Overview of Breast Cancer Screening and Diagnosis

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KEYWORDS

• Screening mammography • Tomosynthesis • Whole-breast ultrasound
• Contrast-enhanced mammography • Breast MR imaging • Breast imaging with sestamibi
• Positron emission mammography

KEY POINTS

- Screening mammography remains the only examination to reduce breast cancer mortality. Among the guidelines, annual screening from ages 40 to 84 has the highest mortality reduction.
- Physiologic plus anatomic imaging is superior to purely anatomic imaging in both sensitivity and specificity for breast cancer detection.
- Molecular imaging of the breasts can detect mammographically occult breast cancers, but the high total body dose of the tracers precludes yearly screening.

INTRODUCTION

Breast cancer is a leading cause of death among women worldwide. Over the past several decades there has been significant improvement in survival. New treatment strategies, including better chemotherapy and targeted therapies (precision medicine), are partially responsible for this improvement. Even in this era of precision medicine, however, it remains true that smaller, node-negative cancers have better outcomes than larger node-positive cancers. The ability to detect smaller cancers is the result of breast cancer screening.

SCREENING MAMMOGRAPHY

Mammographic breast cancer screening (**Fig. 1**) continues to be a controversial issue. Numerous prospective randomized screening trials in the 1970s, however, prove that early diagnosis of breast cancer translates into a survival benefit, which also implies that breast cancer is not necessarily a primary systemic disease. Clinical studies since then consistently show an approximately 30% decrease in breast cancer–specific mortality.[1–3] Additionally, in women from ages 40 years to 49 years, those who are screened are less likely to require chemotherapy or mastectomy compared with those who are not screened.[4]

Routine mammographic screening continues to be highly recommended by many professional organizations. These organizations, however, offer competing guidelines for women at average risk (**Box 1**). The current standard recommendation in the United States is annual screening beginning at age 40 years until life expectancy is less than 5 years. This recommendation is supported by the Society of Breast Imaging (SBI), American College of Radiology (ACR), National Comprehensive Cancer Network (NCCN), National Consortium of Breast Centers, and the American Congress of Obstetricians and Gynecologists (ACOG). In 2009, the United States Preventive Services Task Force (USPSTF) alternatively recommended biennial screening from ages 50 years to 74 years. The USPSTF concluded that evidence was insufficient for screening beyond 74 years. In 2016, USPSTF recommendations as part of updated guidelines remained unchanged but they noted that women between ages 40 years and 50 years may discuss

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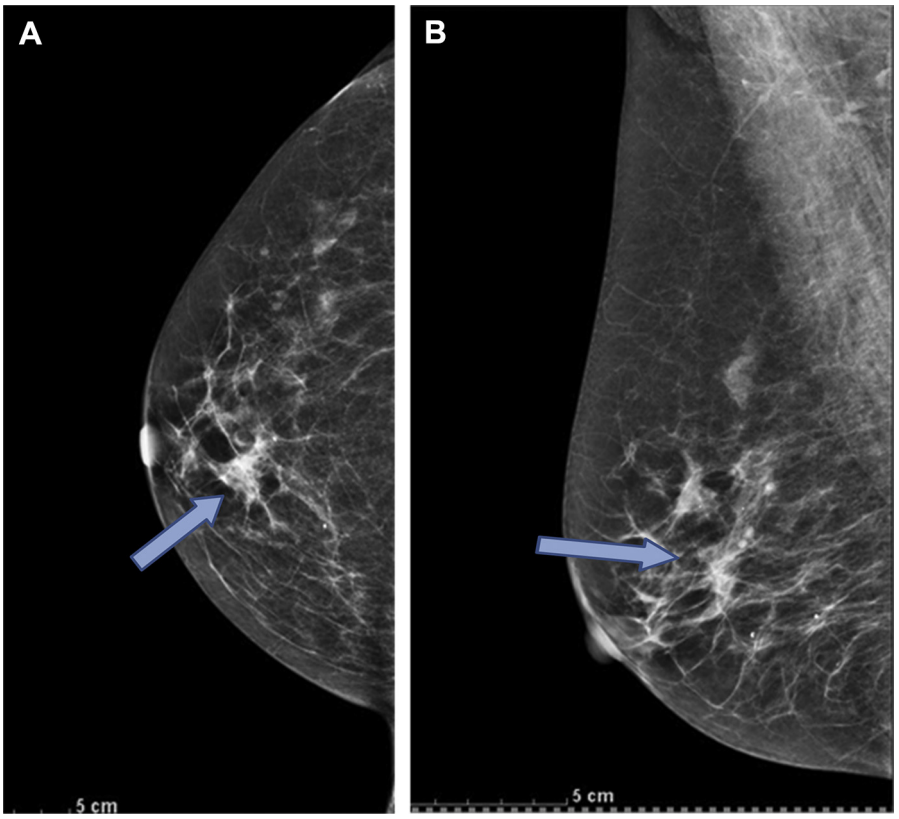

Fig. 1. Screening mammogram. (*A*) Craniocaudal view demonstrating a spiculated suspicious mass (*arrow*) in the medial breast, anterior third depth. (*B*) Mediolateral view demonstrating the partially obscured suspicious mass (*arrow*) in the superior breast, anterior third depth. This was subsequently biopsied and proved to be invasive carcinoma.

Box 1
Summary of the current guidelines for average-risk woman

Screening guidelines 2016: average risk

SBI, ACR, ACOG: current standard

- Annual mammography beginning at age 40 years until life expectancy less than 5 years
- Yearly clinical breast examinations

ACS

- Annual mammography from ages 45 years to 54 years but can begin at age 40
- Transition to every 2 years after age 55 years until life expectancy less than 10 years but can do yearly
- No breast examination by physician, no self-examination

USPSTF

- Ages 40 years to 49 years, discuss with MD
- Biennial mammography from ages 50 years to 74 years

the utility of mammograms with their doctors. This is also supported by American Association of Family Practice and the American College of Physicians. In 2015, the American Cancer Society (ACS) issued new guidelines, taking a middle road between the standard guidelines and USPSTF guidelines. The ACS recommended annual screening from ages 45 years to 54 years and biannual screening until life expectancy is less than 10 years. The American Society of Clinical Oncology and the American Society of Breast Surgeons support these recommendations.

To compare standard guidelines and USPTF guidelines, Arleo and colleagues[5] evaluated outcomes of the 3 screening paradigms using CISNET modeling. They found that the mean mortality reduction was greatest with annual screening from ages 40 years to 84 years (39.6%) compared with the ACS guidelines (30.8%) and the USPSTF guidelines (23.2%).

LIMITATIONS OF MAMMOGRAPHY

Despite substantial benefits, there are several valid criticisms and limitations of screening