

# TOMOSYNTHESIS GUIDED BREAST BIOPSY

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## LEARNING OBJECTIVES

- What is the difference between tomosynthesis guided breast biopsy compared with 2D stereotactic guided biopsy
- When and how do we decide which patients receive tomosynthesis guided biopsy compared to 2D stereotactic biopsy
- Advantages and disadvantages to tomosynthesis guided biopsy
- What advantages does the new prone tomosynthesis/2D table provide
- What is the medical physicist's role with this modality

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## DISCLOSURES

- I have no disclosures to report

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## HISTORY OF TOMOSYNTHESIS

- Basic theoretical framework was provided by Ziedses des Plantes in the 1930's
- In 1972 Grant coined the term 'tomosynthesis' in a landmark paper that described simple tomosynthesis reconstruction
- In the 1970-1980's a number of variants of tomosynthesis were developed (i.e. ectomography and flash tomography)
- With the advent of spiral CT in the 1980's tomosynthesis research halted
- In the 1990's research using tomosynthesis for chest and breast imaging began

Medical Physics Vol. 36, No. 6, June 2009

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## HISTORY OF TOMOSYNTHESIS

- 1992 Christian, Niklason, LT, Niklason, LE and Kopans started looking at digital breast tomosynthesis (DBT) for breast imaging
- 2000 in collaboration with GE Healthcare the first studies were performed using DBT and a patent was granted
- 2011 FDA approved Hologic Selenia Dimensions 3D system for breast tomosynthesis
- 2013 FDA approved Hologic C-view imaging software for use with DBT to reconstruct 2-D images and Hologic Affirm Breast Biopsy Guidance System

Medical Physics Vol. 36, No. 6, June 2009

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## TOMOSYNTHESIS

- DBT is a 3D method of imaging that reduces tissue overlap seen in regular 2D mammography
- It is a form of limited-angle tomography
- Low-dose full field projection images of the breast are obtained from different angles with x-rays passing through the breast from different directions
- Reconstruction produces many 1 mm image slices

AJR2014; 202:299-308

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## TOMOSYNTHESIS

- In the screening patient, both the craniocaudal (CC) and mediolateral oblique (MLO) projections are acquired; however, additional projections may be obtained if warranted.
- The x-ray source moves in a single plane in an arc around the imaged breast.
- These projection images are then reconstructed into 1-mm-thick images for review. Filtered back projection (FBP) is the most commonly used method for reconstruction,

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## TOMOSYNTHESIS

**TABLE 1: Comparison of Food and Drug Administration–Approved Tomosynthesis Units**

Manufacturer	Hologic	GE Healthcare	Siemens Healthcare
Model	Selenia Dimensions	SenoClaire	Mammomat Inspiration
Scanning angle (°)	15	25	50
Projections	15	9	25
Scanning time (s)	4	7	24
Tube motion	Continuous	Step and shoot	Continuous*
Detector material	a-Se	a-Si/CsI	a-Se
Reconstruction	Filtered back projection	Iterative	Filtered back projection

\*Continuous scanning mode with short pulses of radiation. a-Se = amorphous selenium, a-Si/CsI = amorphous silicon/cesium iodide.

AJR 2017; 208:256–266

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## TOMOSYNTHESIS

- Advantages to using DBT:
  - Decreases call back from screening.
  - Better for dense breast tissue.
  - Able to see architectural distortion and isodense masses better.
  - Helps distinguish skin lesions without the use of tangential views.
  - Helps localize a lesion for ultrasound or biopsy.
  - Allows better visualization of mass margins so can go straight to ultrasound from screening call back.

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## TOMOSYNTHESIS

- Disadvantages to using DBT:
  - Longer scan time than 2D mammogram.
  - Increase radiation dose compared with 2D.
  - Not yet covered by all insurance companies.
  - Takes longer time to read.

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## TOMOSYNTHESIS VS. STEROTACTIC GUIDED BIOPSY – LESIONS BEST VISUALIZED

### Tomo Guided Biopsy

### Stereotactic Guided Biopsy

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|---|--|
| <ul style="list-style-type: none"> <li>• Architectural Distortion</li> <li>• Isodense or low density lesions.</li> <li>• Single view findings.</li> </ul> | <ul style="list-style-type: none"> <li>• Calcifications</li> </ul> |
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## TOMOSYNTHESIS VS. STEROTACTIC GUIDED BIOPSY - ADVANTAGES

### Tomo Guided Biopsy

### Stereotactic Guided Biopsy

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|---|--|
| <ul style="list-style-type: none"> <li>• Can be done upright or prone position if you have both available.</li> <li>• Larger field of view 18 x 24 cm.</li> <li>• Shorter biopsy times (13 vs 29 minutes).</li> <li>• 3D imaging for better and more accurate targeting.</li> <li>• Biopsy equipment is easily installed and removed from a mammogram machine.</li> <li>• Less exposures needed.</li> <li>• Patients who are over the weight limit for the prone table.</li> <li>• Better ability to make adjustments due to better visualization of the lesion and trough and needle tip.</li> </ul> | <ul style="list-style-type: none"> <li>• Can be done upright or prone position if you have both available.</li> <li>• If patient does not want to see the needle prone positioning allows for them not to.</li> <li>• Better to see calcifications.</li> <li>• Less vasovagal episodes.</li> </ul> |
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### TOMOSYNTHESIS VS. STEROTACTIC GUIDED BIOPSY – LIMITATIONS

#### Tomo Guided Biopsy

- Vasovagal episodes.
- If only have upright biopsy system more difficult to reach very posterior lesions.
- A mammogram machine is need so won't be able to do mammograms on it when biopsy is occurring.

#### Stereotactic Guided Biopsy

- Difficult to accurately biopsy distortions, isodense masses and one view findings.
- Smaller FOV.
- Longer time for biopsy.
- In only have prone table cannot biopsy patients over weight limit or those who cannot lie on their stomach.
- Posterior lesion accessibility

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### TOMOSYNTHESIS GUIDED BIOPSY

- Use a 7G – 11G vacuum biopsy needle.
- Comes in standard size (20 mm trough), petite (12 mm trough) and Non-firing (12 mm trough).
- Tomosynthesis guidance helps over come technical challenges previously seen in stereotactic biopsy:
  - Superficial lesion
  - Deep or very superior lesion

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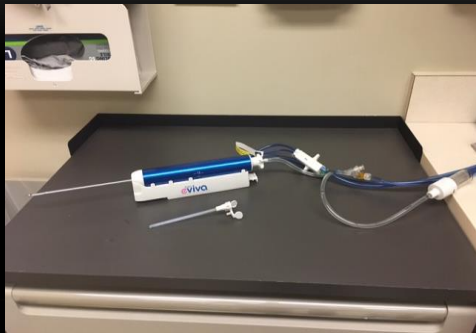
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### TOMOSYNTHESIS GUIDED BIOPSY



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TOMOSYNTHESIS GUIDED BIOPSY



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TOMOSYNTHESIS GUIDED BIOPSY



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TOMOSYNTHESIS GUIDED BIOPSY



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## TOMOSYNTHESIS GUIDED BIOPSY

- The TVAB system is mounted onto the mammogram equipment's C-arm and locked into place.



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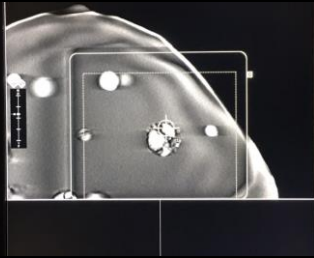
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## TOMOSYNTHESIS GUIDED BIOPSY

- After consent is given and a time out is performed the patient is positioned and a scout tomosynthesis view is performed to acquire the target.



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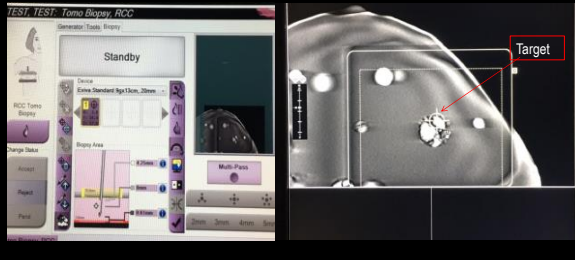
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## TOMOSYNTHESIS GUIDED BIOPSY

- The target is marked and the coordinates are sent to the TVAB system.



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### TOMOSYNTHESIS GUIDED BIOPSY

- The needle is then attached to the system and the needle is homed and then targeted to the appropriate coordinates.



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### TOMOSYNTHESIS GUIDED BIOPSY

- The patient's skin is cleaned and lidocaine is injected into the skin and subcutaneous tissues. Then the needle is advanced along the z-axis to the appropriate depth.



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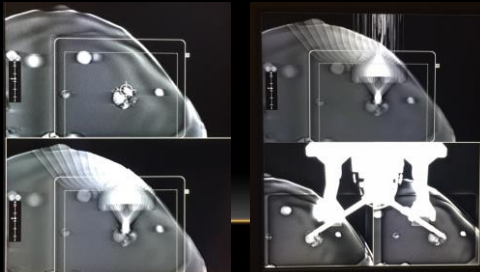
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### TOMOSYNTHESIS GUIDED BIOPSY

- A second set of tomosynthesis images is performed to ensure accurate targeting.



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### TOMOSYNTHESIS GUIDED BIOPSY

- Biopsy is then performed taking 6-12 cores and a clip is then



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### TOMOSYNTHESIS GUIDED BIOPSY

- A tomosynthesis is acquired to ensure clip deployment and appropriate placement.

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### TOMOSYNTHESIS GUIDED BIOPSY

- Pressure is held for 10 minutes to stop bleeding and a post biopsy 2D CC and ML mammogram is performed.

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## NEW PRONE 2D/3D TABLE

- Enables biopsy of lesions only visible with tomosynthesis.
- Amorphous Selenium Detector (same detector technology as the upright).
- X-ray translucent paddles for better visualization of breast tissue surrounding biopsy window.
- 6.5 times larger FOV – 14.3 cm X 11.7 cm.
- Fast one-click targeting.
- True 360 degree access – Lateral arm (no need to take patient out of compression moving from standard approach to lateral approach).
- Clear paddles (easier to see landmarks).

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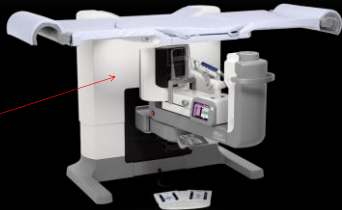
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## NEW PRONE 2D/3D TABLE

Visualize challenging subtle masses and faint calcifications  
Including those only visible under tomosynthesis imaging

Same  
proven  
detector  
technology  
found in  
Selenia®  
Dimensions  
© System



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## CASES

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