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Artificial Intelligence for Breast Arterial Calcification Detection on Mammography: A Systematic Review of Diagnostic Accuracy

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Data analysis.

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 11 December 2025 and was last updated on 11 December 2025.

INTRODUCTION

Review question / Objective In women undergoing mammography, how does artificial intelligence-based detection of breast arterial calcifications compare with manual radiologist evaluation in terms of diagnostic accuracy and reliability?

Rationale As mammography is already widely performed in women aged 40 and older, breast arterial calcification (BAC) could offer significant potential for cardiovascular risk assessment, as it is noninvasive, is detected without additional imaging, requiring no additional exposure to radiation or expense. The use of AI-assisted detection of BAC could therefore fill the gap in assessment of women's cardiovascular health by picking up on this subtle biomarker during regularly scheduled mammograms. A systematic review of retrospective studies is necessary to determine whether AI detection of BAC is as accurate and reliable as manual radiologists' evaluation to determine if this process can be systematically integrated into regular care.

Condition being studied This systematic review examines the diagnostic performance of AI-based detection of breast arterial calcification compared with manual radiologist assessment in women undergoing mammography.

METHODS

Search strategy A systematic literature review was performed using MEDLINE, PubMed Central, ScienceDirect, Scopus, Academic Search Premier, IEEE Xplore Digital Library, Directory of Open Access Journals (DOAJ), NCBI Bookshelf. Searches conducted via EBSCOhost also incorporated the Complementary Index. MedRxiv, BioRxiv and ClinicalTrials.gov were screened to identify relevant grey literature. Publication dates were restricted to the last 10 years to the present

(2015-2025). The last search was completed on November 11th, 2025. The following Boolean/Phrase search string was developed in collaboration with a Sacred Heart University Health Science Librarian ("AI" OR "artificial intelligence" OR "deep learning") AND "breast" AND ("imaging" OR "mammography" OR "mammogram") AND ("calcification" OR "CAC" OR "calcium" OR "calcified") AND ("artery OR arteries"). Filter included Human, English, and 2015-present. For gray literature, the following Boolean/phrase search string was developed in collaboration with a Sacred Heart Universit.

Participant or population Women over 18 were enrolled who had a mammogram that was also assessed if breast arterial calcification was present but both a manual read performed by a Radiologist as well as if artificial intelligence was utilized to read the same image for breast calcifications.

Intervention Mammograms assessed for breast arterial calcifications (BAC), use of Artificial Intelligence (AI), Machine Learning (ML), deep learning, or computer aided detection or diagnostic systems for identifying or quantifying BAC on mammograms, including any architecture or software trained in BAC detection.

Comparator Mammograms with manual radiologist evaluation or expert consensus reading of BAC presence.

Study designs to be included All study designs were included in the literature review search and included if meeting the inclusion and exclusion criteria.

Eligibility criteria Adult women (> 18 years) undergoing diagnostic mammography, mammograms that assessed breast arterial calcifications (BAC), use of Artificial Intelligence (AI), Machine Learning (ML), deep learning, or computer aided detection or diagnostic systems for identifying or quantifying BAC on mammograms, including any architecture or software trained in BAC detection, studies with manual radiologist evaluation or expert consensus reading of BAC presence, any articles that report on diagnostic accuracy or correlation, retrospective studies, and English language.
The exclusion criteria were studies involving male or non-human patients, studies with no mammography imaging or AI models not designed for or not reporting BAC detection, studies utilizing digital breast tomosynthesis (DBT) rather than full-field digital mammography (DM), studies without manual radiologist reference standard. To ensure comparability of diagnostic accuracy estimates, we excluded studies that failed to report at least one key performance metric, including AUC, sensitivity, specificity, precision, accuracy, PPV, or NPV.

Information sources MEDLINE, PubMed Central, ScienceDirect, Scopus, Academic Search Premier, IEEE Xplore Digital Library, Directory of Open Access Journals (DOAJ), NCBI Bookshelf. Searches conducted via EBSCOhost also incorporated the Complementary Index. MedRxiv, BioRxiv and ClinicalTrials.gov were screened to identify relevant grey literature.

Main outcome(s) The outcomes collected include primarily diagnostic accuracy metrics such as AUC, sensitivity, specificity, PPV, NPV, accuracy, precision and F1-scores.

Data management Study screening and data extraction was performed independently by two reviewers using Covidence. Data was extracted into a standardized form, with consensus or third-party adjudication for discrepancies.

Quality assessment / Risk of bias analysis The risk of bias of each study was evaluated by two independent reviewers (A.C and L.P.) The Quality Assessment of Diagnostic Accuracy Studies 2 tool (QUADAS-2) was used to assess bias arising from the design, conduct, and applicability of diagnostic accuracy studies, including potential bias in patient selection, index test performance, reference standard interpretation, and flow and timing of participants through the study.28 RobVis was used to generate Risk of Bias Tables.

Strategy of data synthesis The data will be abstracted from articles into tabular format and outcomes reported along with statistical significance. Due to the variability in AI generated measurements, a meta-analysis is unable to be performed.

Subgroup analysis Not applicable.

Sensitivity analysis Not applicable.

Language restriction Only English-language publications will be included.

Country(ies) involved United States.

Keywords Breast arterial calcifications, artificial intelligence, mammography, deep learning, cardiovascular disease.

Dissemination plans The findings will be disseminated through peer-reviewed publication, presentation at cardiovascular disease or artificial intelligence-focused conferences.

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