©Copyright by Croatian Cardiac Society. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/) which permits users to read, download, copy, distribute, print, search, or link to the full texts of these articles in any medium or format and to remix, transform and build upon the material, provided the original work is properly cited and any changes properly indicated.

Does Preoperative Echocardiography Improve Prediction of Postoperative Atrial Fibrillation Beyond Clinical and Operative Risk? A Systematic Review and Meta-analysis

Nora Knez[1]*, Ivan Strinić[1], Klara Brekalo[1], Mislav Puljević[2], Hrvoje Gašparović[2]

[1]Teaching Institute of Emergency Medicine of the City of Zagreb, Zagreb, Croatia
[2]University Hospital Centre Zagreb, Zagreb, Croatia

KEYWORDS: postoperative atrial fibrillation, echocardiography, cardiac surgery, risk prediction, meta-analysis.

CITATION: Cardiol Croat. 2026;21(11-12):227-8. | https://doi.org/10.15836/ccar2026.227

***ADDRESS FOR CORRESPONDENCE:** Nora Knez, Nastavni zavod za hitnu medicinu Grada Zagreba Heinzelova 88, HR-10000 Zagreb, Croatia. / Phone: +385-99-7466-450 / E-mail: noraknez6@gmail.com

ORCID: Nora Knez, https://orcid.org/0000-0002-4933-4947 • Ivan Strinić, https://orcid.org/0000-0002-8108-9240
Klara Brekalo, https://orcid.org/0009-0008-3636-008X • Mislav Puljević, https://orcid.org/0000-0003-1477-2581
Hrvoje Gašparović, https://orcid.org/0000-0002-2492-3702

Introduction: Echocardiographic markers of atrial remodeling are associated with postoperative atrial fibrillation (POAF), but association does not establish added predictive value beyond clinical or operative models.[1] We evaluated incremental discrimination after preoperative echocardiographic augmentation and the evidence for subsequent inflammatory biomarker augmentation.

Methods: We systematically reviewed cohort and prediction-model studies in adults undergoing cardiac surgery within the prespecified 1 January 2010 to 31 October 2025 evidence window. Adjusted associations for peak atrial longitudinal strain (PALS) and left atrial volume index (LAVI), and within-study changes in area under the receiver-operating-characteristic curve (AUC), were synthesized with restricted maximum-likelihood random-effects meta-analysis. Risk of bias was assessed using QUIPS and PROBAST.

Results: Sixty included reports comprised of 8,540 patients and 2,701 POAF events; 15 unique studies contributed to quantitative synthesis. Each five-percentage-point lower PALS was associated with higher POAF odds (five studies; odds ratio [OR] 2.31, 95% confidence interval [CI] 1.36–3.91; I^2=9.2%). Each 5 mL/m² higher LAVI was also associated with increased odds (ten studies; OR 1.35, 95% CI 1.14–1.59; I^2=39.5%; **Table 1**). Only three nested model comparisons (371 patients; 128 POAF events) assessed incremental discrimination after adding echocardiography: pooled ΔAUC 0.139 (95% CI −0.223 to 0.501; I^2=86.5%; **Figure 1**). All three comparisons had high PROBAST risk of bias and paired-AUC covariance required approximation. One study assessed adding interleukin-6 after echocardiography (ΔAUC 0.044; DeLong p=0.093); net reclassification improvement was 0.019 (95% CI −0.108 to 0.145), and integrated discrimination improvement was 0.074 (95% CI 0.023–0.124). Calibration and decision-curve evidence were insufficient for synthesis.

TABLE 1. Adjusted associations of preoperative left atrial strain and left atrial volume index with postoperative atrial fibrillation.

Predictor / increment	Studies / patients / POAF	Adjusted OR (95% CI)	I^2	95% PI
PALS, 5 percentage-point lower	5 / 383 / 103	2.31 (1.36–3.91)	9.2%	1.22–4.36
LAVI, 5 mL/m² higher	10 / 1,417 / 607	1.35 (1.14–1.59)	39.5%	0.96–1.88

Random-effects meta-analysis (REML) of adjusted prognostic associations.

Abbreviations and symbols: CI, confidence interval; I^2, percentage of observed variability attributable to between-study heterogeneity; LAVI, left atrial volume index; OR, odds ratio; PALS, peak atrial longitudinal strain; PI, prediction interval; POAF, postoperative atrial fibrillation; REML, restricted maximum likelihood.

RECEIVED:
October 25, 2026
UPDATED:
November 4, 2026

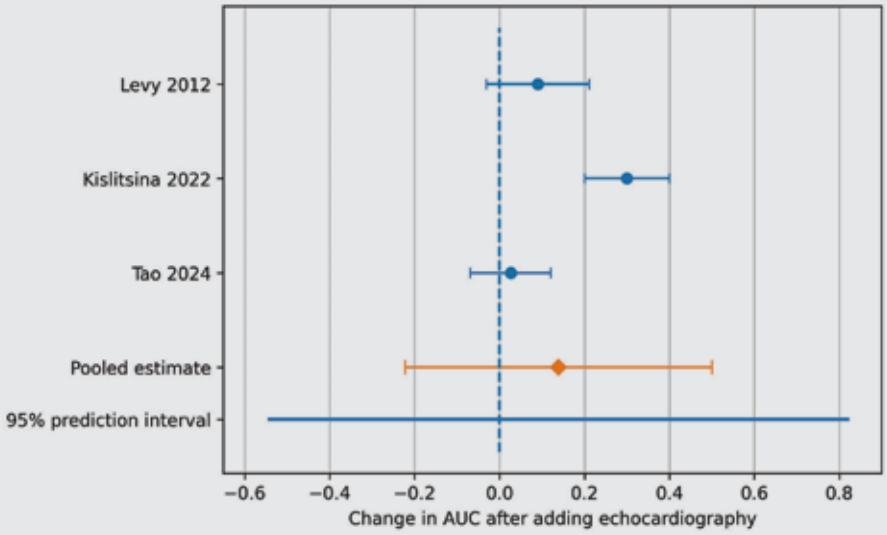


FIGURE 1. Incremental discrimination following the addition of preoperative echocardiography to clinical or operative risk models for postoperative atrial fibrillation.

Three nested model comparisons; pooled random-effects change in area under the receiver operating characteristic curve 0.139 (95% confidence interval −0.223 to 0.501; I^2 = 86.5%).

Abbreviations and symbols: AUC, area under the receiver operating characteristic curve; I^2, proportion of variability attributable to between-study heterogeneity.

Conclusion: Lower PALS and higher LAVI are associated with POAF, but sparse, heterogeneous and high-risk-of-bias model-comparison evidence does not establish incremental prediction beyond clinical or operative factors. Nested-model studies with calibration, clinical-utility assessment and external validation are needed before implementing echocardiography- or inflammation-based POAF scores.

LITERATURE

1. Pandey A, Okaj I, Ichhpuniani S, Tao B, Kaur H, Spence JD, et al. Risk Scores for Prediction of Postoperative Atrial Fibrillation After Cardiac Surgery: A Systematic Review and Meta-Analysis. Am J Cardiol. 2023 Dec 15;209:232-240. https://doi.org/10.1016/j.amjcard.2023.08.161