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Review

Systematic review of 3D mammography for breast cancer screening

Robert Hodgson [a], Sylvia H. Heywang-Köbrunner [b], Susan C. Harvey [c], Mary Edwards [a], Javed Shaikh [a], Mick Arber [a], Julie Glanville [a, *]

[a] York Health Economics Consortium, University of York, York, UK
[b] Referenzzentrum Mammographie Munchen, Munich, Germany
[c] Johns Hopkins Medical Institute, Baltimore, USA

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ABSTRACT

This review investigated the relative performance of digital breast tomosynthesis (DBT) (alone or with full field digital mammography (FFDM) or synthetic digital mammography) compared with FFDM alone for detecting breast cancer lesions in asymptomatic women. A systematic review was carried out according to systematic reviewing principles provided in the Cochrane Handbook for Systematic Reviews of Diagnostic Test Accuracy. A protocol was developed *a priori*. The review was registered with PROSPERO (number CRD42014013949). Searches were undertaken in October 2014. Following selection, five studies were eligible. Higher cancer detection rates were observed when comparing DBT + FFDM with FFDM in two European studies: the summary difference per 1000 screens was 2.43 (95% CI: 1.8 to 3.1). Both European studies found lower false positive rates for individual readers. One found a lower recall rate based on conditional recall. The second study was not designed to compare post-arbitration recall rates between FFDM and DBT + FFDM. One European study presented data on interval cancer rates; sensitivity and specificity for DBT + FFDM were both higher compared to FFDM. One large multicentre US study showed a higher cancer detection rate for DBT + FFDM, while two smaller US studies did not find statistically significant differences. Reductions in recall and false positive rates were observed in the US studies in favour of DBT + FFDM. In comparison to FFDM, DBT, as an adjunct to FFDM, has a higher cancer detection rate, increasing the effectiveness of breast cancer screening. Additional benefits of DBT may also include reduced recalls and, consequently, reduced costs and distress caused to women who would have been recalled.

Contents

* Corresponding author. York Health Economics Consortium (YHEC), Enterprise House, Innovation Way, University of York, Heslington, York, YO10 5NQ, UK.
E-mail address: julie.glanville@york.ac.uk (J. Glanville).

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Introduction

Breast cancer is a significant cause of mortality and morbidity for women worldwide and is the most common cancer diagnosed in women, with an estimated 1.67 million new cases diagnosed worldwide in 2012 [1]. The incidence of breast cancer is highest in developed countries with an age-adjusted incidence rate of 80 per 100,000 in the European Union and 92 per 100,000 in North America [2], and it is the second most common cause of cancer death in women in developed countries [2,3].

Screening with mammography can assist in detecting breast cancer at earlier stages, which is associated with reductions in mortality [4,5]. A recent systematic review of screening programme studies found that the screening reduced mortality from breast cancer for women invited to screening by approximately 23% and for regular participants by approximately 40% [6].

Over the last decade, the majority of screening programmes have changed from two dimensional (2D) analogue mammography to full field digital mammography (FFDM). Digital mammography (DM) is associated with small increases in detection rates and reductions in the number of false positives and is therefore likely to increase the effectiveness of screening programmes [7,8]. It represents the current standard for most mammography programmes and is the comparator in this review.

Description of the intervention

Digital breast tomosynthesis (DBT) (or three-dimensional (3D) mammography) is a development of FFDM providing analysis of 3D mammographic data through a series of tomographic image slices through the breast allowing reconstruction in thin slices. This provides greater detail and addresses the challenges of overlapping tissue, which both obscures and mimics cancer. Both DBT and mammography can be performed in one or two views.

DBT can also be used as an adjunct to FFDM: this requires a second radiation exposure, increasing the dosage required for FFDM. A DBT dataset can also be used to generate so-called synthetic 2D images, avoiding the need for additional radiation exposure. When DBT generates synthetic 2D images, the total patient radiation exposure is similar to or slightly higher than FFDM [9]. The aim of this systematic review was to examine the performance of DBT for breast cancer-screening.

Rationale

Published systematic reviews have assessed the use of DBT for the detection and diagnosis of breast cancer. Lei et al. [10] examined the relative performance of DBT + FFDM compared to FFDM in women with mammographically evident breast lesions. They concluded that one view DBT + FFDM has higher sensitivity and specificity than FFDM. This meta-analysis was limited by search criteria which resulted in the inclusion of relatively small studies (the largest study included 738 patients) with a high degree of variation in design. Houssami et al. [11,12] considered the relative performance of DBT + FFDM and FFDM in detecting breast cancer. Although studies in the Houssami review demonstrated increases in cancer detection rate using DBT + FFDM over FFDM, its conclusions regarding screening were qualified due to the test setting, small numbers and inclusion of diagnostic cases with a high prevalence of cancers. Additionally, the final search date for this review was October 2012, prior to the publication of several major tomosynthesis screening trials. A 2015 editorial by Houssami [12] summarizes several recent screening studies, but this review was not performed systematically and may not be comprehensive. Further studies and reviews are required.

While there is evidence suggesting that DBT shows superior performance diagnosing breast cancer, the relative performance of DBT and FFDM for detecting cancer in an asymptomatic, screening population has not been fully explored and researchers have suggested that this should be assessed by a variety of methods including a current review [11].

Review question

What is the performance of DBT (alone or in combination with FFDM or synthetic DM) for detecting breast cancer compared with FFDM alone when screening asymptomatic women?

Methods

This systematic review was carried out according to the systematic review guidance provided in the Cochrane Handbooks [13,14]. A protocol was developed *a priori* and was registered with PROSPERO (CRD42014013949) on 29 September 2014. The searches were performed and concluded in October 2014.

Eligibility criteria

Prospective studies or retrospective studies with 1000+ participants, evaluating the following comparisons were eligible for the systematic review:

- FFDM alone compared to DBT alone;
- FFDM alone compared to DBT + FFDM;
- FFDM alone compared to DBT + DBT-generated 2D images.