The Miller Method ™

Problem Solving the CC and MLO

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BACK TO THE BASICS

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ANATOMY - PHYSIOLOGY - PHYSICS

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You lucked out……no physics!

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Except……

- For every action there is a reaction
- What goes up, must come down

*Sir Isaac Newton's Laws of Motion

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ANATOMY AND PHYSIOLOGY AS THEY RELATE TO MAMMOGRAPHY POSITIONING USING GENERAL RADIOLOGY PRINCIPLES

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Goals for Mammography Positioning

- Bring the breast back to it's true anatomical position
- Use palpable and visible anatomical landmarks for positioning and clinical image evaluation
- Use consistent and reproducible methods

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The goal for **ALL** body part positioning should be to bring that part back to it's natural anatomical position and perform orthogonal views. This maximizes visualization of that body part and avoids superimposition of structures.

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The goal for **mammography** positioning should be to bring the breast back to it's natural anatomical position (with the nipple perpendicular to the chest wall) on both screening views to maximize visualization of breast tissue and to avoid superimposition of structures.

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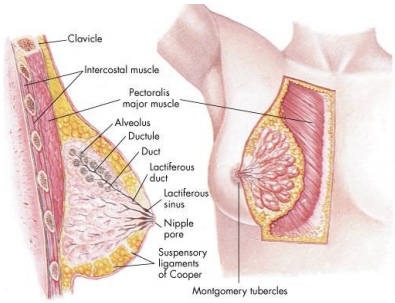
Anatomy of the Breast



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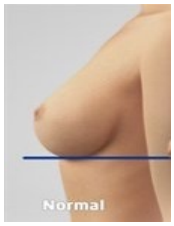
Normal or natural position of the breast is when the nipple perpendicular to the chest wall



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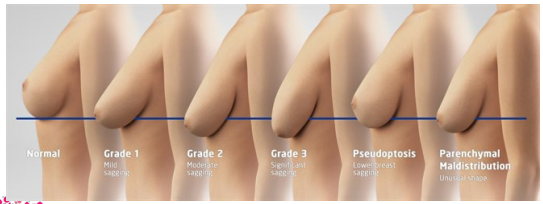
When positioning for mammography we need to bring the breast back to it's 'normal' position



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In order to accomplish this and include the maximum amount of breast tissue we must consider the anatomical landmarks that will be used for positioning and clinical image analysis.

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- Perimeter
- Pectoralis muscle
- PNL
- VNL

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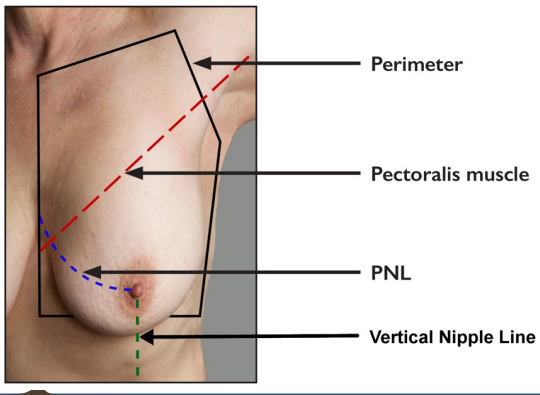

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Perimeter of the breast

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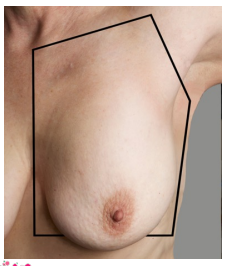
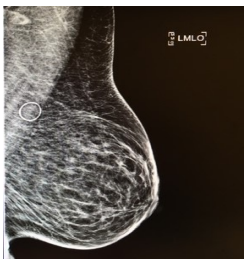
Perimeter used for positioning and clinical image analysis





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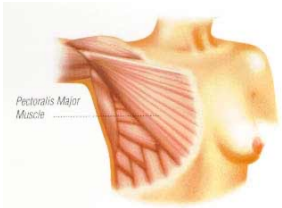
Pectoralis major muscle



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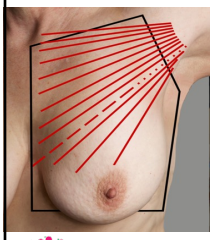
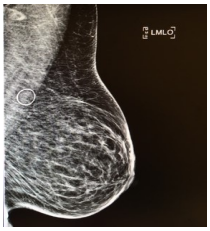
Pectoralis used for positioning and clinical image analysis





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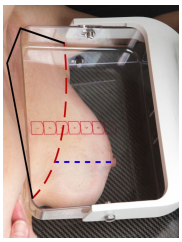
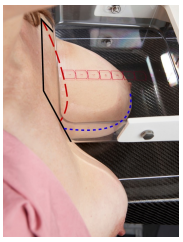
PNL used for positioning:
Elevate the breast so that the PNL is as close as possible to perpendicular to the chest wall





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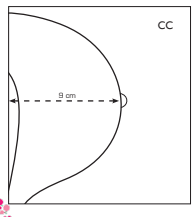
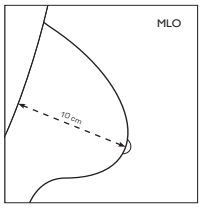
PNL used for clinical image analysis:
PNL measurement of CC should be within 1cm of the PNL measurement on the MLO





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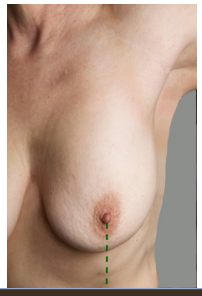
Vertical Nipple Line

Used for postioning the MLO



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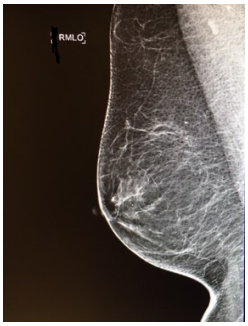
THE MLO

* Inclusion of all breast tissue within perimeter
* Pectoral muscle fully visualized
* Tissue well separated
* Tissue visualized back to retromammary fat space
* IMF



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MLO:
Visualization of the pectoral muscle

- ***The pectoralis muscle is really not part of the breast…..however it serves as an important anatomical landmark for positioning and film evaluation***

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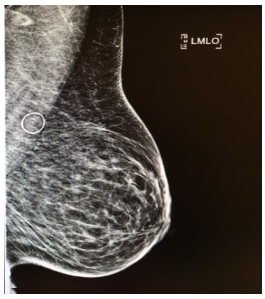
* Visualized down to the PNL

* Wide margin at the axilla

* Convex/straight

* Radiolucent



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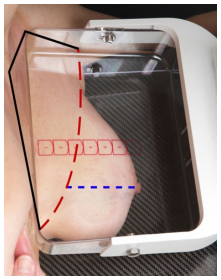

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The absence or presence of these characteristics will tell you exactly what you did right…or did wrong when positioning and therefore….. whether you included or excluded breast tissue!!

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LENGTH OF THE MUSCLE

Should be visualized down to the level of the PNL

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EQUIPMENT: Length of the Muscle is related to the degree of angulation

The average degree of angulation will be 40-50 degrees, but most importantly, the angle should be chosen on the basis of anatomy. The wrong degree of angulation could exclude breast tissue.

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PATIENT: Length of muscle is related to the position of the patient.

The patient must be turned into the machine with both feet, hips and shoulders as far forward as possible as not to impede progress of the compression paddle.

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Angle for the MLO

- Angle to the free margin of the pectoralis muscle.
- Keep angulation consistent
- Steeper angle for patients with longer thoraxes and small breast
- Lesser angles for shorter thoraxes and larger breasts

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Recommended Angulation for MLO

- Depends on body habitus
- Maintain consistency from year to year

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I am going to say something that is shocking!!

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Keep angles consistent

- 40 for shorter, heavier patients with large breasts
- 45 for average patients
- 50 for tall, thinner patients with smaller breasts

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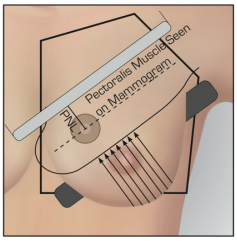
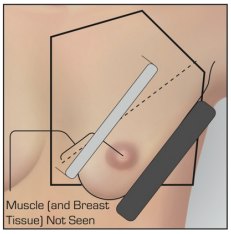
Proper degree of angulation



Angle too steep



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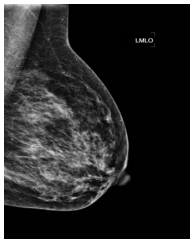
Proper degree of angulation

Angle too steep



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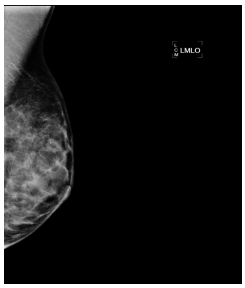
Is it the angle or the patient?



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WIDTH OF THE MUSCLE

There should be a wide margin of the pectoralis muscle at the top of the image (in the axilla).

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EQUIPMENT: Width of the Muscle is related to placement of the IR in the axilla

The back corner of the IR should be placed just anterior to the latissimus dorsi

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PATIENT: Width of the muscle is related to the position of the patient.

The patient must be turned into the machine with both feet, hips and shoulder as far forward as possible, with the shoulder down, relaxed and pulled forward

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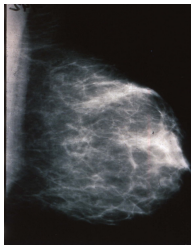
Is it the placement of the IR in the axilla or the patient?



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SHAPE AND OPACITY OF THE MUSCLE

The muscle should be convex or straight

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EQUIPMENT: The shape and opacity of the muscle is related to the height of the IR

The top of the IR should be positioned at height of the sternoclavicular joint, or half way between the top of the shoulder and the axillary crease.

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PATIENT: The shape and opacity of the muscle is related to relaxation of the pectoralis muscle

Patient's shoulder, arm and hand muscle Be relaxed.

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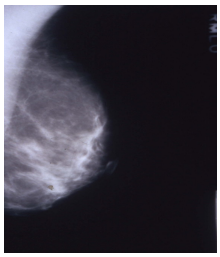
Is it the height of the IR or the patient?



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Problems with the MLO

- No visualization of the IMF
- Folds in the IMF
- Breast drooping

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VISUALIZATION OF THE IMF

Equipment challenges:

Change of the angle will not compensate for the increased length and the width of IR for FFDM and DBT (compared to the bucky)

Change should be made in the patient position

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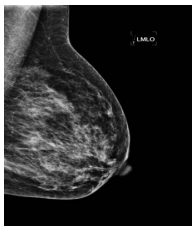
No IMF



IMF

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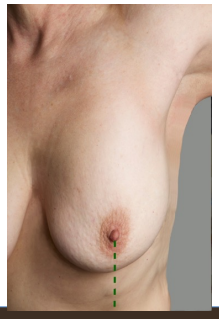
Vertical Nipple Line



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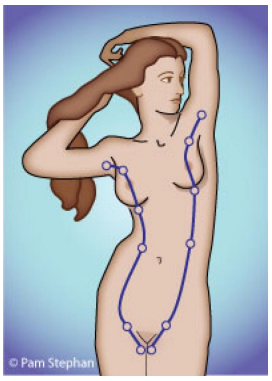

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The position of the patient related to the bottom, front corner of the IR is critical

- Patient must be facing forward with both feet
- Lower front corner of the IR should be directly below the patient's nipple (VNL) or half between her ASIS and umbilicus
- This requires the patient taking a "side step" towards you.

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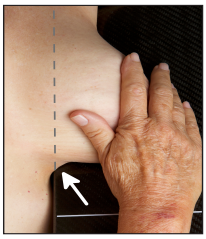
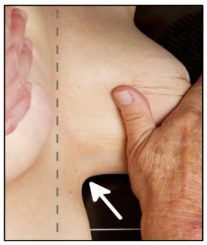
Improper

Edge of IR in front of IMF



Proper

Edge of IR behind IMF



Top edge of IR indicated by vertical dotted line

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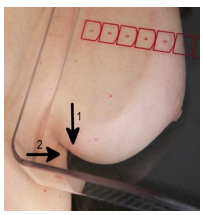
Folds in the IMF



1. Horizontal fold is in the medial breast
2. Vertical fold is in the lateral breast

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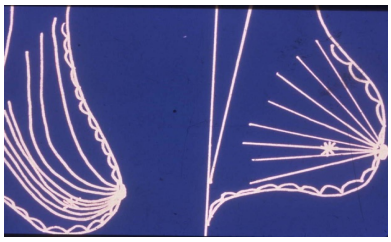
Breast sagging



Courtesy Stephen Feig, MD

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POSITION OF THE BREAST

- Breast held in up and out position to bring the breast back to its 'normal' position (nipple perpendicular to the chest wall)
- Maintained by adequate compression

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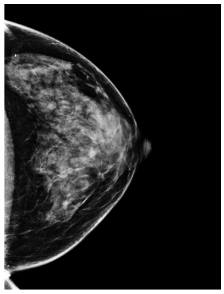
THE CC

- ***Include maximum amount of breast tissue in the axial/ transvers plane***
- ***Visualization of medial breast tissue (cleavage) if possible***
- ***Visualization of pectoralis muscle on approximately 30% of all CCs***



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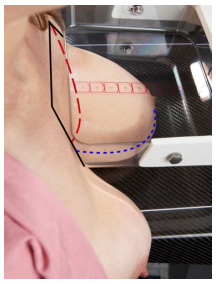

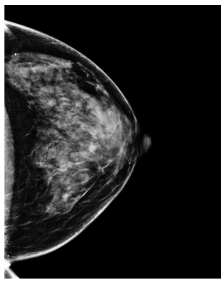

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Due to lack of anatomical landmarks, positioning techniques are extremely important!!

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Standardized method

- Stand on the medial side of the breast to be imaged
- Elevate the breast so that the PNL is perpendicular to the chest wall
- Adjust the height of the IR to elevated IMF
- Pull the breasts on with both hands
- Anchor the breast
- Lift the contralateral breast
- Guide patient's head forward and around
- Pull on lateral breast tissue

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Standardized method

Stand on the medial side of the breast to be imaged

- Facilitates exam
- Better enables you to lift other breast onto IR
- Helps you use your arm to keep patient forward
- Facilitates better eye contact with the patient

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Elevate the breast so the PNL is perpendicular to the chest wall and *pull* the breast on with both hands

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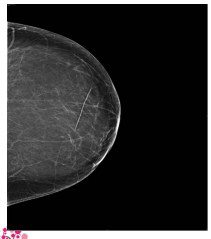
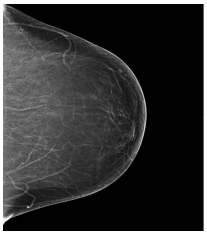
1 handed "plop" 2 handed pull





12.5 CM 14.8 CM

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Lateral, mobile border of the breast pulled forward

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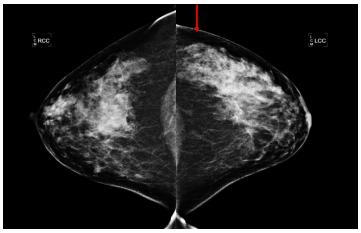
Failure to pull on lateral posterior breast tissue



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NIPPLE IN PROFILE
NIPPLE CENTERED

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Nipple centered

- Nipple should be centered on the CC view, if possible, and without sacrificing breast tissue.
- Nipple may not be centered due to prominent medial or lateral fullness of the breast, which should be noted on the hx sheet.

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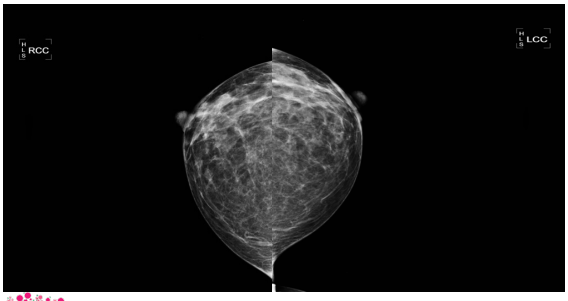
Patient with Prominent Medial Fullness



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- Breast tissue should never be sacrificed in order to center the nipple or show the nipple in profile.
- An additional view should be added and labeled appropriately.
- Notation should be made on hx sheet

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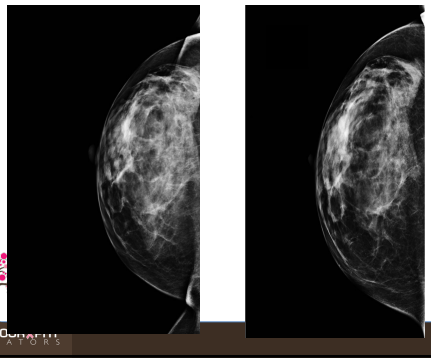
COMPRESSION



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Solutions – Compression

Criteria: Breast should be compressed until taut or less than painful. Glandular tissue should be well separated

- Technologist must compress the breast until "taut" or less than painful
- Technologist must work with the patient to achieve adequate compression.

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Sequence of Views

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All general radiology exams
are done in the same sequence

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But in mammography…..
we are "all over the map".

- LCC, LMLO, RMLO, RCC
- RCC, LCC, RMLO, LMLO
- RMLO, RCC, LMLO, LCC
- LCC, RCC, LMLO, RMLO
- RCC, RMLO, LMLO, LCC
- LCC, LMLO, RCC, RMLO
- LMLO, LCC, RCC, RMLO

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The last bit of shocking news!

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My suggestion:

- Do CC's first
- Then do the MLO on the side you just finished the CC on.
- Do the other MLO

Example: RCC, LCC, LMLO, RMLO

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SO……

Just like in general radiology let's all positioning using the same method and the same sequence.

WHAT A NOVEL CONCEPT!!

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WHY???

- **Consistent**
- **Reproducible**
- **Efficient**
- **Proficient**
- **Ergonomically sound**
- **Decreases errors**
- **Decreases radiation exposure**
- **Finds more early breast cancers**
- **Saves lives**

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MAMMOGRAPHY SAVES LIVES!!

BUT IT IS UP TO YOU……..

THE BEST RADIOLOGIST CANNOT DIAGNOSE A CANCER THAT IS NOT INCLUDED ON THE FILM

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THANK YOU!

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