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Original Article

Digital breast Tomosynthesis vacuum assisted biopsy for Tomosynthesis-detected Sonographically occult lesions☆,☆☆,☆☆☆

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ABSTRACT

Purpose: To assess the utility and pathological results from DBT VAB for lesions occult on 2D mammography and breast ultrasound (US).
Materials and methods: A retrospective review of 1116 consecutive stereotactic biopsies was performed over 27 months. DBT VAB was performed for 38 non-calcified lesions which were solely detected using DBT. Imaging findings and pathology results were reviewed.
Results: Pathologic findings were malignant in 8 of 38 lesions [masses (5) and distortion (3)]. High-risk findings found in 14 lesions.
Conclusion: DBT VAB is easily performed and the majority of cases yield actionable pathologies. Therefore, perform DBT VAB primarily when available.

1. Introduction

The latest major shift in screening mammography has been the addition the digital breast tomosynthesis (DBT). This technology allows the reader to navigate the breast tissue in thin slice reconstructed images and provides significant gains in the detection of masses and architectural distortion, which may be obscured on standard 2D projections [1]. Previous studies have demonstrated an increase in cancer detection rate which has solidified this technology in the frontline of breast imaging techniques [1,2].

In a typical work-up, a non-calcified lesion appreciated on DBT either at the time of screening or diagnostic evaluation, is followed by an ultrasound (US) to help localize the lesion and determine if biopsy will be required [3]. DBT-detected architectural distortions have been shown at surgery to have a high rate of malignancy when wire localized and surgically excised [4]. At our institution, when a DBT-detected lesion meets the mammographic standards for biopsy and is occult on a targeted US, we proceed to digital breast tomosynthesis vacuum assisted biopsy (DBT VAB). The purpose of this study is to present our initial findings over a 27-month study period, to examine the presentation of DBT-detected lesions that then necessitated DBT VAB and the types of pathologies found using this biopsy method.

2. Materials and methods

An IRB waiver was obtained for this retrospective review of a prospectively- maintained database. DBT VAB was performed at two outpatient facilities between December 2012 and February 2016 by two breast fellowship trained radiologists of five and thirteen of experience and one interventional radiologist with sixteen years of experience reading mammography and performing breast procedures. All readers were certified in tomosynthesis interpretation through proctored review of at least 100 cases and had been reading tomosynthesis for one year.

We reviewed 1116 consecutive stereotactic biopsies assessed as Breast Imaging Reporting And Data System (BI-RADS) category 4 or 5 that were imaged with both conventional digital mammography and DBT during the second and third years that tomosynthesis imaging was available at our institution.

Two independent breast radiologists separately reviewed each case for technical feasibility, for sampling under DBT VAB, for lesions lacking calcification and not seen on standard 2D views, versus conventional stereotactic prone biopsy. They agreed that there was no appropriate sonographic target seen on targeted US, which was first performed by a breast sonographer and then followed by a radiologist-performed US. None of the lesions were clinically palpable. All masses were measured in their largest dimension on DBT images and shape and margins were characterized and recorded according to the BI-RADS lexicon.

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All the cases of DBT VAB were drawn from DBT-detected lesions on screening mammography utilizing the CC and MLO Combination mode of the Selenia Dimensions (Hologic, Bedford, MA). A 90-degree lateral view with DBT was performed for the purposes of localization and biopsy planning prior to DBT VAB.

2.1. DBT vacuum assisted biopsy

The Eviva and Affirm Breast Biopsy systems (Hologic, Bedford, MA) were used for all DBT VAB. The lesion was targeted in the projection where the target was best seen and the biopsy needle would traverse the least amount of breast tissue. Patients were positioned seated or in a lateral decubitus position (Fig. 1).

A tomosynthesis localizer series was obtained and a cursor was placed on the lesion in the appropriate DBT slice. Coordinates were sent to the biopsy unit. Under sterile technique and local lidocaine anesthetic, the 9 G needle was introduced and positioning was confirmed with pre- and post-fire 2D stereotactic pair images. Twelve core biopsy samples were obtained. A specimen radiograph was not performed. A biopsy clip was left at the site of biopsy and confirmed with a final set of tomosynthesis images. The duration of the procedure was measured from the time of the first scout image to the time of the post biopsy clip image taken immediately after clip deployment. After the procedure, the patient underwent full CC and ML imaging of the biopsied breast to confirm clip placement at the site of the original DBT-detected lesion.

DBT VAB was performed in 38 consecutive patients for non-calcified lesions detected solely on DBT and not observed on targeted diagnostic US. The age range of the women who underwent the procedure was between 38 and 76 years with a mean of 55 years old. In one case, ultrasound biopsies were first attempted which did not correlate with the site of the originally detected tomosynthesis-detected architectural distortion (Fig. 2a–f). This patient then proceeded to DBT VAB on the same date.

In another case, the biopsy target was attempted under standard prone 2D stereotactic biopsy and could not be performed due to inability to visualize the target. Therefore, the procedure was converted to a DBT VAB. The remainder of the cases proceeded directly from diagnostic mammogram recommendation to DBT VAB.

2.2. Data collection

All DBT images, pathology reports, patient history, and mammographic, US, and MRI reports were reviewed by one author (NSA). Breast parenchymal density information was collected from the screening report and classified according to the Breast Imaging Reporting and Data System lexicon, 4th edition. Density measurements were confirmed with automated software (Volpara, Rochester, NY).

The radiologist who performed the biopsy reviewed the pathology reports (CBL Pathology, Rye, NY) for concordance. All malignant cases were considered concordant and sent for surgical excision. All high-risk lesions (radial scars, lobular carcinoma in situ, atypical papillomas, atypical ductal hyperplasia and atypical lobular hyperplasia) were considered concordant and sent for surgical consultation. All benign lesions were considered concordant and reassessed in six months and subsequent annual screening exam to assure proper target sampling. Procedures were reviewed for complications, including hematoma or infections.

Breast MRI was obtained in 2 patients after DBT VAB for preoperative evaluation of extent of disease.

Fig. 1. 59-year old patient, seated for upright DBT VAB.

2.3. Statistical analysis

The percentage of cases falling into malignant, high risk or benign categories was calculated according to the pathology report from the biopsy. PPV 3 was defined as the percentage of all known biopsies done because of positive screening or diagnostic examinations or additional imaging evaluations of positive screening examinations that resulted in a tissue diagnosis of cancer within 1 year. First, a lesion-level analysis of PPV 3 of DBT VAB was calculated as the number of malignancies on histologic examination of the specimen from DBT VAB divided by the total number of lesions that underwent DBT VAB. Excised high-risk lesions were followed up for their final pathological result to obtain an upgrade rate and a final PPV 3 for this DBT VAB cohort. Analyses were performed using statistical software (Stata version 14).

3. Results

DBT VAB procedures accounted for 3.4% of the total stereotactic procedures reviewed during the exam period (38 of 1116). Technical success was obtained in 38 of the 38 lesions targeted using DBT VAB. The average procedure time was 15 min (range 10–51, median 13 min). One outlier case with duration of 51 min was due to a vasovagal episode after initial positioning and patient anxiety before resuming procedure.

Procedure reports revealed one moderate post biopsy hematoma after DBT VAB. At the time of 6-month follow up in this patient, who had a benign biopsy result, there was no significant residual collection or symptoms at the biopsy site.

Breast density distributions are presented in Table 1.

Upon review of the clinical history for past high risk lesion or breast cancer among the DBT biopsy patients, only one patient had a previous history of atypical lobular hyperplasia (ALH) and one patient had a previous history of DCIS. Four of 38 patients (11%) had a 1st degree relative with history of breast cancer and seven of 38 patients (18%) reported a 2nd degree relative with history of breast cancer.

There were equal numbers of masses and architectural distortions, which were pure distortions without mass. The average mass size was 5.8 mm (range 2 to 8 mm) and the morphologies were well circumscribed oval (10), irregular spiculated (5), and irregular microlobulated (1). There were 6 one-view asymmetries appreciated in only 1 DBT projection.

3.1. Pathologic evaluation

DBT VAB of 38 lesions showed 8 malignancies (5 invasive ductal carcinomas, 1 invasive lobular carcinoma, 2 DCIS). The PPV 3 was 21%.

Fourteen of the 38 DBT VAB yielded high risk lesions, atypical ductal hyperplasia (ADH), ALH, lobular carcinoma in situ (LCIS), papillomas with atypia and radial sclerosing lesions (RSL), which were recommended for surgical consultation. One patient opted for 6 month follow-up for RSL and three additional patients did not undergo surgery due to other medical conditions, after meeting with a surgeon. Of the