Breast Cancer Screening in Chinese Women: Current Status and Exploration of Appropriate Models (Postprint)

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Abstract

Breast cancer has become the most common malignant tumor among Chinese women; however, there are currently no standardized screening criteria and protocols. European and American countries generally adopt a breast cancer screening model that primarily uses mammography as the main method, but significant differences exist between China's economic development level and the characteristics of breast cancer incidence in women compared with European and American countries, making their screening model unsuitable for China. Based on existing research and practice regarding breast cancer screening models for Chinese women, first using a breast cancer risk model for assessment and then employing physical examination combined with ultrasound as the preferred screening method for high-risk women demonstrates higher cost-effectiveness and can improve early diagnosis rates, representing a more suitable breast cancer screening model for Chinese women.

Full Text

Preamble

Current Status and Suitable Mode Evaluation of Breast Carcinoma Screening in Chinese Women

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Abstract

Breast carcinoma has become the most common malignancy in Chinese women, yet standardized screening methods and protocols remain lacking. While Western countries have widely adopted population-based screening programs centered on mammography, significant differences in economic development levels and breast cancer characteristics between China and Western nations render this screening model unsuitable for Chinese women. Existing research and practice specific to Chinese female populations suggest that a more appropriate approach involves first applying breast cancer risk assessment models to identify high-risk individuals, followed by screening using physical examination combined with ultrasound. This strategy demonstrates higher cost-effectiveness and can improve early diagnosis rates.

Keywords: breast carcinoma; screening; ultrasound; mammography

1. Current Status of Breast Cancer Screening in Chinese Women

Breast cancer incidence in China is rising rapidly, exceeding global average growth rates. In major cities such as Shanghai, the growth rate has reached approximately 2% annually, with 269,000 new breast cancer cases reported each year. Against this serious backdrop, early diagnosis and treatment are not only critical for individual patient survival but have also become a major public health priority.

Since the 1960s-70s, developed Western countries have widely implemented population-based breast cancer screening using mammography. Although controversies exist regarding cost-effectiveness and overdiagnosis, screening has demonstrably increased early diagnosis rates and reduced mortality. The UK Independent Review of Breast Cancer Screening concluded that screening reduced breast cancer mortality by 20%, while the U.S. Preventive Services Task Force (USPSTF) meta-analysis indicated a 15% reduction in breast cancer death risk from screening.

China has also launched several large-scale screening initiatives. The "National Million Women Breast Cancer Screening Project," initiated by the Chinese Anti-Cancer Association, aimed to screen 1 million women aged 35-70 nationwide within 3 years. However, the project was terminated early for various reasons, and no updated data have been reported. The first phase (2009-2011) of the "National Rural Women Breast and Cervical Cancer Screening Program," led by the National Health Commission and All-China Women' s Federation, screened 1.46 million women, with 34.8% receiving breast cancer screening. The second phase (2012-2015) adjusted the age range from 35-59 to 35-64 years and shifted from clinical examination alone to physical examination combined with ultrasound for initial screening, with mammography added for suspicious cases.

However, most participating units employed clinical examination combined with near-infrared scanning, and nearly all screening personnel were general medical staff lacking specialized expertise. Beyond these two major programs, additional studies on breast cancer screening in Chinese women have been reported, but these lacked randomized controlled designs or standardized follow-up protocols. Consequently, while some experience has been accumulated, these efforts have not provided high-quality evidence-based medical evidence, and no unified standards or consensus have been established regarding screening targets and methods. Although guidelines such as the Chinese Anti-Cancer Association' s "Breast Cancer Diagnosis and Treatment Guidelines and Norms" address related issues, no uniform specifications exist.

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2. Exploration of Suitable Screening Models for Chinese Women

This section discusses the current status and appropriate models for breast cancer screening in Chinese women.

2.1 Characteristics of Breast Cancer in Chinese Women

Chinese women exhibit significantly different breast cancer characteristics compared to Western populations. The peak age of onset is 45-55 years, approximately 10-20 years younger than in Western women. Chinese women also have relatively smaller breast volumes and a higher proportion of dense breast tissue compared to their Western counterparts. These factors contribute to the poor sensitivity of mammography in Chinese women. Additionally, mammography demonstrates lower sensitivity in younger women, making it particularly unsuitable for Chinese patients. Given these biological differences and varying economic levels and resource allocation across China' s regions, directly adopting Western screening models is inappropriate. Screening models focusing on high-risk women using breast ultrasound as the primary modality may be more suitable for China.

2.2 Screening Target Population

Due to China' s status as a developing country with limited resources, universal screening of all age-appropriate women would create substantial economic pressure. Therefore, screening should target high-risk women to improve cost-effectiveness. Western countries typically use risk assessment models to identify high-risk populations, a strategy China has also adopted. However, risk factors for breast cancer differ between Chinese and Western populations, necessitating the development of risk assessment models specifically for Chinese women.

2.3 Screening Age Range

In Western countries, breast cancer screening typically begins at age 50. Several international authoritative medical organizations have recently adjusted their guidelines: the American Cancer Society (ACS) recommends annual screening for women aged 45-54 and screening every 1-2 years for women aged 40-44 or 55 and older, while the USPSTF recommends biennial screening starting at age 50. Given that Chinese women experience a peak incidence approximately 10 years earlier than Western women, we recommend starting screening at age 40, with high-risk women (those with first-degree relatives diagnosed with breast cancer before age 50, male breast cancer in the family, or other high-risk factors) beginning at age 35.

Regarding the upper age limit for screening, most international randomized controlled trials use 69-74 years as the cutoff. However, breast cancer incidence remains high among elderly Chinese women. We recommend that screening decisions for women over 70 should consider individual health status, life expectancy, and comorbidities. Women with multiple comorbidities and limited life expectancy may discontinue screening, while healthy elderly women may continue with regular self-examination.

2.4 Screening Modalities and Protocols

2.4.1 Breast Cancer Education and Awareness Education plays a crucial role in improving cancer prevention awareness and facilitating early detection. All adult women should become familiar with their breasts and recognize any changes. Education can be delivered through lectures, videos, and online platforms, covering breast anatomy, common breast conditions, self-care practices, and information about high-risk factors and screening methods.

2.4.2 Breast Self-Examination and Clinical Breast Examination While evidence supporting breast self-examination and clinical breast examination remains limited, these practices enhance awareness and preventive consciousness. They are suitable for all adult women.

2.4.3 Imaging Examinations Imaging examinations, including breast ultrasound, mammography, and magnetic resonance imaging (MRI), have been proven to increase early diagnosis rates and reduce mortality.

Mammography and Breast Ultrasound: Western guidelines recommend mammography as the primary screening modality. However, given Chinese women' s younger age at onset and higher prevalence of dense breasts, mammography alone is not ideal for China. The ACRIN 6666 study, a prospective randomized controlled trial from the U.S. that incorporated ultrasound into screening, found that ultrasound detected breast cancers at rates comparable to mammography. Moreover, 91.4% of cancers detected by ultrasound were invasive, compared to only 69.5% of those detected by mammography, indicating

that mammography missed more invasive cancers. This finding was confirmed in a U.S. outpatient retrospective analysis.

A multicenter randomized controlled trial led by our center compared ultrasound versus mammography for screening high-risk Chinese women, demonstrating that ultrasound' s sensitivity and accuracy were significantly superior to mammography. Ultrasound also proved more cost-effective: detecting one case of breast cancer cost 110,000 RMB with mammography but only 6,000 RMB with ultrasound. Another retrospective study confirmed ultrasound' s advantages for Chinese women, particularly premenopausal women with dense breasts. Although Western guidelines do not recommend ultrasound as the primary screening tool due to insufficient evidence and reimbursement issues, Chinese research has demonstrated its clear advantages, especially given the poor compliance with mammography in Chinese populations. Therefore, we recommend ultrasound as the preferred screening modality for Chinese women.

Magnetic Resonance Imaging: Due to its high cost, long examination time, and high sensitivity, MRI should be reserved as a supplementary examination for high-risk women, including: (1) those with BRCA1/2 mutations; (2) women who received chest radiation therapy between ages 10-30; and (3) those with lifetime breast cancer risk of 20-25% based on risk assessment models.

2.5 Recommended Screening Protocol

Based on Chinese epidemiological characteristics and available evidence, we propose the following protocol: First, conduct breast cancer education for all women to enhance awareness and promote regular self-examination. Second, perform risk stratification: low-risk women receive clinical examination, while high-risk women undergo annual imaging screening, with ultrasound as the first-line modality, supplemented by mammography or MRI when necessary.

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3. Conclusion

Breast cancer incidence in Chinese women is increasing rapidly, yet standardized screening protocols remain lacking. Chinese women' s breast cancer characteristics and economic development levels differ substantially from those in Western developed countries, making direct adoption of Western screening models inappropriate. China must establish screening models tailored to its national conditions to improve cost-effectiveness and early diagnosis rates.

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Note: Figure translations are in progress. See original paper for figures.