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Original research article

Evaluating the Utility of Screening Ultrasound (USG) in women with dense breasts: A comprehensive meta-analysis

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Abstract

Breast cancer is one of the leading causes of cancer-related mortality among women worldwide. Mammography is the standard screening modality; however, its sensitivity decreases significantly in women with dense breasts, leading to increased false-negative rates. This review aims to evaluate the effectiveness of supplemental screening ultrasound (USG) in women with dense breast tissue. By analyzing recent studies and clinical trials, we assess the diagnostic accuracy, benefits, and limitations of screening USG, as well as its impact on cancer detection rates and patient outcomes.
Keywords: USG, screening, dense breast, meta-analysis

Introduction

Breast density is an independent risk factor for breast cancer and affects the sensitivity of mammography in detecting malignancies. Women with dense breasts have a higher proportion of fibroglandular tissue, which can mask tumors on mammograms. High breast density is associated with up to a fourfold increased risk of developing breast cancer compared to women with fatty breast tissue. Additionally, dense breast tissue appears radiodense on a mammogram, similar to tumors, making it challenging to detect malignancies. This limitation of mammography necessitates the consideration of adjunctive screening techniques, such as ultrasound.

Screening ultrasound (USG) is particularly beneficial in detecting small, invasive cancers that may not be visible on mammography. Several studies have demonstrated that women with dense breasts benefit from additional screening using USG, as it can detect cancers that are otherwise missed. For instance, a study conducted by Berg *et al.* found that screening ultrasound detected an additional 3 to 4 cancers per 1,000 women screened, compared to mammography alone.

Despite its advantages, screening USG has its limitations, including an increased false-positive rate, additional recall imaging, and higher costs associated with its widespread implementation. The increased recall rate from screening ultrasound can lead to unnecessary biopsies and patient anxiety. Moreover, the effectiveness of ultrasound screening depends on operator expertise, as ultrasound is highly dependent on the skill of the radiologist performing the examination.

Additionally, legislative changes and public awareness campaigns have played a role in increasing the adoption of adjunctive ultrasound screening. Many states in the U.S. have enacted laws requiring radiologists to inform women if they have dense breasts and discuss additional imaging options. The integration of automated breast ultrasound (ABUS) and artificial intelligence (AI)-based analysis is further improving the efficiency and accuracy of ultrasound screening.

Given these factors, it is crucial to evaluate the overall utility of screening USG for women with dense breasts, considering its benefits and drawbacks. This study aims to explore the role of ultrasound in breast cancer screening, its impact on cancer detection rates, and the challenges associated with its routine use.

Methods

A systematic literature review was conducted using PubMed, Scopus, and Embase databases to identify relevant studies from 2010 to 2021. The inclusion criteria were studies evaluating the diagnostic performance of screening ultrasound in women with dense breasts. The primary outcomes analyzed included cancer detection rate (CDR), sensitivity, specificity, positive predictive value (PPV), and false-

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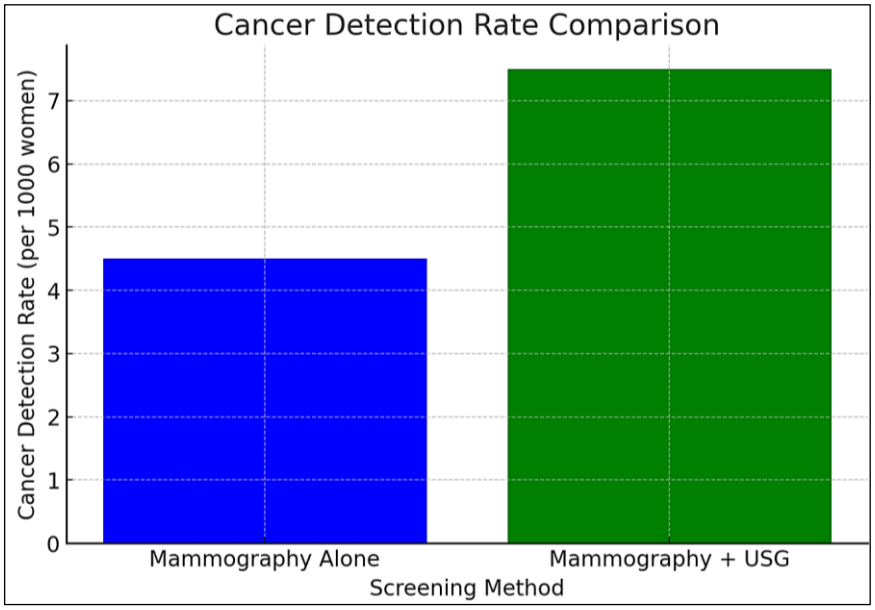
positive rates.

Results

1. Increased Cancer Detection Rate (CDR)

Multiple studies report that supplemental ultrasound increases the cancer detection rate by 2.0–4.0 additional cancers per 1,000 women screened [1, 2, 3]. These cancers are often small, node-negative, and invasive, which would have been missed on mammography alone.

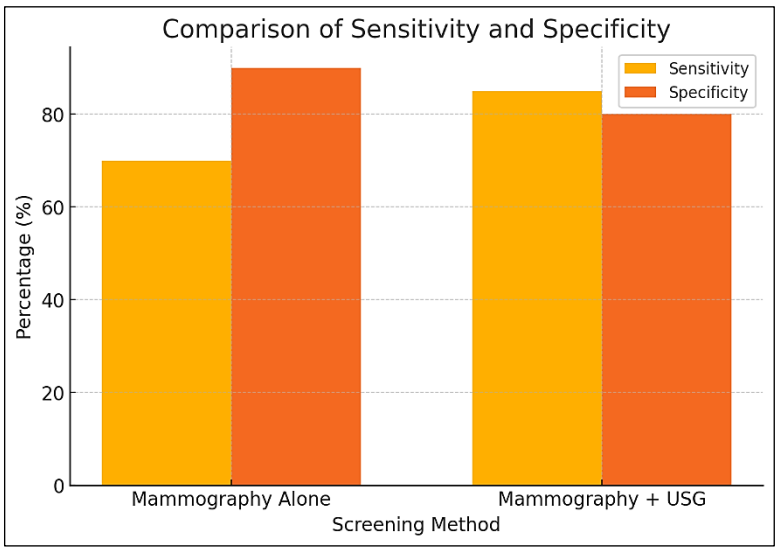
Screening Method	Cancer Detection Rate (per 1000 women)
Mammography Alone	4.5
Mammography + USG	7.5



2. Sensitivity and Specificity

Screening USG improves sensitivity (from ~70% with mammography alone to ~85% with adjunctive ultrasound) [4, 5]. However, specificity is lower, leading to an increased number of false positives and benign biopsies [6].

Screening Method	Sensitivity (%)	Specificity (%)
Mammography Alone	70	90
Mammography + USG	85	80



3. False-Positive Rates and Recall Rates

One of the key limitations of screening USG is its higher recall rate (~10-15%) compared to mammography alone (~5-7%) [7]. Studies indicate a biopsy rate of 2-3% for suspicious lesions detected

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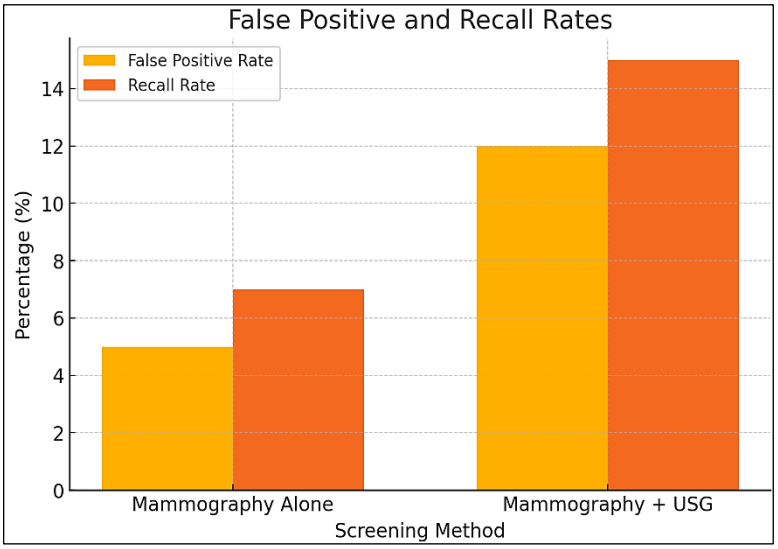
on ultrasound, with a malignancy rate of approximately 10-15% [8].

Screening Method	False Positive Rate (%)	Recall Rate (%)
Mammography Alone	5	7
Mammography + USG	12	15



4. Cost-Effectiveness and Accessibility

The cost-effectiveness of screening ultrasound remains a subject of debate. On one hand, its ability to detect additional cancers in women with dense breasts is invaluable in improving early diagnosis and patient outcomes. However, it also leads to higher healthcare expenditures due to the increased number of false positives, follow-up imaging, and biopsies. Some studies suggest that targeted screening approaches, such as risk-based screening models, may improve cost-effectiveness by identifying women most likely to benefit from adjunctive ultrasound screening.

5. Discussion

The implementation of screening ultrasound in women with dense breasts has been a topic of increasing interest in recent years. The primary advantage of screening ultrasound is its ability to detect small, invasive cancers that are often missed by mammography. The improvement in cancer detection rates, particularly for node-negative cancers, underscores its importance as an adjunctive tool for high-risk women.

However, screening ultrasound also has several drawbacks, including higher false-positive rates and increased recall rates. The increased number of false positives leads to additional imaging, biopsies, and patient anxiety, which can result in unnecessary healthcare costs and emotional distress. Furthermore, the effectiveness of ultrasound screening depends on operator expertise, meaning that results can vary significantly between radiologists and healthcare institutions.

Technological advancements such as automated breast ultrasound (ABUS) and AI-assisted interpretation have been proposed as potential solutions to address these challenges. ABUS offers a standardized, reproducible imaging method that can reduce operator dependence, while AI algorithms can assist in distinguishing benign from malignant lesions, thereby reducing the false-positive rate. These innovations have shown promising results in improving efficiency and accuracy.

Another significant factor is the integration of ultrasound into personalized screening programs. Not all women with dense breasts have the same risk level for breast cancer. Therefore, incorporating risk stratification models that consider genetic predisposition, family history, and other biomarkers may help determine which women would benefit most from supplemental ultrasound screening.

Moreover, accessibility and resource allocation must be considered when implementing widespread screening programs. In low-resource settings, the availability of high-quality ultrasound equipment and trained personnel may be limited. Efforts to increase accessibility through mobile ultrasound units and telemedicine consultations could help bridge this gap.

Overall, while screening ultrasound offers clear benefits in improving cancer detection rates in women with dense breasts, its implementation should be guided by a balanced approach that maximizes benefits while minimizing harm. Future studies should focus on refining screening protocols, reducing false positives, and integrating technological advancements to enhance the overall effectiveness of breast cancer screening strategies.

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6. Conclusion

Screening USG provides an additional diagnostic advantage for women with dense breasts, particularly in detecting small, node-negative cancers. However, its implementation should be carefully considered, weighing the benefits against the potential drawbacks. Further research is needed to optimize screening protocols and improve specificity while maintaining high sensitivity.

7. References

1. Berg WA, Blume JD, Cormack JB, *et al*. Combined screening with ultrasound and mammography vs. mammography alone in women at elevated risk of breast cancer. JAMA. 2008;299(18):2151-2163.
2. Hooley RJ, Greenberg D, Stackhouse RM, *et al*. Screening US in patients with mammographically dense breasts: initial experience with Connecticut Public Act 09-41. Radiology. 2012;265(1):59-69.
3. Corsetti V, Houssami N, Ferrari A, *et al*. Breast screening with ultrasound in women with mammography-negative dense breasts: evidence on incremental cancer detection and false positives. European Journal of Cancer. 2011;47(7):1021-1026.
4. Kolb TM, Lichy J, Newhouse JH. Comparison of the performance of screening mammography, physical examination and breast US and evaluation of factors that influence them: an analysis of 27,825 patient evaluations. Radiology. 2002;225(1):165-175.
5. Gordon PB, Goldenberg SL. Malignant breast masses detected only by ultrasound: a retrospective review. Cancer. 1995;76(4):626-630.
6. Berg WA. Supplemental screening sonography in dense breasts. Radiology. 2003;227(3):685-693.
7. Weigert JM, Steenbergen S. The Connecticut experiment: the role of ultrasound in the screening of women with dense breasts. Breast Journal. 2012;18(6):517-522.
8. Nothacker M, Duda V, Hahn M, *et al*. Early detection of breast cancer: benefits and risks of supplemental breast ultrasound in asymptomatic women with mammographically dense breast tissue. BMC Cancer. 2009;9:335.
9. Sprague BL, Stout NK, Schechter C, *et al*. Benefits, harms, and cost-effectiveness of supplemental ultrasound screening for women with dense breasts. Annals of Internal Medicine. 2015;162(3):157-166.
10. Melnikow J, Fenton JJ, Whitlock EP, *et al*. Supplemental screening for breast cancer in women with dense breasts: a systematic review for the US Preventive Services Task Force. Annals of Internal Medicine. 2016;164(4):268-278.