



Original Research

A prospective study comparing digital breast tomosynthesis with digital mammography in surveillance after breast cancer treatment



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Abstract *Background:* Although the benefit of adjunct digital breast tomosynthesis (DBT) is established in population screening, its benefit in surveillance after breast cancer treatment is not well defined. We prospectively evaluated whether the addition of DBT to digital mammography (DM) reduced the rate of indeterminate findings compared to DM alone in patients after breast cancer treatment.

Methods: Patients had both DM and DBT for routine surveillance. Two-dimensional synthesised mammogram (SM) was generated for each patient from DBT data. DM, SM, and DBT images were read for each patient by one of four radiologists credentialed for DBT. We compared the rates of indeterminate findings between DM + DBT with DM alone in patients with a range of breast densities and between DM and SM.

Results: A total of 618 patients and 1069 breasts were analysed. The rates of indeterminate findings for DM + DBT versus DM alone were 10.5% and 13.1%, respectively ($p = 0.018$). In breasts treated with surgery and radiotherapy ($n = 558$), the corresponding rates of indeterminate findings were 4.9% and 6.9%, respectively ($p = 0.039$). The rate of indeterminate findings for DM + DBT increased with increasing breast density ($p = 0.019$). There was no

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significant difference in the rates of indeterminate findings between DM and SM (13.1% versus 11.5%, $p = 0.1$).

Conclusion: The addition of DBT to DM reduced the rate of indeterminate findings in surveillance of patients after breast cancer treatment. Further research is required to confirm whether DBT and SM could replace DM for patients undergoing surveillance.

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1. Introduction

Digital breast tomosynthesis (DBT) is increasingly recognised as an important adjunct to conventional digital mammography (DM) for the reduction in false positive rates and potentially improvement in cancer detection rates in population screening [1–3]. It is a mammographic technique whereby the X-ray tube and digital detector are rotated in a limited arc to create multiple low-dose projection images through a compressed breast, which are then tomographically reconstructed into a series of thin-slice images to provide three-dimensional (3D) information for radiology reporting. The theoretical advantage of DBT relates to the ability to circumvent the problem of superimposed breast tissue either masquerading as a suspicious lesion or obscuring a malignant lesion. A two-dimensional (2D) image can be digitally reconstructed from the 3D data acquired via DBT to resemble a conventional DM. This 2D synthesised mammogram (SM) is termed C-view by the developers of the technique (Hologic, Bedford, MA, USA).

Current evidence supports the use of DBT in addition to 2D imaging rather than as a stand-alone imaging modality [1]. Recent large non-randomised population-based studies have validated the findings of earlier cancer-enriched cohort studies in regards to the improved diagnostic accuracy with the addition of DBT to 2D imaging [4–7]. Studies published so far have focused on the application of DBT in population screening. In contrast, the incremental benefit of DBT in surveillance after breast cancer treatment is much less well defined, recognising that mammographic appearances after breast conserving surgery and radiation therapy differ from treatment-naïve breasts.

We report a prospective study investigating the performance of DBT in addition to 2D imaging for the surveillance of patients after breast cancer treatment in a large cancer centre.

2. Methods

2.1. Study population

In this prospective study at the Peter MacCallum Cancer Centre, eligible patients were identified from the

mammography booking lists. Patients were scheduled to have mammography for routine surveillance after breast cancer treatment, which included breast conserving surgery or mastectomy with or without post-operative radiotherapy. Patients who had a mastectomy underwent imaging of the contralateral breast. Patients who had mammograms for non-surveillance purposes were excluded. The study protocol was approved by the institutional ethics committee, and written informed consent was obtained from all study participants. Patients who did not consent to study participation had DM only as per local standard practice at the time.

2.2. Study design

The primary objective of the study was to compare the rates of indeterminate findings between DM in combination with DBT (DM + DBT) and DM alone. An indeterminate finding was defined as a lesion detected using DM, SM or DBT necessitating additional imaging studies for clarification. Secondary objectives included comparison of false positive and cancer detection rates between DM + DBT and DM, comparison of rates of indeterminate findings between DM and SM, evaluation of the impact of breast density on the rate of indeterminate findings using DM + DBT, and comparison of average reading times for DM versus DBT plus SM. A false positive event was recorded when an indeterminate lesion was biopsied with no malignancy identified. Breast density was scored on a 4-point system according to the Breast Imaging Reporting and Data System (BI-RADS) breast density classification [8].

All study patients underwent both DM and DBT. Prior to study commencement, all radiographers and four radiologists involved in the study were trained in the imaging system operation and credentialed for interpretation of DBT studies. The DM, SM and DBT images for each patient were read in one of the two predefined sequences by a single radiologist (Fig. 1). The sequences were alternated weekly to reduce reading biases in the comparison of DM and SM. True randomisation of sequences and blinding of the reading of DM or SM to findings of the other modality were not undertaken due to logistical limitations in the reporting workflow. DM was read before SM in one sequence and

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