Insights in Breast Cancer

Editorial Open Access

Will Breast Tomosynthesis Replace Digital Mammography?

Agostino Pozzi[1*], Roberta Maj[2], Angelo Della Corte[3] and Heon-Jae Jeong[4]

[1]Johns Hopkins University Bloomberg School of Public Health, Johns Hopkins University Carey Business School, USA
[2]Vita-Salute San Raffaele University, Italy
[3]Department of Radiology, San Raffaele Hospital, Italy
[4]The Care Quality Research Group, South Korea

[*]**Corresponding author:** Agostino Pozzi, Johns Hopkins Bloomberg School of Public Health, Johns Hopkins Carey Business School, Tel: +1 4434102171; Email: agostinopozzi@hotmail.it

Original Submission

Received: November 13, 2017
Accepted: December 10, 2017
Published: December 28, 2017

Open Peer Review Status: Editorials, news items, analysis articles, and features do not undergo external peer review.

How to cite this article: Agostino Pozzi, Roberta Maj, Angelo Della Corte and Heon-Jae Jeong. Will Breast Tomosynthesis Replace Digital Mammography?. Insights BreastCancer. (2017) 1: 5.1

The aim of a screening program in the perspective of secondary prevention is to detect potentially malignant lesions at the early stages, when symptoms are mainly subclinical or absent, to decrease mortality. Breast mammography is the only screening method that has been demonstrated to significantly reduce breast-cancer mortality [1]. The evidence comes from several randomized controlled trials (RCTs), and pooled estimates showed that mortality is reduced by at least 20%. The majority of RCTs was conducted in Europe and Canada. A weakness of RCTs is the underestimation of the potential advantage of screening mammography due to noncompliance and contamination: the former refers to women refusing to undergo mammography, while the latter refers to subjects in the control group who obtain a mammogram outside the study. Current guidelines suggest that mammography should be performed annually in average-risk women starting at the age of 40 [2].

The main limitation of standard 2D mammography is the superimposition of glandular tissue, which can hide abnormalities or make normal structures appear doubtful lesions, leading to false positive results and decreasing the positive predictive value. Breast tissue density, particularly in younger women, may decrease the sensitivity of mammography [3].

Digital breast tomosynthesis (DBT) is a three-dimensional version of digital mammography in which images are constructed from a series of low-dose images acquired at x-ray source moves over the breast. The x-ray tube moves along a determined arc, obtaining multiple 2D acquisitions. The three-dimensional volume of the breast is restructured from the 2D images thanks to a mathematical algorithm. The breast can be studied by scrolling through the slices, obscuring off-focus information. Thanks to this method, DBT can reduce interference from breast tissue superimposition, also called "anatomical" noise, improving lesion detection and lowering recall rates [3]. Consequently, false positives and associated healthcare costs could notably decrease [4].

DBT was described as using one or two breast views under the restriction that the dose level remains comparable with doses delivered for conventional mammography, thus risk associated to radiation exposure is analogous [5].

Primary experience of tomosynthesis application to breast imaging has revealed the potential of DBT, which might increase the specificity of mammography and might improve detection of breast cancer at early stages, especially in women with dense breasts, without having a negative effect on sensitivity in the detection of malignancy. Shaane et al. performed a large prospective clinical trial [6], named Oslo Tomosynthesis Screening Trial, comparing full-field digital mammography (FFDM) to FFDM with DBT. The addition of DBT to FFDM resulted in 15% decrease of false positives and 40% increase of invasive cancer detection rate. Ciatto et al. enrolled 7292 Italian women in the Screening with Tomosynthesis or Mammography (STORM) trial [3], investigating the potential benefit of integrated 2D and 3D mammography. DBT was shown to improve cancer detection rate from 5.3 to 8.1 per 1000 screens and to decrease by 17% the recall rate.

Some studies focused on reader confidence in mammogram interpretation because whenever a new technology is compared with one that is already established in the clinical practice, previous experience gives an advantage to the latter. Tucker et al. [7] designed a study to assess whether individual reader performance was influenced by the years of experience. They showed that the addition of DBT to conventional mammography significantly increased specificity in all readers; radiologists and advanced practitioner radiographers with less than 10 years of experience showed better improvement in sensitivity (91% vs 86%).

Detecting suspicious architectural distortion in breast tissue, which has high interobserver variability (IOV), may be challenging. Dibble et al. [8] compared IOV, reader confidence, and sensitivity/specificity in detecting architectural distortion (AD) on digital mammography versus digital breast tomosynthesis. Two experienced breast radiologists and two breast imaging fellows in the second half of their 1-year breast imaging fellowships blindly examined the images. The results showed that DBT decreased IOV, increased the level of confidence, improved overall specificity and sensitivity in sentence might better detecting architectural distortion. Although the number of physicians involved was relatively small, this study suggests that DBT may reduce human error by allowing better visualization of the suspected lesion.

Endo et al. [9] evaluated the diagnostic performance of DBT plus FFDM at a radiation dose similar to that of mammography alone. The results are consistent with the previously mentioned studies: the newly developed technologies (DBT plus FFDM) improved the diagnostic performance compared with FFDM alone. Importantly, the mean glandular dose difference of DBT+FFDM and FFDM alone was not significant, suggesting that DBT carries the same radiation exposure risk same as conventional mammography.

Studies of integrated 2D and 3D mammography are needed because emerging evidence encourages new assessment of screening program. DBT has been shown to have several advantages over conventional mammography, including better visualization of breast tissue, increased cancer detection rate, and reduced recall rates. A properly designed, large-scale population screening trial may provide enough evidence to support the switch from standard digital mammography to digital breast tomosynthesis.

References

1. Warner E. Clinical Practice. Breast-cancer Screening. N Engl J Med. 2011; 365: 1025-1032.
2. Niell BL, Freer PE, Wenfurtner RJ, Arleo EK, Drukteinis JS. Screening for Breast Cancer. Radiol Clin North Am. 2017; 55: 1145-1162.
3. Ciatto S, Houssami N, Bernardi D, Caumo F, Pellegrini M, et al. Integration of 3D Digital Mammography with Tomosynthesis for Population Breast-cancer Screening (STORM): A Prospective Comparison Study. Lancet Oncol. 2013; 14: 583-589.
4. Pozzi A, Della Corte A, Lakis MA, Jeong H. Digital Breast Tomosynthesis in Addition to Conventional 2D-Mammography Reduces Recall Rates and is Cost-Effective. Asian Pac J Cancer Prev. 2016; 17: 3521-3526.
5. Gennaro G, Toledano A, Di Maggio C, Baldan E, Bezzon E, et al. Digital Breast Tomosynthesis Versus Digital Mammography: A Clinical Performance Study. Eur Radiol. 2010; 20: 1545–1553.
6. Skaane P, Bandos A, Gullien R, Eben EB, Ekseth U, et al. Comparison of Digital Mammography Alone and Digital Mammography Plus Tomosynthesis in a Population-based Screening Program. Radiology. 2013; 267: 47-56.
7. Tucker L, Gilbert FJ, Astley SM, Dibden A, Seth A, et al. Does Reader Performance with Digital Breast Tomosynthesis Vary According to Experience With Two-Dimensional Mammography? Radiology. 2017; 283: 371–380.
8. Dibble EH, Lourenco AP, Baird GL, Ward RC, Maynard AS, et al. Comparison of Digital Mammography and Digital Breast Tomosynthesis in the Detection of Architectural Distortion. Eur Radiol. 2017.
9. Endo T, Morita T, Oiwa M, Suda N, Sato Y, et al. Diagnostic Performance of Digital Breast Tomosynthesis and Full-Field Digital Mammography with New Reconstruction and New Processing for Dose Reduction. Breast Cancer. 2017.