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Editorial

EDITORIAL

Keeping Pace With Technology Advances in Breast Cancer Screening: Synthetic 2D Images Outperform Digital Mammography

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Long gone from most radiology practices are the light boxes used to view radiology film images. With the rapid evolutionary pace of modern medicine, diagnostic technology that was once revolutionary and widespread has given way to new advancements, but all too often with no clear medical consensus for a path toward successful transition and implementation. Technological changes are particularly pronounced in breast imaging, where indecision surrounding the appropriateness of new and previous technologies can result in varied practices across new and old formats. Important clinical conversations leading to decisions to replace previous standards with new ones are often difficult without rigorously derived data or substantial changes to policies influencing adoption of particular screening methods and technologies. The systematic review and meta-analysis by Alabousi et al. (1) in this issue of the Journal helps address the utility of new breast imaging technology upgrades by comparing outcomes of 4 different types of breast imaging: digital breast tomosynthesis (DBT) alone, combined DBT and digital mammography (DM), combined DBT and synthetic 2-dimensional (2D) mammography, and DM alone. In most practices, the major question is whether to continue obtaining combined DBT and DM or just DBT with reconstruction of synthetic 2D images.

The current landscape of breast cancer imaging offerings has evolved at an accelerated pace over the course of the past several decades. Film mammography exams were standard until the development of digital mammography, which captures 2D images in a format viewed entirely via computer screen, rendering film and light boxes obsolete. Soon after, DBT enabled 3-dimensional (3D) mammography where multiple 2D slices could be constructed into 3D clips to examine the entire breast in more detail slice by slice. Use of DBT has since increased in clinical practice, yet DBT is usually obtained in tandem with DM acquisition to allow for analogous comparisons with previous exams that were obtained with DM. Although studies have compared the use of DBT vs DM in classification performance for breast cancer, the question of using one or both is important. Adding to this armamentarium of imaging offerings are new synthetic 2D mammography images (retrospectively reconstructed from the DBT acquisition), which could possibly replace the need for tandem DM acquisition when the DBT image is obtained.

An important takeaway from the meta-analysis by Alabousi et al. (1) is that all screening performance benchmarks studied were better with combined DBT and synthetic 2D compared with combined DBT and DM, including cancer detection rate (CDR for ductal carcinoma in situ [DCIS] and invasive breast cancer), CDR for invasive cancer only, recall rate, and positive predictive value. Although the 95% confidence interval overlapped between the 2 comparison groups for CDR, invasive CDR, and positive predictive value, all of the mean values were higher for combined DBT and synthetic 2D compared with combined DBT and DM (7.40 vs 6.36 per 1000, 5.68 vs 4.53 per 1000, and 16% vs 10%, respectively). Recall rate was statistically significantly lower for combined DBT and synthetic 2D (42.3 per 1000) than for the DM-alone comparison group. Overall, the synthesis of evidence suggests that combined DBT and synthetic 2D provides the best screening performance for women undergoing routine breast cancer screening.

Detecting more breast cancers does not necessarily lead to the most paramount goal of preventing more breast cancer deaths. It has been suggested that cancer detection endpoints may exacerbate the problem of overdiagnosis (2). As we attempt to keep pace with rapid technological development in medicine, our evaluation of the performance of new breast imaging technologies should include data on interval cancers, rate of advanced cancers, and quality of life.

Why is a synthetic 2D image—one that is generated with postprocessing rather than actual image acquisition—improving screening performance? The ability of synthetic 2D to accentuate some mammographic features, such as architectural distortion, while diminishing the conspicuity of other findings, including subtle groups of amorphous calcifications, is one potential reason why synthetic image screening is outperforming digital mammography. Thus, more invasive processes manifested as architectural distortion may be better identified,

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whereas indolent processes such as low-grade DCIS that present as subtle groups of calcifications may go undetected. Overall, a provocative notion is that synthetic 2D may have some impact on decreasing overdiagnosis of indolent low-grade DCIS at the population level. However, additional studies are required to further explore this theory.

Alabousi et al. (1) suggest that the breast cancer screening community should consider transitioning away from performing both DBT and DM screenings on women to performing just a DBT acquisition supplemented by synthetic software to retrospectively create the synthetic 2D images. With lower recall and potentially improved cancer detection rates, synthetic 2D appears not to have major disadvantages to DM in the screening setting when combined with DBT. This practice change would effectively eliminate the double radiation dose currently incurred by tens of millions of women undergoing routine screening mammography each year and addresses concerns for potential radiation-induced breast cancer from combined DBT and DM screening at the population level (3).

In medicine, reimbursement policies often influence clinical behaviors and practice. A paradigm shift away from having women undergo both DBT and DM exams to just a DBT exam acquisition and reconstruction of synthetic 2D images may require changes to reimbursement structures. Although DBT is currently reimbursed by the Centers for Medicare and Medicaid Services and some third-party payers as an add-on to standard DM screening exams, it is not routinely reimbursed as a standalone procedure (4). A change in practice may therefore require new primary reimbursement for DBT acquisition rather than as an add-on to DM. Currently, practices may feel compelled to perform the combined DBT and DM exam to be reimbursed for the DBT portion of the exam, leading to double radiation dose exposure to women. Eliminating this inadvertent incentive to add DM to screening in current reimbursement practices may be necessary to encourage a shift toward DBT image acquisition alone.

Finally, a shift away from a DM image acquisition model has major implications for promising artificial intelligence (AI) applications in screening mammography. Several AI algorithms are now commercially available for automated interpretation of mammograms, but because the majority were trained and tested using the standard DM images to provide their predictions (5), it is unclear how these AI algorithms will perform on the synthetic 2D images. As we shift away from combined DBT and DM, evaluation of AI algorithms will also need to keep pace with the technology advances in mammography, including the need for robust external validation of algorithms on DBT and synthetic 2D images without inclusion of standard DM images.

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Data Availability

Not applicable.

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