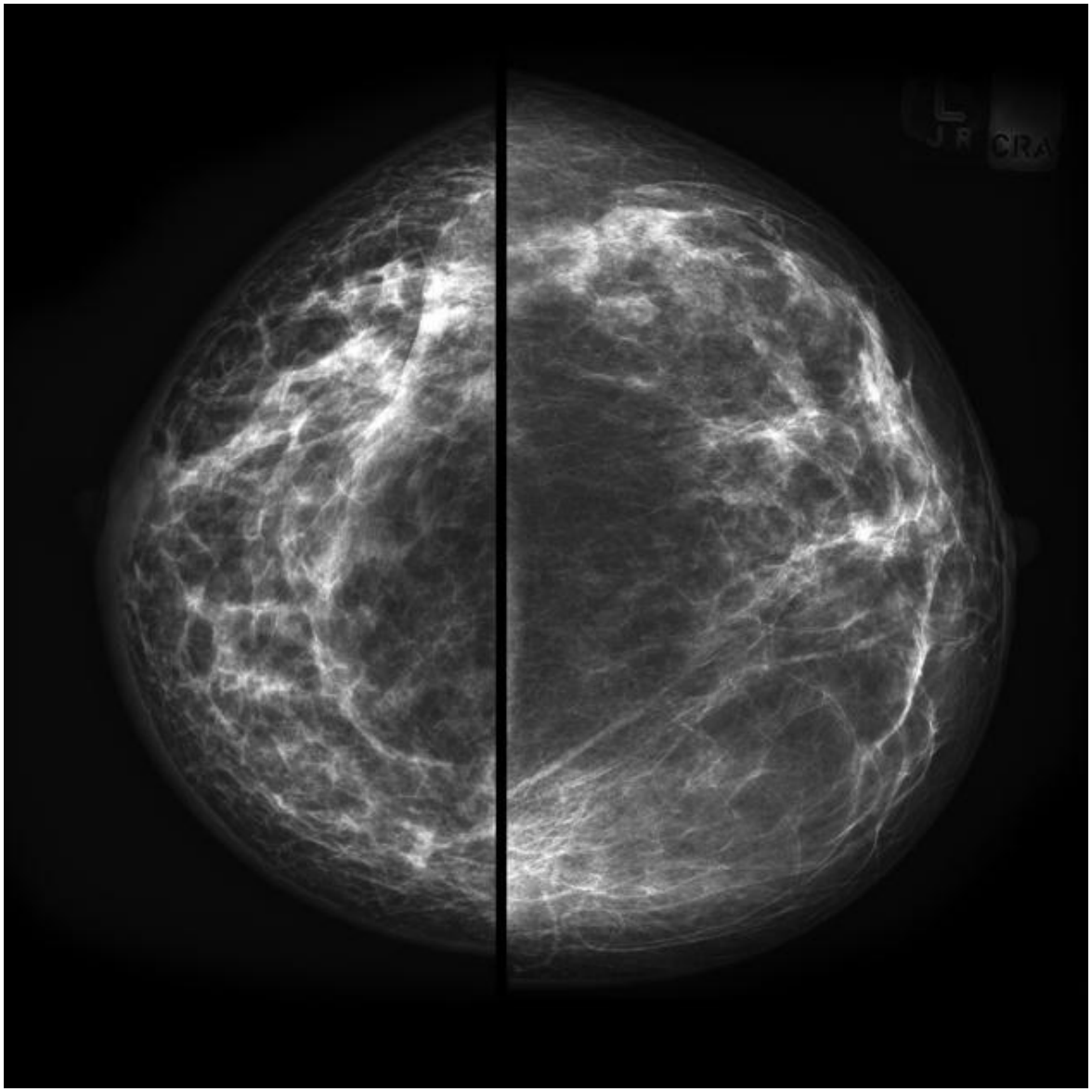
Le Gal Clasification (1984)

Malignant (just for your interst)

- inflammatory breast cancer: one of the most concerning causes of skin thickening: this usually gives diffuse skin thickening
- locally invasive breast cancer: tends to give focal skin thickening
- lymphatic obstruction of metastatic axillary nodes
- certain metastases to the breast
- breast lymphoma

Benign (just for your interst)

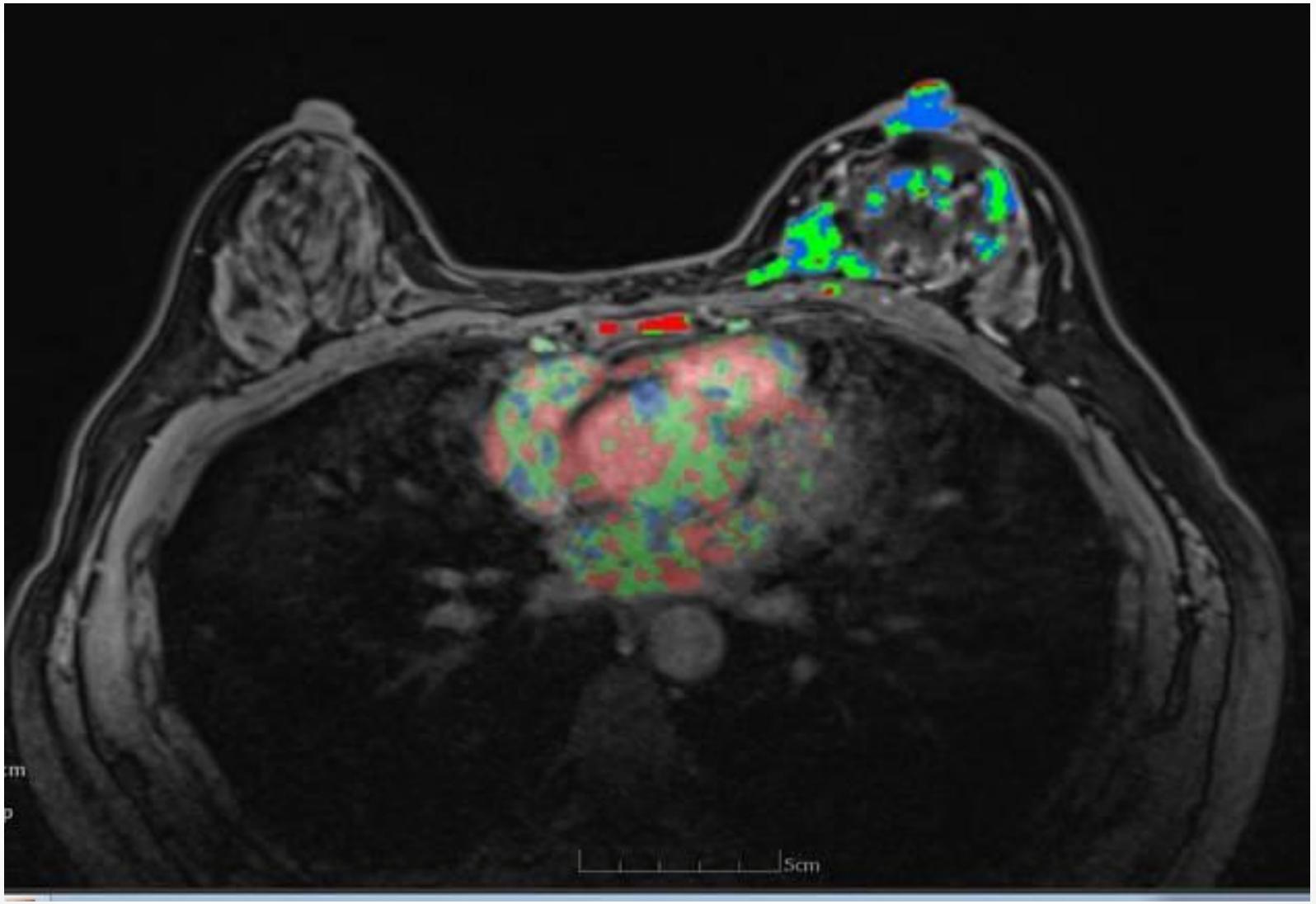
- infection: mastitis
- conditions causing fluid build up in the breast: tends to be bilateral although at times can be asymmetrical if the patient has been lying on a particular side prior to the mammogram
  - cardiac failure
  - renal failure
  - hypoalbuminemia
- trauma to the breast
  - mammary fat necrosis
  - burns to the skin overlying the breast with scarring
- chronic graft-versus-host disease (GVHD) [2]
- breast irradiation: tends to be most prominent around 6 months after irradiation
- certain dermatological conditions
  - pseudoxanthoma elasticum [6]



Radiotherapy changes - breast

Fat necrosis - breast

MRI Breast scan



BREAST MRI

Breast MRI

Practical points

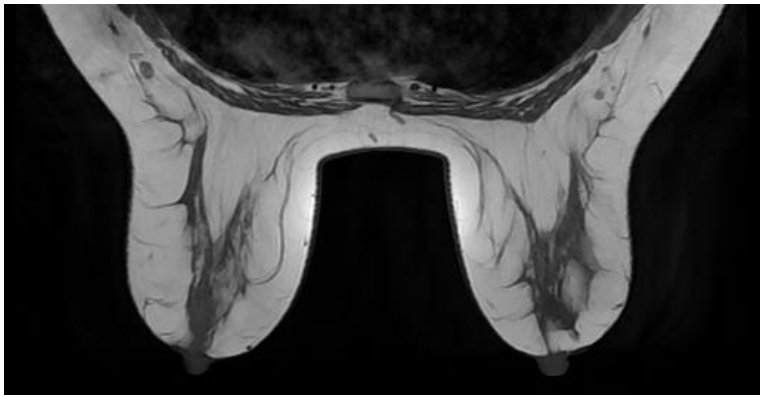
•breast MRI is better than clinical assessment, mammogram, and ultrasound in correlation with pathology; pretreatment MRI should be performed and compared with MRI done after neoadjuvant chemotherapy, this is particularly useful to monitor response to neoadjuvant chemotherapy allowing to identify non-responders early and to delineate the residual tumor after neoadjuvant chemotherapy to determine the appropriate extent of surgical excision [15]

•in patients with a personal history of breast cancer, MRI sensitivity ranges from 80–100%, whereas mammography sensitivity ranges from 0–53%; specificities for MRI screening in this population are relatively high but still lower than for mammography [16]

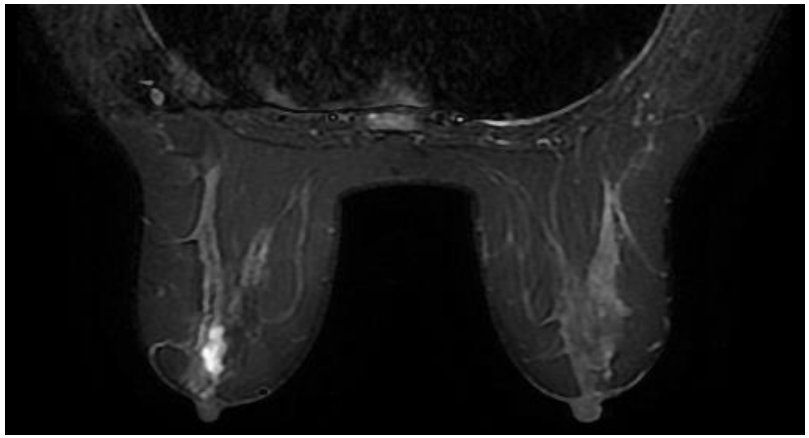
•MRI performed in extremely dense breasts has an additional cancer detection of 3.6% in patients with negative mammography [ref]

How breast MRI is preformed

1-Breast coil
2-Removing all mechanical, electrical, or magnetical devices
3-Caudocranially (feet-first) 4-Prone position
5-there is always a possibility for IV injection



AXIAL T1



AXIAL T2 FAT SAT

Sagittal T2 FAT SAT

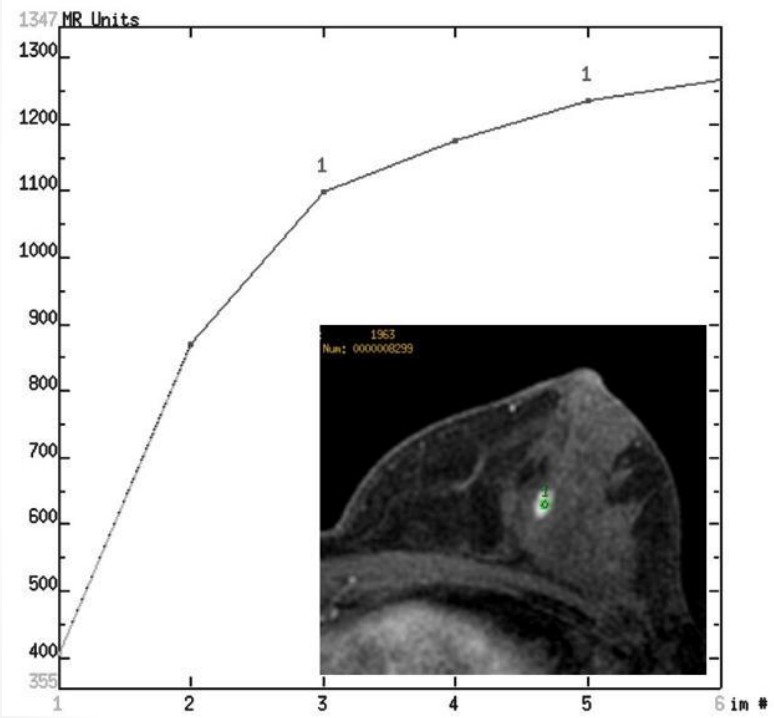
Breast MRI enhancement curves

Following administration of gadolinium, there can be three possible **enhancement (time intensity) kinetic curves** for a lesion on breast MRI (these are also applied in other organs such as prostate MRI). These are sometimes termed the **Kuhl enhancement curves**.

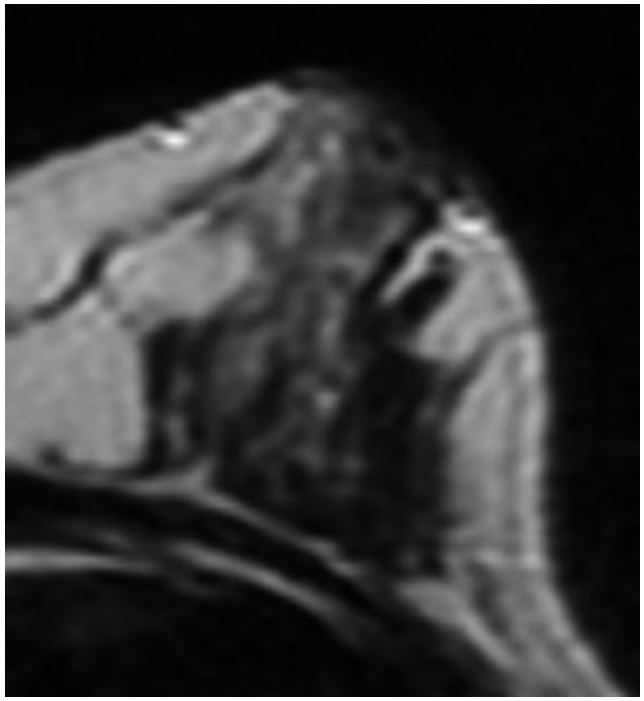
- **type I curve:** progressive or persistent enhancement pattern
  - typically shows a continuous increase in signal intensity throughout time
  - usually considered benign with only a small proportion of (~9%) of malignant lesions having this pattern
- **type II curve:** plateau pattern
  - initial uptake followed by the plateau phase towards the latter part of the study
  - considered concerning for malignancy
- **type III curve:** washout pattern
  - has a relatively rapid uptake shows reduction in enhancement towards the latter part of the study
  - considered strongly suggestive of malignancy

type I curve

- T1 C+ FAT SAT

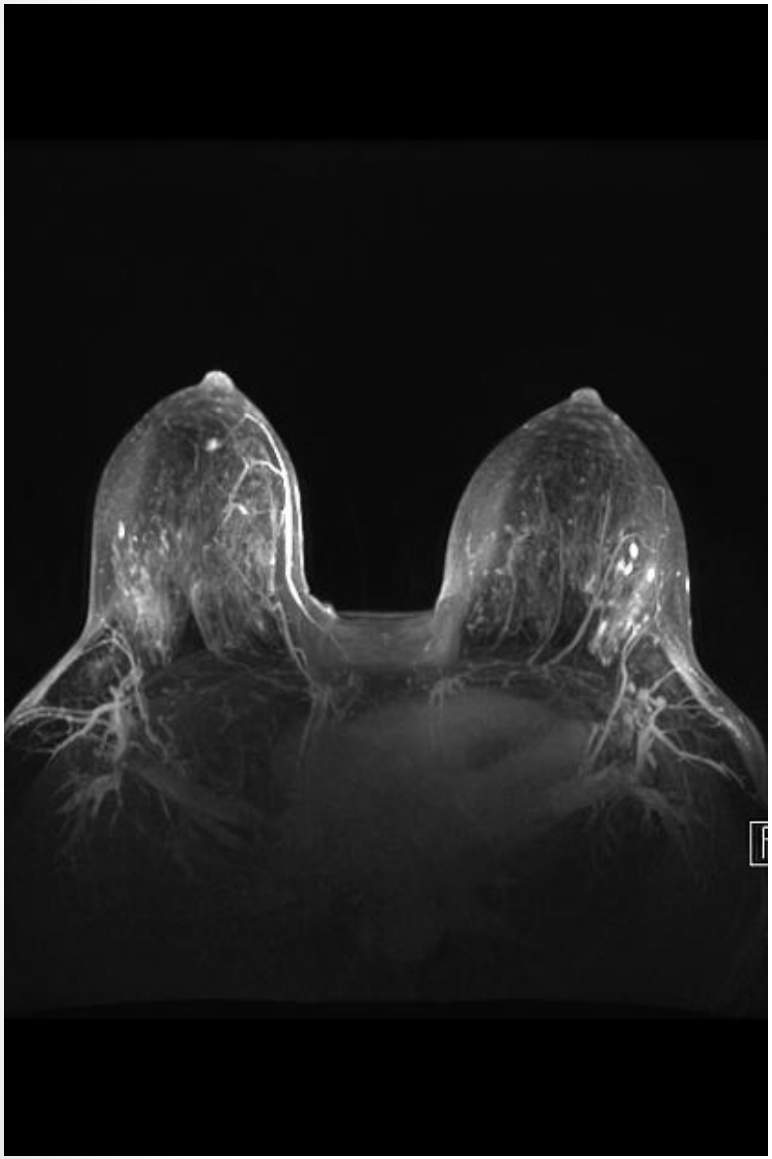


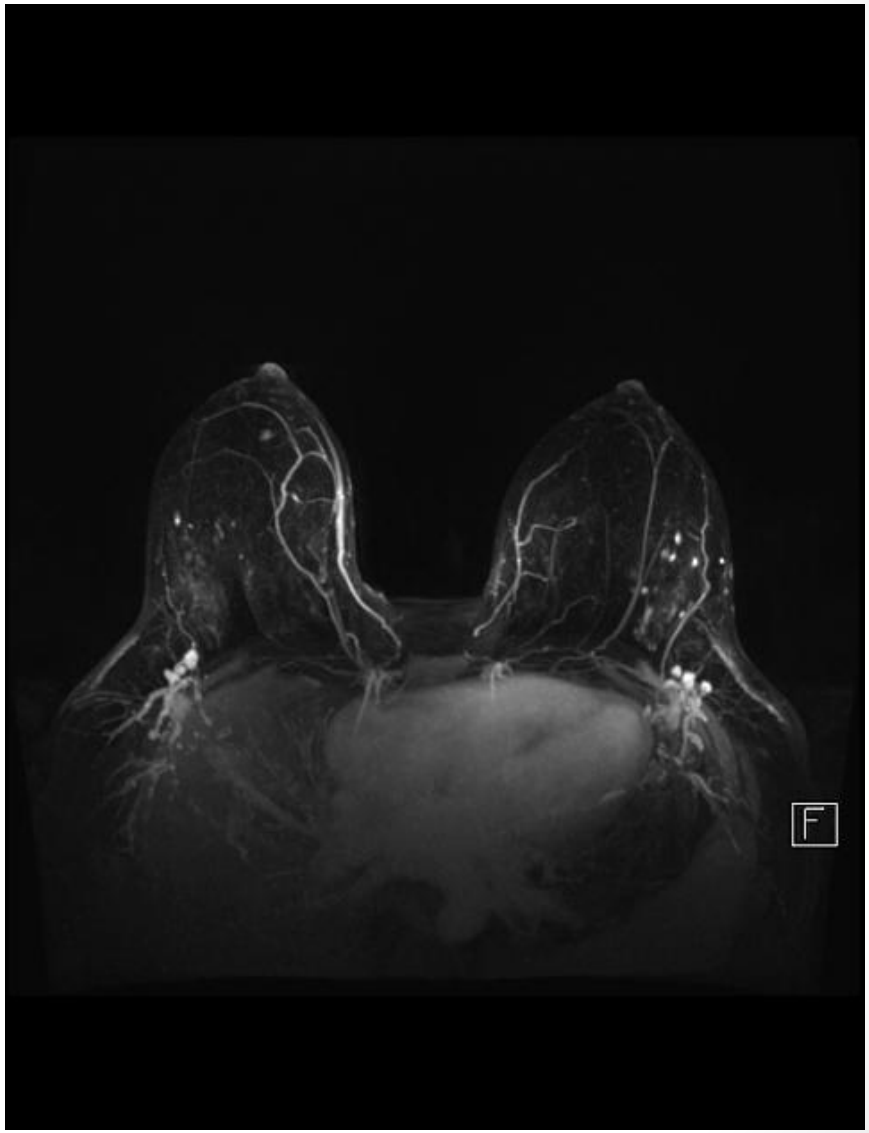
T2 AXIAL



Breast fibroadenoma

NORMAL BREAST MRI





Axial MIPS

THANK YOU

For you attention