



REVIEW PAPER

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Imaging methods of early detection and screening for breast cancer. A review

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ABSTRACT

Introduction. Breast cancer is the most frequent neoplasm among women. That is the reason why scientists all over the world are attempting to improve early detection methods of this particular malignancy.

Aim. The most common and most widely used examination methods for screening for and detecting breast cancer is presented herein.

Material and methods. This review was performed according to systematic literature search of three major bibliographic databases.

Results. Available data suggest that incidence and mortality in high-resource countries has been declining whereas incidence and mortality in low-resource countries has been increasing.

Conclusion. The role of a physician is to select the most suitable one for each patient in order to obtain the best result. No matter the method however, between 2005 and 2011, the 5-year relative survival was found to be 89%. This is thought to be due to both the increase in utilization of population-wide screening, as well as advances in treatment.

Keywords. breast cancer, breast MRI, early detection, screening

Introduction

The most common malignancy in women is breast cancer.¹⁻³⁰ According to the Polish National Cancer Register, it is also second most common cause of cancer

death.¹⁻³⁰ This is probably because risk factors and access to early detection methods and treatment differ in those regions.¹⁻³⁰ Risk factors for breast cancer include increasing age, race, menarche history, breast character-

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istics, reproductive patterns, hormone use, alcohol use, tobacco use, diet, physical activity, and body habitus.¹⁻³⁰ Mutations in the BRCA 1 and BRCA 2 tumor suppressor genes are significantly associated with the development of breast and ovarian cancer by the age of 70.¹⁻³⁰ Survival depends on both stage and molecular subtype.¹⁻³⁰ As there are few signs and symptoms early on, early detection is an important strategy to improve outcomes.¹⁻³⁰ It is not a secret that detecting cancer at an early stage or even precursor lesions provide patients with a better chance of survival. That is why it is so important to constantly evaluate accessible early detection methods and to search for new ones.

Early detection and screening methods

Eighty-one percent of breast cancers are diagnosed among women ages 50 years and older, and 89% of breast cancer deaths occur in this age group. The median age at diagnosis for women with breast cancer is 62 years.³⁰⁻³¹

Breast self-examination

For a number of years breast self-examination was promoted as the simplest method for breast cancer detection.³²⁻³⁸ However, the recent studies show that it does not reduce the breast cancer mortality and is not effective to diagnose cancer at an earlier stage.³⁹ It has also been revealed that it increases the number of unnecessary interventions in women due to false-positive results of this examination method.^{3,38}

Ultrasonography

Conventional ultrasound for breast screening is efficient and relatively easy to perform; however, it lacks systematic recording and localization.⁴⁰ Ultrasound examination is recommended for breast cancer screening in young women whilst mammography is recommended for older female patients. This is due to high density of fibroglandular tissue which is better visualized in ultrasound.^{2,7}

Mammography

Mammography is the only imaging modality to have been shown to reduce mortality rate in asymptomatic age-appropriate women.²⁸ However, sensitivity of this examination method can be limited in dense breast tissue especially in younger patients because fibroglandular tissue reduces visibility of abnormalities.^{2,28} Another aspect worth mentioning is the growth pattern – if the tumor does not produce a mass it is very difficult to detect in mammography.^{7,28}

Digital breast tomosynthesis (DBT)

Digital breast tomosynthesis is relatively new method of breast imaging. In this examination, radiologists re-

construct a 3D image from multiple low-dose 2D x-ray source projection images. Obtained data allow them to evaluate breast tissue in very thin slices (e.g. 1 mm).^{5,8,28}

Breast magnetic resonance imaging (MRI)

Breast MRI is a very useful tool not only for detection and characterization of breast cancer but also for describing the extent of the tumor and evaluation of the treatment response.^{10,28}

Reported sensitivity of breast MRI in detection of invasive breast cancer has approached 100% in several series.^{28,29} This data in one of the reasons why breast MRI is important in preoperative staging.^{28,29} The limitation of breast MRI is low-to-moderate specificity ranging from 37-97%.²⁸⁻³⁶

Comparison of the aforementioned methods of early detection of breast cancer

There are many studies comparing usefulness of different methods of early detection of breast cancer. Many factors contribute to these results. It is believed that breast self-examination is the least useful method of all.^{3,38} It also is the reason for unnecessary medical interventions in female patients.^{3,38}

Mammography is the gold standard in breast cancer detection.⁴¹ It provides a good quality image with reduced radiation dose and can detect breast carcinoma in its earlier stages, resulting in good prognosis and improved patient survival.⁴¹ Obese women are the ones with the highest sensitivity of screening mammography, while the specificity of screening remained stable across weight groups.²¹

The exclusive use of quality-assured breast MRI allows the early detection of breast cancer with a high sensitivity and specificity.⁹ Additionally, breast MRI is a reliable problem-solving method for excluding malignancy that cannot be confirmed by conventional imaging. In such cases, additional findings from MRI may help identify new cancers that cannot be detected with conventional methods. However, it has moderately low specificity which may cause unnecessary biopsies, follow-ups, and anxiety to patients.¹²

Overdiagnosis

There are many studies concentrating on the rate of overdiagnosis in female patients with breast cancer.¹⁵⁻⁴¹ This unfortunately leads to unnecessary medical procedures that could otherwise be avoided. The most plausible estimates of overdiagnosis range from 1% to 10%. Substantially higher estimates of overdiagnosis reported in the literature are due to the lack of adjustment for breast cancer risk and/or lead time.²⁴ MRI yielded the highest performance even though the unexpected specificity may lead to over-diagnosis, and ultrasonography is slightly better than mammography.

Conclusion

Many different imaging methods of early detection and screening for breast cancer are used throughout the world. Indications to application of each method vary. The role of a physician is to select the most suitable one for each patient in order to obtain the best result. No matter the method however, between 2005 and 2011, the 5-year relative survival was found to be 89%. This is thought to be due to both the increase in utilization of population-wide screening, as well as advances in treatment.

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