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Special Report

Education Program for Digital Breast Tomosynthesis (DBT) Interpretation: Initial Experience using Images of Korean Women

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Purpose: In this report, we share our initial experience in organizing a hands-on education program dedicated for digital breast tomosynthesis (DBT) interpretation for radiologists with limited experience.

Materials and Methods: Twelve educational DBT cases (3 benign, 9 cancer cases) were collected from three institutions in Korea, according to different parenchymal densities and abnormality features. The education program consisted of a half-day course, including hands-on session using a dedicated workstation for DBT interpretation.

Results: A total of 31 radiologists registered for the education program, of which 77.4% had either none or < 1 year of experience in DBT. One common difficulty in DBT interpretation described by the participants was assessing abnormality features detected on the images. After education, the majority of participants replied that they wanted to experience more cases on handling false-positive (90.3%)/ false-negative cases (77.4%) or abnormality features of masses/asymmetries (83.8%).

Conclusion: The need for education in DBT interpretation is constantly rising, and we anticipate dedicated education programs and qualifications to be set in near future to maintain adequate performances for Korean women.

Index words: Breast; Mammography; Screening; Breast Cancer; Digital Breast Tomosynthesis

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Introduction

Breast cancer is the leading cause of death for women worldwide. The GLOBOCAN 2020 estimates report that breast cancer has surpassed

lung cancer as the most diagnosed cancer, with an estimated 2.3 million new cases diagnosed each year (1). Similar to the worldwide trend, breast cancer is the most common cancer in Korean women, showing continuous increase in incidence (2). Aiming at favorable outcomes from early diagnosis and treatment, breast cancer screening using mammography has been implemented, proving to be the most effective screening tool to reduce breast cancer related mortality (3, 4). Technical advances have enabled the rapid transition from film mammography to digital 2-dimensional (2D) mammography, and most recently to 3D-digital breast tomosynthesis (DBT) for breast cancer screening.

DBT consists of multiple low-dose x-ray images of the breast acquired at different angles and reconstructed into thin slices for sequential review (5). This technology enables reduction of overlap of parenchymal tissues that leads to reduction of false-positive recalls while at the same time increasing cancer detection by enhancing the suspicious imaging features of small cancers that can be overlooked on 2D mammography (6). Results of a meta-analysis comparing the diagnostic metrics of mammography and DBT showed that pooled incremental cancer detection rate of DBT was 1.6 cancers per 1000 with significant decrease in recall rates (6). Based on the results of early studies, DBT has been rapidly adopted for breast imaging as more than 72% of certified breast imaging facilities have DBT capability in the United States (5). The adoption of DBT in countries outside the United States is relatively slow, and at present, a limited number of DBT machines are installed throughout Korea. Processes for insurance coverage is underway in Korea that is expected to bring about increase in the number of DBT units and examinations. In order to maintain high quality breast cancer screening after DBT implementation, we need to be prepared with well-organized education programs and refined qualifications for the interpreting radiologists that we currently lack. In this background, we report our experience in organizing a hands-on education program for DBT interpretation for radiologists with limited experience.

Materials and Methods

Formation of the Educator Group

Board-certified radiologists dedicated to breast imaging with 7 - 20 years of experience (J.H.Y, S.-Y.K., M-R.K., O.H.W.) in breast imaging were recruited for the education program. Each radiologist had 7-10 years of experience in interpreting DBT in their practice.

Organization of the Hands-on Education Program

Two on-line/off-line meetings were scheduled for organizing the education program. For baseline education of the imaging modality and the indications for clinical application, session 1 was composed of two lectures of introducing DBT, summarizing the performance outcomes of using this modality in various clinical situations, and how to utilize the latest technology applied to this modality. Session 2 was organized as a hands-on session where participants can experience DBT interpretation on their provided workstations. The type of DBT to be included in the hands-on session was discussed by the educators, as summarized in Table 1.

Educators agreed that since this education was for Korean radiologists, mammographic density should be considered in case selection, that is, the proportion of mammographically-dense breast among the cases were higher than 50% (7). Final diagnosis of the cases was organized according to breast density (fatty vs. dense): negative, benign, and cancer. Among mammography features,

Table 1. Demographics and imaging characteristics to be considered for selecting cases for the DBT hands-on session

Density	Final diagnosis	Features on mammography	BI-RADS assessment	DBT utilization
Fatty breast (grade A-B)	Negative	–	BI-RADS 1	
	Benign	Asymmetry Typically benign calcifications	BI-RADS 2	Experiencing parenchymal summation on DBT
	Cancer	Mass Suspicious calcifications Mass with calcifications	BI-RADS 4-5	Detection of cancer features on DBT
Dense breast (grade C-D)	Negative	–	BI-RADS 1	
	Benign	Asymmetry	BI-RADS 2-3	Experiencing parenchymal summation on DBT
	Benign	Calcification	BI-RADS 2-3	Using SM for detection
	Cancer	Mass Suspicious calcifications Mass with calcifications	BI-RADS 4-5	Detection of spiculation, distortion in dense breast

BI-RADS: Breast Imaging Reporting And Data System, DBT: digital breast tomosynthesis, SM: synthetic mammography

asymmetry was the feature that was agreed upon for experiencing how parenchymal summation appears on DBT slices. Cancers presenting as mass and/or calcifications were considered for inclusion in both fatty and dense breasts to experience how these features are presented on DBT.

Collection and Selection of DBT Images for Training

Fifty-six educational DBT cases were collected from three institutions in Korea by educators (J.H.Y, S.-Y.K., O.H.W.), according to Table 1. Digital mammography (DM), synthetic mammography (SM) and DBT images were anonymized and obtained in DICOM files for display. The educators gathered for a case selection session where they reviewed and discussed the DBT cases using dedicated workstations for DBT interpretation.

DBT cases were reviewed focusing on abnormality features and clinical situations where DBT would benefit over 2D mammography. Finally, 12 cases were selected for the hands-on session: 3 benign cases and 9 cancer cases according to different parenchymal densities and abnormality features as summarized in Table 2.

Demographics of the Participants

Participants who are members of the Korean Society of Breast Imaging (KSBI) were invited to the education program via email. Prior to the education program, participants were asked to answer an on-line survey using Naver platform for basic demographics of the participants and the difficulties that they may have during DBT interpretation.

Hands-on Education Program

The education program consisted of a half-day course. After two lectures on the basics of DBT, hands-on session was held using a dedicated workstation (Nio Fusion 12MP, resolution of 4200x2800 pixel). The 12 DBT cases selected for the hands-on session (Table 2) was uploaded in advance to be displayed on SecurView® Breast Imaging Workstation (v.11.1, Hologic Korea Ltd.). The first 6 cases were reviewed with the lecturer who sequentially reviewed the 4-view digital/synthetic mammograms and DBT according to abnormality features, and the remaining 5 cases were given for review by the participants and discussed after the participants had reached a final conclusion for the

Table 2. DBT cases selected for the hands-on workshop program

Case No.	Mammographic density	Final diagnosis	Abnormality feature	Education point
1	Grade B	Cancer	Asymmetry	Subtle asymmetry showing suspicious features on DBT
2	Grade B		Asymmetry	Subtle asymmetry showing suspicious features on DBT
3	Grade C		Mass	Small cancer detected on DBT
4	Grade C		Mass	Small cancer detected on DBT
5	Grade C		Mass	Suspicious mass with more suspicious features on DBT
6	Grade C		Calcification	Localization and extent estimation of calcifications using SM
7	Grade C		Mass with calcification	DBT for combined features
8	Grade C		Mass with calcification	Suspicious mass with calcifications on DBT
9	Grade C		Mass with skin thickening	Advanced breast cancer, accurate mass extent estimated by DBT
10	Grade B	Benign	Asymmetry	Parenchymal summation fading out on DBT
11	Grade C		Asymmetry	Asymmetry in dense breast, DBT to prove parenchymal summation
12	Grade B		Asymmetry with distortion	Parenchymal summation and distortion fading out on DBT

DBT: digital breast tomosynthesis, SM: synthetic mammography

cases. For cancer cases, additional imaging studies such as ultrasonography or MRI were shown in Powerpoint slides for references.

After closing the education program, participants were once again asked to fill out an on-line survey for feedback on the DBT education program.

Results

Demographics of the Participants

A total of 31 radiologists registered and participated in the education program. Figure 1 summarizes the survey results given by the participants. Twenty-two (71.0%) of the 31 participants had breast imaging fellowship training. As expected, most participants of the education program were radiologists with little experience in DBT interpretation; 19 (61.2%) had 3-10 years of experience in mammography interpretation, 24 (77.4%) had either none or less than 1 year of experience in DBT. Twenty participants replied that they interpreted DBT in their practice where 10 (50.0%) had interpreted less than 10 cases per month.

Common difficulties in using DBT in practice described by the participants were 1) having to use a separate dedicated workstation, 2) defining the border of an abnormality amongst breast parenchymal tissue on DBT, 3) assessing calcifications detected on DBT.

Feedback of the Education Program

Figure 2 summarizes the survey results of the survey for feedback of the education program given by the participants. Most of the participants answered that they wanted more experience in handling false-positive (28 of 31, 90.3%) or false-negative cases (24 of 31, 77.4%, Fig 2a), and interpreting mass/asymmetries on DBT (26 of 31, 83.8%, Fig 2b).

Discussion

This report summarizes our initial experience in organizing an education program with hand-on sessions for participants to experience DBT interpretation. Most of the participants had little

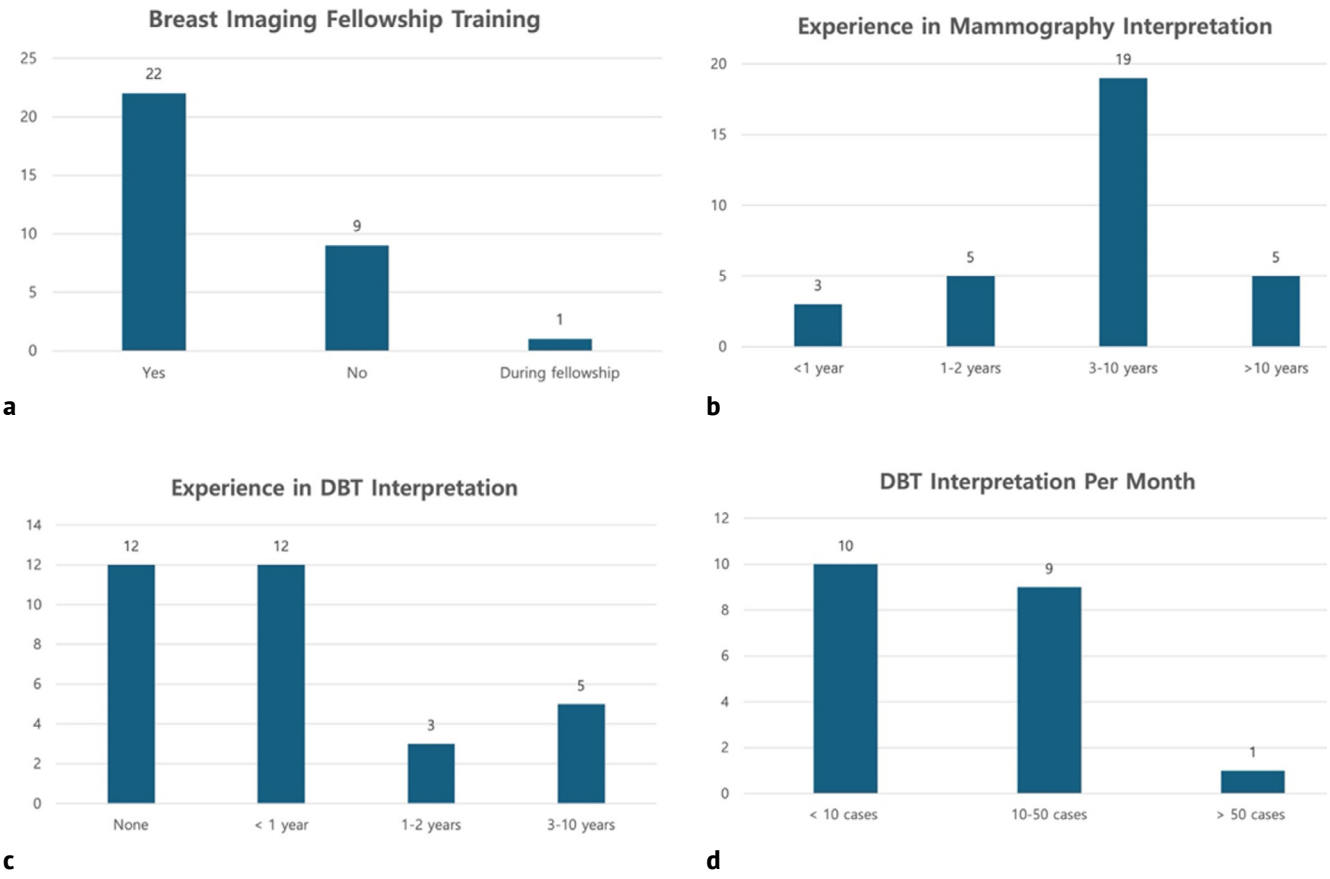

Fig. 1. Summary results of the survey for obtaining demographics. Of the 31 participants, 22 (71.0%) had breast imaging fellowship training (**a**). Nineteen (61.2%) had 3-10 years of experience in mammography interpretation (**b**), 24 (77.4%) had either none or less than 1 year of experience in DBT (**c**), and 10 (50.0%) had interpreted less than 10 cases per month (**d**).

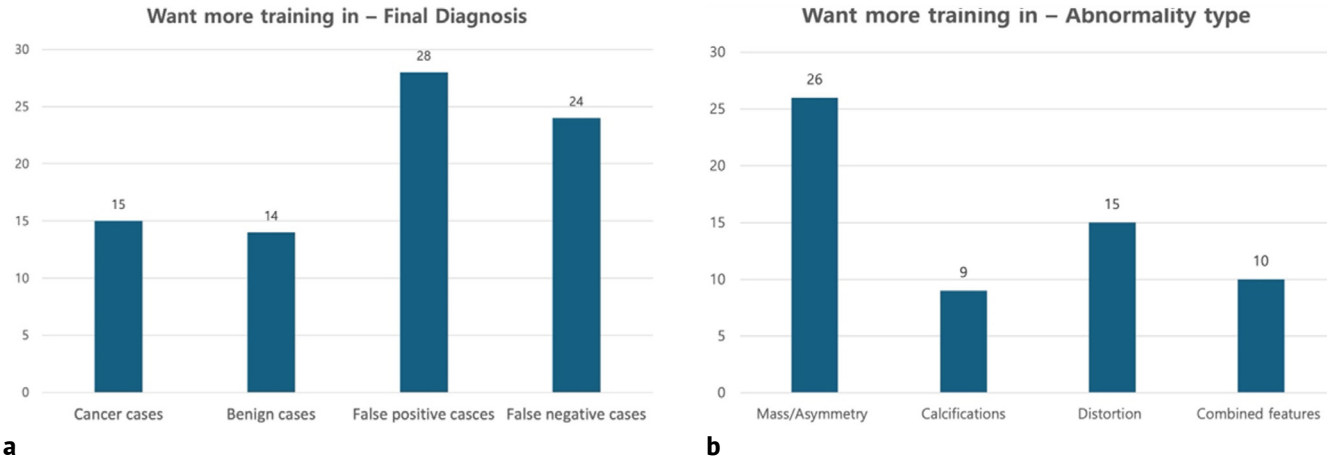

Fig. 2. Summary results of the survey for feedback of the education program (multiple choice). Most of the participants answered that they wanted more experience in handling false positive/false negative cases (**a**), and interpreting mass/asymmetries on DBT (**b**).

experience in DBT interpretation; 61.2% having 3-10 years of experience in mammography interpretation, 77.4% having either none or less than 1 year of experience in DBT. Common difficulties in DBT interpretation described by the participants was assessing abnormality features detected on the images. After the education program, the majority of participants replied that they wanted to experience more cases on handling false positive/negative cases or abnormality features of masses/asymmetries.

Survey results show that the participants in our education program experienced difficulties in defining and assessing abnormality features. This may be related to the characteristics of the Korean women in regard to mammographic density. Korean women are known to have small breast volume and dense breasts, i.e., approximately 54.4% of women aged 40-69 years have dense breasts (8). Mammographic density plays a critical role in performance outcomes of both screening mammography and DBT, as recall rates were reported to be consistently higher with higher breast density for both DM and DBT plus DM in the subanalysis of the TOSYMA trial (9). DBT images are well-known for its poor depth resolution where it is difficult to exactly define the borders of an abnormality, that is, difficult to define true-positives vs. false-positives, in the increased background density.

With the ongoing processes for insurance coverage for DBT examinations, we expect an increase of DBT units and examinations in Korea. To maintain adequate performances using DBT, we need to dedicated education programs and requirements for Korean radiologists. Although DBT is a new imaging technology, images are quite similar to DM that radiologists are familiar with. Based on the similarities between DBT and DM, one study showed that the learning curve for acquiring interpretation skills for DBT is very short and sustained over time after DBT adoption (10). The U.S. Food and Drug Administration require 8-hours of additional training for Mammography Quality Standards Act (MQSA) qualified radiologists to be able to interpret DBT (11). Dedicated Mammography Boot Camps are routinely held in Korea, and having these programs improved the radiologists' performances in interpreting mammograms (12). These training programs can be modified and applied for DBT education, especially when considering the short learning curve for DBT interpretation described above. However, as the radiology board-certification is the only requirement for interpreting mammography in the National Cancer Screening Program in Korea (12) without other qualifications, how dedicated mammography and/or DBT training should be implemented in the Korean environment needs further consideration in the future.

The need for dedicated education for DBT interpretation is constantly rising, and radiologists with limited experience in DBT experience common difficulties during interpretation. Education programs using DBT images of Korean women is required to train radiologists on what to expect in their daily routine. Based on our initial experience, we anticipate dedicated education programs and qualifications to be settled in near future to maintain adequate performances for the Korean women.

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대한유방검진의학회지 2024;21:160-167

한국 여성의 디지털 토모신세시스 영상을 이용한 판독 교육 프로그램 구성 경험 보고

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목적: 유방 디지털 토모신세시스 (DBT) 대한 수요와 검사가 늘어나면서 판독 교육에 대한 수요가 늘고 있다. 이러한 흐름에 맞춰 한국 여성의 DBT 증례를 이용한 판독 실습을 할 수 있는 교육 프로그램을 구상한 경험을 공유하고자 한다.

대상 및 방법: 교육 프로그램을 위해서 국내 3개 기관에서 촬영한 12건의 DBT 영상을 취합하였는데 이중 9건은 암진단 증례, 3건은 위양성 증례였다. 교육 프로그램은 반일 코스로 진행했는데 DBT 판독을 위한 전용 판독대를 사용하여 실제 판독 환경과 유사하게 진행하였다.

결과: 판독에 경험이 적은 31명의 영상의학과 의사가 교육에 참여하였고, 이들 중 61.2%는 유방 영상에 3-10년 경험이 있다 응답했고 77.4%는 DBT 판독에 경험이 없거나 1년 미만이었다. 교육 이후 평가를 위한 설문지에서 다수의 교육 참여자들이 위양성 (90.3%)/위음성 (77.4%) 증례와 이상 소견 중 종괴나 비대칭 (83.8%) 증례에 대한 실습이 더 필요하다고 응답했다.

결론: DBT판독을 위한 교육 프로그램의 경험을 바탕으로 적절한 판독 성적을 유지하기 위해 한국 여성의 증례를 기반으로 한 교육 및 평가 시스템이 마련되기를 기대한다.

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