INPLASY

INPLASY202590040

doi: 10.37766/inplasy2025.9.0040

Received: 11 September 2025

Published: 11 September 2025

Corresponding author:
Ting-Wei Wang

eltonwang1@gmail.com

Author Affiliation:
Taipei Veteran General Hospital.

Diagnostic Accuracy of AI-Based SPECT MPI for Coronary Artery Disease: A Systematic Review and Meta-Analysis Recognizing Imperfect Reference Standards

Wang, TW; Hsu, WC; Tsai, TY; Chen, CL; Tu, YK; Hu, LH.

ADMINISTRATIVE INFORMATION

Support - NR.

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

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202590040

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 11 September 2025 and was last updated on 11 September 2025.

INTRODUCTION

Review question / Objective PICOS: Among adults with suspected/known CAD (P), do AI algorithms applied to SPECT myocardial perfusion imaging (I), compared with invasive/anatomic or physiologic references such as ICA/QCA, FFR, or expert adjudication (C), accurately detect obstructive CAD and, in particular, ischemia (O) across diagnostic-accuracy study designs (S)? Primary objective: estimate sensitivity/specificity using a Bayesian latent-class bivariate model that recognizes imperfect reference standards and generates HSROC summaries. Secondary: explore heterogeneity via meta-regression (AC vs no-AC, CZT vs conventional, stressor, tracer, clinical-image fusion, validation strategy).

Condition being studied Coronary artery disease (CAD) with a focus on physiologically significant ischemia detectable by SPECT myocardial perfusion imaging.

METHODS

Participant or population Adults (≥18 years) undergoing SPECT-MPI for suspected or known CAD in clinical settings (outpatient/inpatient; single- or multicenter; varied prevalence).

Intervention Artificial-intelligence algorithms (deep learning or classical ML) applied to SPECT-MPI images/derived maps (e.g., polar maps, 3D volumes), with or without clinical-image fusion.

Comparator Prespecified reference standards: ICA/QCA using vessel-level stenosis thresholds, FFR (≤0.80), or expert/clinical adjudication of ischemia/abnormal MPI. Analyses recognize reference imperfection via latent-class modeling.

Study designs to be included Diagnostic-accuracy studies (prospective or retrospective; cross-sectional or cohort-like) reporting data enabling 2×2 tables at patient and/or vessel level.

Eligibility criteria Inclusion: Adult SPECT-MPI; AI applied directly to MPI; prespecified reference; extractable TP/FP/TN/FN.Exclusion: Pediatrics; non-MPI imaging (PET/CMR/CCTA-only); non-SPECT; technical papers without clinical validation; <10 participants; reviews/editorials; case reports; conference abstracts without extractable accuracy data; duplicated cohorts (most complete kept).

Information sources Electronic databases (above), backward citation chasing, trial registries/grey literature as needed, author contact for clarification when extractable 2×2 is ambiguous.

Main outcome(s) Study-level and pooled sensitivity and specificity (with 95% CIs/CrIs); HSROC; diagnostic odds ratio; positive/negative likelihood ratios. Primary target condition: ischemia; secondary: obstructive CAD, ischemia±infarction.

Quality assessment / Risk of bias analysis QUADAS-2 for individual studies (selection, index test, reference, flow/timing); GRADE (diagnostic tests) for certainty of evidence (risk of bias, indirectness, inconsistency, imprecision, publication bias). Publication bias: Deeks' funnel plot (P<0.10).

Strategy of data synthesis Reconstruct 2×2 tables. Fit a Bayesian hierarchical latent-class bivariate model (MetaBayesDTA) jointly estimating sensitivity/specificity while relaxing perfect-reference assumptions; default weakly informative priors; MCMC diagnostics (R-hat<1.01). Generate HSROC with 95% confidence/prediction ellipses. Frequentist bivariate/HSROC for comparison. Prespecified meta-regression for moderators. Report medians and 95% credible intervals.

Subgroup analysis Reference type (ICA/QCA vs FFR vs adjudication); task (ischemia vs obstructive CAD vs ischemia+MI); attenuation correction (AC, NAC, DLAC); camera (CZT vs conventional); stress-only vs stress-rest; tracer; image-only vs image+clinical fusion; AI type (DL vs ML); validation (internal vs external); prevalence strata; sex/age strata if available.

Sensitivity analysis Exclude overlapping datasets; include conference/abstract-only where extractable; vary prior widths; remove high/unclear risk-of-bias studies; per-patient vs per-vessel; alternative thresholds where multiple cut-points reported.

Country(ies) involved Taiwan.

Keywords Artificial intelligence; SPECT; myocardial perfusion imaging; coronary artery disease; ischemia; diagnostic accuracy; deep learning; machine learning; Bayesian latent-class; HSROC; attenuation.

Contributions of each author
Author 1 - Ting-Wei Wang.
Author 2 - Hsu Wei-Chun.
Author 3 - Tsung-You Tsai.
Author 4 - Cheng-Long Chen.
Author 5 - Yu-Kang Tu.
Author 6 - Lien-Hsin Hu.