Digital Breast Tomosynthesis

ABSTRACT: Mammography has been the primary screening test for early breast cancer for more than five decades, but conventional mammography imaging continues to have limitations in sensitivity and specificity. Digital mammography detects some cases of cancer that are not identified by film mammography, but overall detection is similar for many women. Digital breast tomosynthesis offers the potential to overcome one of the primary limitations of mammography, which is the inability to image overlapping dense normal breast tissue. Clinical data suggest that digital mammography with tomosynthesis produces a better image, improved accuracy, and lower recall rates compared with digital mammography alone. Further study will be necessary to confirm whether digital mammography with tomosynthesis is a cost-effective approach, capable of replacing digital mammography alone as the first-line screening modality of choice for breast cancer screening.

Mammography has been the primary screening test for early breast cancer for more than five decades. Advances in mammography and treatment of breast cancer have contributed to a 30% reduction in breast cancer mortality since 1990 (1). However, conventional mammography imaging used for screening continues to have limitations, with a sensitivity of 77–95% and a specificity of 94–97% (2). Alternative breast imaging modalities have been developed in an effort to improve the sensitivity and specificity of breast cancer screening. These modalities include digital mammography, ultrasonography, magnetic resonance imaging (MRI), and three-dimensional digital breast tomosynthesis. Ideally, any new screening modality would decrease recall rates, reduce the number of breast biopsies for benign lesions, and improve cancer detection.

A primary three-dimensional modality used for breast cancer screening is MRI. Studies that use MRI for breast cancer screening indicate greater sensitivity but less specificity than mammography for detection of breast cancer in high-risk women (3). The American Cancer Society recommends annual screening using MRI in addition to mammography beginning at age 30 years for women at high risk of breast cancer (greater than 20–25% lifetime risk). High-risk status is based on the woman having a *BRCA1* or *BRCA2* mutation, a strong family history of breast cancer or ovarian cancer, or prior chest radiation therapy (4).

Digital mammography detects some cases of cancer that are not identified by film mammography, but overall detection is similar for many women.
However, for women younger than 50 years or women who have dense breast tissue, overall detection is somewhat higher with digital mammography (5). It is currently unknown whether widespread use of digital mammography will lead to reduced mortality from breast cancer.

When compared with film mammography, the slightly superior sensitivity of digital mammography may detect breast carcinomas that are obscured or “hidden” by dense breast tissue or detect the low contrast of the tumor in comparison with the surrounding breast tissue. Dense breast tissue can mask tumors by lying directly above and below a tumor in a two-dimensional view. Image processing of digital data allows the degree of contrast in the image to be manipulated so that contrast can be increased in the dense areas of the breast with the lowest contrast (6).

Digital breast tomosynthesis is a three-dimensional imaging technology that involves acquiring images of a stationary compressed breast at multiple angles during a short scan. The individual images are reconstructed into a series of thin high-resolution slices that can be displayed individually or in a dynamic cine mode (7). Digital breast tomosynthesis, like both film and digital mammography, still requires breast compression. Digital breast tomosynthesis offers the potential to overcome one of the primary limitations of mammography, which is the inability to image overlapping dense normal breast tissue. This common clinical finding can reduce the accuracy of conventional mammography and digital mammography in distinguishing benign and malignant lesions. Digital breast tomosynthesis creates multiple projections that are imaged across a range of viewing angles to produce a series of section images. This procedure results in a reduction in the amount of superimposed breast tissue in each tomosynthesis section with presumed improved sensitivity for small tumors compared with mammography (8).

Three recent studies suggest that the use of mammography with tomosynthesis can modestly increase the detection of breast cancer when compared with mammography alone. In addition, recall rates for women with false-positive test results were decreased. A decrease in recall rates will result in decreasing patient anxiety, inconvenience, and cost for women with false-positive imaging results (9–11). Initial data indicated a doubling of the mean glandular radiation dose with digital breast tomosynthesis compared with digital mammography (12). The image acquisition strategy used with digital breast tomosynthesis ultimately determines radiation exposure to the breasts.

A recent report indicates digital breast tomosynthesis produces a mean glandular radiation dose to an average-sized breast 8% higher compared with digital mammogram (13).

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REFERENCES


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