The Breast 19 (2010) 439–445

Contents lists available at ScienceDirect

The Breast

journal homepage: www.elsevier.com/brst

Review

Mammographic surveillance in women with a personal history of breast cancer: How accurate? How effective?

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ARTICLE INFO

Article history:
Received 13 April 2010
Received in revised form
20 May 2010
Accepted 20 May 2010
Available online 14 June 2010

Keywords:
Accuracy
Breast cancer
Cancer recurrence
Mammography
Personal history of breast cancer
Screening

ABSTRACT

We review the accuracy and potential effect of mammography in surveillance of women with a personal history of breast cancer (PHBC). A literature review was performed to identify studies on screening mammography or breast surveillance reporting data on the accuracy or detection capability of mammography, or the effect of early detection of second breast cancers, in women with a PHBC. Evidence on mammography screening in women with PHBC comes from non-randomised studies, and is generally limited by several factors including design limitations. The proportion of ipsilateral breast recurrences detected with mammography ranges between 50% and 80% (including cancers detected also on clinical examination) but is lower at 8%–51% for mammography-only detection. Mammography detects approximately 45%–90% of contralateral cancers. There is evidence of a potential benefit for asymptomatic/early-detected second breast cancers (range of estimated hazard ratios: 0.10–0.86) relative to symptomatic or clinical-detection, in various surveillance strategies that include mammography, however these estimates are likely to have overestimated screening benefit. New evaluations of screening women with a PHBC are needed from screening programs or population datasets, to provide comprehensive measures of screening accuracy and outcomes in this population of women.

Introduction

Gains in life expectancy, improved cancer therapy, and population breast screening are some of the factors that have contributed to the growing prevalence of breast cancer, and hence an increasing population of women with a personal history of breast cancer (PHBC). There is general consensus that women who have experienced breast cancer should have follow-up that includes mammography,[1–5] although recommendations on the frequency and duration of mammography surveillance in this special population of women vary in guidelines and in practice.[1,5–8] There is also some debate concerning the effectiveness, efficiency, and optimal model, of long-term surveillance in women with a PHBC.[7–12]

Women with a PHBC are at risk of developing ipsilateral breast recurrence or a new primary cancer in the treated breast (for simplicity, these will be described as ipsilateral breast recurrence, IBR) and/or contralateral breast cancer (CBC). Routine mammography screening, usually combined with clinical breast examination (CBE), is aimed at early detection of further breast cancer events in either breast. Although women with a PHBC are also at risk of developing distant metastases, intensive screening for *asymptomatic* metastatic relapse is not recommended because it does not confer benefit, in terms of survival or quality of life, based on evidence from randomised controlled trials (RCTs).[13–15] The risk of developing a further breast cancer in either the treated or previously unaffected breast varies according to both tumour and therapeutic variables associated with the (first) breast cancer, and the methods used to estimate risk or incidence. In general, women with early-stage invasive breast cancer treated with breast conservation and adjuvant radiation, with long-term follow-up, are reported to develop IBR in the range of 0.5–1% per year.[16–20] In one of the largest population studies of CBC, Gao et al.[21] reported actuarial rates for CBC of 6.1% at 10 years and 12% at 20 years. This risk approximates an annualized incidence rate of 0.6% for CBC in women with a PHBC.

Surveillance of women with a PHBC aims to identify and manage various health and quality of life issues related to breast cancer and its therapy,[3] and is not limited to detection of further breast cancer events. In this review, however, we focus on the evidence relating

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doi:10.1016/j.breast.2010.05.010

to the accuracy and effect of mammography screening in detection of second breast cancers as part of routine surveillance in women with a PHBC.

Methods

We performed a literature review (MEDLINE: searched to December 2009) to identify studies reporting on screening mammography, or breast surveillance, in women with a PHBC, and specifically studies providing data on the *accuracy* and/or the *effect* of breast screening. When summarising the evidence on the effect of mammography screening, we considered all studies reporting an effect related to any screening or surveillance strategy – that is, any effect attributed to early detection in women with a PHBC. However, we distinguished studies reporting the effect of detecting recurrences, IBR or CBC, from those that also included distant recurrences because the inclusion of the latter would bias estimates of the effect of early detection of in-breast recurrences: we therefore considered only those studies focusing on the effect of detecting recurrences (IBR or CBC) in the evidence summary. Because the findings of the literature review indicated some limitations related to the adequacy and quality of the available evidence, we have integrated general concepts and some interpretation with the reporting of the results, to assist in providing context to the findings of the review.

Results and interpretation

Accuracy of screening (surveillance) mammography

General concepts

The accuracy of screening mammography in women with a PHBC has been examined in non-randomized studies, predominantly in cross-sectional studies reporting on the detection capability of mammography in cohorts of women with previously treated (non-metastatic) breast cancer. Most studies have included women with an initial diagnosis of stage I–II breast cancer, although some studies have also included women with DCIS and/or stage I–II invasive breast cancer.[10,22] Although there is a wide range of reported estimates of the accuracy of mammography in this population of women, caution should be given when interpreting the evidence since some of the variability relates to: (a) which clinical events are being considered in analysis of accuracy (IBR or CBC, or both, and whether regional node recurrences were included or not); (b) whether the data are for (any) mammography detection or mammography-only detection; and (c) whether the study examined cohorts of women with a PHBC (at risk of developing IBR or CBC) or was based on cohorts of women with a PHBC who have experienced further breast cancer events in either breast – the latter design may overestimate sensitivity. Therefore, evidence on each of these issues is discussed distinctly in this review.

The majority of studies of mammography in women with a PHBC have reported the proportion of second breast cancers detected by mammography (which may be equivalent to sensitivity depending on the method of analysis). However, little data exists on its specificity in unselected women with a PHBC, and there are few data on 'standard' measures of screening accuracy as defined in contemporary population screening.

Mammographic detection of ipsilateral breast recurrence/relapse (IBR)

Some of the earliest studies on the accuracy of mammography in detection of IBR indicated that mammography had a modest sensitivity, presumably due to changes in the breast parenchyma caused by surgery and radiation therapy.[23–27] In this respect, clinical breast examination (CBE) is recommended as adjunct to mammography in surveillance of women with a PHBC, since a significant proportion of IBR, approximately 10–30%,[7,22,28,29] is detected only on CBE.

The proportion of IBR detected with screening mammography is reported to range between 50% and 80%[20,22,25,27,29–33] if *any* detection by mammography is considered – this range is based on variable screening frequency due to lack of definitive evidence about the optimal screening interval in this population of women. Studies reporting detection of IBR in the above range may have overestimated the detection capability of mammography since many of these studies were based on selection of women with a PHBC who have had further breast cancer events or breast surgery.[20,22,25,27,30–32] For this same reason, there is a paucity of data on false positive screening mammography (or screening specificity) since most studies have selected only subjects who have developed further breast cancer; Ashkanani et al[33] have reported a false positive rate of 2.3% in a study of surveillance mammography in women with a PHBC treated with breast conservation.

In some studies of surveillance in women with a PHBC, any mammographic detection of IBR cannot be easily estimated or quantified, since data from combined screening mammography and CBE are often reported jointly. For example, one of the largest studies on detection of IBR was conducted by van der Sangen[28] et al. who reported that 51% of recurrences were detected by CBE with or without mammography and 38% were detected by mammography alone. The majority of studies identified in the literature provide data for *mammography-only* detection of IBR, which is useful in understanding the additional detection yield for mammography above CBE or patient-detected IBR. However, this may underestimate the sensitivity of mammography in women with a PHBC since it does not count mammographically-detected cancers that are also evident on CBE. Furthermore, studies rarely describe the sequence in which mammography and CBE were performed and interpreted, therefore the reported data on mammography-only detection may be biased, potentially underestimating the detection capability of screening mammography. For the ipsilateral breast, mammography-only detection is reported in the range of 8%–51%.[20,26,29–31,33–39]

A recent study from the Tuscany region examined the time-related sensitivity of mammography in women with a PHBC who had histology-verified IBR or CBC.[22] It reported that in the asymptomatic women, representing 699 from 1044 women who developed either IBR or CBC, the proportion of cancers detected with *mammography-only* increased significantly over time from 33% to 60% ($P < 0.0001$ for trend over 4 time-frames: 1980–1989, 1990–1994, 1995–1999, 2000–2005). An overview by Montgomery et al[7] also suggested a possible temporal increase across studies in the proportion of second breast cancers that are detected through mammography. Thus, it is important to acknowledge that some of the evidence discussed in this review, and in earlier reviews,[7,10] may not entirely reflect the detection capability of mammography screening of women with a PHBC in contemporary practice.

Mammographic detection of contralateral breast cancer (CBC)

Mammography screening, in broad terms, detects a larger proportion of CBC than that reported for detection of IBR,[7,10,22,40] and CBC appears to be more frequently detected with mammography than by either CBE alone or patient-perceived symptoms.[7,22,40] Published estimates of the proportion of CBC detected through mammography screening ranges between 45% and 90%[20,22,24,37,38,40,41] of women who develop CBC. There is evidence that screening mammography detects CBC at an earlier stage than clinically-detected CBC (either through CBE or through patient-