Molecular Breast Imaging

Arison Tower

Lis Maternity center

Cardiovascular center

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Imaging of the breast

Concepts of imaging modality

SCREENING MODALITY

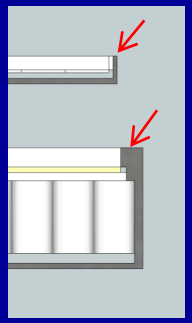
- Healthy population
- Need for repeat studies over the years
- Highly sensitive, reasonable specificity
- Radiation exposure (breast tissue vs whole body)
- Performance in high-risk population
- *Actual* availability and cost

DIAGNOSTIC MODALITY

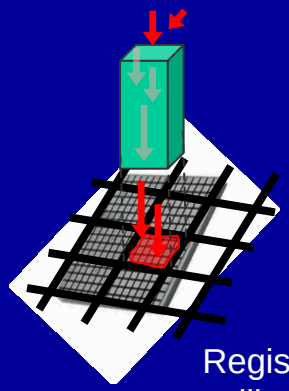
- Cancer patients
- Single of few studies during the course of the disease
- (Radiation exposure. Patients receiving radiotherapy, imaging for staging and restaging)

Discovery* NM750b with CZT technology

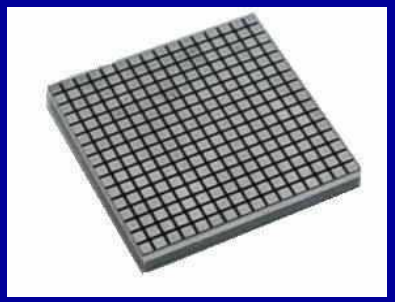
- CZT solid state detectors are the primary enablers for the Discovery NM 750b performance.
- Main benefits:
  - Up-close scanning - only the region of interest, including chest wall
  - Minimizing detector-to-tissue distance to increase sensitivity.
  - **Improved spatial resolution** - collimator is precisely matched to individual detector pixels
  - Up to three times the sensitivity of conventional nuclear detectors
  - No crosstalk and edge-free imaging across the entire FOV



Small “dead space” area



Registered collimator



Optimized pixel size for system spatial resolution and pixel sensitivity

Direct, loss-less conversion with semiconductor Radiation detectors from CdZnTe (CZT)

*Trademark of General Electric Company

Molecular Breast Imaging

Tracers:

99mTc-sestaMIBI

MORE TRACERS TO COME

Molecular Breast Imaging (MBI)

CZT dual-headed system (Discovery NM750b)

The Tel Aviv experience

Breast radiologists, surgeons and oncologists were asked to send women in whom they felt that additional non-invasive assessment of the breast was clinically indicated

Molecular Breast Imaging (MBI)
Indications coming from clinicians 228 studies

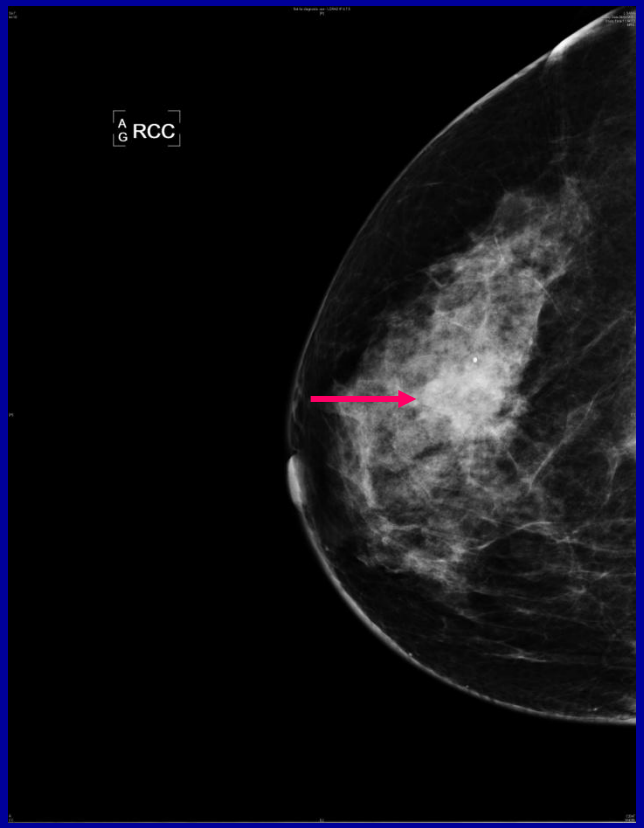
Screening for breast cancer n=72

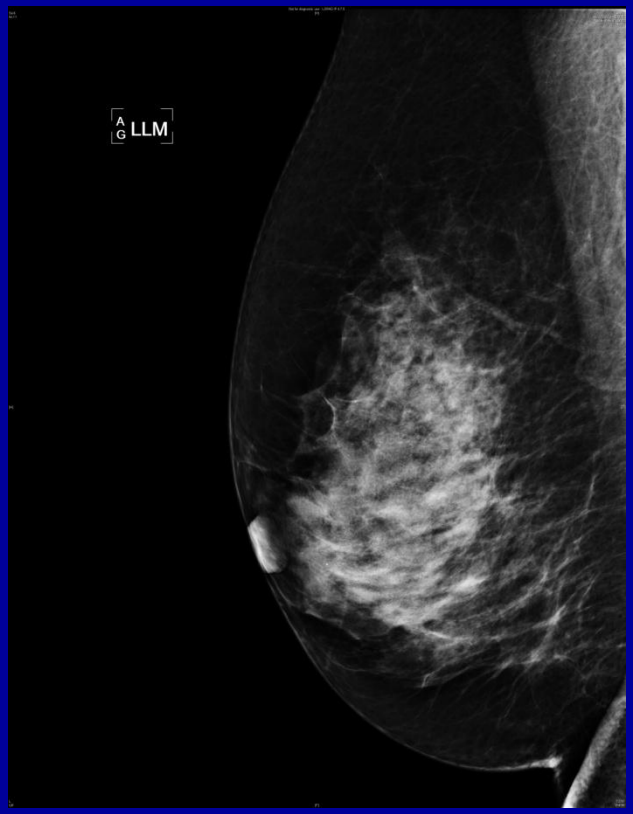
- Genetic and familial high-risk = 3
- equivocal findings on mammography, US and/or MRI = 46
- Nipple discharge = 4
- Discrepancy between clinical and imaging assessment = 8
- Alternative to other examinations = 6
- equivocal findings at the contralateral breast = 5

Diagnostic imaging of the breast in patients with known cancer n=156

- Assessment of the disease extent = 51
- Baseline prior to neo-adjuvant = 21
- Monitoring response after treatment =41
- Assessing the presence of residual disease after surgery = 16
- Suspected recurrence = 11
- Follow up = 13
- Search for primary in patients with LNs mets = 3

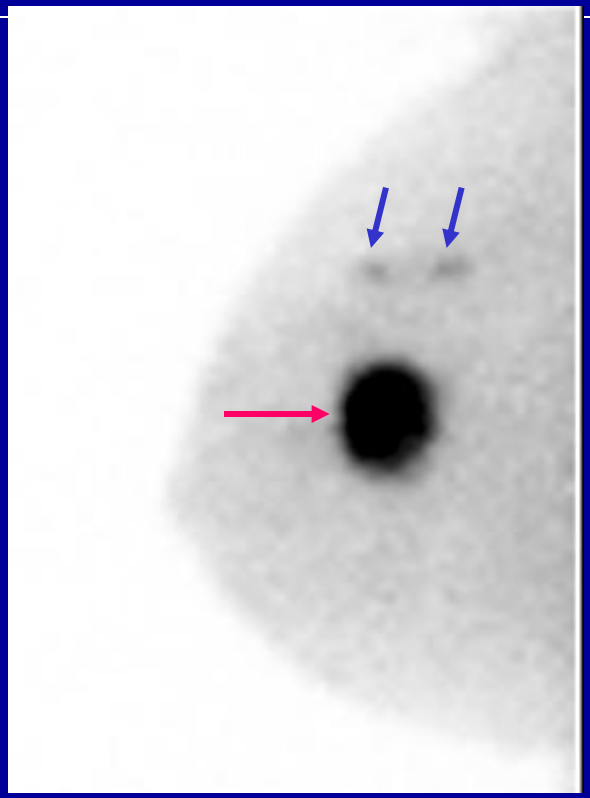
Assessing the extent of disease
Dense breast tissue. BRCA - carrier

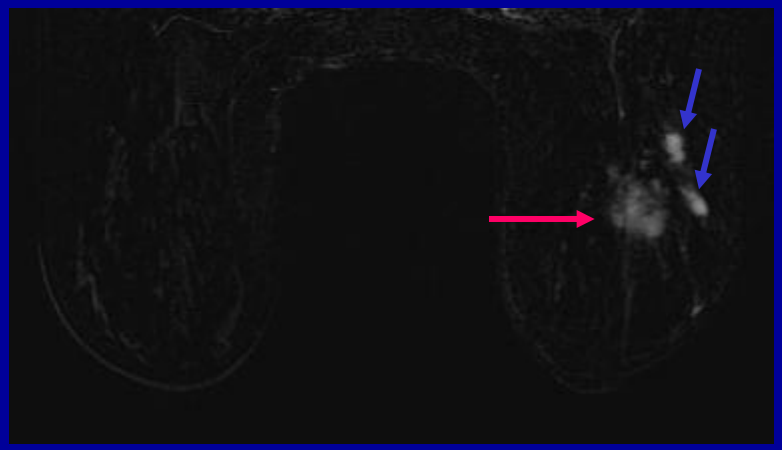


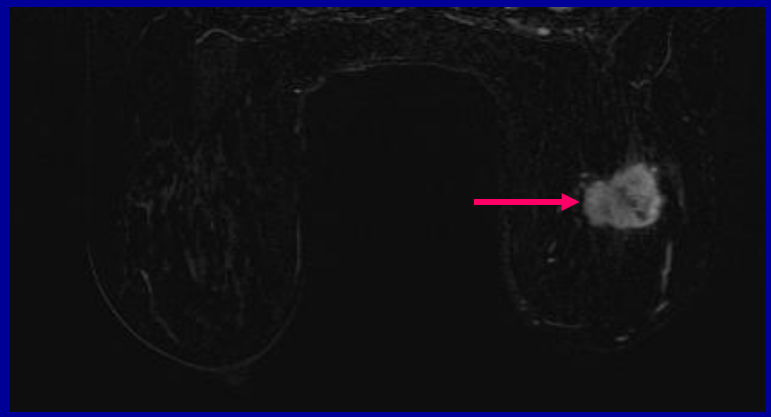


Mammography identifying a highly suspected lesion on the right. IDC on biopsy

Dense breast tissue. BRCA-carrier

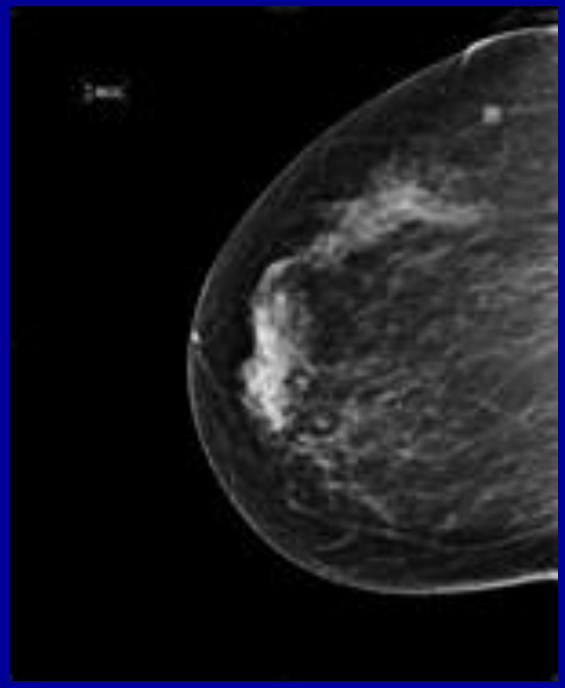


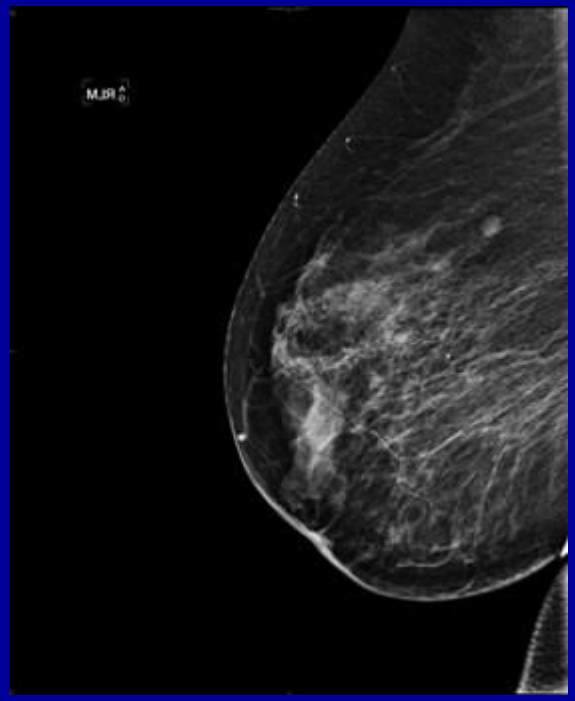




On MBI and MRI , in addition to the known tumor (pink arrow) two small lesions were identified (blue arrows).

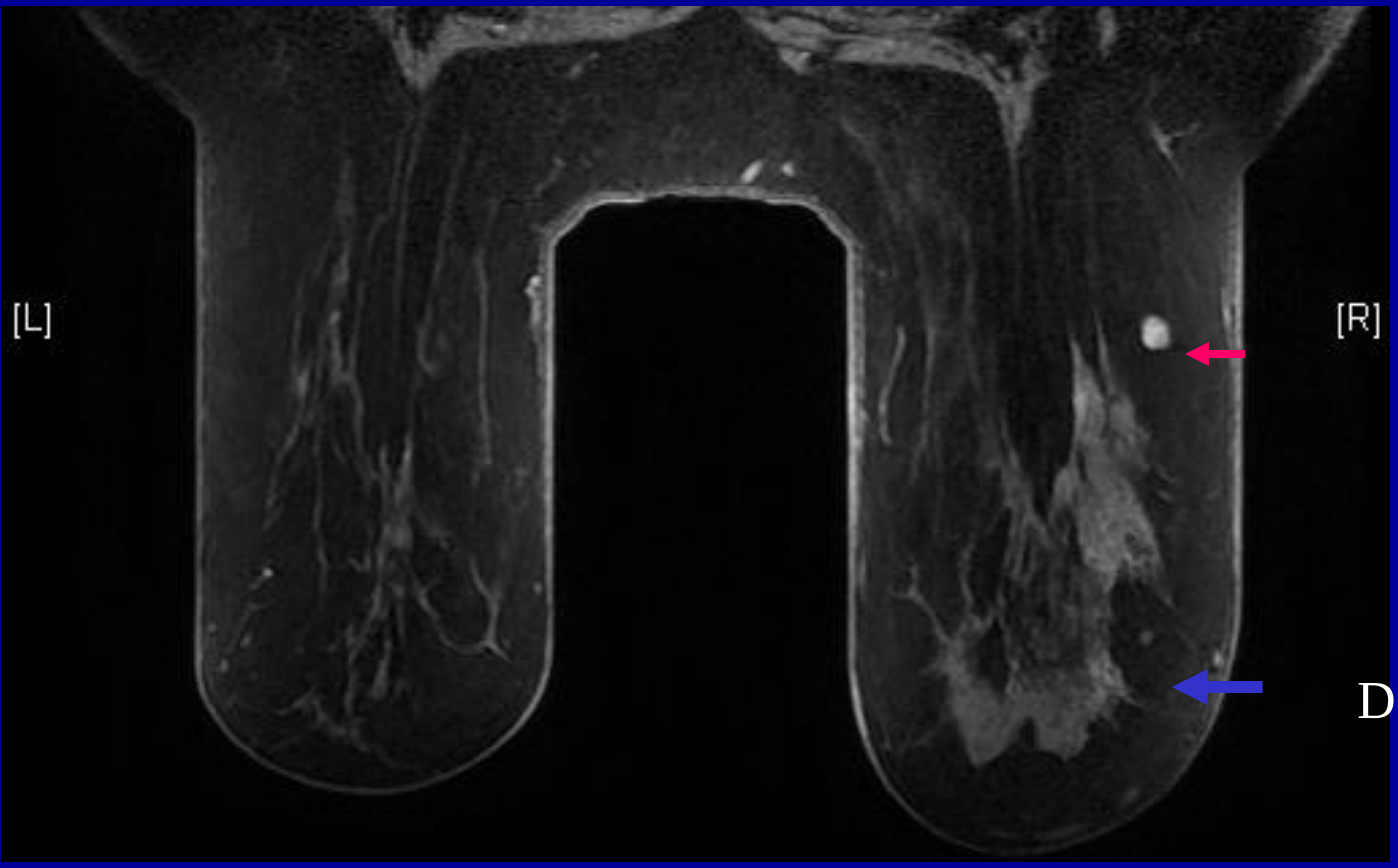
Assessing the extent of disease in the breast



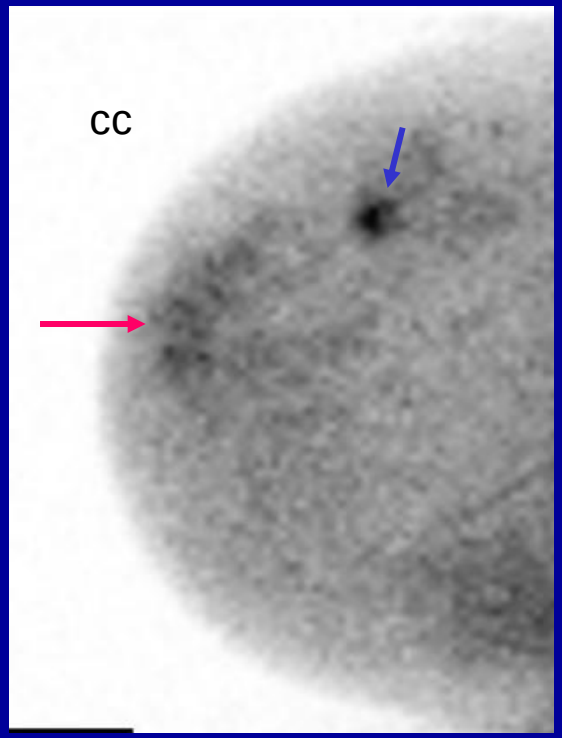


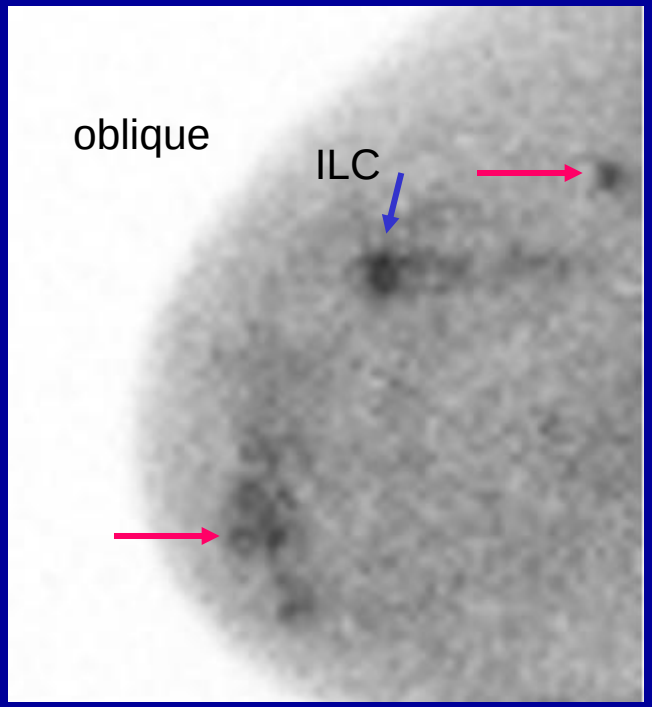
Routine Mammography: Fibroglandular and fatty tissues, small intra-mammary LN. Denser tissue behind the nipple, unchanged compared to last year study, reported as benign but found as fibrocyctic changes and DCIS on US- guided biopsy.

MRI performed in view of the MBI findings



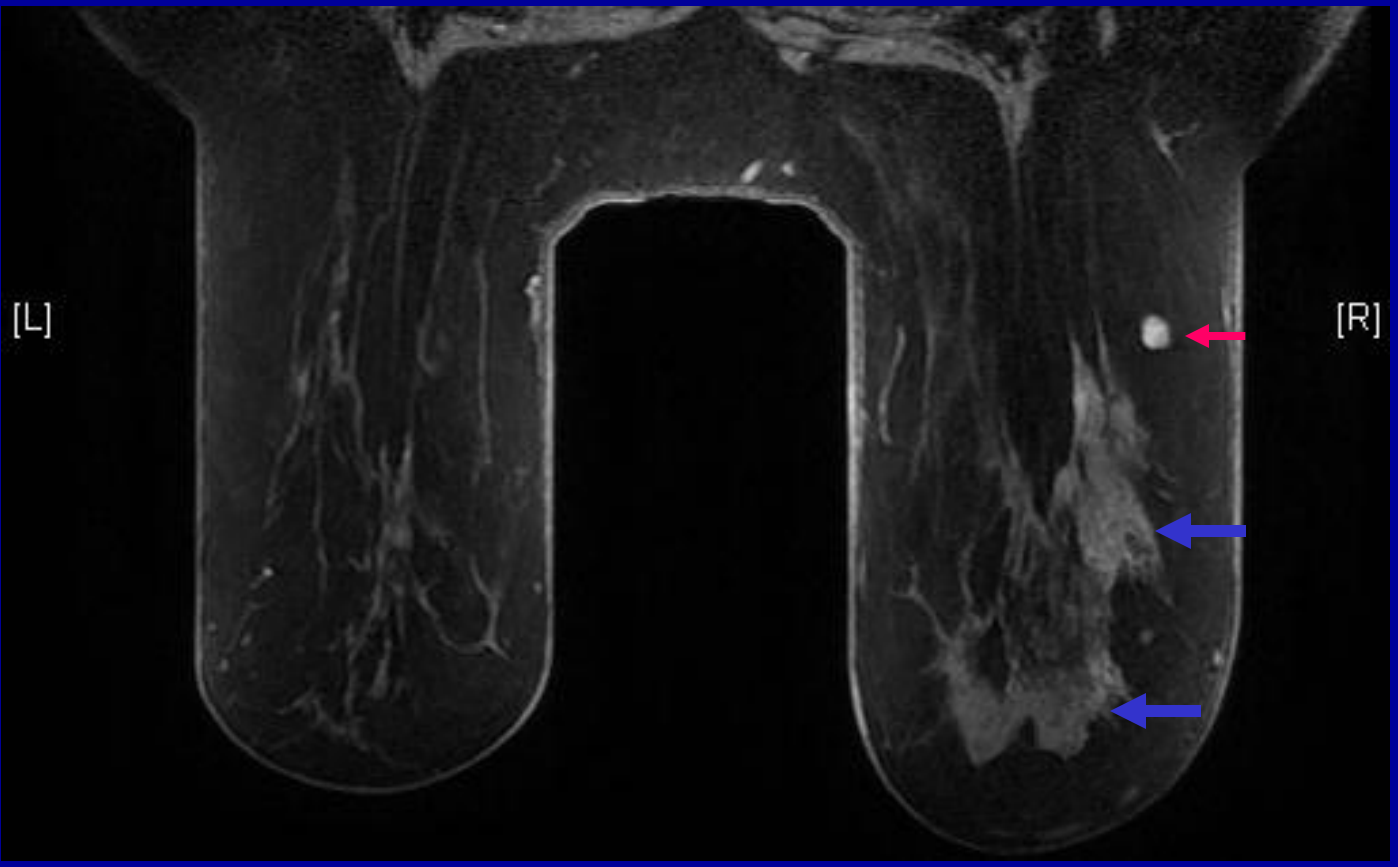
Assessing the extent of disease in the breast





MBI: In addition to uptake at the region of DCIS and LN (pink arrow), another site of increased uptake was detected (blue arrow), diagnosed as ILC. The LN was only reactive.

Final diagnosis of MRI



Reactive LN

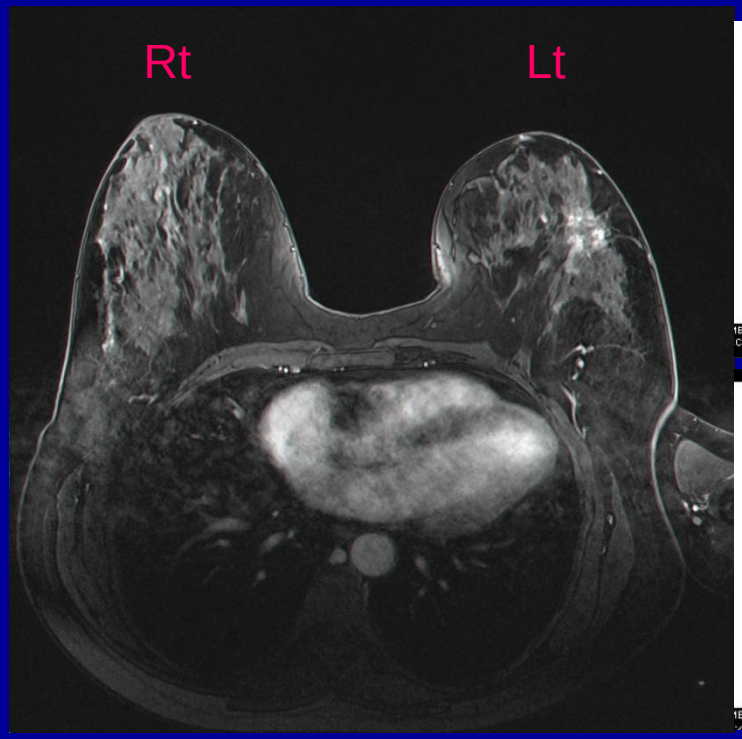
Invasive Lobular Ca

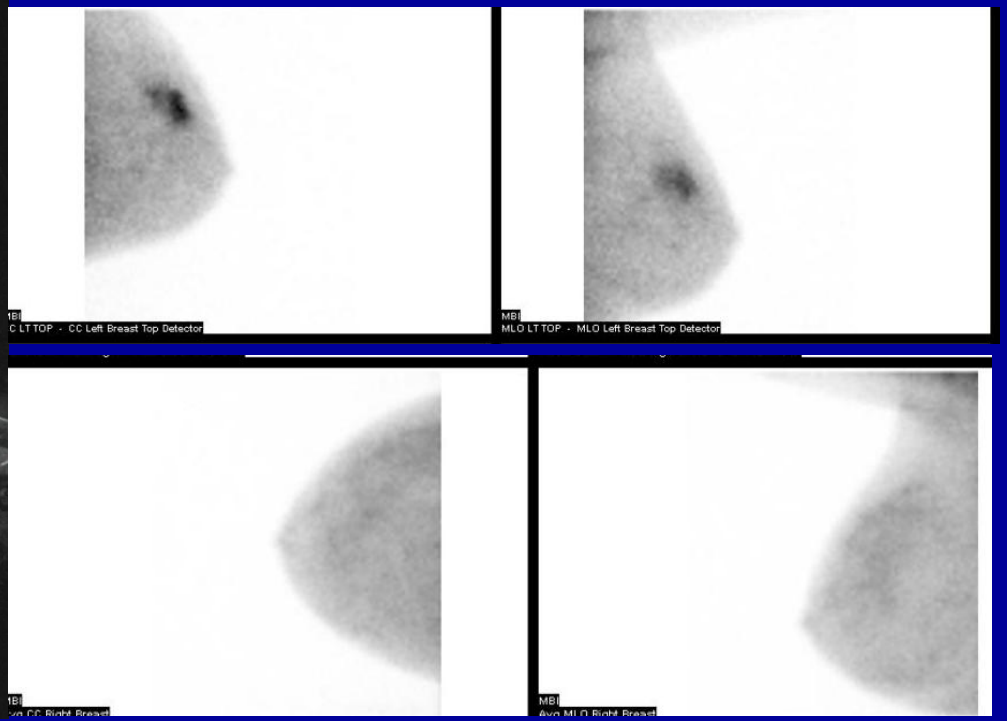
DCIS

Ruling out disease

A 42-year old patient with newly diagnosed cancer in the left breast prior to neo-adjuvant therapy.

Enhanced breast tissue. Is the right breast OK?

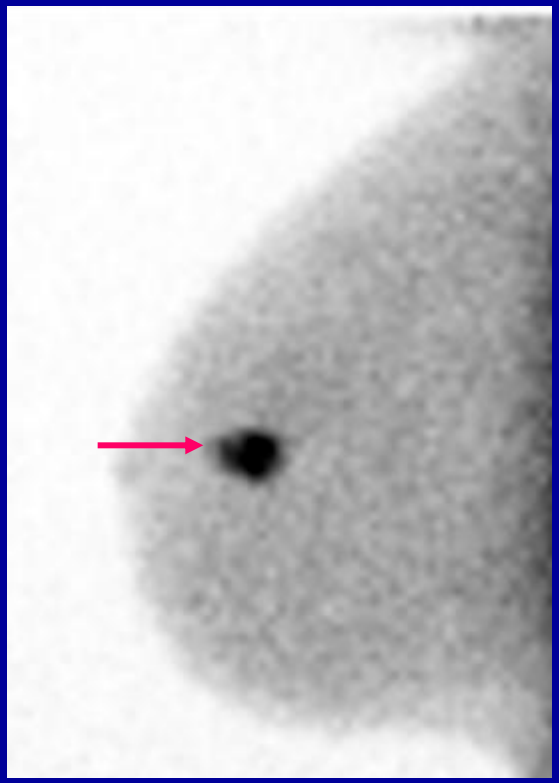




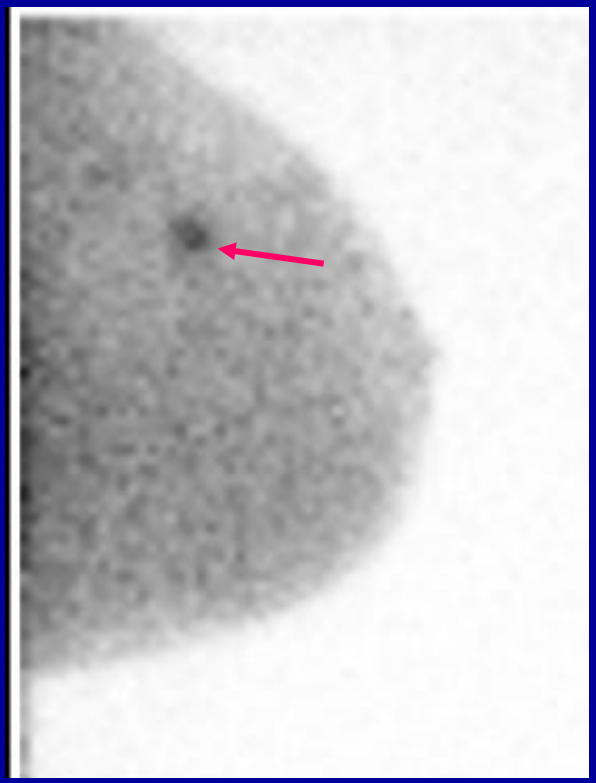
Patients that cannot have MRI

36-old BRCA- carrier. Newly diagnosed IDC on the right. Normal mammography and US on the left.

Patient had *shrapnel injuries*



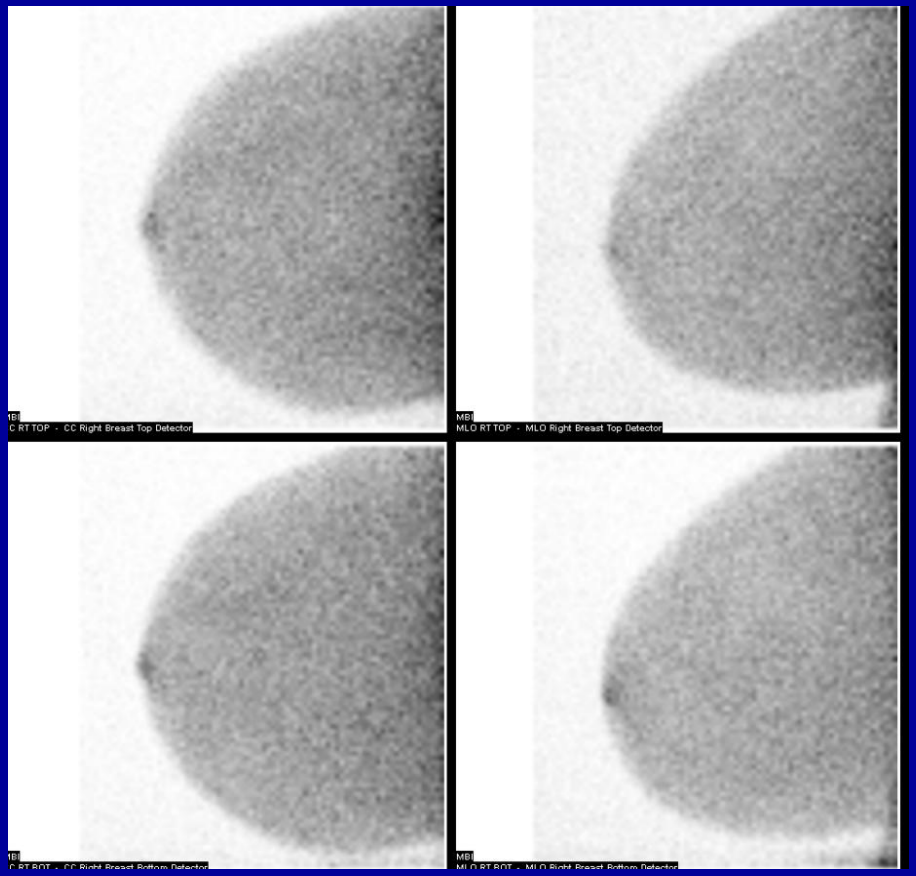
Known IDC on the right



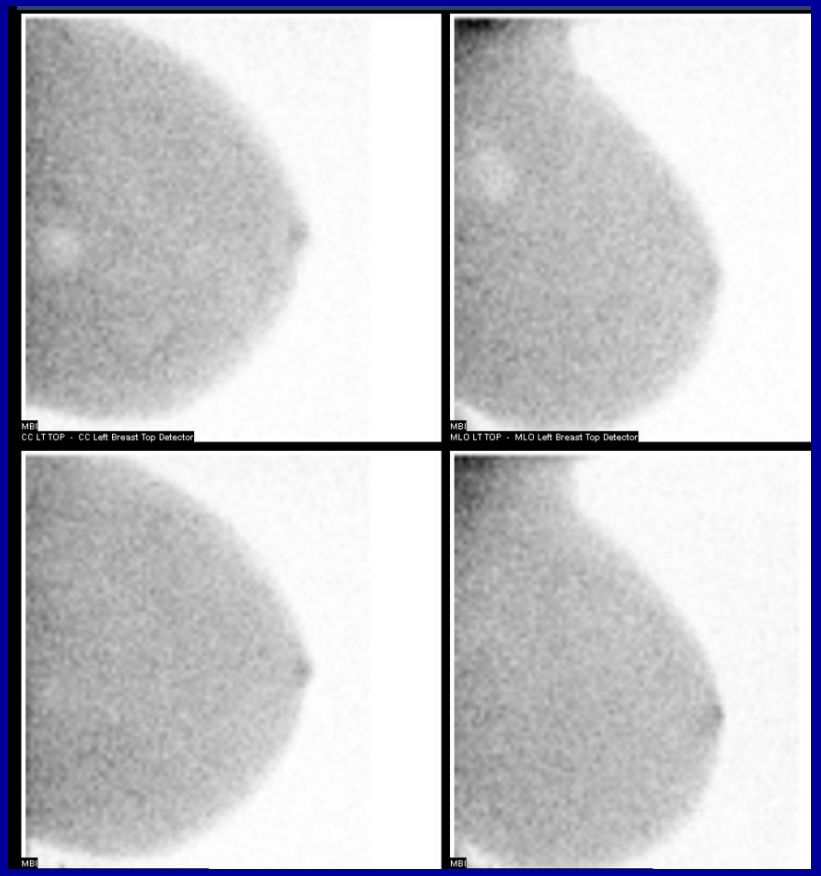
Unexpected 0.4cm IDC on the left

High- risk large patient
Contraindication for MRI (pacemaker)

Normal study on MBI. No malignancy on follow-up

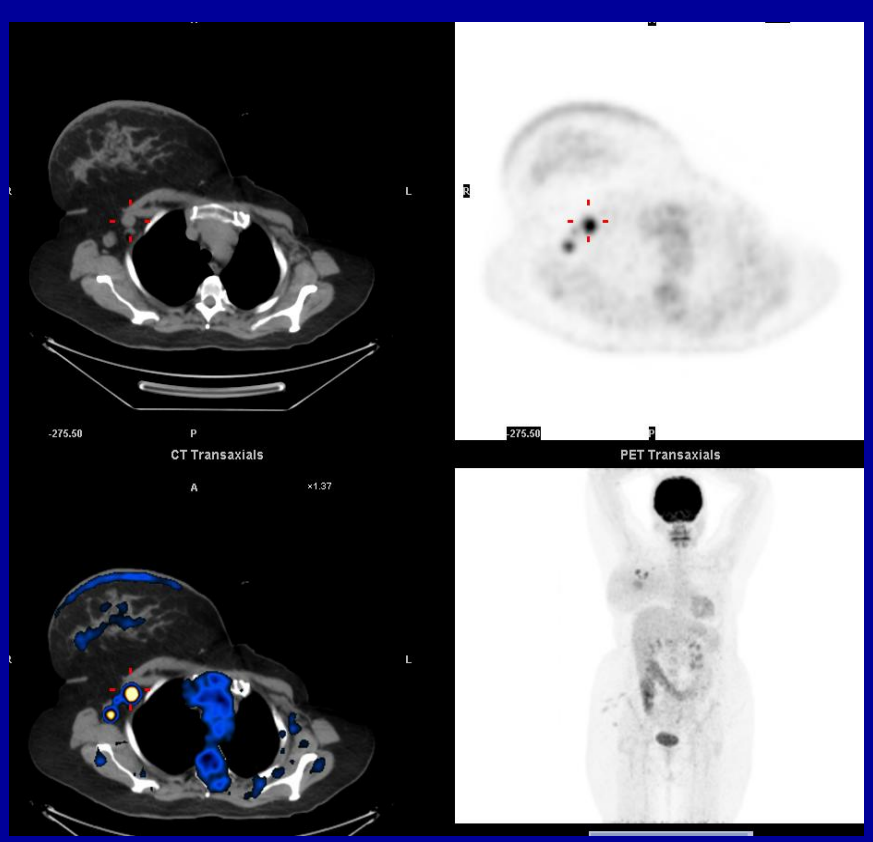


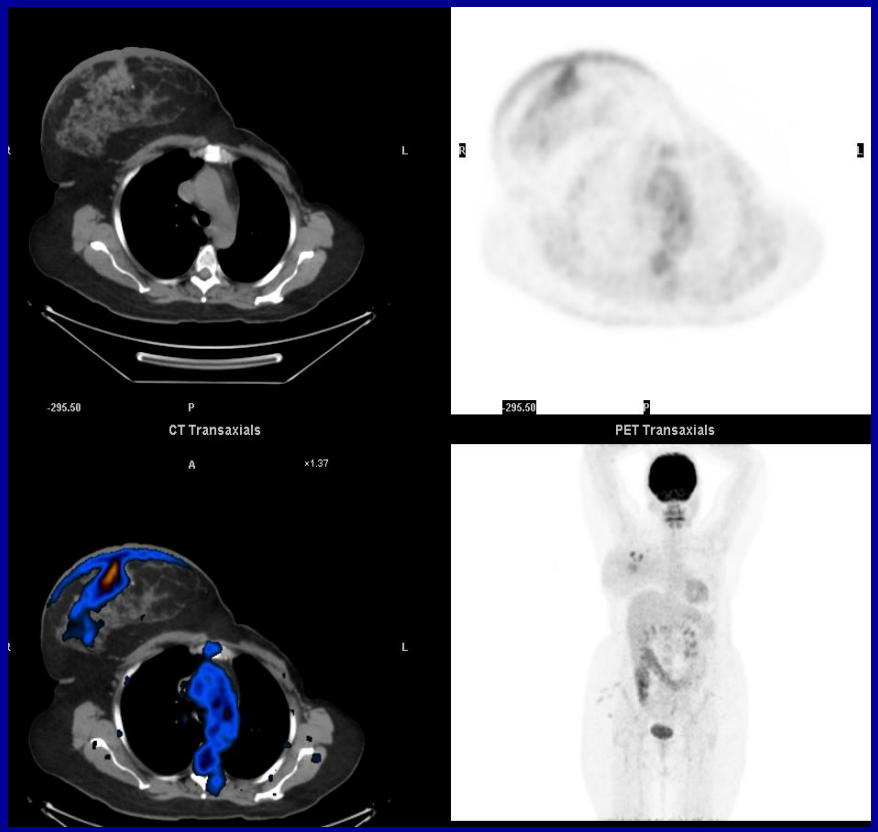
Right breast



Left breast

Searching for primary. PET-CT

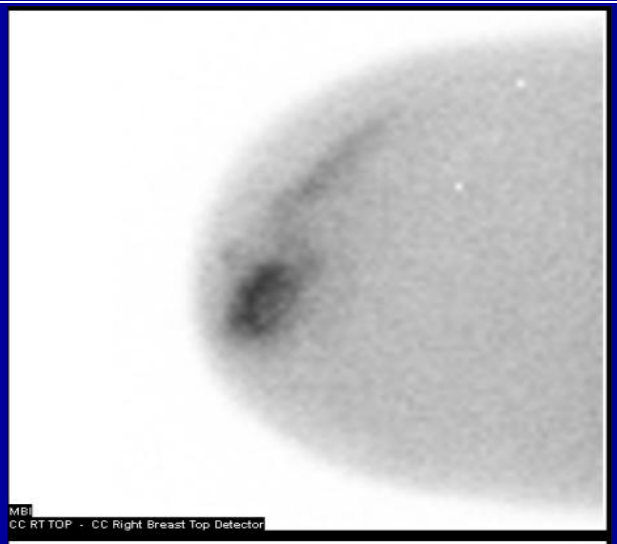




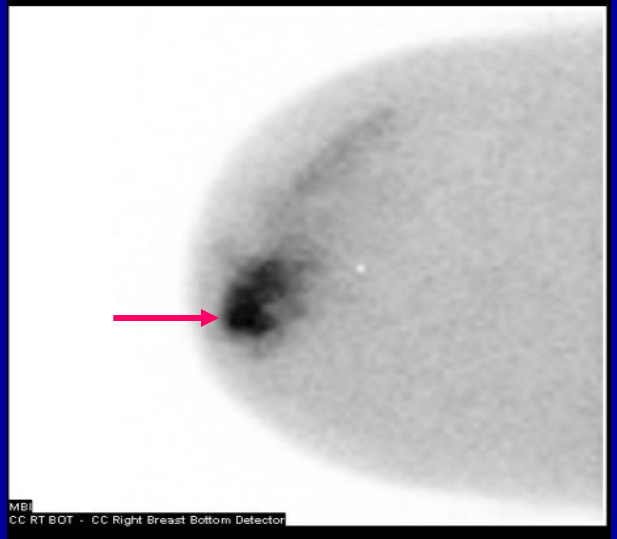
Previous Lt mastectomy. Now Rt axillary metastatic LNs.

Guiding biopsy site. MBI

Upper detector



Lower detector

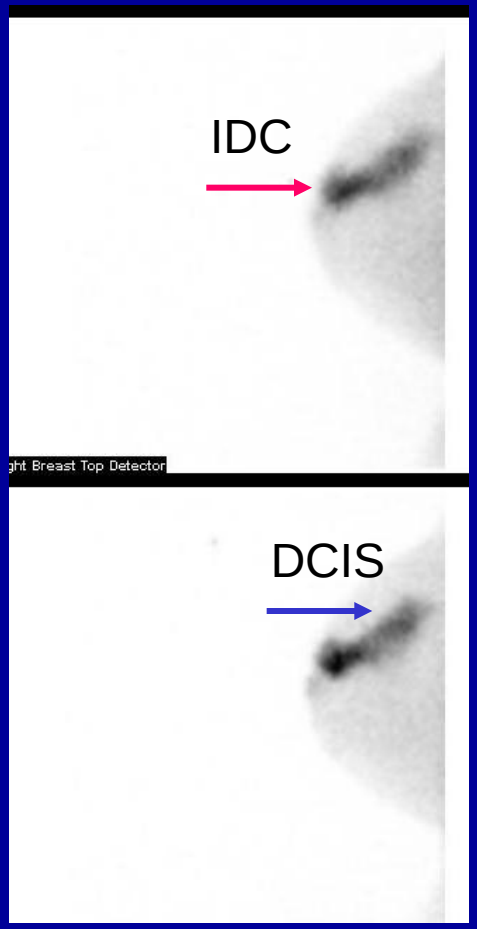


Final diagnosis

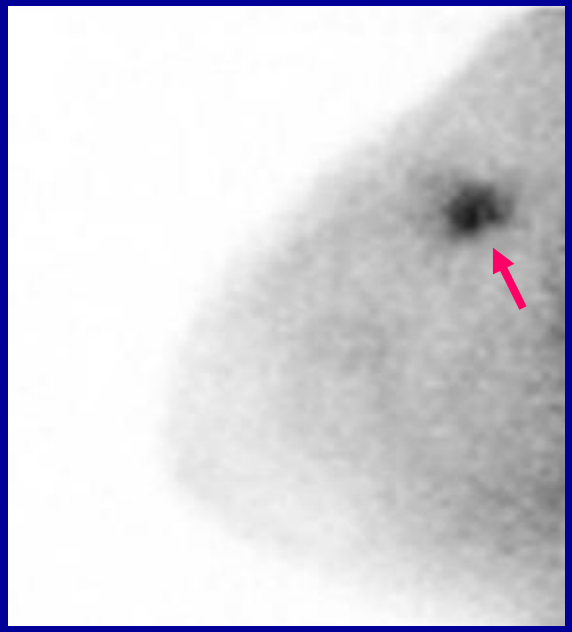
IDC triple negative

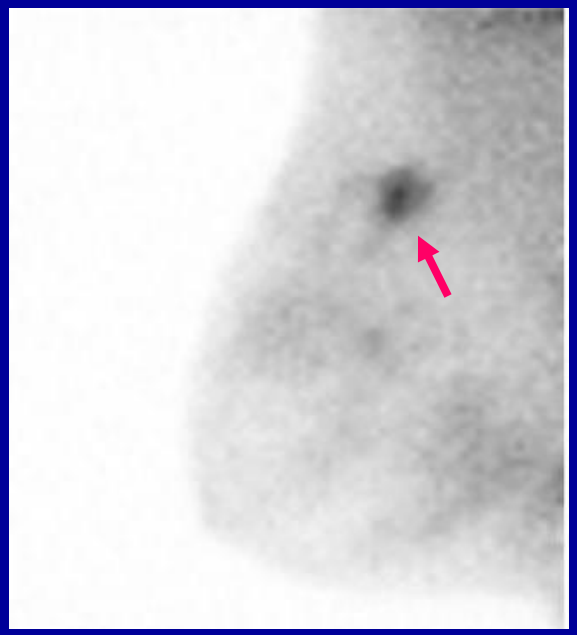
Mixed response to neo-adjuvant: IDC and DCIS

Before neo-adjuvant



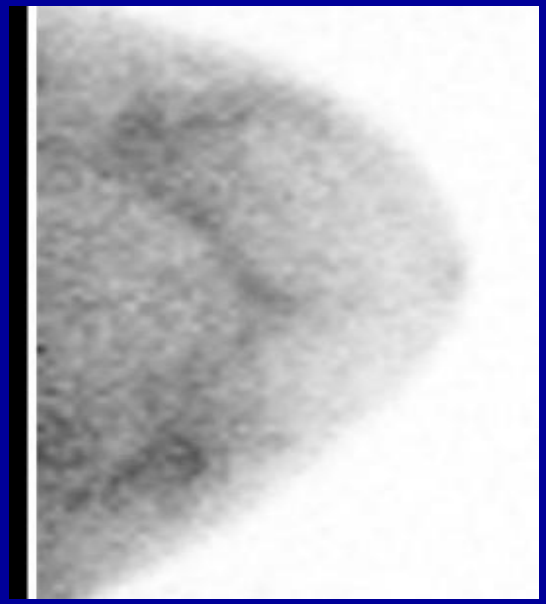
At completion of neo-adjuvant

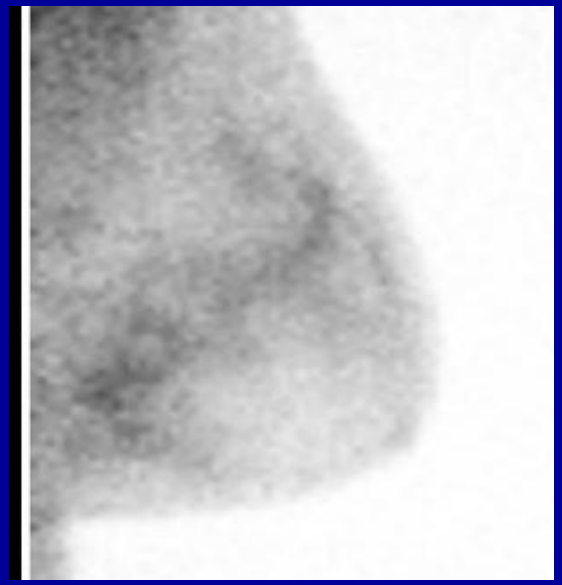




6 months
after delivery

Breast Ca in the right breast (arrow) diagnosed during lactation.

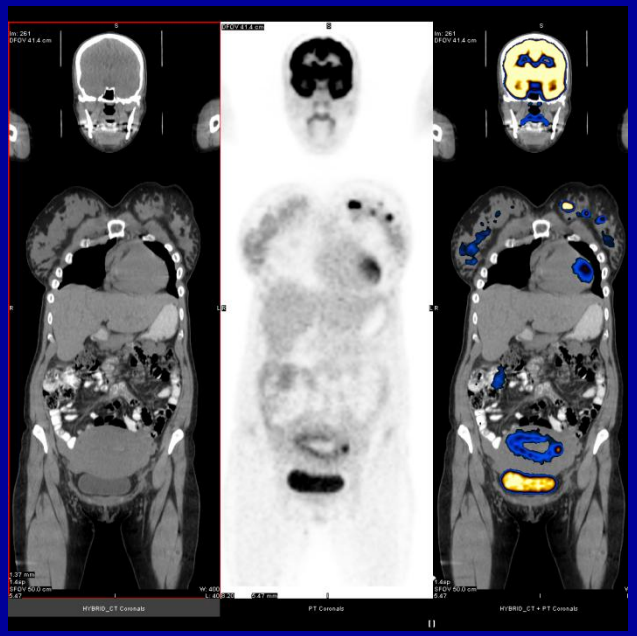


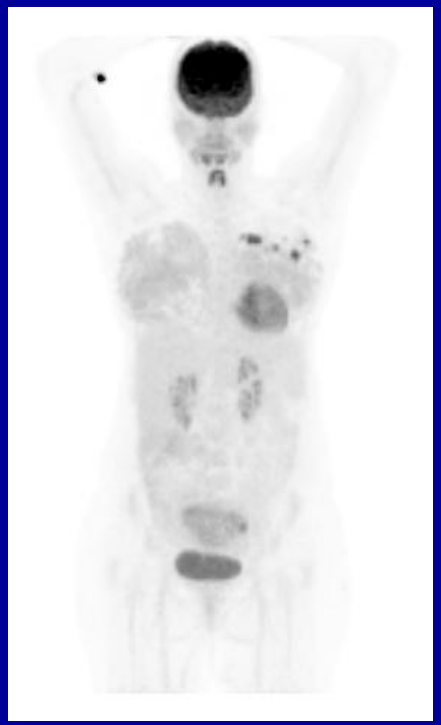


Since the diagnosis breast feeding only on the left.

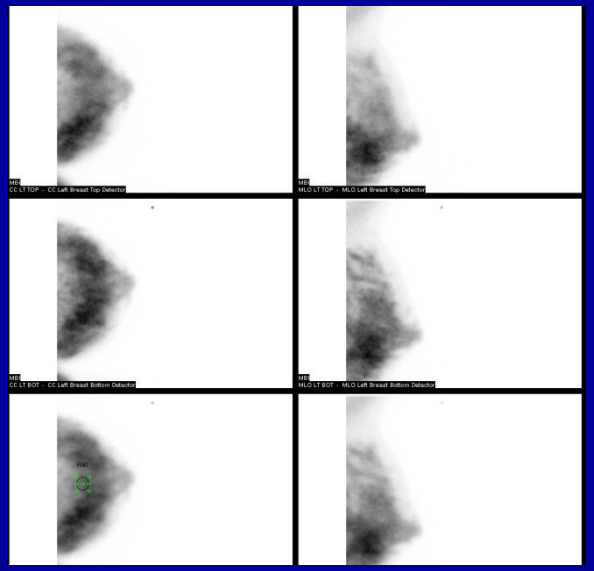
One day after delivery

PET/CT

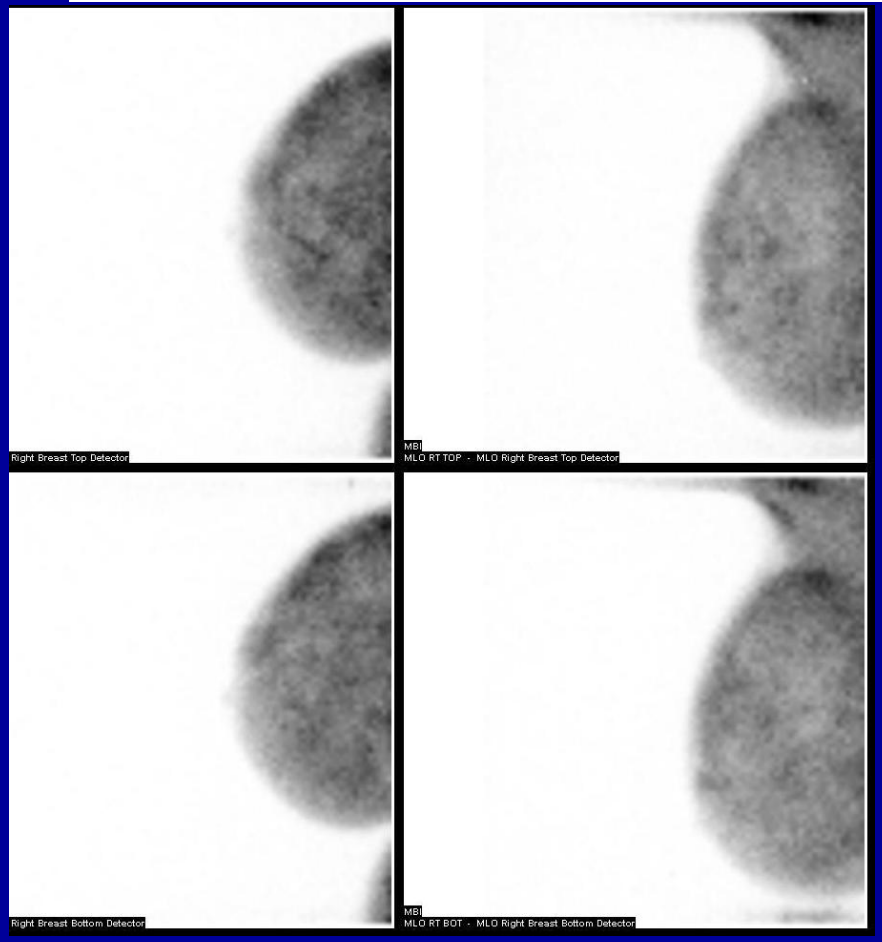


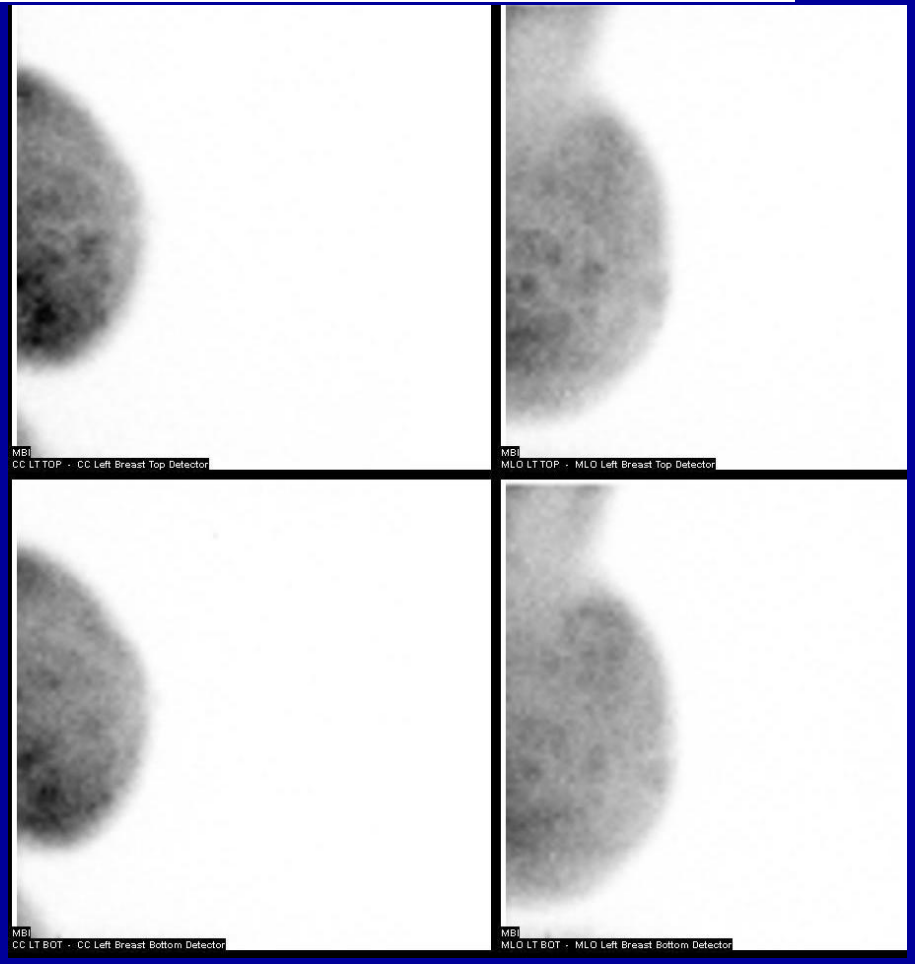


MBI



“problematic reading”
High-risk patient





Further assessment of MBI: Challenges

- **Technology and radiochemistry:**

  Optimization of technology in order to maintain good lesion detection with reduced tracer dose.

  Allow an online biopsy.

  Development of new tumor-specific tracers

  (improve specificity with tumor-specific agents)

Further assessment of MBI: Challenges

- **Clinicians**

The added value of MBI both as a screening modality as well as a diagnostic one in various clinical scenarios should be tested in specific patient groups conducting well designed prospective studies.

Introduce MBI in the breast imaging algorithm

Tel- Aviv Jaffa