

INPLASY

A Meta-Analysis of the Synergistic Impact of Magnetic Resonance Imaging and Mammography in the Detection of Breast Cancer in Women with Dense Breasts

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Lian, XF; Lu, L; Wang, H.

Corresponding author:

Yufei Lian

lyf1970s@126.com

Author Affiliation:

Department of Radiology, Affiliated Beijing Chaoyang Hospital (Shijingshan Branch) of Capital Medical University.

ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 7 October 2024 and was last updated on 7 October 2024.

INTRODUCTION

Review question / Objective To determine the diagnostic accuracy of combined mammography and MRI screening for breast cancer in women with dense breast tissue, and to compare its effectiveness to standalone mammography or MRI screening, by conducting a systematic review and meta-analysis of existing studies that report on sensitivity, specificity, and predictive values.

Condition being studied The condition being studied in the provided background knowledge is breast cancer detection, specifically in women with dense breast tissue. The research is focused on evaluating the diagnostic accuracy of combined mammography and MRI screening methods for the early detection of breast cancer in this population.

METHODS

Participant or population The review will focus on women who have dense breast tissue and are at

risk for breast cancer. Dense breast tissue can make it more difficult to detect breast cancer using traditional mammography, hence the interest in evaluating combined mammography and MRI screening methods for this specific population. These women will be the subjects of the studies included in the systematic review, and the review will aim to assess the effectiveness of the screening methods within this demographic. The term "population" is used here to refer to the broader group of women who could potentially benefit from the screening methods being studied

Intervention Combined screening using both mammography and MRI. This typically involves either performing both tests concurrently as part of the initial screening process or using MRI as a follow-up test after an initial mammography result that is negative or inconclusive, especially in cases where breast tissue is dense.

Comparator This involves using MRI alone as the primary screening method for breast cancer detection in women with dense breast tissue.

Study designs to be included We a comprehensive literature search and selected studies that reported sensitivity, specificity, and positive predictive values of combined mammography and MRI screening. Two independent researchers extracted data and assessed the quality of the included studies using the QUADAS-2 tool. Statistical analyses were performed using Stata 15.0, including the construction of forest plots and a summary operating characteristic (SROC) curve to assess overall accuracy. Heterogeneity was evaluated using the I^2 statistic and the Q-test.

Eligibility criteria Additional Inclusion Criteria:
 Studies that provide detailed participant demographics, including age, menopausal status, and breast density measurements.
 Studies that use standardized definitions for what constitutes dense breast tissue (e.g., based on the American College of Radiology's Breast Imaging Reporting and Data System).
 Studies that report on the interval between the screening tests and the diagnosis of breast cancer, to assess the timeliness of detection.
 Studies that include follow-up data to confirm the diagnosis of breast cancer through biopsy or other diagnostic procedures.

Additional Exclusion Criteria:
 Studies that do not report on the specific mammography and MRI techniques used, making it difficult to compare across studies.
 Studies that do not provide sufficient data on the outcomes of interest, such as sensitivity, specificity, positive predictive value, and negative predictive value.
 Studies with a high risk of bias, as determined by quality assessment tools (e.g., Newcastle-Ottawa Scale, QUADAS-2).
 Studies that include participants with a previous history of breast cancer, as this could confound the results.
 Studies that do not have a clear definition of the reference standard used to confirm the diagnosis of breast cancer (e.g., histopathology from a biopsy).
 Studies that are published only in abstract form without full methodology and results, as these may not provide enough information for a comprehensive analysis.

Information sources PubMed, Web of Science, and EMBASE.

Main outcome(s) This study provides evidence supporting the use of combined mammography and MRI screening as an effective strategy for

breast cancer detection in women with dense breast tissue. The findings could inform clinical guidelines and improve screening protocols for this high-risk population.

Quality assessment / Risk of bias analysis Diagnostic Accuracy Studies-2 (QUADAS-2) tool was applied to evaluate the quality of the included literature from two dimensions: risk of bias and clinical applicability. For the assessment of bias, four domains were evaluated: case selection (three questions), index test (two questions), reference standard (two questions), and flow and timing (four questions). For clinical applicability, the case selection, index test, and reference standard were evaluated separately. If the actual situation in a domain poorly matched the research question, the domain was considered to have poor clinical applicability. If the actual situation in a domain closely matched the research question, the domain was considered to have good clinical applicability. If the actual situation in a domain was difficult to assess due to incomplete information, the domain was considered to have unclear clinical applicability. Two researchers independently extracted data and assessed the quality of the literature, resolving any discrepancies t.

Strategy of data synthesis Statistical analyses were performed using Stata 15.0. Forest plots were used to summarize the pooled sensitivity and specificity of the studies. Additionally, a summary receiver operating characteristic (SROC) curve was fitted to assess overall accuracy. The heterogeneity of sensitivity and specificity was evaluated using the I^2 statistic in conjunction with the Q-test. An I^2 value $\leq 25\%$ was considered low heterogeneity, an I^2 value between $>25\%$ and $<75\%$ was considered moderate heterogeneity, and an I^2 value $\geq 75\%$ was considered high heterogeneity. Considering the heterogeneity between studies and the negative correlation between sensitivity and specificity, a bivariate random-effects model was used to pool the sensitivity and specificity. A funnel plot was created with the diagnostic odds ratio (DOR) on the x-axis and the inverse square root of the effective sample size on the y-axis, and the Deeks test was applied to detect publication bias.

Subgroup analysis N/A.

Sensitivity analysis The sensitivity analysis revealed that excluding any single study, studies with ≥ 2 outcomes or overlapping participants, or studies with high risk or unknown risk in certain aspects of quality assessment had no significant impact on the pooled sensitivity and specificity, indicating a relatively robust result.

Country(ies) involved China.

Keywords Breast cancer screening, Mammography, Synergistic Impact, Systematic review.

Contributions of each author

Author 1 - Yufei Lian - Methodology, Investigation, Data curation, original draft.

Email: lyf1970s@126.com

Author 2 - Li Lu - Methodology, Investigation, Data curation, originaldraft.

Email: 19801112650@163.com

Author 3 - Hui Wang.

Email: wanghui19932019@163.com