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Janet Cochrane Miller, D.Phil., Author Raul N. Uppot, M.D., Editor

Upright Digital Breast Tomosynthesis-Guided Breast Biopsy

- Digital breast tomosynthesis (DBT) increases the detection rate of small invasive breast cancers and decreases false positive callback rates on screening mammography.
- DBT-guided vacuum assisted biopsy (DBT VAB) is an accurate and efficient method of sampling lesions seen on DBT (without ultrasound or MRI correlates) such as architectural distortion, masses, asymmetries, and calcifications.
- VAB is a less invasive alternative to excisional biopsy given minimal scarring, decreased morbidity, faster patient recovery time, and lower cost.
- Upright DBT VAB is proving to be a faster and more comfortable method to biopsy patients compared to prone stereotactic table VAB.

Several trials have demonstrated the superiority of screening and diagnostic mammography using digital breast tomosynthesis (DBT) over full-field 2D mammography, specifically demonstrating how DBT increases the detection rate of small invasive cancers and decreases false positive callback rates.

With DBT, multiple low-dose full-field projection images are obtained from multiple angles in a 180° arc over the patient's breast to reconstruct 3D images of the breast. This allows radiologists to scroll through both fatty and fibroglandular breast tissue on multiple slices, improving the visualization, localization, and assessment of breast lesions.

DBT has been shown to decrease false positive findings on screening mammography that often result from overlapping breast tissue that might mimic a suspicious finding. DBT has also proved to be particularly helpful in detecting architectural distortion, which can often be overlooked on standard 2D mammography. If there is no prior history of surgery and no definitive correlate on breast ultrasound, architectural distortion requires further intervention since it can be associated with a high rate of malignancy.

Stereotactic Vacuum Assisted Biopsy

Vacuum-assisted biopsy is a less invasive alternative to excisional biopsy for breast calcifications, masses and architectural distortion. It is associated with minimal scarring, decreased morbidity, faster patient recovery time, and lower cost.

Stereotactic vacuum assisted biopsy (stereotactic VAB), historically performed using a prone table under 2D mammographic guidance, is a well-established method of tissue sampling for suspicious breast lesions (BI-RADS 4 or 5). It is most commonly used to sample calcifications but is less effective for sampling low-density breast lesions such as non-calcified masses, asymmetries, and architectural distortion.

DBT Vacuum Assisted Biopsy

DBT-guided vacuum assisted biopsy (DBT VAB) is a relatively new technique that enables sampling of lesions seen only on tomosynthesis (without a sonographic or MRI correlate) or 2D mammography (Figure 1). Although DBT VAB can be performed while the patient is prone or upright, the upright position offers several advantages.

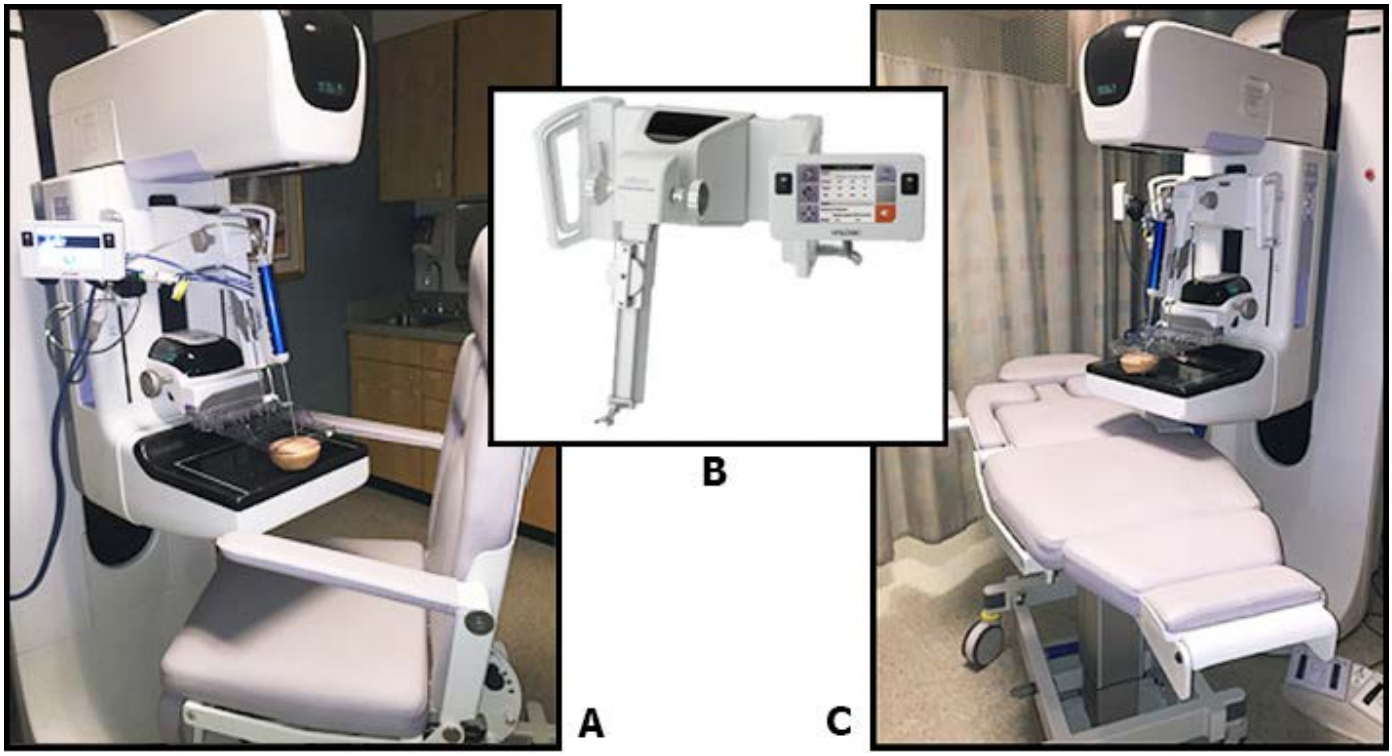

Figure 1. DBT VAB system: (A) Complete system; **(B)** Add on biopsy arm to DBT mammography unit; **(C)** Upright/reclining biopsy chair.

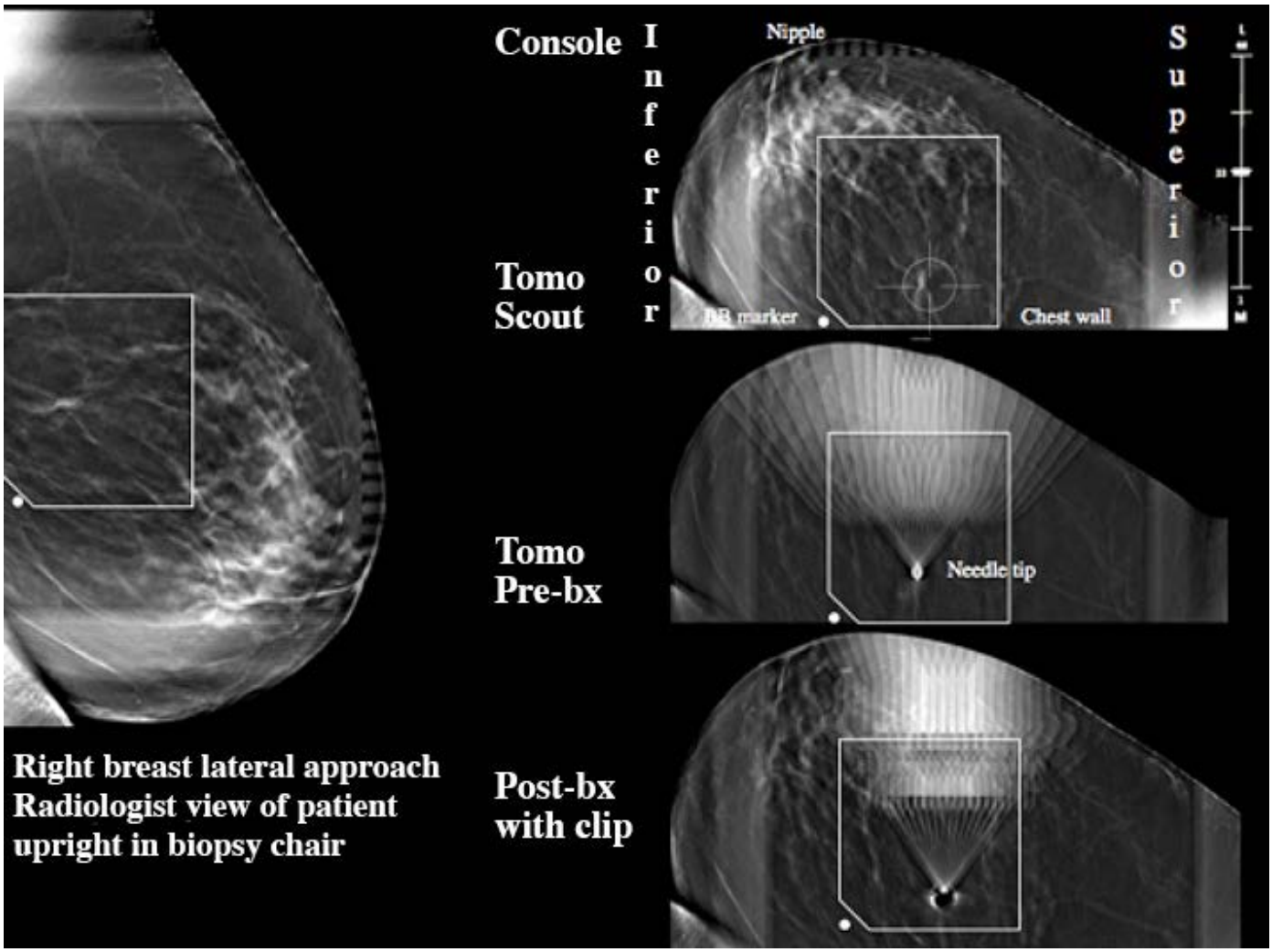

Figure 2. DBT VAB biopsy of an architectural distortion in the upper outer right breast that was detected only on DBT.

Comparison of Prone Stereotactic VAB and Upright DBT VAB

In both methods, the breast is positioned and compressed with the target lesion placed within an open window of the compression paddle. In prone stereotactic VAB, the depth of the lesion is calculated from a paired stereotactic set of images by triangulation, which can be challenging and time-consuming, especially for low-contrast lesions such as uncalcified masses, asymmetries, and architectural distortion. In DBT VAB, the depth of the lesion is calculated immediately on the initial tomographic scout image from a single tomographic slice where the lesion is most conspicuous. Coordinates for sampling are then automatically determined by biopsy software after the radiologist indicates the position of the target lesion with a cursor (Figure 2).

Table 1. Comparison of Prone Stereotactic VAB and Upright DBT VAB

	Prone Stereotactic VAB	Upright DBT VAB
Equipment	Dedicated biopsy table and suite	Add-on biopsy arm to standard diagnostic equipment
Patient position	Prone	Upright with the option to recline
Lesion location	Calculated from stereotactic images obtained from two viewpoints	Obtained directly from single scout DBT image showing depth
Mean procedure time*	29 min	13 min
Technical success rate*	93.1%	100%
Average total number of images acquired for procedure*	8	5

**Data from Shrading et al. evaluating 205 patients with 216 suspicious mammographic findings (Upright VAB – 46 patients with 51 lesions; Prone VAB – 159 patients with 165 lesions)*

A 9-gauge biopsy needle is used for both types of biopsies, and Lidocaine (1% buffered with sodium bicarbonate) is given to anesthetize the skin superficially and deep within the breast along the needle tract. After inserting the needle to the calculated position, images are obtained to confirm accurate needle placement in relation to the target lesion. Multiple core tissue samples are obtained and the specimen is radiographed immediately to confirm the lesion's presence in the tissue specimen. A metallic clip is then placed in the biopsy cavity to mark the location of the biopsied lesion and aid in further intervention if surgery is required.

Upright DBT VAB – Technical and Practical Advantages

Since instituting the upright DBT VAB procedure, we have experienced several practical and technical advantages over the prone stereotactic VAB procedure for lesions identified with either DBT or 2D mammography. It takes less time to position upright patients and target lesions because the technologists find that this position emulates standard mammographic procedures. A clear plastic full-field paddle allows better visualization of the target lesion and better access to posterior breast lesions, which are difficult to access on a prone table. Patients are biopsied sitting upright in a comfortable padded chair that also reclines so lesions can be sampled from any approach (including inferiorly) and pressure can be held at the biopsy site in a relaxed supine position. Additionally, a wider variety of patients can be biopsied in the upright chair who may not have been unable to tolerate prone positioning, including those with limited mobility, obesity, osteoarthritis and kyphosis.

Although the radiation dose for DBT is slightly greater than for standard 2D mammography, the overall radiation dose for DBT VAB is less since fewer images are acquired during the procedure.

For each DBT VAB procedure, we use a team approach focused on the patient, with two breast imaging technologists (one who assists the radiologist and one who engages/distracts the patient), one radiologist and one trainee. Patients' post-procedure images are also performed in the biopsy room with the same technologists, providing continuity of care.

Ultimately, upright DBT VAB streamlines and improves patient care by reducing procedure times, decreasing radiation dose and providing histology to help guide clinical management and potentially aid in pre-surgical evaluation and planning.

Scheduling

Massachusetts General Hospital, which pioneered DBT, has offered this technology to patients since 2011. It is now the standard of care in the Breast Imaging Division, with all patients receiving a DBT exam when they present for a screening or diagnostic mammogram. The upright DBT VAB procedure was instituted in January 2016 and is performed at the Avon Foundation Comprehensive Breast Center on the 2nd floor of the Wang Building on the main campus of Massachusetts General Hospital. Appointments can be made through EPIC (inside the Partners network) or Physician Gateway (outside the Partners network) or by calling 617-724-9729 (XRAY).

Further Information

For further information on upright DBT VAB, please contact Helen Anne D'Alessandro, MD, Breast Imaging Division, Department of Radiology, Massachusetts General Hospital, at 617-726-3093.

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