Indonesian Journal of Cardiology

An Official Publication of the Indonesia Heart Association

Volume 47, Suppl_A, 2026

Proudly presents

The 12th Annual Scientific Meeting InaHRS 2025

Systematic Review and Meta-Analysis Abstracts

This supplement consists of abstracts presented at:
The 12th Annual Scientific Meeting InaHRS 2025, held September 11–13, 2025, at Raffles Jakarta, Jakarta, Indonesia.

The 12th Annual Scientific Meeting InaHRS 2025 is supported by the Indonesian Heart Rhythm Society (InaHRS).

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

The Indonesian Journal of Cardiology and the Scientific Committee of The 12th Annual Scientific Meeting InaHRS would like to express our appreciation to all the Abstract Reviewers for their dedication and time.

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The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV1]

Beneath the Skin or Through the Vein? A Meta-Analysis of the Safety and Efficacy of ICD Therapies

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Background: Implantable cardioverter-defibrillators (ICDs) are a cornerstone in the prevention of sudden cardiac death. There are currently two main ICD types in use: the traditional transvenous ICD (TV-ICD) and the newer subcutaneous ICD (S-ICD), which avoids transvenous access by placing leads beneath the skin. While both systems aim to deliver life-saving therapies, they differ in procedural risks, long-term complications, and clinical outcomes. As the adoption of S-ICD increases, questions remain regarding its comparative safety and efficacy relative to that of TV-ICD.

Materials and methods: We conducted an electronic literature search through PubMed, Google Scholar, EMBASE, Scopus, and the Cochrane database to locate randomized controlled trials (RCTs) and observational studies comparing S-ICD and TV-ICD, published between 2015 and 2025. The primary outcome was mortality, and the secondary outcomes were appropriate shocks (AS), inappropriate shocks (IAS), and device-related complications. Data were analyzed using a random-effects model to calculate pooled odds ratios (ORs) with 95% confidence intervals (CIs).

Results: Eight studies (3312 patients) demonstrated no statistically significant difference between S-ICD and TV-ICD across multiple clinical outcomes. Pooled analyses showed comparable rates of mortality (RR 1.16 [95% CI 0.89–1.51], $P = 0.26$) and inappropriate shocks (RR 1.17 [0.87–1.59], $P = 0.30$), both with low heterogeneity ($I^2 \leq 11\%$). While analyses of appropriate shocks (RR 0.72 [0.37–1.39], $P = 0.33$) and device-related complications (RR 0.86 [0.44–1.67], $P = 0.66$) suggested potential benefits of S-ICDs, these findings were not statistically significant.

Conclusion: This meta-analysis suggests that subcutaneous and transvenous ICDs offer comparable safety and efficacy profiles in patients requiring defibrillator therapy. Although trends toward fewer device-related complications and inappropriate shocks were observed with S-ICDs, these differences did not reach statistical significance.

Keywords: subcutaneous implantable cardioverter-defibrillator, transvenous implantable cardioverter-defibrillator, mortality, device-related complications, inappropriate shock

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV2]

Spontaneous Type 1 ECG and PVS for Risk Stratification in Asymptomatic Brugada Syndrome: A Meta-Analysis

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Background and Aims: The prognostic significance of spontaneous type 1 ECG and programmed ventricular stimulation (PVS) in asymptomatic Brugada syndrome (BrS) remains unclear. While the annual incidence of arrhythmic events in asymptomatic subjects with Brugada ECG pattern is low (~1%), it cannot be considered negligible, as approximately 50% of cases present with ventricular tachycardia/fibrillation (VT/VF) without warning symptoms. This meta-analysis synthesizes global evidence to clarify arrhythmic risk stratification, addressing discrepancies in ECG patterns, PVS utility, and implications for ICD therapy in asymptomatic patients.

Methods: A systematic literature search was conducted in Scopus, PubMed, and Cochrane databases (2000–2024). Twelve prospective observational studies involving 3,565 asymptomatic patients with BrS (2,462 men; mean age, 45 ± 12 years) were included. The follow-up duration ranged from 22 months to 6 years.

Results: Data from 1,298 asymptomatic participants with spontaneous type 1 ECG were extracted from eight studies. Among 1,298 asymptomatic participants with spontaneous type 1 ECG, 64 experienced arrhythmic events (sustained ventricular tachycardia/fibrillation, appropriate device therapies, or arrhythmic death) (4.9% vs. 1.2% in drug-induced; OR 4.24, 95% CI 2.45–7.31, $p<0.00001$; heterogeneity: $I^2=24\%$). PVS-inducible patients (n=649) had higher events (8.0% vs. 1.8% non-inducible; OR 3.55, 95% CI 2.02–6.24, $p<0.0001$; heterogeneity: $I^2=0\%$). Both analyses showed robust overall effects ($Z = 5.21$, $Z = 4.39$).

Conclusion: Spontaneous type 1 BrS ECG and PVS predict higher arrhythmic risk in asymptomatic BrS patients versus drug-induced/non-inducible patients, guiding ICD decisions.

Keywords: Brugada syndrome, Asymptomatic patients, Risk stratification, Meta-analysis, Spontaneous type 1 ECG, Programmed ventricular stimulation

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV3]

Conduction System Pacing as a Primary Strategy for Bradyarrhythmia: A Systematic Review and Meta-analysis

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Background & aims: Right ventricular pacing (RVP) remains the most commonly employed therapy for patients with bradyarrhythmia and pacemaker indications. However, RVP is associated with electrical and mechanical dyssynchrony of the ventricles, which may lead to adverse outcomes, including pathological cardiac remodelling, atrial fibrillation (AF), and progressive decline in left ventricular (LV) systolic function. Conduction system pacing (CSP), which encompasses his bundle pacing (HBP) and left bundle branch area pacing (LBBaP), offers a more physiological pattern of ventricular activation and has the potential to supersede RVP. Nevertheless, the current evidence supporting its efficacy is still emerging.

Materials and methods: We conducted a systematic literature search in PubMed, the Cochrane Library, and ScienceDirect. Relevant articles obtained from other sources were also included in this study. Studies were screened using a PICO framework comparing CSP (i.e., HBP or LBBaP) and RVP in patients with bradyarrhythmia. The risk of bias was assessed using appropriate tools, and the data were analyzed using RevMan 5.4, reporting pooled effects as risk ratios (RR) or mean differences (MD) with 95% confidence intervals (CI).

Results: Seventeen studies, comprising 16 observational studies and one randomized controlled trial, were included, enrolling 5,591 patients with bradyarrhythmia who received either CSP or RVP. Pooled analysis showed that CSP was associated with a significantly lower risk of the composite clinical outcome (RR 0.61 [0.45–0.82]), all-cause mortality (RR 0.63 [0.53–0.75]), HFH (RR 0.58 [0.48–0.71]), and the need for upgrading to a biventricular pacemaker (RR 0.21 [0.07–0.67]). These benefits were more pronounced with an increasing pacing burden. Additionally, CSP was associated with better preservation of LVEF (MD 7.09% [5.93–8.25]) and narrower QRSd (MD –35.64ms [–41.91 to –29.36]) during follow-up. However, CSP procedures were technically more demanding, resulting in longer procedural times (MD 22.90 min [20.23–25.57]) and increased fluoroscopy duration (MD 5.58 min [3.76–7.39]). Notably, CSP was associated with higher pacing thresholds (MD 0.76V [0.64–0.88]) and a higher risk of lead revision (RR 2.43 [1.39-4.27]).

Conclusion: In our analysis, conduction system pacing (CSP) demonstrated superiority over conventional right ventricular pacing (RVP) and may be considered a first-line pacing modality for bradyarrhythmia, given the procedural complexity and associated costs.

Keywords: conduction system pacing, right ventricular pacing, composite clinical outcome, heart failure hospitalization, LVEF

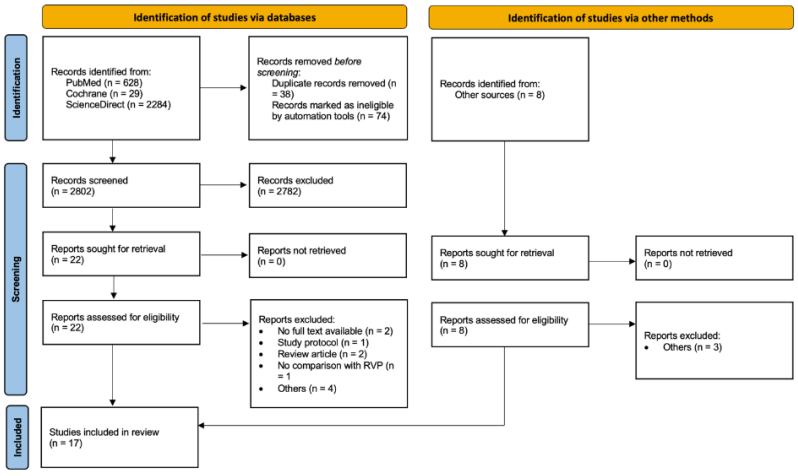

Figure 1. PRISMA Flowchart.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV4]

Decoding Cardiomyopathy: Exploring the Performance of Deep Learning-Enhanced Electrocardiography for Detecting Cardiomyopathies through Meta-Analysis of Diagnostic Accuracy

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Background and Aims: Cardiomyopathy is a significant underlying cause of sudden cardiac death. Accurate identification of specific cardiomyopathy subtypes remains challenging, largely due to non-specific clinical presentations and electrocardiographic (ECG) findings, an issue further exacerbated in rural settings with limited access to echocardiography. Recent advancements in artificial intelligence (AI) have demonstrated its potential to enhance diagnostic precision across a range of medical conditions. This study aimed to evaluate the diagnostic efficacy of deep learning (DL)-augmented ECG in identifying different forms of cardiomyopathy.

Materials and Methods: A comprehensive literature search was conducted in PubMed, Cochrane, Scopus, and Embase to identify studies evaluating DL algorithms, a subset of AI, for the diagnosis of arrhythmogenic right ventricular cardiomyopathy (ARVC), hypertrophic cardiomyopathy (HCM), and phospholamban cardiomyopathy (PLN-CM). The analysis was limited to studies involving adult populations only. Prior training and validation are mandatory for developing an AI framework. A bivariate random-effects model was applied to estimate pooled estimates of sensitivity, specificity, and the log diagnostic odds ratio (DOR), along with the corresponding 95% confidence intervals (CIs) and area under the curve (AUC). Data were illustrated using forest plots and summary receiver operating characteristic (SROC) curves.

Results: A total of 12 cohort studies (ARVC=2, HCM=7, PLN-CM=3) recruiting 436,557 participants (ARVC=1582, HCM=433,998, PLN-CM=977) were included in quantitative analysis. The meta-analysis revealed pooled sensitivity and specificity of 76.1% (95% CI 66.3-83.7%) and 78.7% (95% CI 60.6-89.8%) for AI-ECG in ARVC detection, respectively, with a log DOR of 2.438 and an acceptable SROC-AUC of 0.786 in the ARVC cohort analysis. The pooled sensitivity and specificity for HCM detection using AI-incorporated ECG were 87.6% (95% CI 83.5-90.8%) and 90.5% (95% CI 78.9-96.1%), respectively. Analysis of the HCM population revealed a log DOR of 4.203 and an outstanding SROC-AUC value of 0.942. AI-implemented ECG demonstrated a pooled sensitivity of 72.9% (95% CI 63.1-80.9%) and pooled specificity of 72.8% (95% CI 55.4-94.9%) for PLN-CM detection. The meta-analysis yielded a log DOR of 2.639 and a decent SROC-AUC value of 0.793.

Conclusion: The Implementation of DL on ECG recordings provides exceptional diagnostic performance in detecting ARVC, HCM, and PLN-CM. Further studies are warranted to assess the prognostic value of the AI framework in predicting arrhythmia occurrence in cardiomyopathies.

Keywords: artificial intelligence; neural network; arrhythmogenic right ventricular cardiomyopathy; hypertrophic cardiomyopathy; phospholamban cardiomyopathy

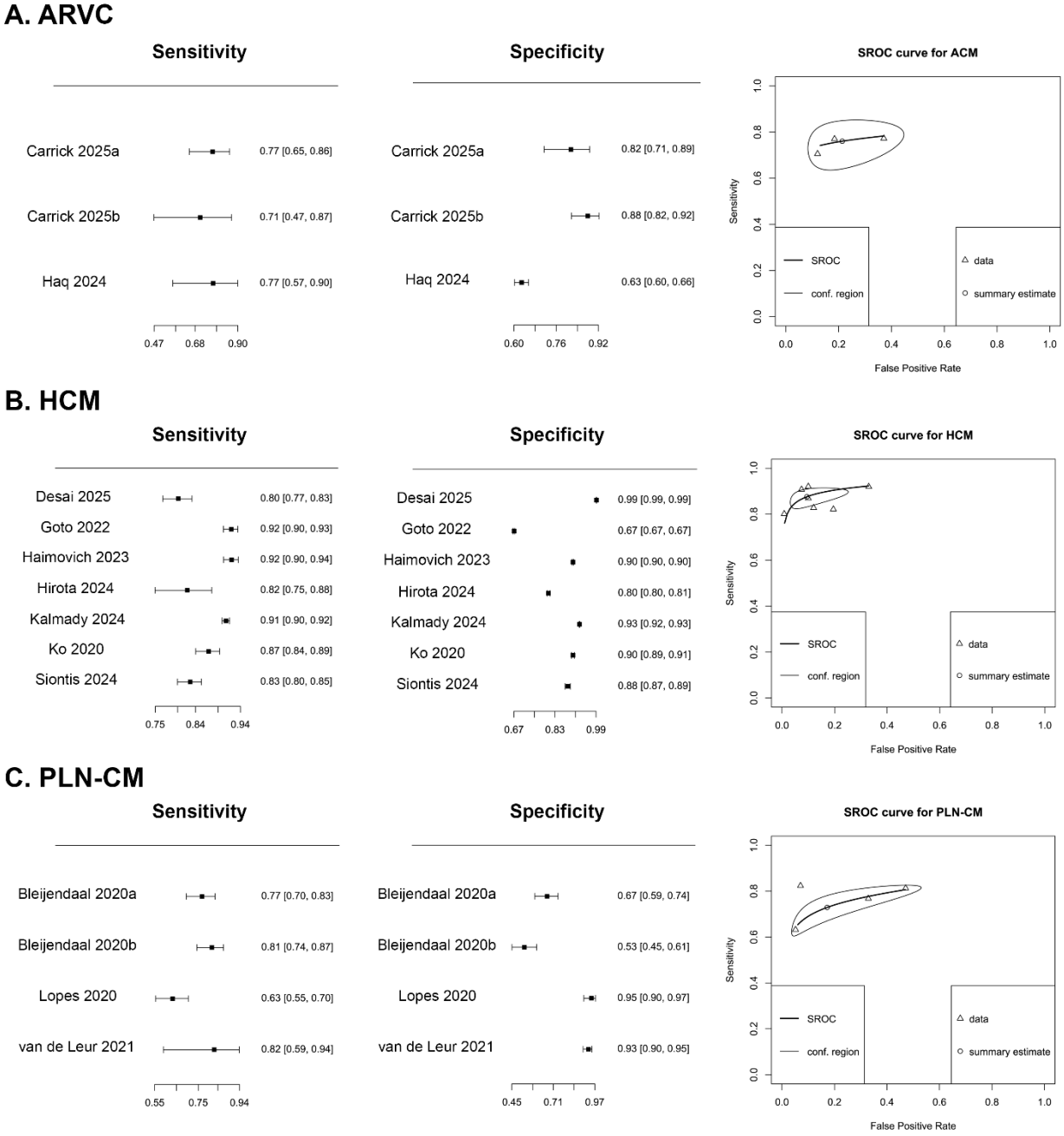

Figure 1. Forest plots representing pooled sensitivity and specificity and SROC curves for all cardiomyopathy subtypes. (A) ARVC, (B) HCM, and (C) PLN-CM.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV5]

Exploring the Link Between Non-alcoholic Fatty Liver Disease, Atrial Fibrillation, and Associated Biomarkers: A Systematic Review

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Background and aims: Non-alcoholic liver disease is an emerging disease with a rapid increase in the global and Asian regions, with an estimated prevalence of 30%. NAFLD also increases the risk of atrial fibrillation (AF), with a prevalence of 59 million in 2019. As the diagnosis and assessment of NAFLD severity frequently use an invasive approach, we evaluated the association between NAFLD and AF, along with non-invasive biological markers that link the two.

Materials and methods: A systematic search of the PubMed, ScienceDirect, and SCOPUS databases identified cohort and cross-sectional studies published between 2021 and 2025. We screened 263 studies for inclusion. After removing duplicates and filtering titles, abstracts, and full texts, five studies were included in the final review. Bias assessed using Risk of Bias in Non-randomized Studies - of Exposure. The NAFLD-AF link and the influence of biomarkers were also evaluated. The subgroup characteristics included age, sex, and cardiovascular risk factors.

Results: 5 studies were included in this review with a total sample of 16,573,965. Male participants predominated. NAFLD is significantly associated with the prevalence of new-onset AF. The four non-invasive biomarkers reviewed in this study are the fatty liver index (FLI), fibrosis-4 (FIB-4) index, triglyceride-glucose index (TyG), and circulating inflammatory protein (CIP). High FLI is related to an increased incidence of AF, regardless of cardiovascular risk, especially in those with a lower BMI. FIB-4 $\geq$ 1.3, patients usually presented with cardiovascular risk and a higher risk of AF. TyG is also significantly associated with AF. One unit increase in TyG, corresponding to 4.84, was associated with an increased risk of developing AF. From the CIP evaluation, C-X-C motif chemokine ligand 10 (CXCL10) emerged as a key inflammatory link between liver fibrosis and prevalent AF.

Conclusion: NAFLD significantly influenced new-onset AF, with FLI, TyG, and Fib-4 serving as predictive biomarkers for AF, and CXCL10 linking NAFLD and AF.

Keywords: NAFLD, AF, Biomarker, Link, FLI, TyG, FIB-4 index, CIP, CXCL10

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV6]

A Systematic Review and Network Meta-Analysis of Direct Oral Anticoagulant Strategies Following Hemorrhagic Transformation of Ischemic Stroke in Atrial Fibrillation—Too Early, Too Late, or Not at All?

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Background and Aims: The optimal timing of direct oral anticoagulant (DOAC) resumption after ischemic stroke with hemorrhagic transformation (HT) in atrial fibrillation (AF) is unclear. This study evaluated whether early, delayed, or discontinued DOAC strategies influence ischemic recurrence and safety outcomes.

Materials and Methods: We conducted a PRISMA-guided systematic review across six databases (up to June 7, 2025) that included randomized trials and cohort studies enrolling patients with AF and HT-complicated ischemic stroke. The interventions included early DOAC resumption (typically within 2–7 days), late resumption (typically after 7 days), or discontinuation. Outcomes included recurrent ischemic stroke, functional outcomes, symptomatic intracranial hemorrhage (sICH), major/non-major bleeding, systemic embolism, and death. Bayesian network meta-analysis was performed using a random-effects model with two iterations (short: 1,000; extended: 50,000) and 95% Credible Intervals (CrI). Surface Under the Cumulative Ranking curve (SUCRA), DOAC timing ranks, and posterior probabilities were estimated. A 10% increase in ischemic stroke recurrence was used as a clinically meaningful threshold for interpreting the posterior probabilities.

Results: Four studies (n = 3,222) were included in this review. Early DOAC resumption showed the lowest ischemic recurrence risk (RR: 0.56; 95% CrI: 0.17–1.84), followed by late resumption (RR: 0.89; 95% CrI: 0.31–2.80), compared with discontinuation. The probability of ≥10% increased stroke recurrence with late vs. early treatment was 74.83%. SUCRA values ranked highest recurrence risk with discontinuation (0.71), followed by late (0.61) and early (0.18) treatment. Functional outcomes (mRS 3–6) were worse in the early DOAC group with parenchymal hemorrhage (72.4% vs. 48.1%, $p<0.05$) but not in the hemorrhagic infarction subgroup. No excess risk was observed between the early and late groups for sICH, extracranial bleeding, embolism, or death. Despite the potential radiologic progression of HT, early DOAC treatment was not associated with a higher sICH rate.

Conclusion: Early DOAC resumption may lower stroke recurrence without increasing the bleeding risk, particularly in hemorrhagic infarction, whereas delayed resumption may be safer in parenchymal hemorrhage. These findings support individualized timing and require validation in future studies.

Keyword: Atrial Fibrillation, Direct Oral Anticoagulants, Hemorrhagic Transformation, Ischemic Stroke, Meta-Analysis

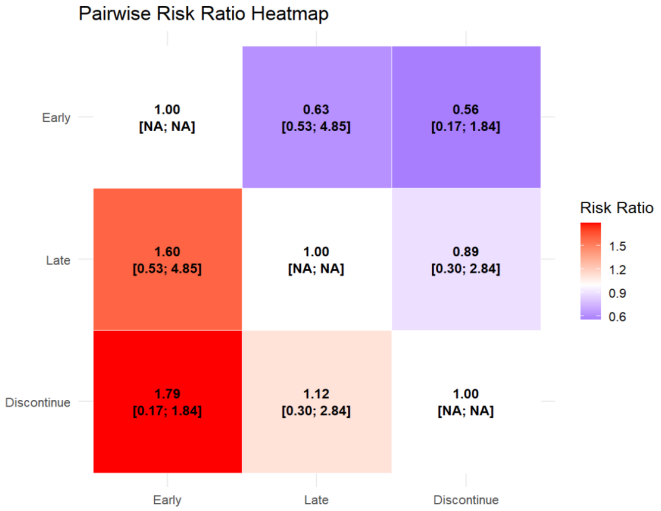

Figure 1. Heat Map Showing the Pairwise Risk Ratios (95% Credible Intervals) Between Treatments for Ischemic Stroke Recurrence Outcome.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV7]

Breaking the Storm: A Proportional Meta-Analysis of the Efficacy, Safety, and Cost-Effectiveness of Stellate Ganglion Block in Refractory Ventricular Arrhythmias

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Background and aims: Refractory ventricular arrhythmias (RVA) are serious and life-threatening conditions characterized by repeated episodes of ventricular tachycardia (VT) or ventricular fibrillation (VF) that do not respond to standard treatments. The stellate ganglion block (SGB), a minimally invasive procedure that blocks sympathetic nerve activity, has emerged as a potential treatment for RVA management. Thus, we conducted a meta-analysis of proportions to assess the effectiveness, safety, and cost-effectiveness of the SGB.

Materials and methods: A comprehensive search of multiple databases was performed to identify relevant studies. Statistical analyses were performed using an R Shiny-based web application. Generalized linear mixed models (GLMMs) and mean differences (MDs) were used to analyze the proportional outcomes, accounting for differences between and within studies. The leave-one-out sensitivity analysis method was used for outcomes with high heterogeneity ($I^2 > 50\%$). Egger's and Begg's tests were also used to assess publication bias.

Results: A total of 21 observational studies involving 703 patients were included. Our studies demonstrated a significant reduction in VT/VF and defibrillation episodes following SGB, with MD of - 5.103 episodes (95% CI : - 6.758 to - 3.628; $I^2 = 91\%$) and - 3.037 episodes (95% CI: - 3.985 to - 2.09; $I^2 = 0$ %), respectively. Moreover, VT/VF free and recurrence rates were 69.5 % (95% CI: 55.1% - 80.9%; $I^2 = 49$) and 22.4% (95% CI: 9.4% - 44.6%; $I^2 = 74\%$) 24 h post-SGB, respectively. Regarding safety profiles, transient hoarseness and major adverse event (MAE) rates were 3.3% (95% CI: 1.4%–7.6%; $I^2 = 30\%$) and 4.6% (95% CI: 0.8%–21.9%; $I^2 = 74\%$), respectively, across populations. In-hospital mortality reached 25.1% (95% CI: 19.5% - 31.8%; $I^2 = 40$ %). Overall hospital stay was 13.045 days (95% CI: 8.469–17.622; $I^2 = 69\%$).

Conclusion: SGB is an effective and relatively safe therapeutic option for managing patients with RVA. Despite notable heterogeneity and substantial variation in certain outcomes, sensitivity analysis supports SGB's potential of SGB as a temporizing and adjunctive strategy in the acute management of RVA. Further high-quality prospective studies are needed to clarify its long-term clinical and economic outcomes.

Keywords: refractory ventricular arrhythmia, stellate ganglion block, efficacy, safety, cost-effectiveness, proportional meta-analysis

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
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Outcome of Interests	Data Entry	Number of Populations	Effect Size (95% CI)	I^2 (%)	Tau^2	Egger's Test	Begg's Test
Efficacy							
VT/VA episodes before and after SGB	11	607	MD : -5.103 [-6.758, -3.628]	91	4.411	0.0783	0.2429
Defibrillation episodes before and after SGB	3	148	MD : -3.037 [-3.985, -2.09]	0	0	0.5507	0.6015
Free for VT/VA post 24 hours	7	114	GLMM : 0.695 [0.551, 0.809]	49	0.324	0.1641	0.0985
Recurrence in VT/VA burden post 24 hours	5	91	GLMM : 0.224 [0.094, 0.446]	74	0.861	0.1636	0.3272
Safety							
In hospital mortality	18	528	GLMM : 0.251 [0.195, 0.318]	40	0.189	0.0755	0.1385
Major adverse events	4	217	GLMM : 0.046 [0.008, 0.219]	74	2.113	0.3599	1
Hoarseness	8	391	GLMM : 0.033 [0.014, 0.076]	30	0.475	0.3073	0.017
ICD shocks after SGB	6	146	GLMM : 0.602 [0.354, 0.807]	63	1.257	0.3689	0.3476
Need for catheter ablation after SGB	10	137	GLMM : 0.312 [0.203, 0.446]	36	0.427	0.5699	0.6547
Cost-Effectiveness							
Hospital stay	2	81	MD : 13.045 [8.469, 17.622]	69	7.953	-	-

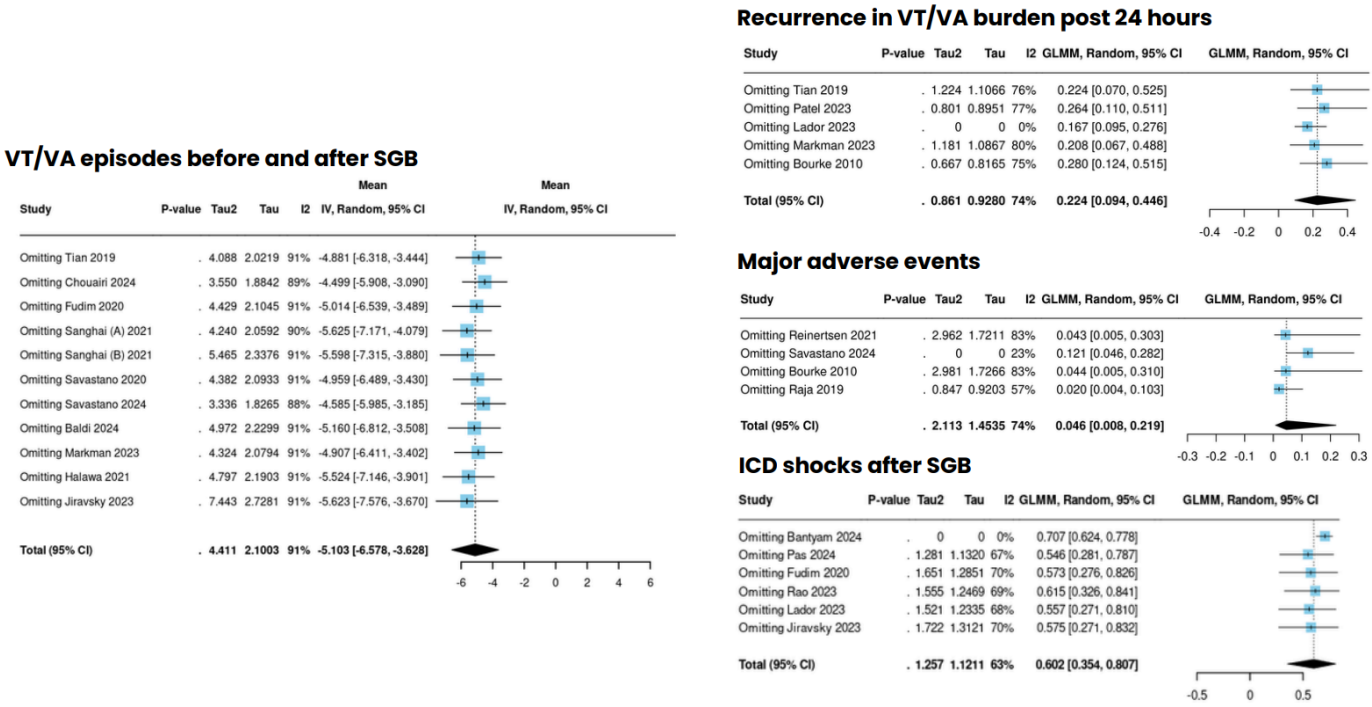

Figure 1. Summary of effect sizes, heterogeneity metrics, and publication bias across efficacy, safety, and cost-effectiveness outcomes (top), and leave-one-out sensitivity analysis for outcomes with high heterogeneity ($I^2 > 50\%$) (bottom). The hospital stay outcome was not included in the sensitivity analysis because of the limited number of data entries (n = 2).

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV8]

Prognostic Significance of S-Wave Amplitude in Lead I for Life-Threatening Arrhythmias in Brugada Syndrome: A Meta-Analytic Review

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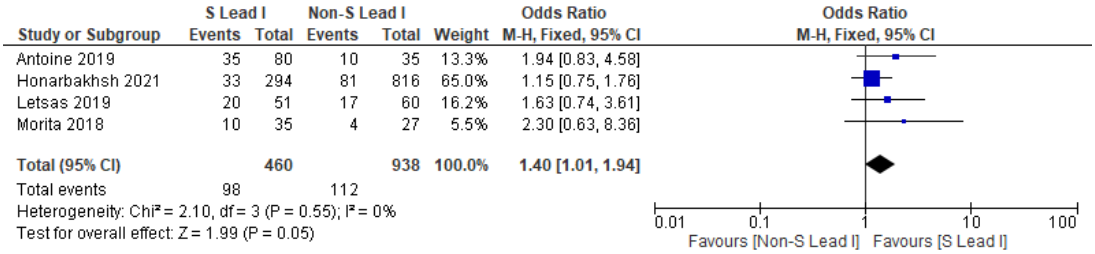
Background: Electrocardiographic (ECG) markers, such as S-wave amplitude, have been proposed to predict life-threatening arrhythmias in patients with Brugada Syndrome (BrS); however, existing evidence remains inconclusive. This study aimed to evaluate the predictive value of S-wave amplitude in lead I for sudden cardiac death (SCD) in patients with BrS.

Methods: We extracted data from PubMed, Cochrane, and EBSCO using the MeSH terms "Brugada syndrome, sudden cardiac death, arrhythmia". The inclusion criteria were cohort studies published within the last 10 years on the BrS population that used S-wave amplitude as a predictor. We excluded patients with channelopathies other than BrS and low-quality studies. We assessed the quality of the studies using the Newcastle-Ottawa Scale (NOS). Data will be presented as odds ratios (OR) with 95% confidence intervals (CI). The endpoint was a life-threatening arrhythmia resulting in sudden cardiac death. S-wave in lead I is defined as an amplitude of ≥0.1 mV. Heterogeneity will be assessed using the I2 statistic, and publication bias will be assessed using funnel plots.

Results: Four cohort studies involving 1,398 patients with BrS were included. An S-wave amplitude ≥0.1 mV in lead I was significantly associated with an increased risk of life-threatening arrhythmias (OR 1.40 [95% CI 1.01–1.94]; $I^2 = 0\%$; $p = 0.05$). Additionally, an S-wave duration ≥40 ms in lead I is associated with an elevated risk. All included studies were considered high-quality according to the NOS. These ECG markers may be useful in identifying high-risk BrS patients when used alongside other markers, such as R-wave amplitude in lead aVR. Heterogeneity was low, and the funnel plot showed a symmetrical distribution.

Conclusion: Our findings suggest that S-wave amplitude in lead I can be a valuable predictor of sudden cardiac death in patients with BrS. Incorporating this marker into clinical risk stratification could enhance patient management and preventive strategies.

Keywords: Brugada syndrome; S wave; ventricular arrhythmia; electrocardiograph



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Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV9]

Fragmented QRS in Brugada Syndrome: A Meta-Analytic Review of the Role in Predicting Life-Threatening Arrhythmia

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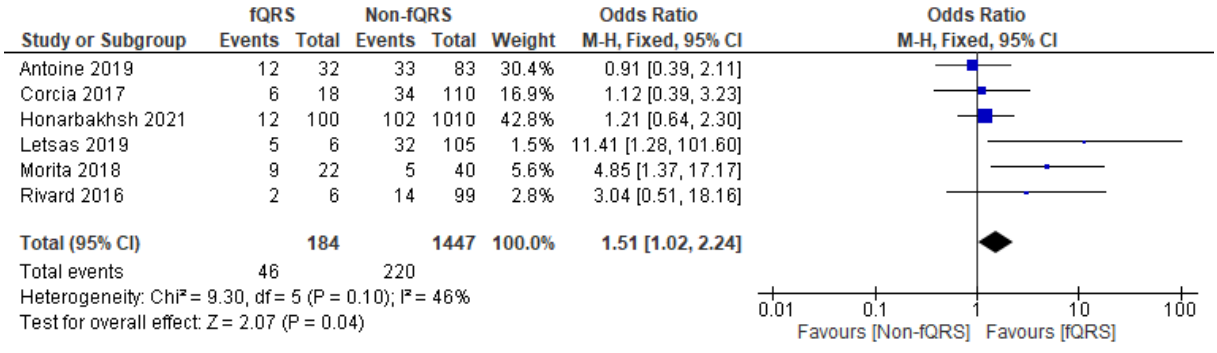
Background: Fragmented QRS (fQRS) has been recognized as an indicator of various cardiac conditions; however, its potential to predict sudden cardiac death (SCD) in patients with Brugada Syndrome (BrS) has not been extensively investigated. This study aimed to assess the prognostic value of fQRS in predicting SCD in individuals with BrS.

Methods: A systematic literature search was conducted across the PubMed, Cochrane, and EBSCO databases using the MeSH terms "Brugada syndrome," "sudden cardiac death," and "arrhythmia." The inclusion criteria were cohort studies published within the past 10 years that examined the BrS population and used fQRS as a predictive marker. Studies involving other channelopathies or of low quality were excluded from the study. The quality of the included studies was assessed using the Newcastle-Ottawa Scale (NOS). fQRS was defined as the presence of ≥3 spikes within the QRS complex in leads V1–V3. Data were reported as Odds Ratios (OR) with 95% Confidence Intervals (CI). Heterogeneity was assessed using the I^2 statistic, and publication bias was evaluated using funnel plots. The primary endpoint was the occurrence of life-threatening arrhythmias that led to SCD.

Results: Six cohort studies comprising 1,631 patients with BrS were included. The presence of fQRS in leads V1–V3 was significantly associated with an increased risk of life-threatening arrhythmia (OR, 1.51; 95% CI, 1.02–2.24; $I^2 = 46\%$; $p = 0.04$). fQRS observed in the inferior leads was also associated with an increased risk of SCD. All included studies were rated as high-quality according to the NOS. The included studies demonstrated low-to-moderate heterogeneity, and the funnel plot indicated no significant publication bias. This marker can be integrated with other ECG markers to improve the stratification performance.

Conclusion: Our findings suggest that fQRS in the anterior and inferior leads can be a valuable predictor of sudden cardiac death in patients with BrS. Incorporating this marker into clinical risk stratification could enhance patient management and preventive strategies.

Keywords: Brugada syndrome; S wave; ventricular arrhythmia; electrocardiograph



The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV10]

Effectiveness and Safety of Landiolol in Managing Supraventricular Tachycardia in Pediatric and Adult Patients: A Systematic Review

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Background: Supraventricular tachycardia (SVT) presents diagnostic and therapeutic challenges in both pediatric and adult patients because of the risk of hemodynamic instability and impaired cardiac output. Although adenosine is widely used as a first-line therapy, it has unpleasant side effects and requires rapid bolus injection. Landiolol is a highly selective β1-blocker with ultra-short action, offering precise heart rate control with minimal blood pressure effects, making it a promising alternative, especially in hypotensive patients. However, the clinical application of landiolol in SVT remains limited and varies by region. Several studies have highlighted its potential benefits; however, the available evidence has not yet been systematically reviewed. This systematic review aimed to evaluate the effectiveness and safety of landiolol in managing SVT across age groups.

Methods: All studies were retrieved from PubMed, PMC, and ScienceDirect using the keywords "*Supraventricular Tachycardia*" and "*Landiolol*." The literature search will be conducted from June 3rd, 2025, until June 5th, 2025. Three authors independently screened, extracted, and evaluated studies that met the inclusion criteria, comprising RCTs, CTs, and cohort studies assessing the effectiveness and safety of landiolol in managing supraventricular tachycardia in pediatric and adult patients. Animal studies and non-English articles without available translations were excluded. Study quality was assessed using the RoB II and ROBINS-I tools.

Results: Three studies, including two RCTs and one CT, were included, comprising a total of 2,357 patients with supraventricular tachycardia aged between 1 day and 70 years. All three studies reported positive outcomes, demonstrating that landiolol is effective and safe for reducing heart rate and controlling supraventricular tachycardia with minimal adverse effects. Based on the final bias assessment, two studies had a low risk of bias, while one had a moderate risk.

Conclusion: Landiolol demonstrates consistent efficacy and tolerability in the acute management of SVT, as shown by significant heart rate reduction within minutes, reduced need for rescue interventions compared to placebo, and maintained effectiveness even at low-to-moderate doses without increased adverse events. These findings highlight its clinical utility, especially for patients requiring prompt and controlled rate reduction with a favorable safety profile

Keywords: Supraventricular tachycardia, Landiolol

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV11]

Trimethylamine N-oxide and Atrial Fibrillation in Cardiovascular Disease Patients: A Systematic Review and Meta-analysis

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Background and Aims: Atrial fibrillation (AF) is the most prevalent persistent cardiac arrhythmia, and its association with an increased risk of heart failure, stroke, and cardiac death is established; however, the underlying causes remain largely unknown. Trimethylamine N-oxide (TMAO), a byproduct of the gut microbiota, has been increasingly recognized as being associated with various cardiovascular diseases (CVDs), including AF. Therefore, this study aimed to evaluate the association between TMAO and AF in patients with CVD.

Materials and Methods: We conducted a systematic review and meta-analysis of cohort studies evaluating the relationship between TMAO levels in the bloodstream and the prevalence of AF, retrieved from PubMed, Scopus, EBSCO, and Cochrane databases until June 2025. The prevalence of AF was compared between participants with higher TMAO concentrations (above the median) and those with lower TMAO concentrations (below the median). Binary outcomes were pooled using odds ratios (ORs) with confidence intervals (CIs) in RevMan Version 5.4.

Results: Four cohort studies from four countries with a total of 6.466 patients were included in our analysis. Higher circulating TMAO levels were associated with a higher prevalence of AF than lower circulating TMAO levels (OR: 1.45 [95% CI [1.26-1.67], p <0.00001).

Conclusion: The study found that TMAO is associated with the prevalence of AF in patients with CVD. However, large-scale, multicenter, randomized controlled trials are still required to establish the association between TMAO and AF.

Keywords: Atrial fibrillation, gut microbiome, trimethylamine n-oxide, cardiovascular disease, meta-analysis

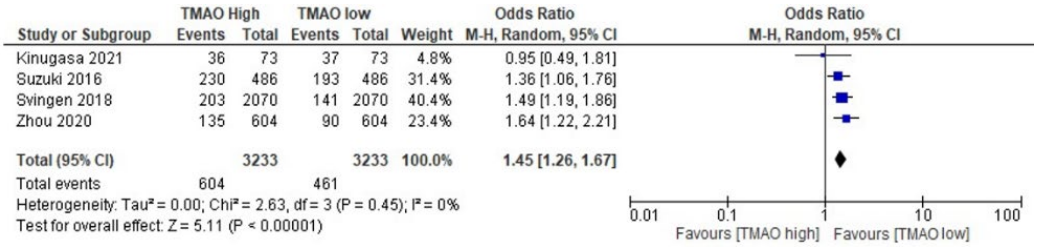

Figure 1. Forest plot of the association between TMAO Levels and Atrial Fibrillation.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV12]

Beneath the Beat: Pre-Ablation Biomarkers Predicting AF Recurrence – A Meta-Analysis of Cohort Studies

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Background and Aims: Atrial fibrillation (AF) is a common cardiac arrhythmia that can lead to serious health issues, such as stroke and reduced quality of life. Although catheter ablation (CA) is widely used, AF often recurs after the procedure. Blood-based markers have shown promise in predicting recurrence, prompting a comprehensive meta-analysis to identify additional potential biomarkers for clinical use in HCC.

Materials and Methods: A systematic literature search of the PubMed, EMBASE, SpringerLink, Web of Science, Cochrane Library, and Google Scholar databases was performed. Eligible studies were observational studies evaluating AF recurrence after the first CA, with available or convertible data on blood marker levels. The biomarkers assessed included soluble suppression of tumorigenicity-2 (sST2), pro-adrenomedullin (pro-ADM), galectin-3 (Gal-3), systemic immune-inflammation index (SII), and pan-immune-inflammation value (PIV). Pooled standardized mean differences (SMDs) with 95% confidence intervals (CIs) were calculated, and heterogeneity was assessed using Cochran's Q test and I^2 statistic. A random-effects model was applied when significant heterogeneity was observed.

Results: A total of 20 cohort studies were qualified for this meta-analysis (sST2=5, galectin-3=5, pro-ADM=2, SII=7, PIV=3), recruiting 4,667 participants, with 1,231 experiencing AF recurrence and 3,091 remaining free of recurrence. This meta-analysis found that patients with AF recurrence had significantly higher pre-ablation levels of certain blood biomarkers than those without recurrence. Specifically, sST-2 (MD 7.65, 95% CI: 1.72–13.57, $p = 0.01$), pro-ADM (MD 0.18, 95% CI: 0.06–0.30, $p = 0.002$), SII (MD 270.74, 95% CI: 167.73–373.76, $p < 0.00001$), and PIV (MD 546.11, 95% CI: 148.22–943.99, $p = 0.007$) were significantly elevated in patients with AF recurrence. In contrast, galectin-3 did not show a significant association (MD 0.89, 95% CI: –0.48 to 2.26, $p = 0.20$).

Conclusion: Elevated pre-ablation levels of certain blood markers—sST2, pro-ADM, SII, and PIV— may reflect the underlying mechanisms linked to AF recurrence. Their assessment prior to ablation could enhance patient stratification, inform clinical decision-making, and guide the development of novel pharmacological strategies.

Keywords: biomarkers; atrial fibrillation; catheter ablation; recurrence

Indonesian Journal of Cardiology
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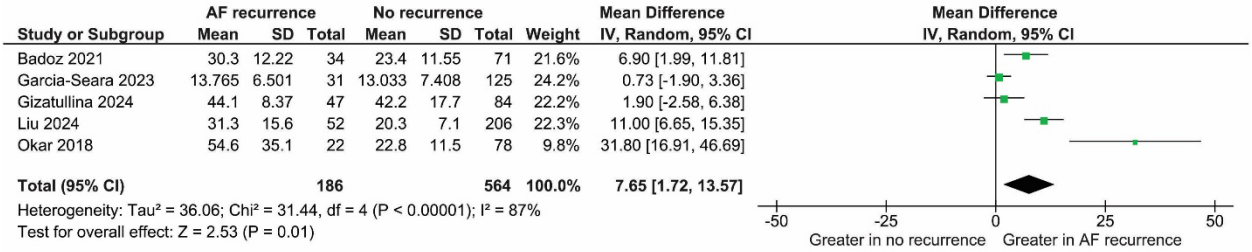
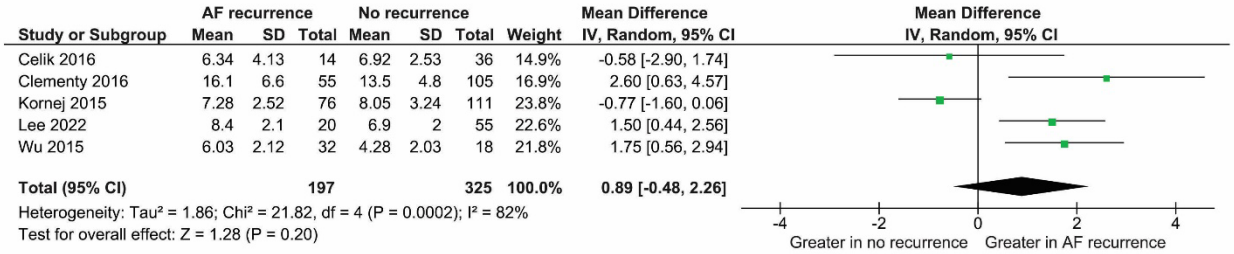
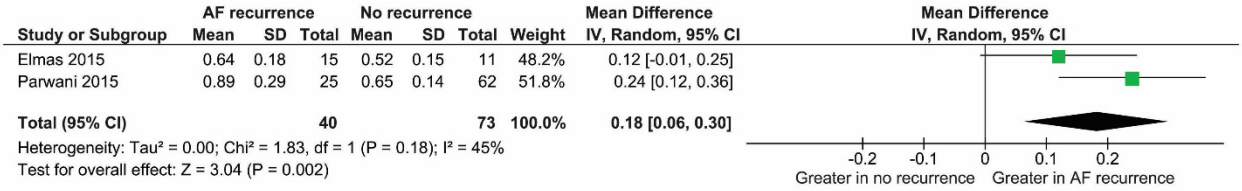
sST2



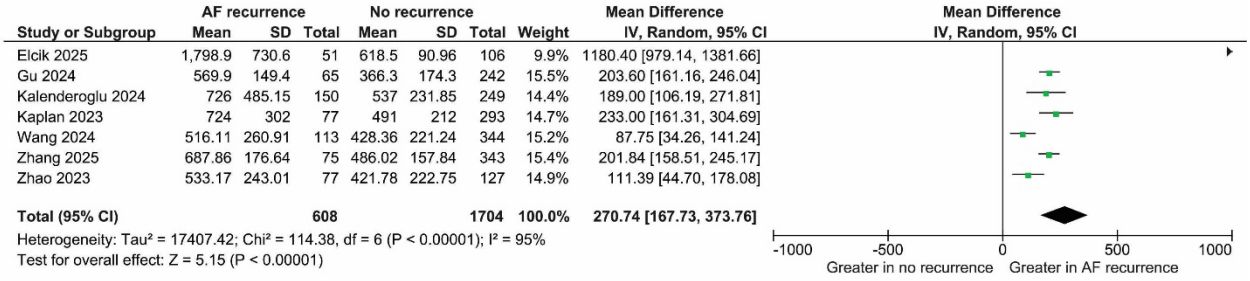
Galectin-3



Pro-ADM



SII



PIV

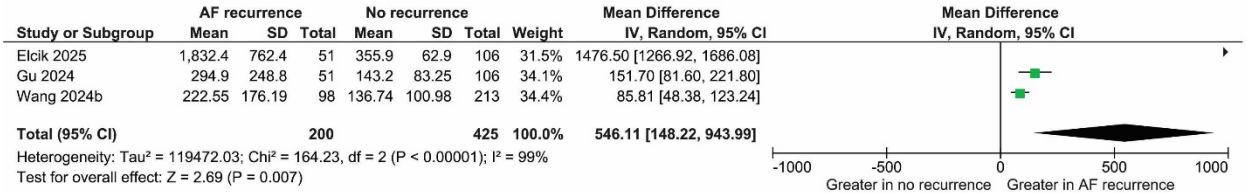


Figure 1. Forest plots showing the mean differences in pre-ablation levels of five blood-based biomarkers between patients with and without atrial fibrillation (AF) recurrence following catheter ablation.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV13]

Antithrombotic strategies for preventing recurrent stroke in embolic stroke of undetermined source (ESUS) with a closer look at atrial cardiopathy populations: A network meta-analysis of trials

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[2]*RSAL Marinir Cilandak, Jakarta, Indonesia*

Background and aims: Embolic stroke of undetermined source (ESUS) and cryptogenic stroke without documented atrial fibrillation (AF) carry a high risk of recurrence, with limited consensus on the optimal secondary prevention strategy. While anticoagulants may address covert cardioembolism, the risk of bleeding must be carefully balanced. We aimed to compare the safety and efficacy of available antithrombotic therapies and assess the outcomes in patients with atrial cardiopathy or related risk features.

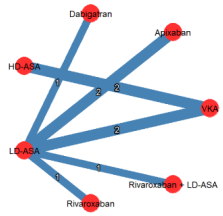
Materials and methods: A systematic search of PubMed, ClinicalTrials.gov, and the Cochrane Library was conducted until June 2025, identifying randomized controlled trials (RCTs) comparing anticoagulants and antiplatelets in patients with ESUS or cryptogenic stroke without known AF. Nine RCTs (n = 15,288) were included, evaluating seven interventions: apixaban, dabigatran, rivaroxaban, rivaroxaban plus low-dose aspirin (LD-ASA), LD-ASA alone, high-dose aspirin (HD-ASA), and vitamin K antagonists (VKA), with LD-ASA as the reference. The primary outcomes were recurrent stroke and major bleeding. Network meta-analysis was conducted using a frequentist random-effects model in RStudio using the “netmeta” package.

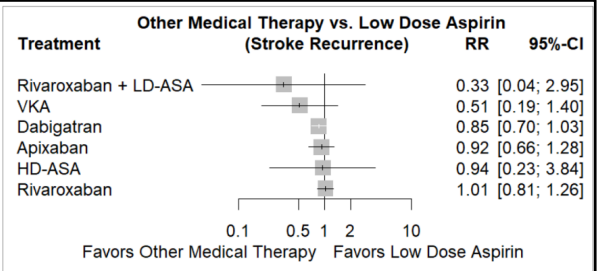
Results: Rivaroxaban + LD-ASA and VKA were associated with lower rates of stroke recurrence (RR 0.33 [0.04–2.95] and 0.51 [0.19–1.40], respectively) than LD-ASA, although the differences were not statistically significant. Dabigatran and apixaban showed modest stroke risk reductions (RR 0.85 and 0.92, respectively). Regarding major bleeding, apixaban had the most favorable profile (RR 0.46 [0.18–1.22]), whereas VKA and rivaroxaban showed higher bleeding risks (RR 2.33 [0.46–11.83] and RR 2.69 [1.67–4.33]). A focused analysis of five trials enrolling patients with atrial cardiopathy showed no statistically superior therapy; however, rivaroxaban + LD-ASA demonstrated the greatest trend toward stroke reduction (RR 0.33 [0.04–2.95]).

Conclusion: This analysis suggests that although no antithrombotic therapy was statistically superior to LD-ASA in preventing recurrent stroke, rivaroxaban + LD-ASA and VKA may offer greater benefits at the cost of increased bleeding. Apixaban may balance efficacy with a lower bleeding risk. The findings in the atrial cardiopathy population were similar. Risk-tailored therapy is essential.

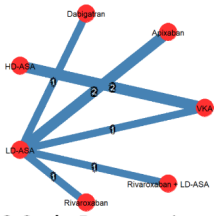
Keywords: ESUS, anticoagulation, antiplatelet, network meta-analysis, atrial cardiopathy

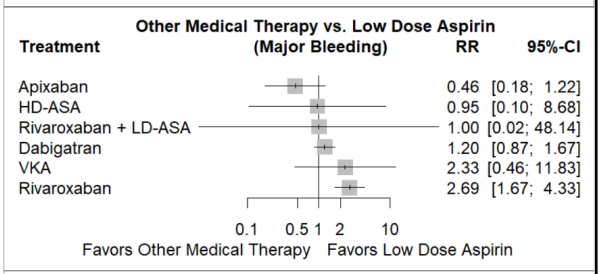
A. Stroke Recurrence



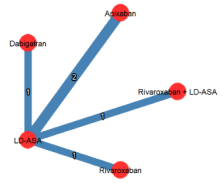


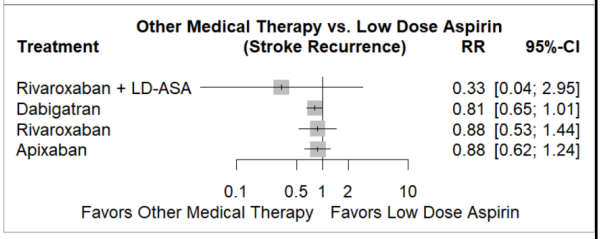
B. Major Bleeding



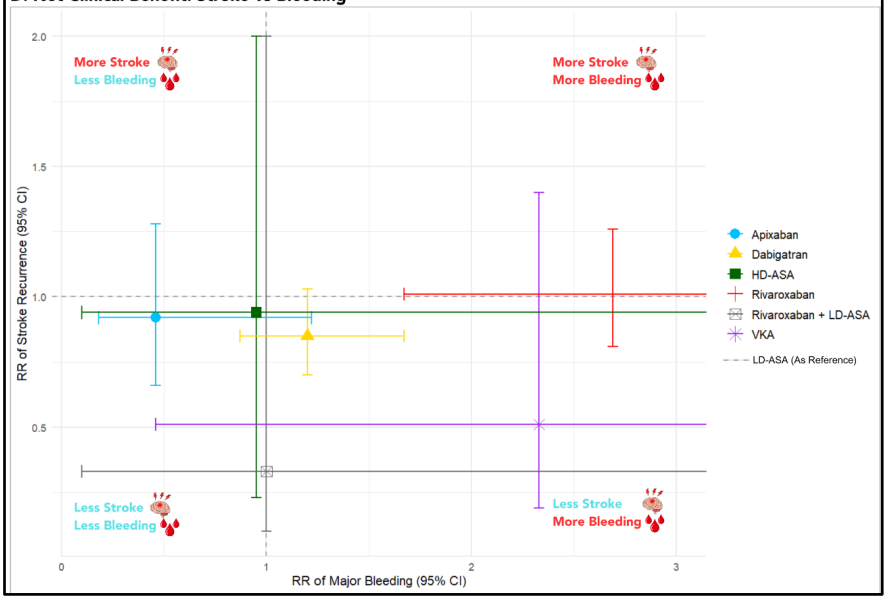


C. Stroke Recurrence in Atrial Cardiopathy Population





D. Net Clinical Benefit: Stroke vs Bleeding



The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV14]

Initial Pacing Approaches for Bradycardia with Preserved Left Ventricular Function: A Systematic Review and Meta-Analysis of His Bundle Versus Left Bundle Branch Pacing

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[2]Faculty of Medicine, Udayana University, Denpasar, Indonesia
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Background and aims: Conduction system pacing has emerged as a promising approach for managing bradycardia. However, direct comparisons between CSP modalities remain limited. This study aimed to compare the electrophysiological and procedural outcomes of His bundle pacing (HBP) and left bundle branch pacing (LBBP) in patients with preserved left ventricular ejection fraction (LVEF).

Materials and methods: A comprehensive search of online databases was conducted to identify relevant articles until February 2024. The outcomes of interest were implant success rate, capture thresholds, R-wave amplitude, mean difference in QRS duration reduction, procedure and fluoroscopy duration, and lead revision rate. The statistical analysis used fixed- and random-effects models to estimate the risk ratio (RR), mean difference (MD), and 95% confidence intervals (CI).

Results: Four observational studies involving 422 patients with a follow-up duration of 3–6 months were analyzed. The mean age was 69.5 years and the mean LVEF was 55.7%. LBBP showed lower capture thresholds (MD -0.65 V, 95% CI -0.85 to -0.45, p<0.00001) and higher R-wave amplitudes (MD 9.30 mV, 95% CI 6.80 to 11.80, p<0.00001) than HBP. The LBBP group also had a shorter procedure time (MD -23.37 min, 95% CI -30.33 to -16.42, p<0.00001) and reduced fluoroscopy time (MD -7.06, 95% CI -8.03 to -6.09, p<0.00001). The mean difference in QRS duration reduction was comparable between the LBBP and HBP groups. The implant success and lead revision rates also yielded no significant differences between the two groups.

Conclusion: LBBP and HBP yielded comparable reductions in QRS duration and procedural outcomes. Although LBBP offers advantages, including better pacing parameters and shorter procedure and fluoroscopy times. A further prospective study is needed to compare the long-term outcomes between these two conduction system pacing modalities.

Keywords: Left bundle branch pacing, his bundle pacing, bradycardia

Table 1. Baseline characteristics of the studies.

Author and year/ Baseline characteristics	Hou et al, 2019[1]	Hua et al, 2020[2]	Sheng et al, 2021[3]	O'Connor et al, 2023[4]	Ponnusamy et al, 2023[5]
Study design	Combined prospective-retrospective	Retrospective	Retrospective	Retrospective	Retrospective
Follow-up (months)	6	3	3	NA	12
Participants (HBP vs LBBP)	29 vs. 56	125 vs. 126	26 (crossover)	30 vs. 30	35 vs.45
Pacing indication	AV block or SND	AV block or SND	Symptomatic bradycardia and AF	AV block or SND	AV block
Age (years)	69.1 ± 10.4 vs. 68.3 ± 11.8	62.2 ± 15.2 vs. 65.3 ± 11.1	72.9 ± 9.0	NA	70.8 ± 12.6 vs. 65.3 ± 13
Baseline LVEF (%)	63.3 ± 5.8 vs. 63.8 ± 3.2	57.4 ± 8.2 vs. 58.7 ± 7.2	62 ± 12	54	59.3 ± 6.4 vs. 58.3 ± 5.8

1. Hou X, et al. *Europace*. 2019; 21: 1694-1702.
2. Hua W, et al. *JACC Clin Electrophysiol*. 2020; 6: 1291-1299.
3. Sheng X, et al. *Pacing Clin Electrophysiol*. 2021; 44: 1523-1531.
4. O'Connor M, et al. *Int J Cardiol Heart Vasc*. 2023; 44:101171.
5. Ponnusamy SS, Vijayaraman P. Indian Pacing Electrophysiol J. 2023; 23: 196-202.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV15]

Comparative Outcomes of Substrate-Based and Conventional Mapping-Guided Ventricular Tachycardia Ablation: A Meta-Analysis

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[1]Faculty of Medicine, Sam Ratulangi University, Manado, Indonesia
[2]Faculty of Medicine, Udayana University, Denpasar, Indonesia
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Background and aims: Substrate-based catheter ablation is an increasingly utilized strategy for treating scar-related ventricular tachycardia (VT). However, direct comparisons with conventional ablation techniques guided primarily by activation and entrainment mapping of inducible and hemodynamically tolerated VTs are limited to date. This meta-analysis aimed to compare the acute procedural efficacy and long-term clinical outcomes of predominantly substrate-based and activation/entrainment mapping-guided ablation.

Materials and methods: A systematic literature search from inception to the present identified 11 eligible studies comprising 796 patients, including one randomized controlled trial. The primary endpoint was VT recurrence during follow-up, which was assessed using a random-effects model to calculate the relative risk (RR). Secondary outcomes included acute procedural success (defined as non-inducibility of VT at the end of the procedure), procedure duration, fluoroscopy time, procedural complications, cardiovascular mortality, and all-cause mortality.

Results: At a median follow-up of 20 months, VT recurrence was significantly lower in the substrate-based ablation group than in the activation/entrainment-guided group (RR 0.71; 95% CI, 0.54-0.93; P=0.01). Acute procedural success rates were similar between the two strategies (RR 1.08; 95% CI, 0.98-1.18; P=0.12). The procedure duration and fluoroscopy time were also comparable. No significant differences were observed in the procedural complications, cardiovascular mortality, or all-cause mortality.

Conclusion: Substrate-based ablation is associated with lower VT recurrence and demonstrates comparable procedural efficacy, safety, and long-term outcomes relative to ablation guided primarily by activation and entrainment mapping in patients with scar-related VT.

Keyword: scar-related ventricular tachycardia, substrate-based mapping

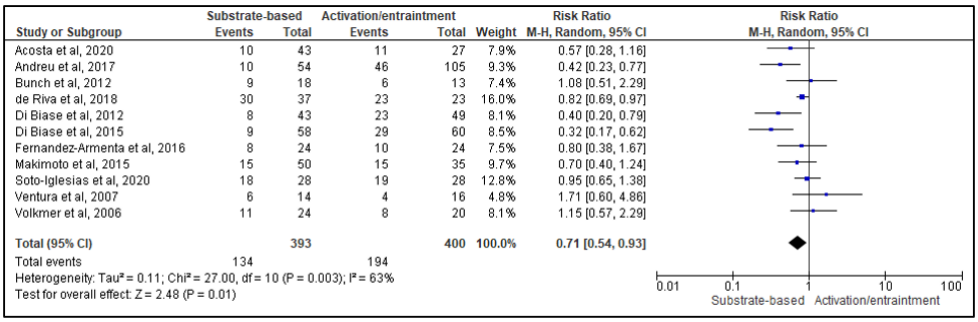

Figure 1. Lower VT recurrence of substrate-based ablation group compared to the activation/entraintment-guided group (RR 0.71; 95% CI, 0.54-0.93; P=0.01)

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV16]

The Role of Glucagon Signaling in Heart Failure with Preserved Ejection Fraction: A Systematic Review and Meta-Analysis of Preclinical and Clinical Evidence

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[1]General Practitioner, Kanjuruhan General Hospital, Malang, Indonesia
[2]Master's Program of Biomedical Science, Faculty of Medicine, Brawijaya University, Dr. Moenir Air Force Hospital, Malang, Indonesia

Background: Heart Failure with Preserved Ejection Fraction (HFpEF) accounts for over half of heart failure diagnoses and disproportionately affects individuals with obesity and type 2 diabetes mellitus. Recent findings have implicated glucagon signalingvia the glucagon receptor (GCGR) and glucagon-like peptide-1 receptor (GLP-1R)in myocardial fibrosis, endothelial dysfunction, and diastolic impairment. This systematic review and meta-analysis evaluated the preclinical and clinical impact of modulating glucagon signaling in HFpEF populations.

Methods: This study followed the PRISMA 2020 guidelines. A structured search identified five eligible studies published between 2021 and 2025: two preclinical (n = 210 rodents) and three clinical (n = 2,836). The inclusion criteria targeted interventions modulating GCGR or GLP-1R in HFpEF. The outcomes included diastolic function (E/e′ ratio), myocardial fibrosis, flow-mediated dilation (FMD), 6-minute walk distance (6 MWD), and quality of life (QoL). Data were extracted by two reviewers and pooled using a random-effects model analysis. The risk of bias was assessed using the SYRCLE and Newcastle-Ottawa tools.

Results: The pooled mean difference in the E/e′ ratio across clinical studies (n = 2,836) favored GLP-1R agonists versus placebo: –2.47 (95% CI: –3.19 to –1.74; $p < 0.001$; $I^2 = 26\%$). GCGR antagonism in rodents reduced TGF-β1 expression by 43% and myocardial fibrosis by 37% and significantly improved EDPVR (Gao et al., n = 120). GLP-1R agonists improved FMD by +5.1% (Hullon et al., n = 685), 6 MWD by +48.7 ± 6.2 m, and QoL (KCCQ score +12.4 points, Shchendrygina et al., n = 945). Overall, the heterogeneity was low to moderate (I^2 range: 21–32%).

Conclusion: Glucagon signaling modulationvia GLP-1R agonism or GCGR antagonismconsistently improves diastolic function, vascular health, and clinical symptoms in HFpEF, especially in metabolically compromised populations. These findings support its therapeutic potential and warrant validation in larger RCTs.

Keywords: HFpEF; glucagon receptor; GLP-1 receptor; diastolic dysfunction; heart failure

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV17]

Mapping the Optimal Strategy for Ventricular Tachycardia Ablation in Arrhythmogenic Right Ventricular Cardiomyopathy: Endocardial Versus Endo-epicardial Insights from A Meta-Analysis

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Background and aims: Arrhythmogenic right ventricular cardiomyopathy (ARVC) is a genetic myocardial disorder that predisposes patients to life-threatening ventricular tachyarrhythmias. Catheter ablation is a key rhythm-control strategy that is increasingly enhanced by modern mapping and epicardial techniques. However, the relative efficacy and safety of endocardial-only versus combined endo-epicardial ablation remain unclear. This systematic review and meta-analysis compared the two approaches in patients with ARVC undergoing ventricular tachycardia (VT) ablation.

Materials and methods: A systematic search of PubMed, Cochrane Library, Scopus, and Embase up to May 2025 identified cohort studies comparing endocardial-only and combined endo-epicardial VT ablation in adults with ARVC diagnosed according to the Revised 2010 Task Force Criteria. The extracted data included mapping techniques, epicardial access, and ablation endpoints. The primary outcome was VT recurrence, and the secondary outcomes included major procedural complications, all-cause mortality, acute procedural efficacy, and post-ablation antiarrhythmic drug (AAD) use. Pooled risk ratios (RRs) with 95% confidence intervals (CIs) were calculated using a random-effects model, and heterogeneity was assessed using the I^2 statistic.

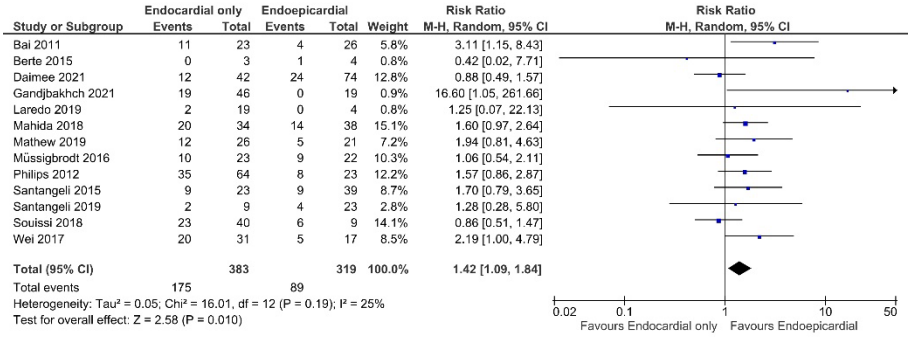
Results: Thirteen observational studies encompassing 702 patients with ARVC were included, of whom 391 underwent combined endoepicardial and endocardial-only ablation. The combined endoepicardial approach was associated with a significantly lower risk of VT recurrence (RR: 1.42; 95% CI: 1.09–1.84; $p = 0.01$; $I^2 = 25\%$), indicating improved long-term rhythm control. However, this benefit was counterbalanced by a significantly higher incidence of major procedural complications than with endocardial-only ablation (RR: 0.34; 95% CI: 0.12–0.96; $p = 0.04$; $I^2 = 0\%$). No significant differences were found in all-cause mortality (RR: 1.53; 95% CI: 0.33–7.11; $p = 0.59$; $I^2 = 11\%$), acute procedural efficacy (defined as non-inducibility of any VT at procedure end; RR: 1.31; 95% CI: 0.62–2.75; $p = 0.47$; $I^2 = 6\%$), or post-ablation AAD usage (RR: 1.15; 95% CI: 0.84–1.57; $p = 0.38$; $I^2 = 73\%$).

Conclusion: In patients with ARVC undergoing catheter ablation for VT, the combined endo-epicardial approach achieves better long-term VT suppression but carries higher procedural risks than endocardial-only ablation. These findings highlight the importance of individualized ablation strategies that balance patient-specific risk profiles, operator expertise, and institutional resources.

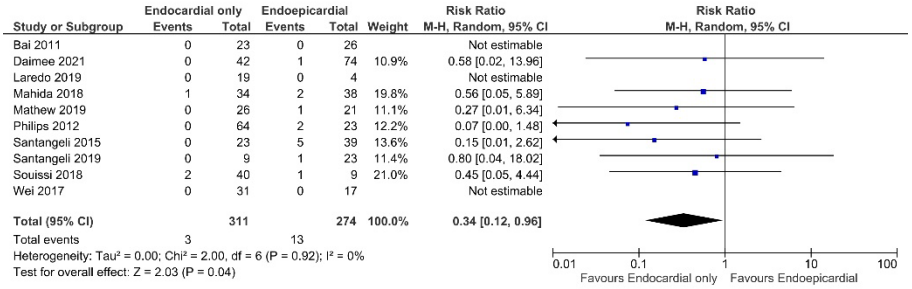
Keywords: arrhythmogenic right ventricular cardiomyopathy, ventricular tachycardia, catheter ablation, endocardial, epicardial

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

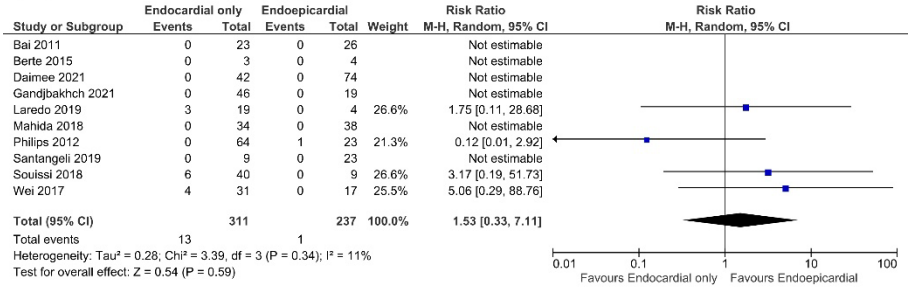
(A) VT Recurrence



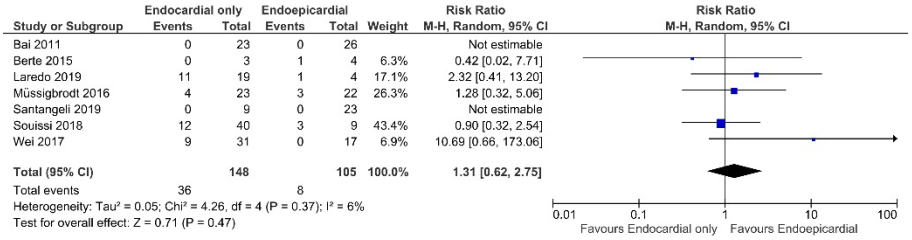
(B) Major Procedural Complications



(C) All-cause Mortality



(D) Acute Procedural Efficacy



(E) Post-ablation AAD usage

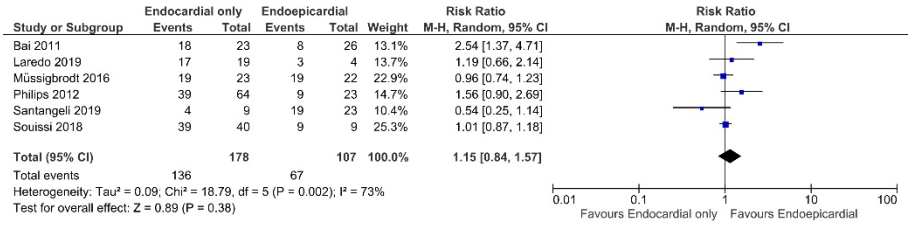


Figure 1. Forest plots representing the comparative outcomes of endocardial versus endoepicardial ablation. (A) VT Recurrence; (B) Major Procedural Complications; (C) All-cause Mortality; (D) Acute Procedural Efficacy; (E) Post-ablation AAD usage.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV18]

Saving Limbs, Saving Lives: A Meta-Analysis of Endovascular vs. Surgical Revascularization in Acute Limb Ischemia

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Background: The optimal approach to revascularization in acute limb ischemia (ALI) remains debatable, as the existing literature lacks robust comparative effectiveness data on endovascular versus surgical interventions.

Objectives: This meta-analysis aimed to systematically evaluate the outcomes of endovascular and surgical revascularization in patients with acute limb ischemia.

Methods: A comprehensive search of the Google Scholar, Medline, and Cochrane databases was conducted following the PRISMA guidelines to identify comparative studies on endovascular and surgical revascularization for acute limb ischemia. Two independent reviewers screened the titles, abstracts, and full texts, extracted relevant data, and assessed bias and evidence quality. The primary outcomes analyzed included all-cause mortality, amputation, major bleeding, and major adverse cardiovascular events (MACEs).

Results: Eight comparative studies including 152,779 patients were included. A meta-analysis using odds ratios (ORs) with 95% confidence intervals (CIs) and a random-effects model revealed that endovascular revascularization was associated with a 22% reduction in all-cause mortality compared with surgical revascularization (OR 0.78, 95% CI 0.63–0.96) and a 6% lower risk of amputation (OR 0.94, 95% CI 0.91–0.97). No significant differences were observed between the two strategies in terms of major bleeding (OR 0.80, 95% CI 0.53–1.22) or MACEs (OR 0.85, 95% CI 0.65–1.09).

Conclusion: Endovascular revascularization appears to offer advantages over surgical intervention for acute limb ischemia, particularly in reducing mortality and amputation risks. Given the comparable risks of major bleeding and cardiac events, these findings suggest that endovascular procedures may be a preferable strategy for limb preservation in patients with CLI.

Keywords: Limb Ischemia; Endovascular Procedures; Vascular Surgical Procedures

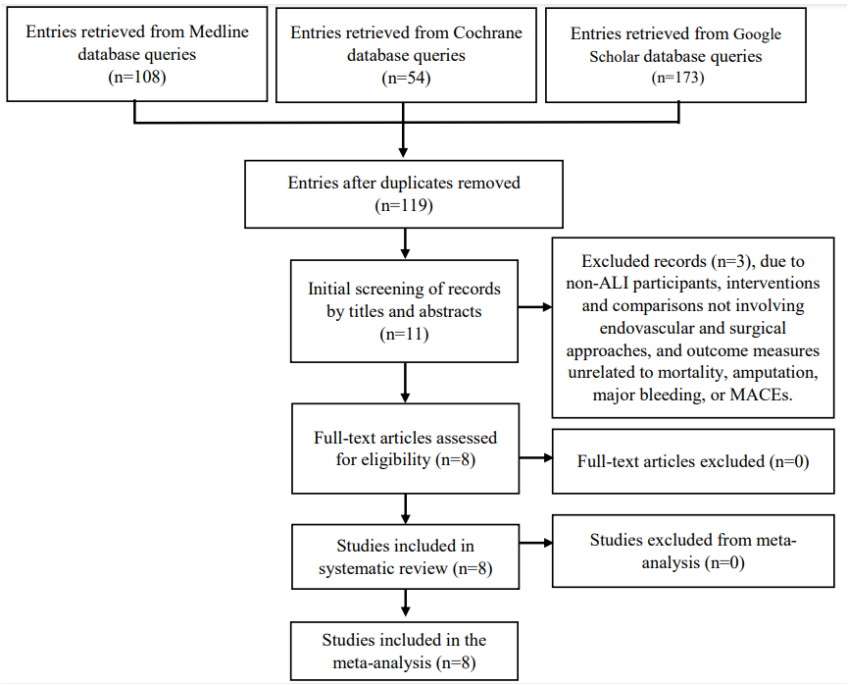

Figure 1. PRISMA Flowchart.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV19]

Comparative Diagnostic Accuracy of Photoplethysmography vs Electrocardiography in Atrial Fibrillation Detection: a Meta-Diagnostic Study

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Background: Atrial fibrillation (AF) is the most common cardiac arrhythmia worldwide, affecting 60 million individuals by 2024. AF is associated with various complications and health burdens, including stroke, heart failure, and mortality. Approximately 1 in 8 patients remain underdiagnosed, leading to detection after complications. This raises the need for a tool to diagnose AF as accurately as possible in the future. Photoplethysmography (PPG) and electrocardiography (ECG) are the gold standards. However, there is a lack of direct comparative studies between the PPG and ECG. This study aimed to systematically compare the diagnostic accuracies of PPG and ECG in AF detection.

Methods: A systematic review and meta-analysis of data from PubMed, Scopus, and Cochrane databases was conducted until June 2025, following the PRISMA 2020 guidelines. Seven studies compared PPG and ECG in the diagnosis of AF, with 4037 samples. The Cochrane ROB 2.0 tool was used to assess the risk of bias, and statistical analysis was conducted using the R{meta} package with a 95% confidence interval. A random-effects model was used to pool the risk ratios (RR) for the area under the curve (AUC), sensitivity, and specificity.

Results: Meta-diagnostic analysis showed several results in the form of AUC Score, sensitivity, and specificity. PPG had an AUC score of 98,6% while ECG had 98,2%. The sensitivity of PPG was 95,9% while that of ECG was 95%. PPG had a specificity of 98,2%, whereas ECG had a specificity of 96,8%. Overall, the results show that PPG has a slight advantage in detecting atrial fibrillation, as evidenced by its higher sensitivity. ECG has a slight advantage in correctly diagnosing patients without atrial fibrillation.

Conclusion: PPG has a higher sensitivity, making it more effective in detecting patients with atrial fibrillation. ECG has a higher specificity, which makes it more compatible in detecting persons without atrial fibrillation

Keywords: PPG, ECG, atrial fibrillation, diagnostic, arrhythmia

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV20]

Beyond the Beat: Scoping Review on the Impact of Transcutaneous Electrical Nerve Stimulations (TENS) in Ventricular Arrhythmia Management

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Background and aim: Transcutaneous electrical nerve stimulation (TENS), particularly low-level tragus stimulation (LLTS), is gaining attention as a noninvasive neuromodulation technique for arrhythmia control. This scoping review aimed to map the current evidence on LLTS in the context of cardiac arrhythmias, with a focus on ventricular tachyarrhythmias.

Materials and methods: A scoping review was conducted using the Arksey and O'Malley (2005) framework. Literature searches were performed using PubMed, Scopus, the Cochrane Library, and reference lists of the identified papers. The collected data included population, intervention details, outcomes, and adverse events.

Results: Five studies involving 256 participants were included in the analysis. A total of 136 patients received active LLTS and 120 received sham stimulation or standard care. Across all studies, LLTS was associated with significant reductions in atrial fibrillation (AF) burden, suppression of inflammatory cytokines (e.g., TNF-α, CRP), and improved autonomic balance. In one STEMI study, LLTS reduced reperfusion-related ventricular arrhythmia and improved cardiac function, suggesting potential benefits beyond AF. Notably, patients with an increase in P-wave alternans during the initial stimulation showed greater long-term benefit. No serious adverse events were reported.

Conclusion: LLTS is a promising and safe modality for autonomic modulation in arrhythmia management. The upcoming TASC-V trial is expected to clarify its role in the management of VA.. Standardization of protocols is therefore needed.

Keywords: Ventricular tachyarrhythmia, transcutaneous electrical nerve stimulation, TENS, noninvasive therapy, arrhythmia management, autonomic nervous system.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV21]

When the Heart Speaks in P-Waves – How Clinical Factors Shape New-Onset Atrial Fibrillation Risk in Hypertension: A Systematic Review, Meta-Analysis and Meta-Regression

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Background and Aims: Hypertension is a well-established clinical predictor of new-onset atrial fibrillation (NOAF). P-wave index (duration of maximum (Pmax), minimum (Pmin), and dispersion (Pd)) could predict NOAF. We evaluated the P-wave index and associated clinical factors influencing its utility, along with left ventricular hypertrophy (LVH) as an NOAF risk parameter in hypertension.

Materials and Methods: We followed the PRISMA 2020 guidelines and searched eight databases. We included observational studies from inception to December 13, 2023, focusing on the P-wave index and LVH in NOAF risk in hypertension. Random-effects meta-analyses and meta-regression for age, sex, systolic and diastolic blood pressure (SBP/DBP), left atrial dimension (LAD), and left ventricular ejection fraction (LVEF) were employed. The quality of the studies was evaluated using the Newcastle-Ottawa Scale.

Results: The search yielded 770 articles, including one cohort and six case-control studies. Meta-analysis revealed a statistically significant prolongation in both Pmax (12.33ms,95%CI,5.13-19.53,p=0.0008; I^2=91%) and Pd (15.16ms,95%CI,6.63-23.68,p=0.0005; I^2=96%) within the NOAF group compared to the normal sinus rhythm group. No significant difference was observed in Pmin. LVH was significantly associated with NOAF (OR: 1.74, 95% CI: 1.04-2.90, p = 0.04, I2 = 36%). Meta-regression analyses found that higher SBP and DBP elevations contribute to an augmented Pmax mean difference; higher LVEF amplifies the Pd mean difference; while advancing age and increased LAD escalate the Pmin mean difference. No publication bias was detected for any of the outcomes.

Conclusion: Our study confirmed that longer Pmax, Pd, and LVH are associated with NOAF in hypertensive patients. This suggests a potential association among Pmax, Pd, and LVH in NOAF development. Importantly, we found that age, SBP, DBP, LVEF, and LAD could further modulate P-wave index values for NOAF risk in hypertensive patients.

Keywords: atrial fibrillation, electrocardiography, hypertension, meta-regression, P-wave index, systematic review

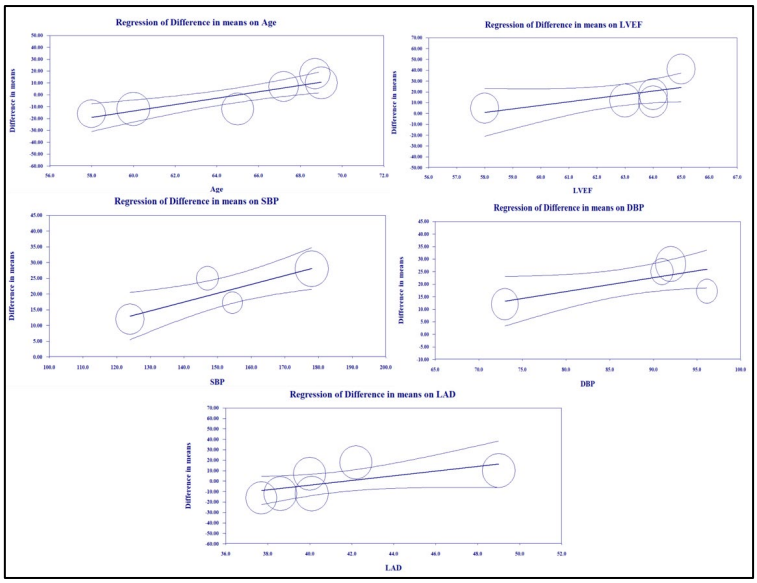

Figure 1. Meta-Regression of P-Wave Index Differences by Clinical Modifiers (age, systolic blood pressure (SBP), diastolic blood pressure (DBP), left ventricular ejection fraction (LVEF), and left atrial dimension (LAD)) in Hypertensive Patients.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV22]

Implementation of polygenic risk score for personalized coronary artery disease prevention in Southeast Asia: A systematic review

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Background and Aims: Despite advances in cardiovascular prevention, coronary artery disease (CAD) remains a leading cause of mortality in Southeast Asia. CAD causes coronary artery occlusion, impairing myocardial perfusion. This may lead to myocardial dysfunction and electrical conduction disturbances, thereby increasing the risk of cardiac arrhythmias. While polygenic risk scores (PRS) are emerging as powerful tools to predict lifetime CAD risk, current models are largely derived from European populations and lack accuracy in Asian cohorts. This study aimed to explore the potential impact of building a region-specific PRS model and integrating it with traditional risk prediction for earlier and more precise CAD prevention in Southeast Asia.

Materials and Methods: We conducted a systematic review to compare PRS performance across ethnicities, highlighting discrepancies in risk stratification between European-based PRS and actual CAD outcomes in Asian populations. We then simulated a hypothetical integration model using regionally available genomic data from Southeast Asian biobanks, coupled with conventional tools such as SCORE or pooled cohort equations (PCE), to evaluate shifts in preventive decision-making (e.g., statin eligibility).

Results: The findings suggest that current PRS models underperform among Southeast Asians, with reduced sensitivity for high-risk individuals. In South Asian populations, the integration of region-tailored PRS improved the early identification of high-risk individuals by up to approximately 27%, particularly in younger adults, enabling more timely interventions. Given the shared cardiometabolic profiles across South and Southeast Asian populations, developing PRS models specific to Southeast Asia holds promise for improving early detection and precision prevention in this region. Approximately 9% more individuals would be eligible for preventive statin therapy under the integrated model without increasing the risk of overtreatment.

Conclusions: Genomic diversity must be addressed to ensure equitable precision medicine. Developing a Southeast Asian PRS model could redefine primary prevention in the region by uncovering hidden genetic risks earlier, before clinical risk factors manifest. This integration has the potential to transform the long-term burden of CAD by enabling personalized and proactive care. When integrated with established clinical risk scores, a Southeast Asia-specific PRS can significantly enhance predictive accuracy, enabling more comprehensive and stratified CAD prevention strategies.

Keywords: Coronary artery disease, polygenic risk score, Southeast Asia, genetic risk stratification

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV23]

Prognostic Value of Spontaneous Type 1 ECG Pattern and Programmed Ventricular Stimulation in Asymptomatic Brugada Syndrome: A Systematic Review and Meta-Analysis

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Background: Brugada syndrome (BrS) is associated with an elevated risk of sudden cardiac death; however, risk stratification in asymptomatic patients who represent 60-80% of diagnoses remains challenging. Although the annual arrhythmic event rate in asymptomatic patients is relatively low (~1%), approximately 50% of events occur without warning. Various risk markers have been proposed, but their predictive values in asymptomatic populations remain controversial. This meta-analysis aimed to evaluate the prognostic significance of spontaneous type 1 ECG patterns and programmed ventricular stimulation (PVS) inducibility in asymptomatic patients with BrS.

Methods: We systematically searched the PubMed, Scopus, and Cochrane Library databases (January 2000-January 2024) for prospective observational studies that enrolled patients with asymptomatic BrS. Studies were included if they reported data on spontaneous type 1 ECG pattern and/or PVS with arrhythmic events as outcomes and a minimum 12-month follow-up. Study quality was assessed using the Newcastle-Ottawa scale. A meta-analysis was performed using fixed- or random-effects models, depending on heterogeneity. The primary outcome was a composite of sustained ventricular tachycardia/fibrillation, appropriate ICD therapy, or arrhythmic death.

Results: Twelve studies involving 3,565 asymptomatic patients with BrS (2,462 men; mean age 45±12 years) were included, with follow-up ranging from 22 months to 6 years. Among 3,142 patients evaluated for ECG pattern, spontaneous type 1 ECG significantly increased arrhythmic risk compared with drug-induced patterns (87/3,142 events [2.7%]; OR 4.24, 95% CI 2.46-7.31, $p<0.00001$; $I^2=24\%$). Among 1,660 patients undergoing PVS, inducibility predicted future arrhythmic events (70/1,660 events [4.2%]; OR 3.55, 95% CI 2.02-6.24, $p=0.0001$; $I^2=0\%$). No publication bias was observed.

Conclusion: Both spontaneous type 1 ECG pattern and PVS inducibility are significant predictors of arrhythmic events in asymptomatic patients with BrS, conferring approximately 4-fold and 3.5-fold increased risk, respectively. These findings support the use of risk stratification tools to guide decisions regarding prophylactic ICD implantation in this challenging population.

Keywords: Brugada syndrome, sudden cardiac death, risk stratification, electrocardiography, programmed ventricular stimulation

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV24]

The Artificial Intelligence Breakthrough in Critical Cardiac Care: Pinpointing Supraventricular and Ventricular Tachycardia Before It's Too Late - A Systematic Review and Meta-Analysis

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Background and Aims: Supraventricular tachycardia (SVT) and ventricular tachycardia (VT) are life-threatening arrhythmias that require rapid identification and intervention. Conventional diagnostic tools may delay the initiation of appropriate treatments. Artificial intelligence (AI) has emerged as a potential game-changer in the early detection and classification of these arrhythmias using electrocardiographic (ECG) and clinical data. This systematic review and meta-analysis aimed to evaluate the diagnostic performance of AI-based algorithms in detecting SVT and VT compared to standard methods.

Materials and Methods: We conducted a comprehensive literature search in PubMed, Scopus, Embase, and IEEE Xplore until April 2025. Eligible studies included AI applications in SVT/VT detection with reported sensitivities and specificities. Data extraction and quality assessment were conducted according to the PRISMA guidelines. Meta-analyses were performed using a random-effects model.

Results: A total of 28 studies involving over 1.2 million ECG samples were included. The pooled sensitivity and specificity for AI-based SVT detection were 92% (95% CI: 89–94%) and 90% (95% CI: 87–93%), respectively. For VT, the sensitivity reached 94% (95% CI: 91–96%) and specificity 91% (95% CI: 88–94%). The area under the curve (AUC) for most of the deep learning models exceeded 0.95. AI systems outperform traditional ECG interpretation in terms of speed and accuracy, especially in emergency settings.

Conclusion: AI shows high diagnostic accuracy for SVT and VT, making it a promising tool for the accurate detection of arrhythmias in critical care, to reduce morbidity and mortality.

Keywords: Artificial Intelligence, Supraventricular Tachycardia, Ventricular Tachycardia, ECG Interpretation, Arrhythmia Detection, Machine Learning, Deep Learning, Critical Cardiac Care, Diagnostic Accuracy, meta-analysis

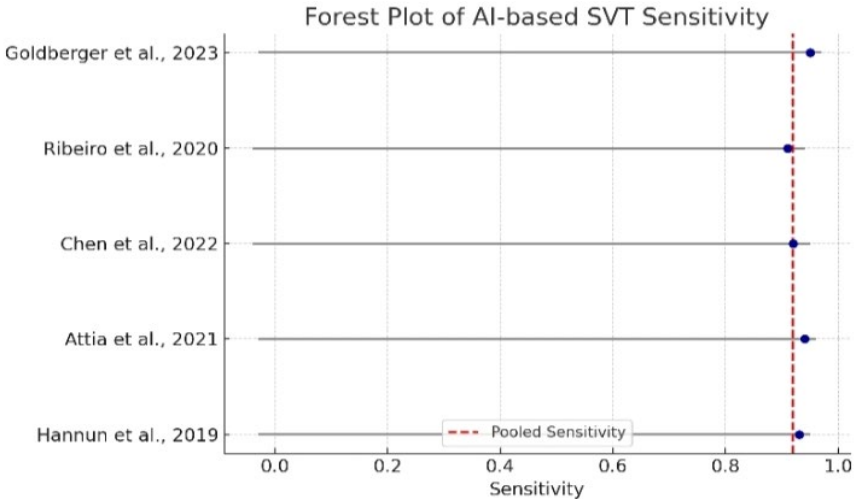

Figure 1. Forest Plot of AI-based SVT Sensitivity

The forest plot (Figure 1) illustrates the sensitivity values of the AI algorithms for detecting SVT based on five major studies.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV25]

The Role of Low-Level Transcutaneous Electrical Stimulation in Atrial Fibrillation Management: A Systematic Review

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Background and aims: Atrial fibrillation (AF) is the most common supraventricular arrhythmia, characterized by rapid and disorganized atrial electrical activation, leading to ineffective atrial contraction. The cardiac autonomic nervous system (ANS) plays a vital role in regulating the electrical signals and mechanical contractions of the heart. Therefore, identifying low-level transcutaneous electrical stimulation (LLTS) as a noninvasive alternative therapy is essential for improving the management of atrial fibrillation. This study aimed to determine the effectiveness of low-level transcutaneous electrical stimulation in the treatment of atrial fibrillation.

Materials and methods: This study was conducted using the SWiM checklist. A search was conducted in MEDLINE, the Cochrane Library, and other sources to identify articles on the effect of low-level transcutaneous electrical stimulation in patients with atrial fibrillation. A systematic review method was used for screening and extracting data. The Cochrane Collaboration tool was used to assess the methodological quality of the studies included in this systematic review.

Results: Three clinical studies involving 113 samples were analyzed. Low-level transcutaneous electrical stimulation (LLTS) markedly decreases the duration of pacing-induced atrial fibrillation (AF) and prolongs the AF cycle length.

Conclusion: Low-level transcutaneous electrical stimulation is more effective than sham stimulation in treating atrial fibrillation. Further research is needed in diverse populations using improved methodologies.

Keywords: Rhythm disorder, Atrial Fibrillation, Autonomic nervous system, LLTS

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV26]

Catheter Ablation vs Antiarrhythmic Drugs for Atrial Fibrillation in Heart Failure Patients: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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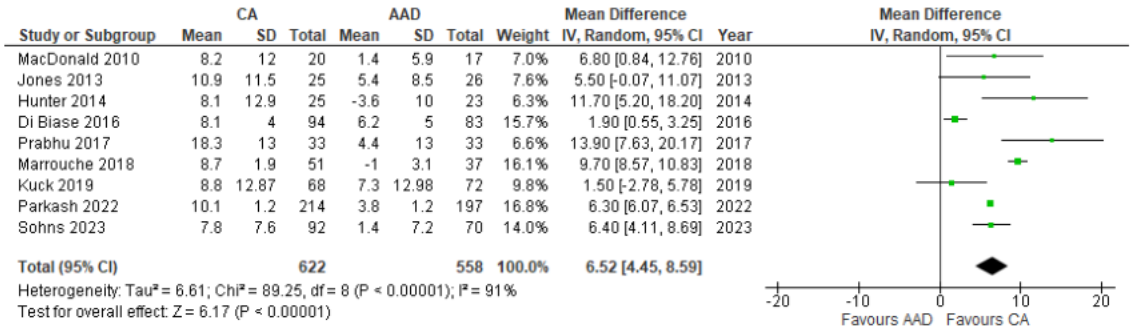
Background and aims: Atrial fibrillation (AF) and heart failure (HF) frequently coexist, leading to impaired cardiovascular function and poor prognosis. Although antiarrhythmic drugs (AADs) remain the standard initial approach, catheter ablation (CA) has emerged as a potential strategy for this population. Therefore, this study aimed to perform a comprehensive analysis of the effectiveness of CA compared with AADs in patients with AF and HF.

Methods: A systematic search of randomized controlled trials (RCTs) was conducted in PubMed until June 2025. The outcomes of interest were changes in left ventricular ejection fraction (LVEF) and distance in the 6-minute walk test (6-MWT). A random-effects model was used to estimate the mean difference and 95% confidence interval (CI). Potential sources of heterogeneity in the results were analyzed using sensitivity analysis.

Results: Eight RCTs published between 2010 and 2023, involving 769 patients, were included. Statistical analysis showed that CA significantly improved LVEF compared to AADs, with a pooled mean difference of 6.84% (CI: 3.45-10.23; p<0.001). Similarly, patients undergoing CA demonstrated superior functional capacity, with an increased 6 MWT distance of 18.80 (CI: 11.05-26.54, p = 0.11) m compared to the AADs group.

Conclusion: In patients with AF and HF, CA significantly improved LVEF and functional capacity compared to AADs alone.

Keywords: antiarrhythmic drugs, atrial fibrillation, catheter ablation, heart failure



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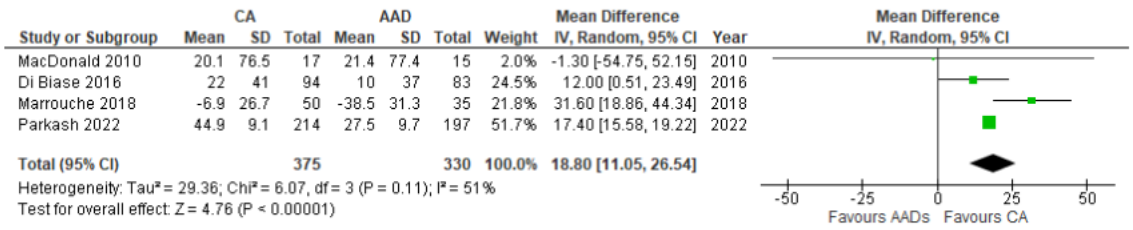

B

Figure 1. Forest plot of mean differences between CA and AADs in (A) changes in LVEF and (B) changes in 6-MWT.

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Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV27]

Safety Profile of Fondaparinux vs Enoxaparin in Non-ST Elevation Acute Coronary Syndrome Patients: A Systematic Review and Meta-Analysis

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Background: Non-ST-elevation acute coronary syndrome (NSTE-ACS) requires prompt anticoagulation to prevent thrombus formation. Fondaparinux and enoxaparin are commonly used anticoagulants; however, their safety profiles, particularly regarding bleeding risk, differ. Although fondaparinux is associated with a lower bleeding risk, concerns regarding its efficacy in certain scenarios, such as PCI, persist. This meta-analysis aimed to compare the safety profiles of fondaparinux and enoxaparin in patients with NSTE-ACS to guide clinical decision-making.

Methods: A systematic literature search was conducted in PubMed, Cochrane Library, and EMBASE to identify studies comparing the safety profiles of fondaparinux and enoxaparin in patients with NSTE-ACS. We included randomized controlled trials and observational studies reporting bleeding and mortality outcomes. Data were extracted and a meta-analysis was performed using Review Manager (RevMan). Heterogeneity was assessed using the I^2 statistic, and fixed or random-effects models were applied accordingly.

Results: The meta-analysis included four observational studies with a total of 4,526 patients comparing fondaparinux and enoxaparin in NSTE-ACS. Mortality rates were similar between the two groups at 7 and 30 days, but those in the fondaparinux group were significantly lower at 180 days (RR: 1.66, $p < 0.0001$). Fondaparinux was also associated with a lower risk of myocardial infarction at 7 days (RR: 0.64, $p = 0.03$) and major bleeding at both 7 and 30 days (RR: 0.52, $p = 0.02$).

Conclusion: Fondaparinux is safer than enoxaparin in terms of reducing major bleeding events, and there was no significant difference in short-term mortality between the two interventions.

Keywords: fondaparinux, enoxaparin, non-ST elevation, acute coronary syndrome

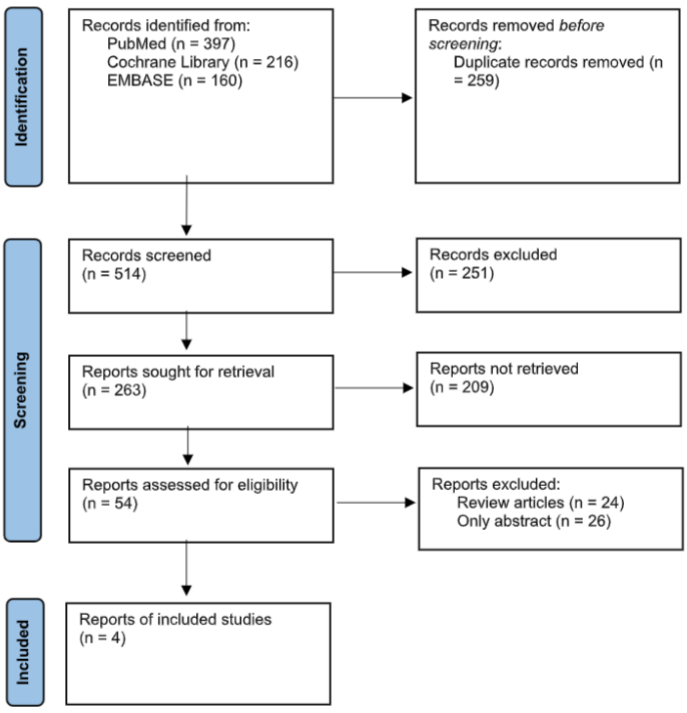

Figure 1. PRISMA flowchart

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV28]

Pulsed Field vs Conventional Ablation in Paroxysmal Atrial Fibrillation: A Systematic Review and Meta-Analysis of Efficacy and Safety

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Background: Pulsed Field Ablation (PFA) is an emerging nonthermal technique that employs high-voltage electric fields to achieve pulmonary vein isolation (PVI) with high tissue selectivity and safety. While PFA has been widely studied in patients with persistent atrial fibrillation, evidence specific to paroxysmal atrial fibrillation is relatively limited.

Objectives: To compare the efficacy and safety of pulsed-field ablation (PFA) and conventional ablation in paroxysmal atrial fibrillation (pAF).

Methods: A comprehensive literature search was conducted in PubMed, Scopus, and the Cochrane Library from inception to March 2025 to identify studies comparing pulsed-field ablation with conventional ablation in patients with paroxysmal atrial fibrillation. Randomized controlled trials (RCTs) were assessed for risk of bias using the RoB 2.0 tool, whereas cohort studies were evaluated using the ROBINS-I tool. Two independent reviewers screened the studies and extracted the data. Meta-analysis was performed using the RevMan software.

Results: Five studies, including 2,077 patients, were included. Pulsed-field ablation (PFA) showed no significant difference in arrhythmia freedom compared to conventional ablation (OR: 0.74; 95% CI: 0.28–1.92). Among safety outcomes, vascular complications were significantly more frequent with PFA (OR: 4.00; 95% CI: 1.06–15.09). No significant differences were observed in phrenic nerve injury (OR: 1.50; 95% CI: 0.30–7.46), cardiac tamponade (OR: 0.13; 95% CI: 0.02–1.09), or stroke/TIA (not estimable). Notably, no cases of pulmonary vein stenosis >70% were reported in either group; thus, no comparative effect could be estimated.

Conclusion: PFA appears comparable to conventional ablation in terms of efficacy for paroxysmal AF but may carry a higher risk of vascular complications. The absence of reported pulmonary vein stenosis events in all studies limits the interpretation of this outcome. Further research with standardized reporting is required to clarify the complete safety profile of PFA.

Keyword: Pulsed Field Ablation, Paroxysmal Atrial Fibrillation, Freedom from Atrial Fibrillation, Safety

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
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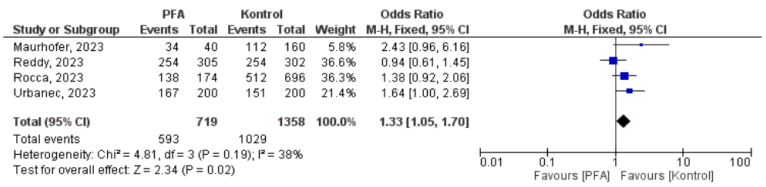


Figure 1. Forest Plot of Freedom from Atrial Fibrillation Comparing Pulsed Field Ablation and Conventional Ablation in Paroxysmal AF Patients

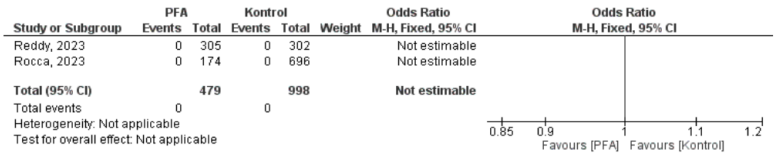


Figure 2. Forest Plot of Pulmonary Vein Stenosis Comparing Pulsed Field Ablation and Conventional Ablation in Paroxysmal AF Patients

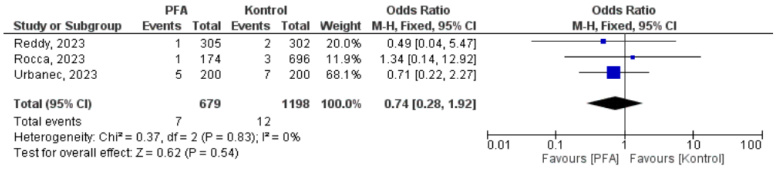


Figure 3. Forest Plot of Freedom from Vascular Complication Pulsed Field Ablation and Conventional Ablation in Paroxysmal AF Patients

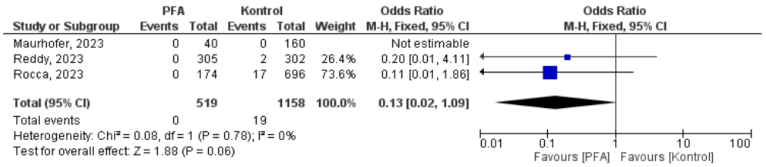


Figure 4. Forest Plot of Phrenic Nerve Injury Comparing Pulsed Field Ablation and Conventional Ablation in Paroxysmal AF Patients

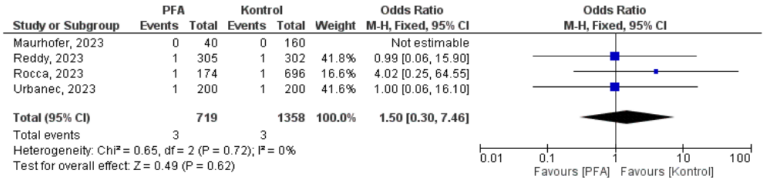


Figure 5. Forest Plot of Stroke/TIA Comparing Pulsed Field Ablation and Conventional Ablation in Paroxysmal AF Patients

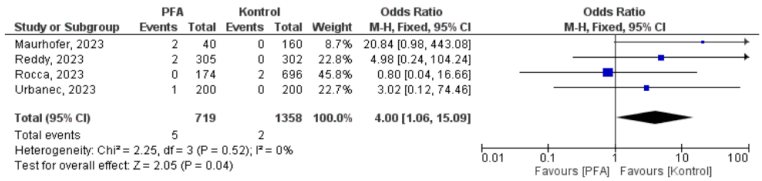
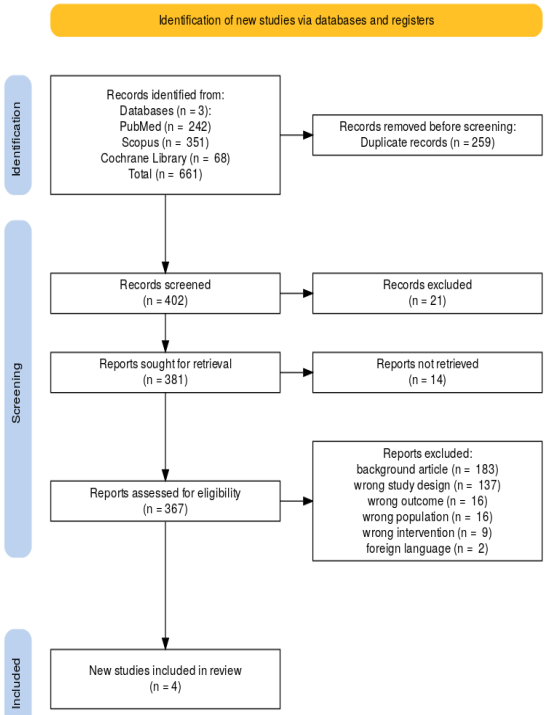


Figure 6. . Forest Plot of Freedom from Cardiac Tamponade Comparing Pulsed Field Ablation and Conventional Ablation in Paroxysmal AF Patients



The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV29]

Atrial High Rate Episodes detected by Cardiac Implantable Electronic Devices as Prognostic Factor of Stroke or Systemic Embolism Incidence in non-prior Atrial Fibrillation Patients: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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Background and aims: AHRE are asymptomatic atrial tachyarrhythmias detected by CIEDs, such as pacemakers, implantable cardioverter defibrillators (ICDs), or loop recorders (ILRs). They are often considered precursors to atrial fibrillation (AF) and are linked to an increased risk of stroke. With rising CIED use, understanding AHRE's clinical implications is increasingly critical. This study evaluated the association between AHREs detected by CIEDs and the incidence of stroke/systemic embolism in patients without prior AF.

Materials and methods: A systematic search was conducted in PubMed, Embase, and Cochrane Library until June 2025. The inclusion criteria focused on RCTs examining AHRE/subclinical AF as prognostic factors for stroke/systemic embolism, although the definitions and cutoff durations varied. Data extraction included study characteristics, AHRE definitions, populations, and hazard ratios (HRs). Eligible data were extracted using Review Manager 5.4.1 with a fixed effects model. The study quality was assessed using the Cochrane RoB 2.0 tool.

Results: Five RCTs with 16,462 participants (Healey 2012, Witt 2015, Svendsen 2021, Kirchhoff 2023, Healey 2024) were included. Pooled analysis showed an overall HR for stroke/systemic embolism of 1.04 (95% CI: 0.65–1.66), indicating no significant association (Z=0.17, P=0.87). Substantial heterogeneity was present (I^2=81%, Chi^2=21.13, df=4, P=0.0003). As shown in Figure 1, while earlier studies reported higher risk estimates, newer and larger trials showed HRs near or below 1.0, with confidence intervals crossing unity (CI crossing unity).

Conclusion: Current RCT evidence does not support AHREs as independent prognostic factors for stroke or systemic embolism in patients without AF. The high heterogeneity highlights the need for standardized AHRE definitions, cut-off durations, and further research to identify patient subgroups that may benefit from targeted intervention.

Keywords: Atrial fibrillation, atrial high-rate episodes, cardiac implantable electronic devices, stroke, systemic embolism.

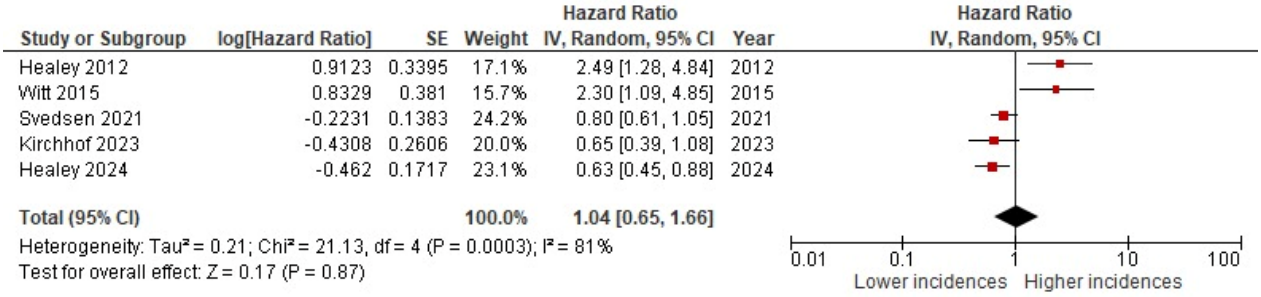

Figure 1. The forest plot shows the overall hazard ratio for stroke/systemic embolism in AHRE detected in CIED patients.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV30]

Efficacy and Safety of Left Bundle Branch Pacing Compared to Left Ventricular Septal Pacing: A Systematic Review and Meta-Analysis

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[1]Department of Cardiology and Vascular Medicine, Faculty of Medicine, Padjadjaran University, Bandung, Indonesia.

Background and aims: Although numerous studies have compared the efficacy and safety of left bundle branch pacing (LBBP) and left ventricular septal pacing (LVSP), the results remain inconclusive. This meta-analysis aimed to systematically compare the efficacy and safety of LBBP and LVSP.

Materials and methods: A comprehensive literature search was conducted across PubMed, Europe PMC, and ScienceDirect to identify studies comparing the procedural duration, complications, electrophysiological and echocardiographic parameters, and clinical outcomes of LBBP and LVSP.

Results: A total of 22 cohort studies involving 1360 LBBP and 1186 LVSP procedures were included. The paced QRS duration [MD = -9.65 ms (95% CI, -13.35 to -5.96); I^2=84.9%; p<0.001] and stimulation-to-left ventricular activation time (s-LVAT) [MD = -14.62 ms (95% CI, -16.99 to -12.24); I^2=77.2%; p<0.001] were significantly shorter in the LBBP group. The ventricular pacing burden between LBBP and LVSP was not significantly different [MD, 0.32%; 95% CI, -4.79 to 5.43; I^2=85.7%; p=0.901]. In patients with baseline reduced LVEF and wide QRS duration, the reduction in QRS duration [MD = 20.82 ms (95% CI, 13.07 to 28.56; I^2=0%; p<0.001] and the improvement in LVEF [MD = 6.05% (95% CI, 2.9 to 9.2; I^2=51.3%; p<0.001] were significantly greater in the LBBP group. Additionally, the LBBP group demonstrated a significant and independent reduction in the risk of all-cause mortality and/or heart failure hospitalization [RR = 0.28 (95% CI, 0.17 to 0.48; I^2 =0%; p<0.001] compared to the LVSP group. In patients with preserved baseline LVEF and narrow QRS duration, post-pacemaker LVEF and LVEDD, as well as the risk of heart failure hospitalization, were comparable between the two groups (p > 0.05). Furthermore, procedural duration, complications, and pacing parameters (sensing amplitude, capture threshold, and lead impedance) did not differ significantly between the groups (p > 0.05).

Conclusion: In patients with reduced LVEF and wide QRS duration, LBBP demonstrated superior efficacy compared with LVSP. In contrast, in patients with preserved LVEF and narrow QRS duration, the efficacies of LBBP and LVSP are similar. Both groups exhibited comparable safety profiles and procedural efficiency.

Keywords: left bundle branch area pacing; left bundle branch pacing; left ventricular septal pacing; efficacy; safety

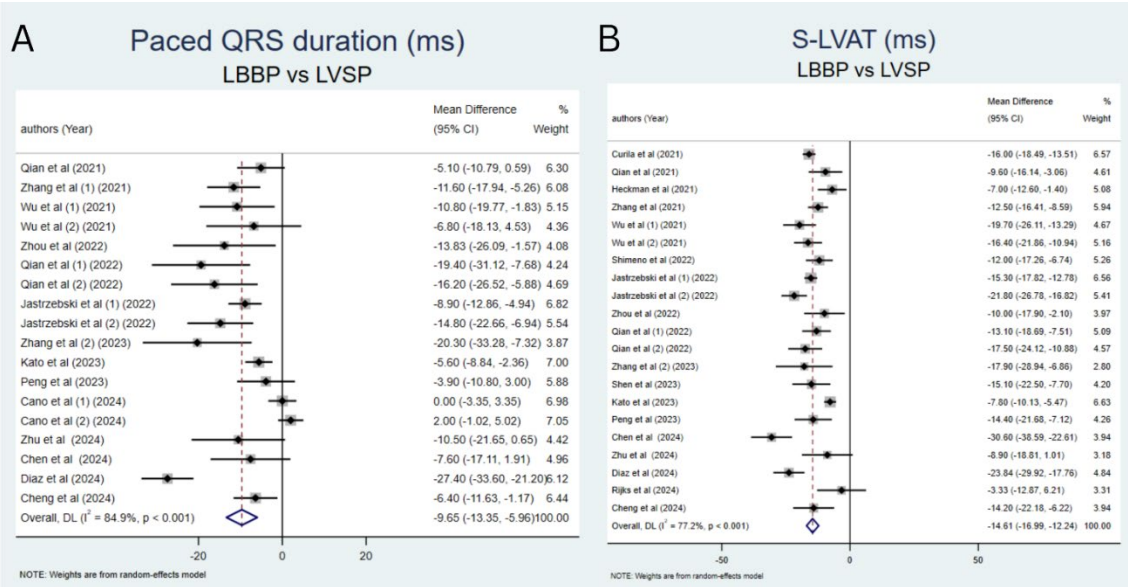

Figure 1. Comparison of paced QRS duration and s-LVAT between LBBP and LVSP

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV31]

Comparing Patient-Reported Quality of Life in Leadless Pacemakers versus Conventional Pacemakers: A Systematic Review

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[2] *Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Airlangga - Dr. Soetomo General Hospital, Surabaya, Indonesia*

Background and aims: Conventional pacemakers (C-PM) have long been the standard of care for permanent pacemaker implantation; however, recent technological advances have led to the development of leadless pacemakers (L-PM). Evolving clinical guidelines increasingly emphasize quality of life (QoL) in device selection, with L-PM hypothesized to offer superior QoL outcomes because of its minimally invasive design, absence of a surgical pocket, and fewer postoperative physical limitations. However, the variability in patient selection criteria complicates device selection. This systematic review aimed to compare patient-reported QoL between L-PM and C-PM.

Materials and methods: A literature search was conducted on PubMed, EMBASE, Cochrane CENTRAL, ScienceDirect, Scopus, ProQuest, Google Scholar, and Wiley Online Library from 2015 to 2025. The included studies compared QoL between L-PM and C-PM groups using the SF-36 questionnaire. The ROBINS-I tool was used to assess the risk of bias. Physical functioning (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE), mental health (MH), physical component summary (PCS), and mental component summary (MCS) were analyzed as SF-36 questionnaire outcomes.

Results: Of 5280 studies, three met the inclusion criteria, encompassing 468 patients, with an overall moderate risk of bias. Baseline QoL did not differ significantly between L-PM and C-PM ($p>0.05$). L-PM had significantly higher PCS and MCS at 1 week, better PF, RP, BP, VT, GH, and MCS at 1 and 3 months, and sustained better PF, RP, MH, and PCS at the 6-months than C-PM ($p<0.05$).

Conclusions: L-PM was associated with better physical health QoL than C-PM, likely due to less fear of complications and fewer activity restrictions. However, mental health superiority is inconsistent across studies, highlighting the need for further research.

Keywords: pacemaker, artificial; cardiac pacing, artificial; quality of life; surveys and questionnaires; systematic review

Table 1. SF-36 questionnaire results comparing L-PM and C-PM at baseline and follow-ups

SF-36	Cabanas-Grandío, 2019			Palmisano, 2021			Yu, 2023a		
	L-PM	C-PM	p	L-PM	C-PM	p	L-PM	C-PM	p
Baseline									
PF	44±29	41±25	0.508	57±11	59±14	0.191	41±10	41±5	0.752
SF	75±29	73±28	0.757	66±11	64±14	0.419	61±15	65±11	0.195
RP	23±35	22±38	0.962	40±16	38±14	0.657	27±10	30±12	0.194
RE	61±48	62±47	0.882	59±8	61±8	0.245	57±8	59±7	0.174
MH	61±22	61±23	0.984	68±9	70±14	0.275	55±12	59±8	0.128
BP	51±26	52±30	0.894	58±6	59±7	0.337	48±9	48±8	0.746
VT	40±20	39±22	0.856	36±4	35±9	0.623	39±9	41±8	0.386
GH	43±18	44±16	0.723	43±5	42±6	0.276	44±10	44±6	0.874
PCS	33±10	33±11	0.793	36±9	36±11	0.855	40±7	41±6	0.583
MCS	46±14	46±15	0.936	45±14	46±15	0.868	53±8	56±5	0.100
1 week follow up									
PF	-			63±7	57±10	**<0.001**	-		
SF				64±14	54±14	**<0.001**			
RP				55±10	38±12	**<0.001**			
RE				59±5	48±8	**<0.001**			
MH				73±12	70±14	0.096			
BP				47±7	42±6	**<0.001**			
VT				42±8	34±9	**<0.001**			
GH				48±7	43±7	**<0.001**			
PCS				39±7	33±8	**<0.001**			
MCS				46±11	41±12	**<0.009**			
1 month follow up									
PF	61±30	45±27	**0.035**	-			56±13	42±8	**<0.001**
SF	88±22	79±30	0.165				74±14	69±11	0.055
RP	59±44	18±32	**<0.001**				52±14	24±8	**<0.001**
RE	74±42	61±44	0.243				71±11	62±9	**<0.001**
MH	73±20	70±21	0.670				70±10	67±9	0.092
BP	66±30	64±27	0.760				59±12	54±13	**0.042**
VT	55±27	47±22	0.188				54±13	45±8	**<0.001**
GH	53±18	48±19	0.236				55±10	45±7	**<0.001**
PCS	41±9	34±9	**0.004**				56±10	41±5	**<0.001**
MCS	50±13	49±13	0.792				67±9	61±6	**<0.001**
3 months follow up									
PF	-			63±9	59±9	**0.026**	63±9	47±7	**<0.001**
SF				65±11	58±12	**0.001**	80±10	74±8	**0.004**
RP				58±9	50±10	**<0.001**	60±10	40±9	**<0.001**
RE				64±9	55±9	**<0.001**	76±10	71±6	**0.015**
MH				75±9	71±9	**0.002**	75±10	68±9	**<0.001**
BP				55±7	55±8	0.939	65±9	61±9	**0.042**
VT				47±12	45±11	0.200	56±10	49±9	**0.001**
GH				55±8	46±8	**<0.001**	55±12	52±9	0.175

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

PCS				42±3	38±5	**<0.001**	61±8	50±5	**<0.001**
MCS				47±11	42±12	**0.008**	72±6	65±5	**<0.001**
6 months follow up									
PF	63±27	42±26	**<0.001**	62±9	59±10	**0.035**	-		
SF	85±21	78±29	0.149	73±11	60±10	**<0.001**			
RP	64±43	36±45	**0.004**	57±9	52±12	**<0.001**			
RE	75±40	68±44	0.428	64±10	58±9	**<0.001**			
MH	75±16	65±21	**0.017**	75±10	71±9	**0.005**			
BP	69±25	60±30	0.167	54±7	53±9	0.402			
VT	52±21	44±23	0.091	49±7	46±9	**0.013**			
GH	48±18	48±20	0.945	56±8	48±7	**<0.001**			
PCS	41±11	35±10	**0.007**	42±3	38±4	**<0.001**			
MCS	50±11	48±12	0.393	49±12	43±13	**0.006**			

L-PM: leadless pacemaker; C-PM: conventional pacemaker; p: p-value of L-PM versus C-PM; PF: Physical Functioning; SF: Social Function; RP: Role Physical; RE: Role Emotional; MH: Mental Health; BP: Bodily Pain; VT: Vitality; GH: General Health; PCS: Physical Component Summary; MCS: Mental Component Summary

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
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[12INAHRS-RV32]

Atrial High Rate Episodes detected by Cardiac Implantable Electronic Devices as Prognostic Factor of Stroke or Systemic Embolism Incidence in non-prior Atrial Fibrillation Patients: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

M. Akbar[1], C. Parameswari[2], P.S. Andjari[3], K. Fahrurrozi[4], R. Amalia[5], W.W. Andriati[3], B. Dwiatmojo[3], D.P. Andryan[3]

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Background and aims: AHRE are asymptomatic atrial tachyarrhythmias detected by CIEDs, such as pacemakers, implantable cardioverter-defibrillators (ICDs), and loop recorders (ILRs). They are often considered precursors to atrial fibrillation (AF) and linked to increased stroke risk. With rising CIED use, understanding AHRE's clinical implications is increasingly critical. This study evaluated the association between AHREs detected by CIEDs and the incidence of stroke/systemic embolism in patients without prior AF.

Materials and methods: A systematic search was conducted in PubMed, Embase, and Cochrane Library until June 2025. The inclusion criteria focused on RCTs examining AHRE/subclinical AF as prognostic factors for stroke/systemic embolism, although the definitions and cutoff durations varied. Data extraction included study characteristics, AHRE definitions, populations, and hazard ratios (HRs). Eligible data were extracted using Review Manager 5.4.1 with a fixed-effects model. The study quality was assessed using the Cochrane RoB 2.0 tool.

Results: Five RCTs with 16,462 participants (Healey 2012, Witt 2015, Svendsen 2021, Kirchhoff 2023, Healey 2024) were included. Pooled analysis showed an overall HR for stroke/systemic embolism of 1.04 (95% CI: 0.65–1.66), indicating no significant association (Z=0.17, P=0.87). Substantial heterogeneity was present (I^2=81%, Chi^2=21.13, df=4, P=0.0003). As shown in Figure 1, while earlier studies reported higher risk estimates, newer, larger trials showed HRs near or below 1.0, with confidence intervals that crossed 1.0.

Conclusion: Current RCT evidence does not support AHREs as independent prognostic factors for stroke or systemic embolism in patients without AF. The high heterogeneity underscores the need for standardized AHRE definitions and cutoff durations, as well as further research to identify patient subgroups that may benefit from targeted interventions.

Keywords: Atrial fibrillation, atrial high-rate episodes, cardiac implantable electronic devices, stroke, systemic embolism.

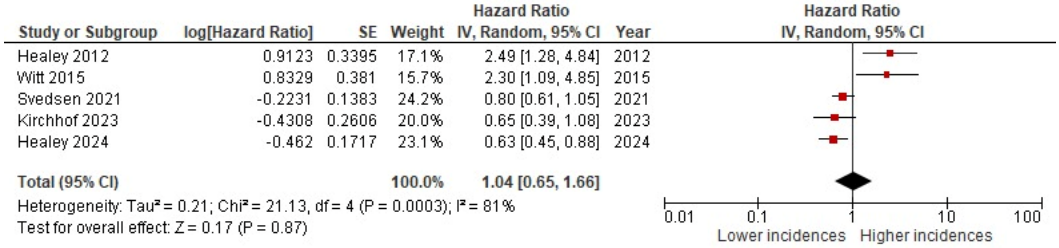

Figure 1. The forest plot shows the overall hazard ratio for stroke/systemic embolism in AHRE detected in CIED patients.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV33]

Efficacy and Safety of Left Bundle Branch Pacing Compared to Left Ventricular Septal Pacing: A Systematic Review and Meta-Analysis

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Background and aims: Although numerous studies have compared the efficacy and safety of left bundle branch pacing (LBBP) and left ventricular septal pacing (LVSP), their results remain inconclusive. This meta-analysis aimed to systematically compare the efficacy and safety of LBBP and LVSP.

Materials and methods: A comprehensive literature search was conducted across PubMed, Europe PMC, and ScienceDirect to identify studies comparing the procedural duration, complications, electrophysiological and echocardiographic parameters, and clinical outcomes of LBBP and LVSP.

Results: A total of 22 cohort studies involving 1360 LBBP and 1186 LVSP procedures were included. The paced QRS duration [MD = -9.65 ms (95% CI, -13.35 to -5.96); I^2=84.9%; p<0.001] and stimulation-to-left ventricular activation time (s-LVAT) [MD = -14.62 ms (95% CI, -16.99 to -12.24); I^2=77.2%; p<0.001] were significantly shorter in the LBBP group. The ventricular pacing burden between LBBP and LVSP was not significantly different [MD, 0.32%; 95% CI, -4.79 to 5.43; I^2=85.7%; p=0.901]. In patients with baseline reduced LVEF and wide QRS duration, the reduction in QRS duration [MD = 20.82 ms (95% CI, 13.07 to 28.56; I^2=0%; p<0.001] and the improvement in LVEF [MD = 6.05% (95% CI, 2.9 to 9.2; I^2=51.3%; p<0.001] were significantly greater in the LBBP group. Additionally, the LBBP group demonstrated a significant and independent reduction in the risk of all-cause mortality and/or heart failure-related hospitalization [RR, 0.28; 95% CI, 0.17–0.48; I^2 =0%; p<0.001] compared with the LVSP group. In patients with preserved baseline LVEF and narrow QRS duration, post-pacemaker LVEF and LVEDD, as well as the risk of heart failure hospitalization, were comparable between the two groups (p > 0.05). Furthermore, procedural duration, complications, and pacing parameters (sensing amplitude, capture threshold, and lead impedance) did not differ significantly between the groups (p > 0.05).

Conclusion: In patients with reduced LVEF and wide QRS duration, LBBP demonstrated superior efficacy compared with LVSP. In contrast, in patients with preserved LVEF and narrow QRS duration, the efficacies of LBBP and LVSP are similar. Both groups exhibited comparable safety profiles and procedural efficiency.

Keywords: left bundle branch area pacing; left bundle branch pacing; left ventricular septal pacing; efficacy; safety

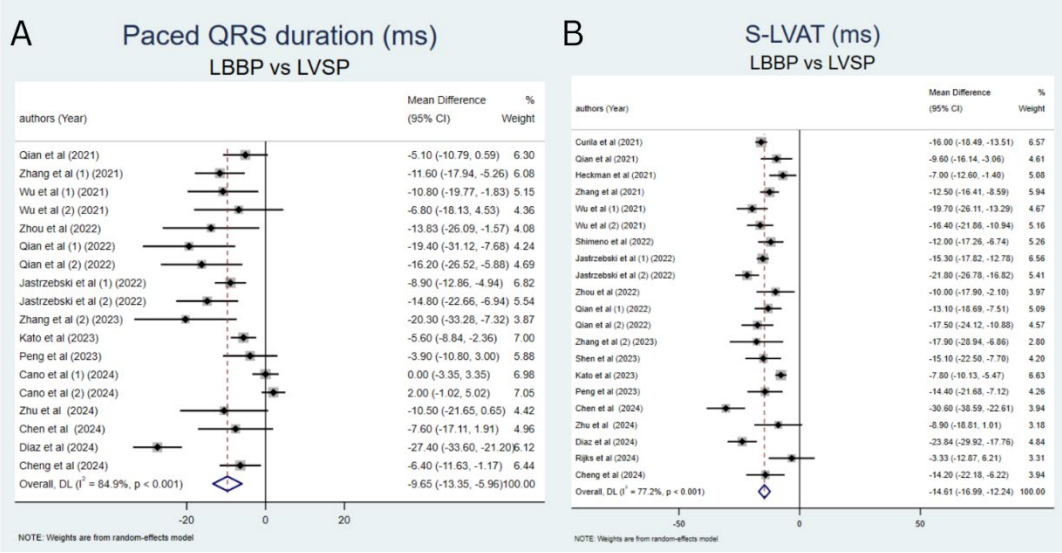

Figure 1. Comparison of paced QRS duration and s-LVAT between LBBP and LVSP groups.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV34]

Digoxin versus Beta-Blockers in Atrial Fibrillation: A Meta-Analysis of Mortality, Hospitalization, and Rate Control Outcomes

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Background and aims: The comparative effectiveness of digoxin and beta-blockers (BB) in atrial fibrillation (AF) remains unclear. Digoxin is widely used, particularly in resource-limited settings, but is associated with increased mortality, as shown in observational studies. This meta-analysis compared the effects of digoxin and BB on mortality, hospitalization, and rate control.

Materials and methods: We conducted a PRISMA-compliant meta-analysis (PROSPERO: CRD420251030670) of randomized and observational studies without date or language restrictions. The databases searched included MEDLINE, CENTRAL, CINAHL, Scopus, and ClinicalTrials.gov. The primary outcomes were all-cause mortality and hospitalization, and rate control was a secondary outcome. The risk of bias was assessed using the ROBINS-I and ROB 2.0 tools. Evidence certainty was rated using the GRADE.

Results: Nineteen studies (n = 1,060,400) were included in the analysis. Pooled data from 10 observational studies (n = 120,189) showed that digoxin was associated with a 33% higher mortality risk (HR 1.33; 95% CI 1.25–1.41; $p < 0.001$), with remarkably low heterogeneity ($I^2 = 6.5\%$). Direct comparisons were not statistically significant (HR 1.14 [95% CI 0.98–1.33]; $p = 0.093$). The leave-one-out sensitivity analysis confirmed the robustness of the results across all studies. The risk of hospitalization was similar (HR 1.03; 95% CI 0.66–1.59). Beta-blockers consistently achieve superior rate control across trials and registries. An advanced publication bias assessment showed a minimal impact on the findings. For example, in the AFFIRM registry subset, 68% of patients on beta-blockers achieved rate targets versus 58% on digoxin. Evidence certainty was rated low due to the study design and indirectness.

Conclusion: Digoxin is associated with a higher mortality risk than beta-blockers in patients with AF based on observational data, although direct comparisons remain inconclusive. Beta-blockers demonstrated superior rate control and aligned with the ESC 2024 recommendations as first-line agents. High-quality trials directly comparing these drugs are urgently required.

Keywords: atrial fibrillation, digoxin, beta-blockers, mortality, meta-analysis

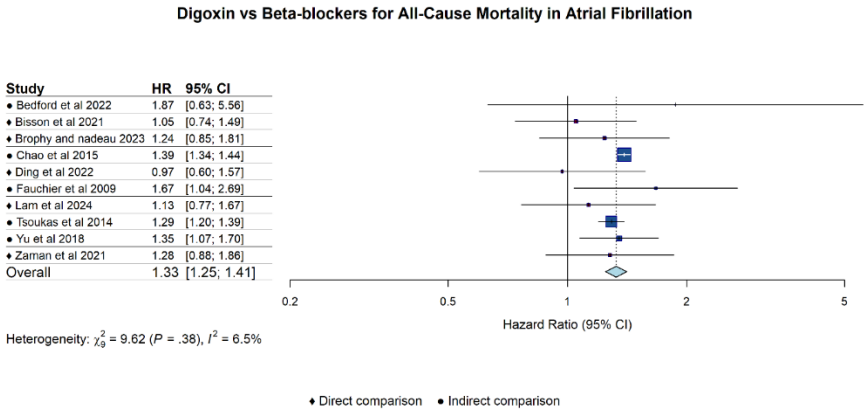

Figure 1. Forest Plot: Meta-analysis of digoxin vs. beta-blocker mortality comparison

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV35]

Restoring Rhythm, Saving Lives: Impact of Sodium–glucose cotransporter-2 Inhibitors on Reducing Arrhythmic Events and Sudden Cardiac Death in Heart Failure Patients - A Meta-Analysis

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Background and Aims: Arrhythmic events, including atrial fibrillation (AF)/ atrial flutter (AFL), ventricular arrhythmias (VA), and sudden cardiac death (SCD), are common complications in patients with heart failure (HF). Sodium–glucose cotransporter-2 inhibitors (SGLT2i) have cardiovascular benefits; however, their effects on arrhythmic outcomes remain unclear.

Materials and Methods: A systematic search was conducted for Randomized Controlled Trials (RCTs) published up to June 16, 2025. RCTs comparing SGLT2i with placebo or standard care in patients with HF were included. The primary outcomes of interest were new onset of AF/AFL, incidence of VA/ ventricular tachycardia (VT)/ ventricular fibrillation (VF), and SCD. Subgroup analyses were performed according to the ejection fraction (EF) category, SGLT2i type, and follow-up duration. The risk of bias was assessed using the Cochrane RoB 2.0 tool, and heterogeneity was quantified using I^2 statistics.

Results: Thirteen RCTs involving 23,379 patients were included in this review. The analysed SGLT2i included canagliflozin, dapagliflozin, and empagliflozin. The participants were patients with chronic HF, regardless of their EF type, with a median follow-up duration ranging from 12 to 119.9 weeks. Compared with the control, SGLT2i did not significantly reduce the risk of new-onset AF/AFL (RR, 0.91; 95% CI, 0.72–1.16; p = 0.45). However, in the Heart Failure with reduced Ejection Fraction (HFrEF) subgroup, SGLT2i significantly reduced the risk of AF/AFL (RR 0.71; 95% CI 0.54–0.93; p = 0.01). There was no significant reduction in VA events (RR 0.98; 95% CI 0.80–1.21; p = 0.88) in any of the subgroups. Importantly, SGLT2i significantly reduced the risk of SCD (RR 0.85; 95% CI 0.73–0.98; p = 0.03), although this effect was not statistically significant in any of the subgroups.

Conclusion: SGLT2i may reduce the incidence of new-onset AF/AFL, especially in patients with HFrEF, and is associated with a significant reduction in SCD across all EF subtypes. However, their impact on VAs appears to be limited.

Keywords: SGLT2 inhibitors, heart failure, sudden cardiac death, arrhythmia

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
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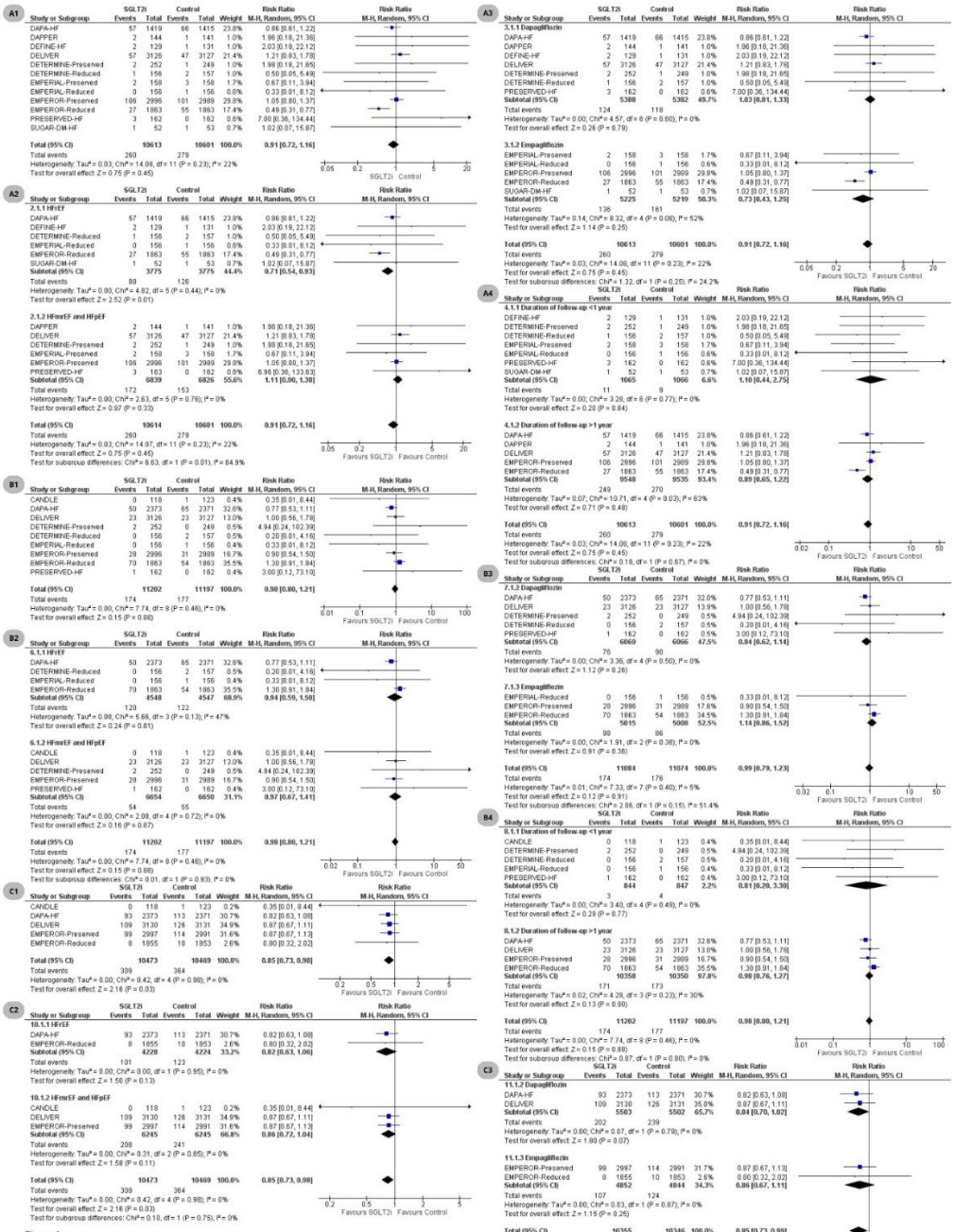

Figure 1.
Forest plot of **A1**: Impact of SGLT2i on new onset of AF/AFL; **A2**: Subgroup analysis of impact of SGLT2i on new onset of AF/AFL by type of HF; **A3**: Subgroup analysis of impact of SGLT2i on new onset of AF/AFL by drug use; **A4**: Subgroup analysis of impact of SGLT2i on new onset of AF/AFL by duration of follow-up. **B1**: Impact of SGLT2i on the incidence of VA/VT/VF; **B2**: Subgroup analysis of impact of SGLT2i on the incidence of VA/VT/VF by type of HF; **B3**: Subgroup analysis of impact of SGLT2i on the incidence of VA/VT/VF by drug use; **B4**: Subgroup analysis of impact of SGLT2i on the incidence of VA/VT/VF by duration of follow-up. **C1**: Impact of SGLT2i on reducing the incidence of SCD; **C2**: Subgroup analysis of impact of SGLT2i on reducing the incidence of SCD by type of HF; **C3**: Subgroup analysis of impact of SGLT2i on reducing the incidence of SCD by drug use.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV36]

Efficacy and Safety of Cardioversion Strategies in Early Atrial Fibrillation in the Emergency Department: A Meta-Analysis of Electrical-Only vs. Pharmacological Approaches

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Background and Aims: Early rhythm control is a key strategy for managing recent-onset atrial fibrillation (AF) in the emergency department (ED), with cardioversion being a common approach. However, the comparative efficacy and safety of electrical-only versus pharmacological cardioversion, with or without electrical backup, remain unclear. This study evaluated these strategies in terms of conversion success, time to rhythm restoration, adverse events, and length of stay in the ED.

Methods: A systematic search of PubMed, ScienceDirect, and ResearchGate was conducted from 2009 to 2025 for randomized controlled trials (RCTs) and observational studies comparing electrical-only cardioversion to pharmacological approaches (with or without electrical cardioversion) in adult patients with recent-onset AF presenting to the ED. Data extraction and risk of bias assessments were performed independently by three reviewers. Pooled risk ratios (RR) or mean differences (MD) were calculated using a random-effects model.

Results: Six studies involving 1,789 patients (691 in the electrical cardioversion [EC] group and 1,098 in the pharmacological cardioversion [PC] group) were included in the analysis. There was no significant difference in the success rate of conversion to sinus rhythm between the EC and PC groups (RR 1.17, 95% CI 0.92–1.50; p = 0.20; I^2 = 96%). However, patients in the EC group had a significantly shorter emergency department length of stay than those in the PC group (MD –57.49 minutes, 95% CI –106.90 to –8.06; p = 0.02; I^2 = 83%). No significant differences were observed in the hospital admission rates (RR 0.55, 95% CI 0.14–2.19; p = 0.40; I^2 = 93%), 30-day return visits to the emergency department (RR 1.00, 95% CI 0.39–2.60; p = 1.00; I^2 = 73%), or adverse events during the cardioversion procedure (RR 0.55, 95% CI 0.29–1.04; p = 0.07; I^2 = 49%).

Conclusion: Electrical and pharmacological cardioversion were similarly effective in restoring sinus rhythm in patients with recent-onset AF. However, EC offers a shorter ED length of stay without an increased risk of adverse outcomes. These findings support the use of EC as a time-efficient strategy that does not compromise safety or efficacy.

Keywords: atrial fibrillation, cardioversion, emergency department, electrical cardioversion, pharmacological cardioversion

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV37]

Transfusion-dependent β-thalassemia Disorder Leads to Atrial Fibrillation; Is Anticoagulant Still Necessary? -A Systematic Review

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Background: Transfusion-dependent β-thalassemia patients have a higher survival rate due to repeated blood transfusions because of erythropoiesis failure. In contrast, the prevalence of atrial fibrillation increased in BT Patients in all age groups owing to iron overload. These conditions are challenging to manage. Both AF and Thalassemia increase the risk of thromboembolic events because of hypercoagulability. Anticoagulants are first-line prophylactic agents but also carry a risk of bleeding.

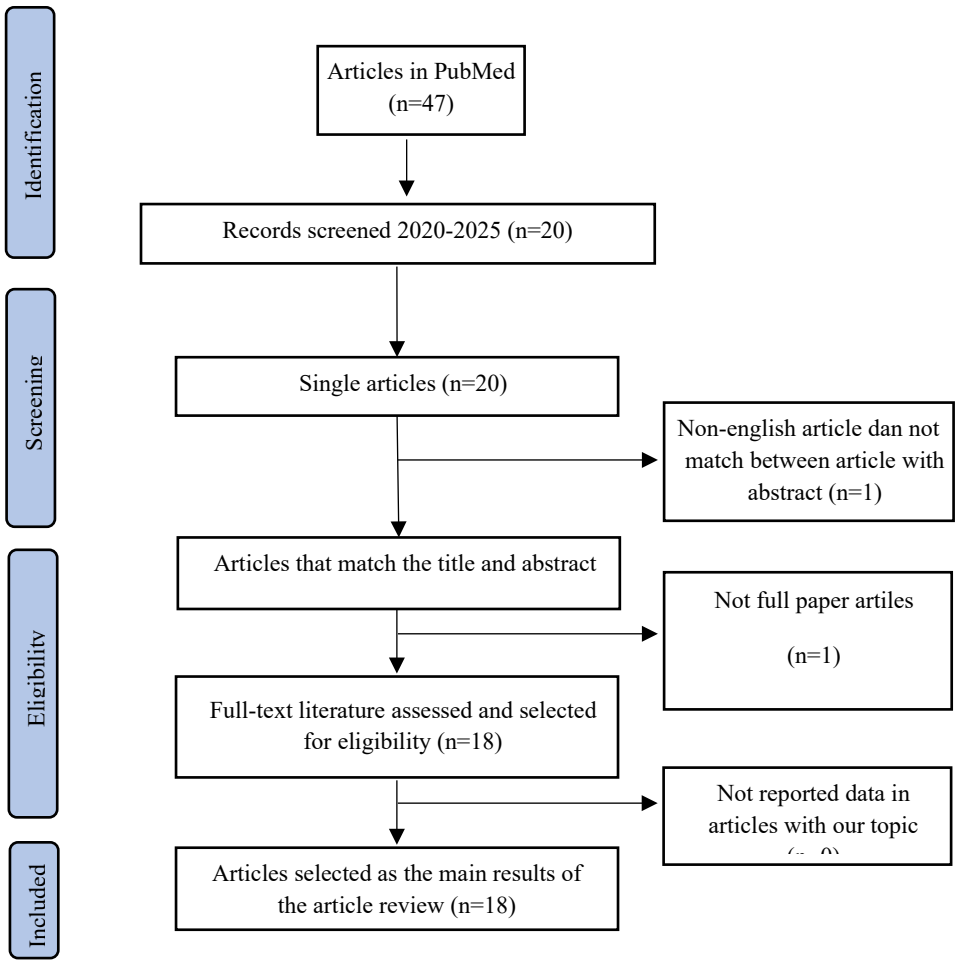
Methods: A systematic search of PubMed was conducted from July 2020 to July 2025. Studies reporting the incidence of Atrial Fibrillation among transfusion-dependent β-thalassemia, its pathophysiology, treatment efficacy, and prognosis.

Results: Eighteen studies from 20 specific studies from PubMed were eligible for the systematic review. Thus, studies have examined the relationship between the two diseases in many countries. The similar utility of the CHA_2DS_2-VASc score is a major risk factor for stroke incidence in atrial fibrillation in BT patients with a minimum score of two for women and one for men. These studies represent better outcomes of using anticoagulants in BT patients and could help control the mortality rate.

Conclusion: Anticoagulation remains an effective treatment for patients with Transfusion-Dependent Thalassemia. Although the risk of bleeding cannot be excluded, these studies show more benefits and seem safe.

Keywords: Atrial Fibrillation, Anti coagulant, Thalassemia, Transfusion

Figure 1. PRISMA Study Flow Chart.



The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV38]

Short-Term Exposure of Fine Particulate Air Pollution and Ventricular Arrhythmia in High-Risk Patients: A Systematic Review and Meta-Analysis

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Background: Previous studies have suggested that exposure to fine particulate air pollution may increase the risk of ventricular arrhythmias (VAs) in high-risk patients, particularly those with implantable cardioverter defibrillators (ICDs). However, the evidence remains unclear. This systematic review and meta-analysis aimed to assess the published evidence on the association between short-term exposure to fine particulate matter and the risk of VAs in patients with ICDs.

Methods: We systematically searched the PubMed, Web of Science, Embase, and CENTRAL databases to identify studies examining the short-term association between daily increases in fine particulate air pollutants [particulate matter with aerodynamic diameters ≤2.5 μm (PM2.5) and ≤10 μm (PM10)] and the incidence of ventricular arrhythmias recorded by ICDs. We included studies with exposure periods of up to seven days (lag 0-7). Statistical heterogeneity was assessed using the I^2 statistic and Q-test. A random-effects model was used to pool the estimates, with results presented as odds ratios (OR) and 95% confidence intervals (CI) for VAs per 10 $\mu g/m^3$ increase in PM2.5 and PM10 concentrations.

Results: Of the 824 articles identified, ten studies met the inclusion criteria, encompassing data from North America (USA and Canada) and Europe (Italy, UK, and Sweden). Pooled analysis demonstrated increased VA risk within 7 days for each 10 $\mu g/m^3$ increment in PM2.5 [OR: 1.018 (95% CI: 1.001–1.036)] and PM10 [OR: 1.020 (95% CI: 1.004–1.035)]. Both associations were statistically significant.

Conclusions: Our results demonstrate that short-term exposure to fine particulate matter is associated with an increased risk of ventricular arrhythmias in high-risk patients. From a clinical perspective, these results should encourage physicians to consider environmental risks when addressing VA prevention and advise patients to avoid exposure to high levels of fine particulate matter.

Keywords: Ventricular arrhythmia, fine particulate matter, implantable cardioverter-defibrillator, air pollution.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV39]

Efficacy and Safety of Low-Level Tragus Stimulation in Paroxysmal Atrial Fibrillation: A Meta-Analysis of Randomised Controlled Trials

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Background and Aims: Atrial fibrillation (AF) is the most common cardiac arrhythmia globally, affecting up to one in three individuals over the age of 45 years, with paroxysmal atrial fibrillation (PAF) contributing to approximately 50% of AF cases. The activity patterns of the autonomic nervous system (ANS) are key to the pathogenesis of AF. Low-voltage percutaneous stimulation of the auricular vagal branch through the tragus, also known as Low-Level Tragus Stimulation (LLTS), may suppress AF noninvasively by modulating the ANS and decreasing inflammatory cytokines. This study aimed to synthesize evidence on the efficacy and safety of LLTS in patients with PAF.

Methods: A systematic database search was conducted in PubMed, Scopus, ScienceDirect, Wiley, and ProQuest following the PRISMA guidelines. Identified RCTs investigating the efficacy or safety of LLTS in patients with PAF were included. The outcomes to be assessed included AF parameters, such as AF duration and burden, as well as inflammatory cytokines, such as IL-6 and IL-10. The risk of bias was evaluated using the Cochrane criteria. A meta-analysis was conducted using RevMan version 5.4.

Results: Data from 175 patients were obtained from five studies that examined PAF with LLTS. AF outcomes, including AF burden (SMD = -0.61; 95% CI: [-1.8, 0.59]; P = 0.3224) and duration (SMD = 1.82; 95% CI: [-4.37, 8.02]; P = 0.564), showed no difference in effect size between the LLTS and placebo groups. In addition, inflammatory cytokines (IL-6 and IL-10) were also statistically not significant with effect size (SMD= 0.02; 95%CI: [-0.38, 0.43]; P= 0.91) and (SMD= -0.00; 95%CI: [-0.41, 0.40]; P= 0.99), respectively.

Conclusion: No device-related adverse events were observed; however, LLTS did not significantly improve outcomes in patients with PAF. This may be linked to the scarcity of clinical trials on LLTS. The protocol and dosing of LLTS procedures have yet to be systematically determined and agreed upon. This suggests the need for further investigation and adjustment of LLTS procedures.

Keywords: low-level tragus stimulation, neuromodulation, paroxysmal atrial fibrillation, vagus nerve stimulation

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV40]

More than Meets the Eye: Ivabradine's Antiarrhythmic Potential in Automatic Supraventricular Tachycardias - A Systematic Review and Single-Arm Meta-Analysis

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Background and aims: Automatic supraventricular tachycardias (SVTs), notably junctional ectopic tachycardia (JET), focal atrial tachycardia (FAT), and multifocal atrial tachycardia (MAT), are often incessant, poorly responsive to conventional antiarrhythmic drugs, and can precipitate tachycardia-induced cardiomyopathy. Ivabradine, a selective I(f)-current inhibitor with hemodynamic neutrality, has been used off-label; however, its antiarrhythmic properties remain unexplored.

Materials and methods: Following PRISMA guidelines (PROSPERO CRD420251080412), nine databases were searched from inception to May 2025 for studies enrolling ≥5 patients of any age with uncomplicated automatic SVTs treated with oral/nasogastric ivabradine. Single-arm proportions were pooled using inverse-variance random-effects models after arcsine transformation, and continuous data were aggregated as means. The risk of bias was assessed using RoB-2, ROBINS-I, or the Methodological Quality and Synthesis of Case Series and Case Reports tools. Robustness was evaluated using subgroup and leave-one-out analyses.

Results: Seven studies (one randomized controlled trial, five cohort studies, and one case series) met the inclusion criteria, comprising 127 patients (94 with postoperative JET, 31 with FAT, one with congenital JET, and one with MAT), with a low to moderate risk of bias. Ivabradine dosing ranged from 0.05-0.20 mg/kg/dose twice daily. The pooled analysis showed a sinus rhythm conversion rate of 91.1% (95% CI, 74.3-100; I^2=76%), with a mean conversion time of 21.6 ± 18.2 hours. Automatic SVTs recurrence was 3.0% (95% CI, 0.0-12.0; I^2=36%). Concomitant antiarrhythmic drug (AAD) use was observed in 43.7% of patients (95% CI, 11.1-79.2; I^2=92%). No hypotension, QT prolongation, or conduction block was observed; the pooled bradycardia incidence was 0.0% (95% CI, 0-0.71; I^2=0%). All-cause mortality was 1.5% (95% CI, 0-7.7; I^2=14%). Subgroup analyses confined to postoperative JET or pediatric studies and leave-one-out sensitivity testing yielded nearly identical effect sizes, confirming the robustness of the results.

Conclusion: Ivabradine safely achieved rapid and durable sinus rhythm restoration in >90% of automatic SVTs episodes, even without concomitant AAD in over half of the cases. These data establish ivabradine as a credible salvage or adjunct antiarrhythmic for automatic SVTs and justify larger multicenter RCTs to refine dosing and combination strategies.

Keyword: Ivabradine; Supraventricular Tachycardia; Junctional Ectopic Tachycardia; Atrial Tachycardia; Anti-Arrhythmic Agents

Table 1. Pooled ivabradine outcomes for automatic SVTs.

Outcome	Studies	Events	Estimate (%)	I^2 (%)
Sinus Rhythm Conversion	7	110/127	91.1 (74.3-100.0)	76
Conversion Time	4	66/68	21.6 ± 18.2 hours	NA
Automatic SVTs recurrence	5	7/94	3.0 (0.0-12.0)	36
Concomitant AAD	7	31/127	43.7 (11.1-79.2)	92
Hypotension	7	0/127	NA	0
QT prolongation	7	0/127	NA	0
Conduction block	7	0/127	NA	0
Bradycardia	7	1/127	0.0 (0.0-0.7)	0
All-cause mortality	6	5/99	1.5 (0.0-7.7)	14

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV41]

Flecainide as an Adjunct Therapy to Beta-Blockers for Exercise-Induced Ventricular Arrhythmias in Catecholaminergic Polymorphic Ventricular Tachycardia: An Updated Systematic Review and Meta-Analysis

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[2]*Majenang Regional Public Hospital, Cilacap, Central Java, Indonesia*
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Background and aims: Catecholaminergic polymorphic ventricular tachycardia (CPVT) is a rare inherited arrhythmia that causes dangerous rapid heartbeats during exercise or adrenergic stress. Although β-blockers are the first-line treatment for CPVT, they often fail to completely prevent adrenergically mediated arrhythmias. Flecainide has been shown to significantly reduces exercise-induced ventricular arrhythmias when combined with maximally tolerated β-blocker therapy. This study aimed to investigate the effects of flecainide as an add-on to conventional β-blocker therapy on exercise-induced ventricular arrhythmias.

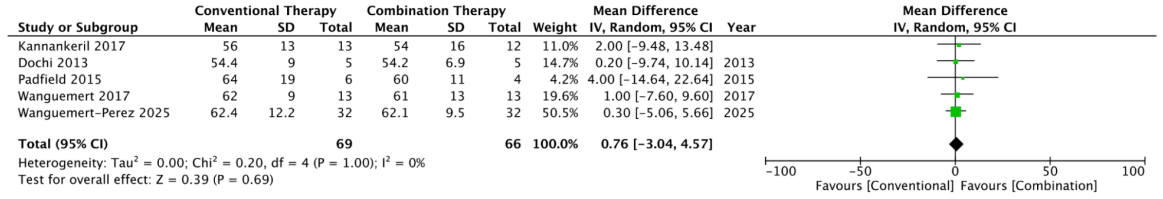
Materials and methods: A comprehensive literature search was conducted across PubMed, ScienceDirect, Wiley, Scopus, and Cochrane Library following the PRISMA 2020 guidelines to identify retrospective cohort studies and randomized controlled trials (RCTs). Data were extracted and analyzed using RevMan, with outcomes expressed as risk ratios (RR) or mean difference (MD).

Results: Eight cohort studies and one RCT involving 378patients with CPVT who received flecainide were included in the analysis. Flecainide, in addition to conventional therapy, significantly reduced the risk of exercise-induced arrhythmia (RR = 2.44, CI = [0.16, 1.43], P = 0.01). Patients receiving combination therapy also showed a significantly lower maximal heart rate during exercise testing than those receiving conventional therapy (RR = 4.03, CI = [7.16, 20.74], P <0.0001). However, no significant differences were observed in resting heart rate (RR = 0.76, CI = [-3.04, 4,57], P = 0.69) or sinus rate at the onset of ventricular arrhythmias (RR = -4.88, CI = [-16.75, 7.00], P = 0.42) when treated with the combination therapy of flecainide and β-blocker compared to β-blocker alone. No fatalities were reported in patients who received flecainide.

Conclusion: The addition of flecainide to β-blocker therapy was associated with a significantly reduced incidence of exercise-induced ventricular arrhythmias compared to β-blocker monotherapy in patients with CPVT.

Keywords: catecholaminergic polymorphic ventricular tachycardia, flecainide, β blocker, exercise-induced ventricular arrhythmia

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125



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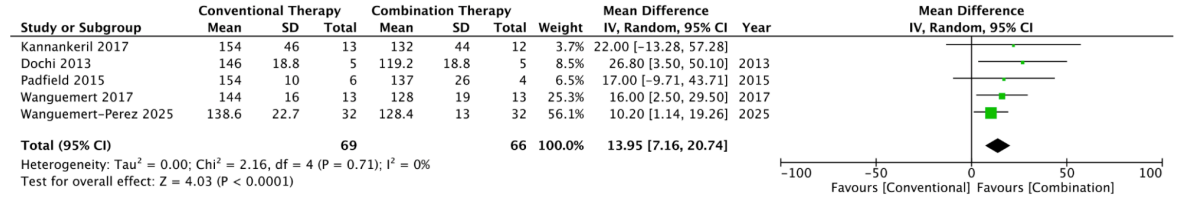

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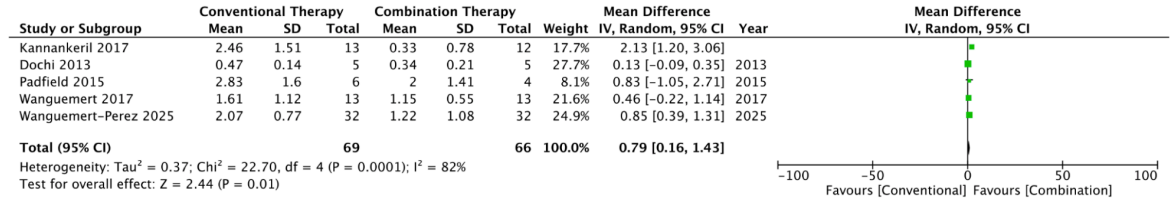

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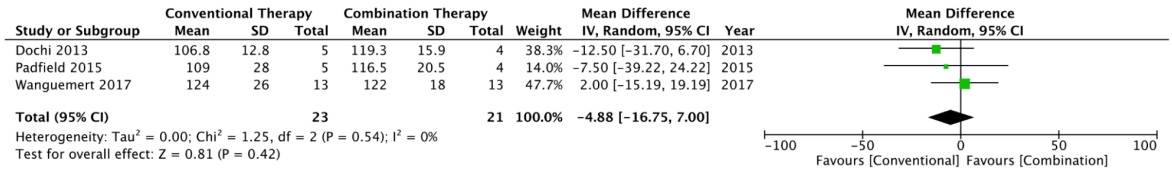

(D)

Figure 1. Forest plots of mean differences in the comparison between flecainide in addition to β-blocker therapy (combination) and β-blocker monotherapy (conventional) for (A) resting heart rate, (B) maximal heart rate, (C) exercise-induced arrhythmia score, and (D) sinus rate at the onset of ventricular arrhythmias during exercise testing.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV42]

Improving ICD and CRT-D Candidate Selection Through Cardiac MRI Scar Characterization: A Systematic Review

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Background: Implantable cardioverter-defibrillators (ICDs) and cardiac resynchronization therapy-defibrillators (CRT-Ds) are guideline-recommended therapies for patients with left ventricular ejection fraction (LVEF) ≤35% at risk of sudden cardiac death. However, a significant proportion of patients receive these devices without subsequently requiring appropriate therapy, while others experience inappropriate shocks or psychological and quality of life burdens. This highlights the need for improved patient selection. Cardiac magnetic resonance (CMR) imaging, particularly late gadolinium enhancement (LGE), offers a noninvasive method to characterize myocardial scars, which may aid in risk stratification and refine ICD/CRT-D implantation decisions.

Materials and methods: We systematically searched PubMed for English-language studies evaluating CMR-based characterization of myocardial scars and their association with appropriate ICD/CRT-D therapy. From an initial yield of 132 articles, five studies met the inclusion criteria.

Results: All included studies assessed myocardial scar metrics, including scar mass, scar percentage, and border zone (BZ) mass/percentage, using LGE-CMR. These parameters were correlated with appropriate ICD therapies, including antitachycardia pacing (ATP) and shocks. Patients who experienced appropriate ICD interventions consistently demonstrated significantly higher total scar and BZ masses. In some studies, specific scar thresholds demonstrated a high negative predictive value (up to 100%) for ICD therapy, suggesting strong clinical utility. These findings highlight the role of CMR not only in identifying high-risk individuals but also in potentially avoiding unnecessary device implantation in lower-risk patients, such as the selection of CRT-P over CRT-D.

Conclusion: Myocardial scar assessment via CMR is a valuable tool for improving patient selection for ICD and CRT-D implantation. Incorporating scar quantification into the current criteria may reduce overtreatment and optimize outcomes in patients with heart failure.

Keywords: Myocardial scar, Cardiac Magnetic Resonance, Implantable Cardioverter Defibrillator, Cardiac Resynchronization Therapy

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV43]

Comparative Effectiveness of Substrate-Guided Ablation Strategies Versus Conventional Pulmonary Vein Isolation in Persistent Atrial Fibrillation: A Systematic Review and Meta-analysis of Electroanatomic Mapping-Guided Interventions

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Background and aims: Atrial fibrillation (AF) affects more than 37 million individuals globally, with catheter ablation, predominantly pulmonary vein isolation (PVI), constituting a fundamental approach for rhythm management. In persistent atrial fibrillation (PeAF), pulmonary vein isolation (PVI) is frequently inadequate because of atrial substrate remodeling. Strategies for substrate-guided ablation aimed at electroanatomic irregularities, including low-voltage areas (LVA), complex fractionated atrial electrograms (CFAE), rotors, and fibrosis, have been suggested to enhance outcomes. This study aimed to compare substrate-guided ablation with conventional pulmonary vein isolation in patients with persistent atrial fibrillation, assessing their efficacy in rhythm control and procedural results.

Materials and Methods: This study followed the Preferred Reporting Items for Systematic Review and Meta-analysis extension for Network Meta-Analyses (PRISMA-NMA) and the Cochrane Collaboration Handbook guidelines. Literature searches were conducted in PubMed, Scopus, EBSCOhost, and ScienceDirect until July 2025. A meta-analysis using RevMan assessed the effects of substrate-guided ablation versus pulmonary vein isolation (PVI) on reducing recurrence rate of atrial arrhythmia recurrence rates, achieving arrhythmia freedom, and comparing rhythm control outcomes.

Results: Ten studies with 2,407 participants were analyzed. Substrate-guided ablation showed a trend toward reduced arrhythmia recurrence (RR 0.89; 95% CI: 0.77–1.02) and enhanced freedom from arrhythmia (RR 1.10; 95% CI: 0.99–1.23) compared with that of pulmonary vein isolation alone. Although these findings did not reach statistical significance, the consistent direction of the benefits observed across studies indicates a potentially meaningful clinical trend.

Conclusion: Substrate-guided ablation showed a favorable trend toward reducing arrhythmia recurrence and improving rhythm control in persistent atrial fibrillation, although statistical significance was not consistently achieved. This underscores the potential significance of substrate-guided strategies in addressing the intricate atrial remodeling associated with persistent atrial fibrillation. The consistent direction of effect across studies supports the use of substrate-guided strategies as promising adjuncts to conventional ablation, warranting further investigation.

Keywords: Persistent atrial fibrillation, substrate-guided ablation, pulmonary vein isolation, meta-analysis

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV44]

Harmful or Beneficial? A Systematic Review of Anticoagulant Usage for Sepsis-Driven Atrial Fibrillation

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Background and aims: New-onset atrial fibrillation (AF) is common in patients with sepsis and is associated with an increased risk of thromboembolism and high recurrence rates. The decision to initiate anticoagulant therapy in this context remains a dilemma. This study aimed to review the relevant literature on the efficacy and risks of anticoagulants in patients with sepsis-driven AF.

Materials and methods: This systematic review was conducted following the PRISMA guidelines. Articles in English published between 2015 and 2025 were searched in PubMed/MEDLINE and Google Scholar using the keywords "sepsis (AND) atrial fibrillation (OR) AF (AND) anticoagulation (OR) anticoagulants".

Results: A total of 41,179 patients with sepsis-driven AF from five studies were reviewed. Anticoagulants were prescribed in 27.4–50% of patients, and heparin was the most frequently prescribed drug in this study. The results demonstrated that anticoagulant utilization did not reduce the risk of stroke, with a recorded incidence ranging from 1.05-7.14% compared to 1.40-5.40% in non-anticoagulated patients. Bleeding outcomes have been inconsistently reported with the use of anticoagulants; three studies found no significant association, whereas one study reported an association between anticoagulants and bleeding risk. The mortality rates of patients with new-onset AF during sepsis were consistently lower in anticoagulated patients, reported at around 17.44-47.13%, and up to 66.43% in non-anticoagulated patients.

Conclusion: Although anticoagulants in sepsis-driven AF may not lower the stroke risk, their association with reduced mortality suggests potential benefits in selected patients. Considering the varying bleeding risks associated with anticoagulant therapy, clinical decision-making should be individualized based on patient risk profiles.

Keywords: anticoagulants, atrial fibrillation, sepsis

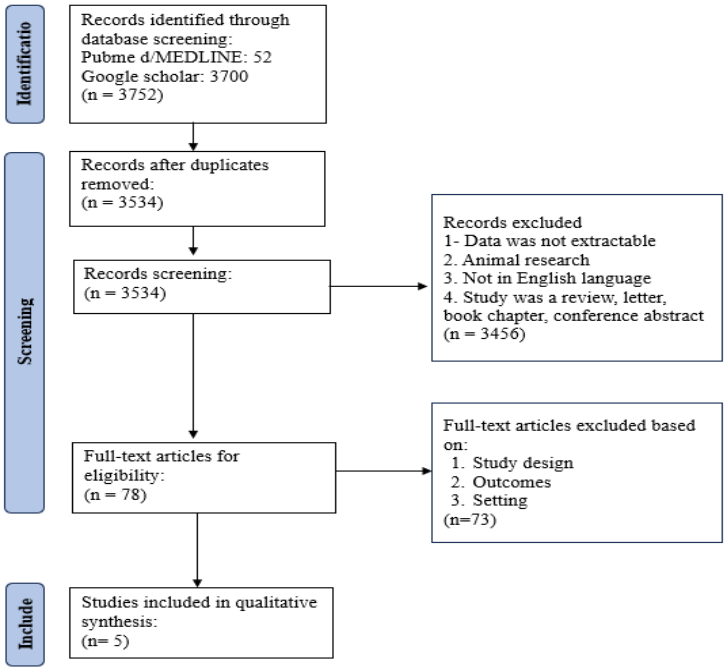

Figure 1. PRISMA Flow diagram.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV45]

Uncovering Occult Atrial Fibrillation from Sinus Rhythm ECGs Using Artificial Intelligence: A Meta-Analysis of Predictive Accuracy

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Background and aims: Atrial fibrillation (AF) is often underdiagnosed, but is associated with significant morbidity and mortality. Conventional risk stratification based on visible electrocardiogram (ECG) features and clinical characteristics is limited in its ability to detect subclinical AF. Advances in artificial intelligence (AI) have enabled subtle detection of occult AF. This meta-analysis evaluated the accuracy of AI algorithms in predicting hidden paroxysmal AF from sinus rhythm ECGs and compared their performance across model types.

Materials and methods: A literature search was conducted in PubMed, Scopus, Web of Science, ProQuest, and EBSCOhost in June 2025. Studies on the use of AI models to detect paroxysmal AF from sinus rhythm ECGs were included. Quality was assessed using the Prediction Model Risk of Bias Assessment Tool (PROBAST). The pooled AUC, sensitivity, specificity, and diagnostic odds ratio (DOR) were calculated using metafor package 4.8 in R 4.5.1, MetaDTA, and Meta-DiSc. Funnel plot asymmetry was assessed using Egger's test. Subgroup analyses were performed according to the AI model type and ECG lead.

Results: Forty-five studies with 361,810 patients and 1,268,246 sinus rhythm ECG recordings were included. Twenty-seven studies reported model development outcomes, and 20 reported cohort validation outcomes. The pooled sensitivity and specificity of the AI-based prediction of paroxysmal AF were 75.5% (95% CI: 69.8%–80.4%) and 66.2% (95% CI: 59.9%–72.0%), respectively. The pooled DOR was 6.04 (95% CI: 4.44–8.21). Studies incorporating ECG with clinical parameters showed a higher sensitivity of 76% (95% CI: 70.6%–80.6%), specificity of 77.3% (95% CI: 70.5%–83.0%), and DOR of 10.80 (95% CI: 6.64–17.56). Subgroup analysis revealed higher accuracy for image-based models than for sequential, feature-based, and traditional algorithms. Twelve-lead and 24-hour Holter ECG inputs were also found to be superior. Egger's test showed no significant publication bias.

Conclusion: AI demonstrated high diagnostic accuracy in identifying paroxysmal AF from sinus rhythm ECGs. These findings support the incorporation of AI-based ECG analysis into AF screening strategies, particularly for asymptomatic at-risk populations.

Keyword: Atrial fibrillation; Artificial intelligence; Electrocardiogram; Sinus rhythm

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

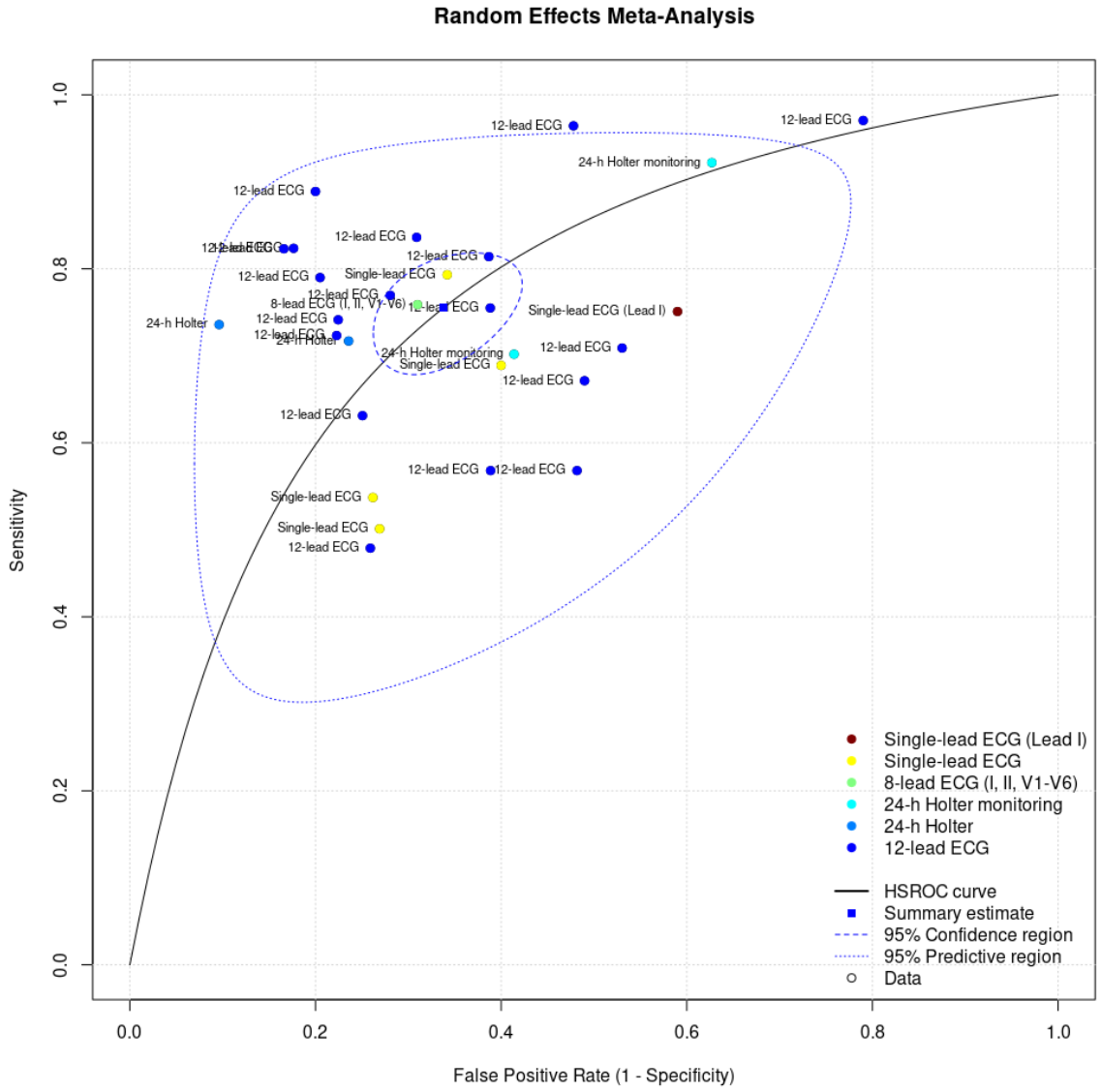

Figure 1. Summary Receiver Operating Characteristic (SROC) Curve of Artificial Intelligence Performance in Detecting Hidden Paroxysmal Atrial Fibrillation from Sinus Rhythm Electrocardiograms.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV46]

Revisiting the Obesity Paradox in Atrial Fibrillation: A Meta-Analysis of Randomized Controlled Trials

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Background and aim: While obesity is a known risk factor for atrial fibrillation (AF), emerging evidence suggests a paradoxical association in which overweight and obese patients may experience better cardiovascular outcomes—termed the "obesity paradox." This phenomenon has been observed particularly in anticoagulated AF populations, raising questions about the impact of body mass index (BMI) on thromboembolic and mortality risk. This meta-analysis aimed to assess the relationship between BMI and adverse outcomes in patients with AF who received oral anticoagulant therapy.

Materials and methods: This study adheres to the PRISMA guidelines, with a search conducted in PubMed, ScienceDirect, and Scopus using the keywords "obesity" and "atrial fibrillation." Data were extracted from clinical trials, and risk ratios (RRs) with 95% confidence intervals (CIs) were calculated using a random-effects model.

Results: This meta-analysis included five randomized controlled trials (RCTs) comprising anticoagulated atrial fibrillation (AF) patients, all of which were assessed as having a low risk of bias. Across all outcomes, overweight and obese individuals consistently demonstrated a protective effect compared with their normal-weight counterparts. For stroke/systemic embolism, both overweight (RR 0.87, 95% CI: 0.76–0.98) and obese patients (RR 0.62, 95% CI: 0.56–0.70) had significantly lower event rates. Similarly, for major bleeding, obesity (RR 0.70, 95% CI: 0.59–0.84) and being overweight (RR 0.80, 95% CI: 0.70–0.92) were associated with a reduced risk. The most notable impact was observed in mortality, where obese (RR 0.63, 95% CI: 0.56–0.70) and overweight individuals (RR 0.87, 95% CI: 0.78–0.98) experienced significantly decreased risk of death compared with normal-weight individuals. Notably, direct comparisons revealed that obese patients had significantly lower risks of stroke (RR 0.72), major bleeding (RR 0.88), and mortality (RR 0.80) than overweight patients, suggesting a graded protective effect across the BMI categories.

Conclusion: Our findings support the presence of an obesity paradox among anticoagulated patients with AF, particularly for mortality and stroke-related outcomes.

Keywords: obesity paradox, body mass index, atrial fibrillation, oral anticoagulants, meta-analysis

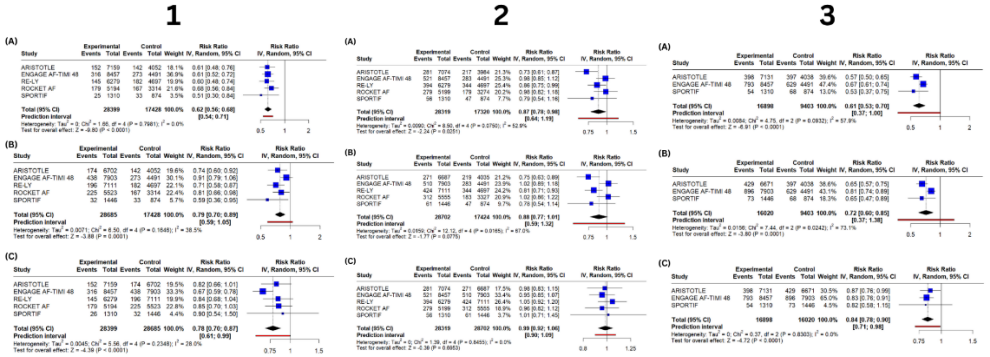

Figure 1. Forest plots comparing (A) obese vs. normal BMI, (B) overweight vs. normal BMI, and (C) obese vs. overweight patients across three outcomes: (1) stroke/systemic embolism, (2) major bleeding, and (3) all-cause mortality.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV47]

Catheter Ablation Versus Antiarrhythmic Drug Therapy as First-Line Rhythm Control in Atrial Fibrillation: Comparative Efficacy in Reducing Symptom Recurrence

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Background: Atrial fibrillation (AF) is the most prevalent form of cardiac arrhythmia. Current treatment guidelines for patients with AF recommend initial management with antiarrhythmic drugs (AADs), which play a key role in long-term rhythm control, particularly in patients who are considered ineligible for catheterization. Conversely, catheter ablation (CA) is a therapeutic option for patients intolerant to AAD therapy. This study aimed to evaluate the efficacy of first-line CA compared with AAD therapy as a rhythm-control strategy for reducing the long-term recurrence of AF.

Methods: A systematic literature search was conducted in PubMed, ScienceDirect, and the Cochrane Library, targeting randomized controlled trials (RCTs) published within the past ten years. Studies were included if they compared CA with AAD therapy as first-line management in patients with AF. The study selection, data extraction, and methodological quality assessment were performed using the Center for Evidence-Based Medicine (CEBM) Study Appraisal Tool.

Results: Three RCTs met the inclusion criteria, with publication years ranging from 2015 to 2025 and sample sizes ranging from 203–303 participants. The first study demonstrated that the proportion of patients achieving freedom from AF at 12 months was significantly higher in the CA group (82.2% vs. 67.6%; RR < 1; RRR = 0.451). Additionally, the incidence of symptomatic palpitations was lower in the CA group (7.61 days/year) than in the AAD group (18.96 days/year; IRR = 0.40, $p < 0.001$). The second study similarly reported a higher proportion of patients free of AF at 12 months in the CA group than in the AAD group (73.0% vs. 64.3%; 95% CI: 64.3%–81.7% vs. 25.3%–43.9%). The third study reported a significantly lower rate of AF recurrence in the CA group than in the AAD group (42.9% vs. 67.8%; 95% CI: 0.35 to 0.66; $p < 0.001$).

Conclusion: Catheter ablation as an initial treatment for symptomatic AF was associated with a higher rate of freedom from AF and a lower burden of recurrent symptoms within approximately one year of follow-up compared with ADD therapy.

Keywords: Catheter Ablation, Antiarrhythmic Drugs, Atrial Fibrillation

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV48]

Comparative Efficacy and Safety of Modern Ablation Strategies Versus Conventional Radiofrequency Ablation in Atrial Fibrillation: A Multiple Treatment Comparison Meta-Analysis

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Backgrounds and aims: Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia, contributing significantly to morbidity, mortality, and healthcare utilization. Modern ablation strategies, such as high-power short-duration (HPSD), cryoballoon ablation (Cryo), and pulsed-field ablation (PFA), have emerged as alternatives to conventional radiofrequency ablation (RFA) for AF. Each modality offers distinct mechanisms and theoretical safety advantages; however, comparative data regarding efficacy and safety remain inconclusive. We conducted a meta-analysis to evaluate these outcomes head-to-head against RFA.

Methods: A systematic literature search was conducted in several databases, including PubMed, Embase, SCOPUS, and Web of Science, up to June 2025, identifying randomized controlled trials and observational studies comparing modern ablation modalities (HPSD, Cryo, PFA) with conventional RFA. Efficacy outcomes included freedom from atrial arrhythmia and first-pass isolation (FPI) rate. Safety outcomes included pericardial effusion, cardiac tamponade, stroke or thromboembolism, vascular complications, and phrenic nerve injury.

Results: Thirty-three studies encompassing > 5000 participants met the inclusion criteria. The population was middle-aged (mean age 63 years) and predominantly male. Compared with conventional radiofrequency ablation (RFA), none of the modern techniques altered rhythm-control efficacy at ≥12 months: high-power short-duration (HPSD) versus RFA risk ratio (RR) 1.06 (95 % CI 0.97–1.16); cryoballoon versus RFA RR 1.02 (0.94–1.12); pulsed-field ablation (PFA) versus RFA RR 0.98 (0.85–1.12); and HPSD versus very-high-power short-duration (vHPSD) RR 1.03 (0.89–1.19). Major acute complications, including pericardial effusion/tamponade, stroke or systemic thromboembolism, vascular injury, and phrenic nerve palsy, were rare and statistically comparable across modalities, with all confidence intervals crossing unity. Only HPSD improved procedural efficiency, shortening procedure duration by a pooled mean of 41.9 minutes (95 % CI : –60.9 to –22.8), while fluoroscopy time remained unchanged. Evidence of pseudoaneurysm and pulmonary vein stenosis was too sparse for quantitative synthesis.

Conclusions: Modern ablation technologies, such as HPSD, cryoballoon, PFA, and vHPSD, provide freedom from atrial arrhythmia and safety profiles equivalent to those of conventional RFA. HPSD alone provides a meaningful procedural time advantage without compromising efficacy or safety. Accordingly, the selection of ablation modality should prioritize operator expertise, equipment availability, and workflow considerations rather than expectations of superior rhythm outcomes.

Keywords: Atrial fibrillation, radiofrequency ablation, high-power short-duration, cryoballoon ablation, and pulsed field ablation

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV49]

Diagnostic accuracy of artificial intelligence for atrial fibrillation detection using electrocardiogram: a single-arm meta-analysis

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Background and aims: Atrial fibrillation (AF) is the most prevalent sustained cardiac arrhythmia, associated with significant morbidity and mortality. Although electrocardiography (ECG) remains the gold standard for AF detection, manual interpretation is time-consuming and subject to inter-observer variability. Artificial intelligence (AI) has emerged as a promising approach for improving diagnostic accuracy and efficiency. This study aimed to evaluate the diagnostic performance of AI-based algorithms for AF detection through a systematic review and meta-analysis.

Materials and methods: A comprehensive search of PubMed, Scopus, the Cochrane Library, and Google Scholar was conducted to identify studies reporting the diagnostic accuracy of AI-based algorithms for AF detection using ECGs. Studies providing sufficient data to construct 2×2 contingency tables were included in this review. Pooled sensitivity, specificity, and diagnostic odds ratios (DOR) were calculated with 95% confidence intervals (CI) using RStudio. Study quality was assessed using QUADAS-2.

Results: Twenty-six studies encompassing 2,222,373 ECG data points met the inclusion criteria. The pooled sensitivity and specificity of the AI algorithms for AF detection were 0.90 (95% CI: 0.83–0.94) and 0.94 (95% CI: 0.90–0.97), respectively. The DOR was 134.182 (95% CI: 51.182–352.085). The summary receiver operating characteristic (SROC) curve showed an area under the curve (AUC) of 0.965, indicating excellent diagnostic performance.

Conclusion: AI-based ECG interpretation demonstrates high accuracy in detecting atrial fibrillation, with excellent sensitivity, specificity, and AUC values. These findings support the clinical integration of AI tools to enhance the early diagnosis of AF and potentially reduce the related complications.

Keywords: atrial fibrillation, electrocardiogram, artificial intelligence, sensitivity, specificity

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV50]

Diagnostic Accuracy of Remote Dielectric Sensing in Detecting Pulmonary Congestion Among Heart Failure Patients: A Systematic Review and Meta-Analysis

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Background and Aims: Pulmonary congestion is a pivotal complication of heart failure (HF), driving morbidity and frequent hospitalizations. It occurs in up to 90% of hospitalized HF patients and precipitates nearly 80% of acute decompensation cases. Traditional detection methods lack both sensitivity and specificity. Remote dielectric sensing (ReDS), a non-invasive approach, quantifies lung fluid content with a reported sensitivity of 85% and specificity of 80% for detecting pulmonary congestion in patients with HF. This systematic review and meta-analysis aimed to robustly assess the diagnostic accuracy of ReDS and support informed clinical management of HF.

Materials and methods: Our systematic review and meta-analysis were conducted according to the PRISMA 2020 guidelines. PubMed, Scopus, and Cochrane were searched until July 2025 for studies assessing the diagnostic accuracy of ReDS in detecting pulmonary congestion in patients with heart failure. A random-effects meta-diagnostic model was employed. Sensitivity, specificity, and AUC were pooled using the R{mada} package with 95% confidence intervals (CIs). Heterogeneity was assessed using Higgins I^2 statistic.

Results: Four studies met our inclusion criteria. The pooled sensitivity was 87.5%, specificity was 50.5%, and area under the curve was 0.844. The sensitivity of 87.5% indicates perfect accuracy in detecting individuals with heart failure, supported by a high area under the curve of 0.844. Overall, this tool is a perfect medium for detecting pulmonary congestion. However, low specificity may increase the risk of misdiagnosis in patients without pulmonary congestion.

Conclusion: Remote dielectric sensing (ReDS) shows strong potential as a non-invasive tool for detecting pulmonary congestion in heart failure, offering high sensitivity and clinical utility for identifying true-positive cases. However, its limited specificity underscores the need for cautious interpretation and potential adjunctive use with other diagnostic methods to improve its accuracy. Further large-scale studies are necessary to optimize the diagnostic thresholds and improve the generalizability across varied patient populations.

Keywords: Heart Failure, Pulmonary Congestion, Mobile, App

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV51]

Comparative Efficacy Of SGLT2 Inhibitors Versus DPP-4 Inhibitors And GLP-1 Receptor Agonists On The Incidence Of Atrial Fibrillation In Patients With Type 2 Diabetes Mellitus: A Systematic Review And Meta-analysis

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Background and aims: Type 2 diabetes mellitus (T2DM) is an established independent risk factor for atrial fibrillation (AF), driven by complex pathophysiological mechanisms, including structural and electrical remodeling. Newer antihyperglycemic agents, such as sodium-glucose cotransporter-2 inhibitors (SGLT2i), dipeptidyl peptidase-4 inhibitors (DPP4i), and glucagon-like peptide-1 receptor agonists (GLP1RA), have demonstrated diverse cardiovascular effects beyond those of glycemic control. However, their comparative efficacy in preventing incident AF remains uncertain, representing a critical knowledge gap in clinical decision-making in this high-risk population. This meta-analysis aimed to compare the relative risks of incident AF among these three major drug classes in patients with T2DM.

Materials and methods: A systematic search was conducted in PubMed and EMBASE for studies comparing the risk of incident AF between newer antihyperglycemic agents. From the initial 364 articles, 20 studies were included in the final analysis. A random-effects meta-analysis was performed to estimate the pooled relative risks (RRs) with 95% confidence intervals (CIs). The restricted maximum-likelihood (REML) method was used to estimate the between-study variance, and the Hartung-Knapp adjustment was applied to the confidence intervals.

Results: Twenty studies comprising 1,868,778 patients with T2DM were included. Overall, the use of SGLT2i significantly reduced the risk of AF compared with DPP4i (RR, 0.78; 95%CI, 0.72–0.84; $p<0.0001$; 15 studies; $I^2=65.3\%$) and GLP1RA (RR, 0.84; 95%CI, 0.75–0.95; $p=0.0042$; 14 studies; $I^2=85.1\%$). Significant heterogeneity was observed across the studies (overall $I^2 = 78.7\%$). A test for subgroup differences found no significant difference in the protective effect of SGLT2i compared with that of DPP4i or GLP1RA ($p=0.34$).

Conclusion: In this large-scale meta-analysis, treatment with SGLT2i was associated with a significantly lower risk of incident AF in patients with T2DM than treatment with either DPP4i or GLP1RA. Although heterogeneity was present, the protective effect of SGLT2i was consistent across the two comparator subgroups. These findings support the consideration of SGLT2i as the preferred agent for the primary prevention of AF in high-risk populations. However, the final choice of antihyperglycemic therapy should be individualized, considering patient-specific factors, contraindications, and healthcare economic aspects not covered by this analysis.

Keywords: Atrial Fibrillation, GLP-1 Receptor Agonists, Type 2 Diabetes Mellitus, SGLT2 Inhibitors, DPP-4 Inhibitors

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
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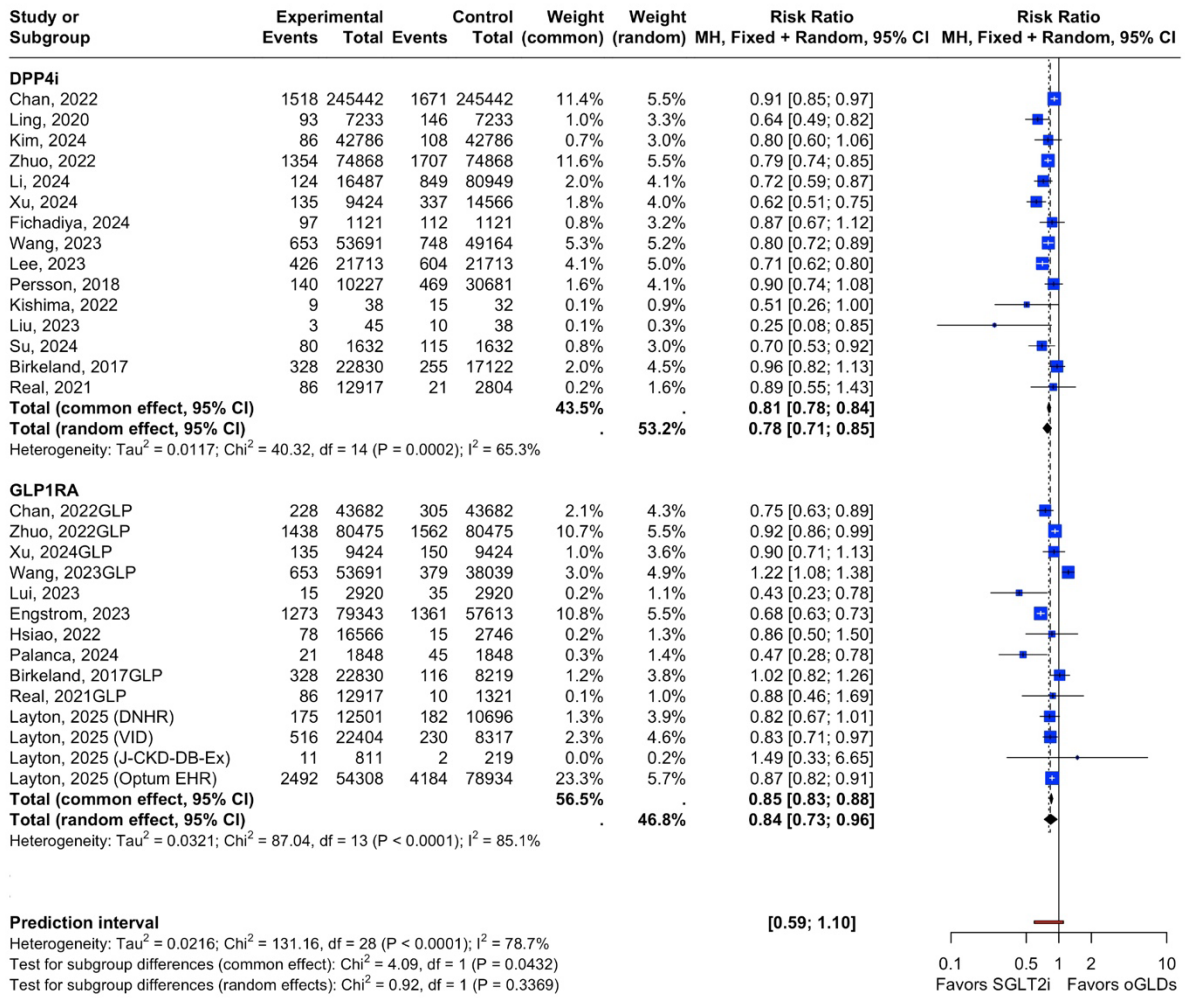

Figure 1. Main forest plot of incident AF RR between SGLT2i and DPP4i and SGLT2i and GLP1RA.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV52]

Etripamil Nasal Spray for Supraventricular Tachycardia: A Rapid, Safe Solution? Insights from a Network Meta-Analysis

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Background and aims: Supraventricular tachycardia (SVT) is a major public health issue that significantly affects patients' health. Rapid conversion to sinus rhythm is challenging because of the limited non-parenteral options, especially outside healthcare settings. Etripamil nasal spray, a short-acting calcium channel blocker, offers a promising solution by enabling effective, self-administered treatment for acute SVT episodes. This study aimed to perform a comprehensive network meta-analysis to determine the most effective dosing strategy for etripamil.

Materials and methods: We conducted a systematic search in accordance with the PRISMA guidelines using PubMed, Cochrane, Scopus, and ScienceDirect to identify relevant cohort studies. We included studies published up to June 2025 that involved adults aged 17 years and older who were treated with etripamil nasal spray for acute SVT. The outcomes of this network meta-analysis included a network plot of the included studies, comparisons of different doses, and the incidence of serious adverse events (SAEs). Data were analyzed using Review Manager (RevMan), and the quality of each study was assessed using the Cochrane Risk of Bias Tool 2.0.

Results: This network meta-analysis included four studies with 560 patients and assessed the efficacy and safety of etripamil nasal spray (doses ranging from 35 mg to 140 mg) for the acute conversion of SVT. The pooled risk ratio (RR) for efficacy was 1.84 [95%CI: 1.37–2.47], indicating a significant improvement in SVT conversion rates compared to placebo. The network plot illustrated strong interconnections across the treatment arms, reinforcing the robustness of the efficacy findings. For safety, the pooled RR for serious adverse events (SAEs) was 1.74 [0.29–10.43], suggesting a non-significant increase in the risk of SAEs with etripamil. Overall, although etripamil at a 70 mg dose appears to be both effective and safe for acute SVT therapy, further large-scale studies are needed to confirm these findings.

Conclusion: This network meta-analysis suggests that etripamil nasal spray at a 70 mg dose is a promising, effective, and safe option for the acute conversion of SVT, with a significantly higher success rate than placebo. Further large-scale randomized trials are warranted to refine the optimal dosing strategies.

Keywords: Supraventricular tachycardia, Etripamil nasal spray, Efficacy, Serious adverse events, Network meta-analysis

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
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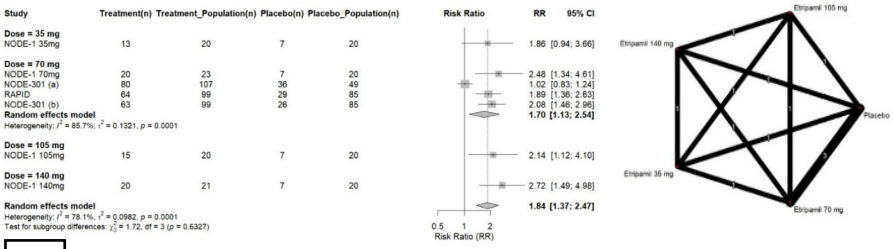

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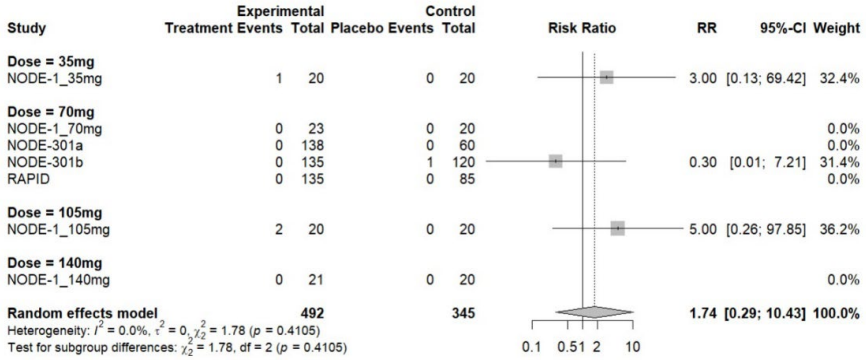

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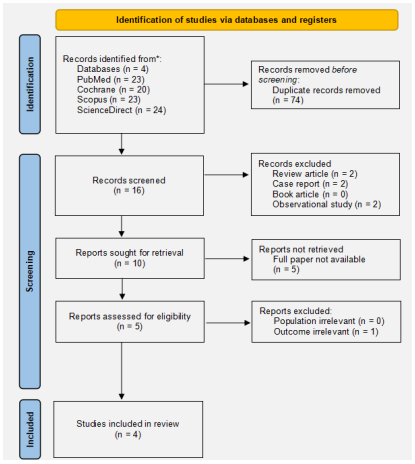

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Figure 1. (A) Forest and network plot for etripamil nasal spray for acute conversion of SVT; **(B)** Forest Plot for etripamil nasal spray for serious adverse events (SAEs) as safety aspects; **(C)** PRISMA flowchart.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV53]

Pericardial Fat Volume as a Predictor of Atrial Fibrillation: A Systematic Review and Meta-Analysis of Prospective Imaging Studies

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Background and Aim: Pericardial fat is metabolically active adipose tissue that surrounds the heart. Its proximity to the myocardium allows it to release inflammatory and oxidative mediators that may affect atrial structures and functions. This interaction is thought to contribute to the development of atrial fibrillation (AF). Although several imaging studies have investigated this relationship, the findings remain inconsistent. This study aimed to assess whether a higher pericardial fat volume, as measured by cardiac CT or MRI, is independently associated with an increased risk of incident or recurrent AF.

Methods: We performed a systematic review and meta-analysis of prospective cohort studies published between 2015 and 2025. Eligible studies included adults without baseline permanent AF, used CT or MRI to measure pericardial or epicardial fat, and reported hazard ratios (HRs) for incident or recurrent AF. Data on the study design, adjusted effect sizes, and risk of bias (assessed using the ROBINS-I tool) were extracted. Log-transformed HRs were pooled using a fixed-effects model, and subgroup analyses were conducted according to imaging modality.

Results: Three prospective studies involving 1,240 participants met the inclusion criteria. Two studies used CT, and one used MRI. All were adjusted for major cardiovascular risk factors, including age, sex, BMI, hypertension, and diabetes. The pooled analysis showed that a higher pericardial fat volume was significantly associated with an increased AF risk (HR 1.71; 95% CI 1.33–2.20; standard error 0.13; $p < 0.001$). Subgroup analysis showed consistent associations across both CT and MRI modalities. The overall risk of bias was rated as low to moderate.

Conclusions: Greater pericardial fat volume, as measured by CT or MRI, is independently associated with a higher risk of developing atrial fibrillation. These findings support the potential use of LAVI as a noninvasive imaging biomarker for AF risk prediction. Future studies should focus on standardizing fat measurement methods to improve their clinical applicability.

Keywords: Pericardial Fat, Atrial Fibrillation, Cardiac Imaging, Computed Tomography, Magnetic Resonance Imaging

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV54]

Insulin Resistance and Atrial Fibrillation: Is the Triglyceride-Glucose (TyG) Index a Reliable Post-Ablation Prognostic Marker? A Systematic Review and Meta-Analysis

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Background and aims: Atrial fibrillation (AF) is a common tachyarrhythmia associated with high mortality rates. Insulin resistance (IR), a hallmark of diabetes, is a risk factor for atrial fibrillation (AF). Ablation as a first-line therapy for AF is effective in improving arrhythmia-related outcomes in patients with AF. AF recurrence after catheter ablation is more common in patients with diabetes. Recent studies have proposed a novel measure of IR, the triglyceride-glucose (TyG) index, which is more convenient and has been validated as an effective estimator of IR. This study aimed to investigate the relationship between the TyG index and the risk of AF recurrence after ablation.

Materials and methods: We conducted a systematic search in accordance with the PRISMA guidelines using PubMed, Cochrane, Scopus, and ScienceDirect to identify cohort studies. We included studies published until June 2025 that involved adults aged 18 years and older. These studies need to examine the TyG index as an exposure and explore its association with the risk of AF. Data were analyzed using Review Manager (RevMan), and the quality of each study was assessed using the Cochrane Risk of Bias Tool 2.0.

Results: This meta-analysis included seven studies with 57.213 patients highlights a clear link between elevated TyG index levels and a higher risk of AF. When the TyG index was treated as a continuous variable across seven studies, each 1-unit increase was associated with a 33% greater risk of AF (HR=1.33; 95% CI: 1.23–1.45; p<0.00001), with moderate heterogeneity between studies (I^2=60%), suggesting fairly consistent findings. When comparing individuals with the highest TyG indices to those with the lowest, the pooled data from two studies showed a 36% higher risk of AF (HR=1.36; 95%CI: 1.14–1.62; p=0.0007). However, this analysis showed substantial heterogeneity (I^2=77%), indicating that differences in the study populations or methods may have influenced the results.

Conclusion: This meta-analysis found that higher TyG index levels were significantly associated with an increased risk of AF recurrence after ablation. These findings suggest that the TyG index may serve as a useful prognostic marker; however, further research is needed to confirm its clinical utility.

Keywords: Triglyceride-glucose index, Atrial fibrillation, Insulin resistance, Prognostic marker, Meta-analysis

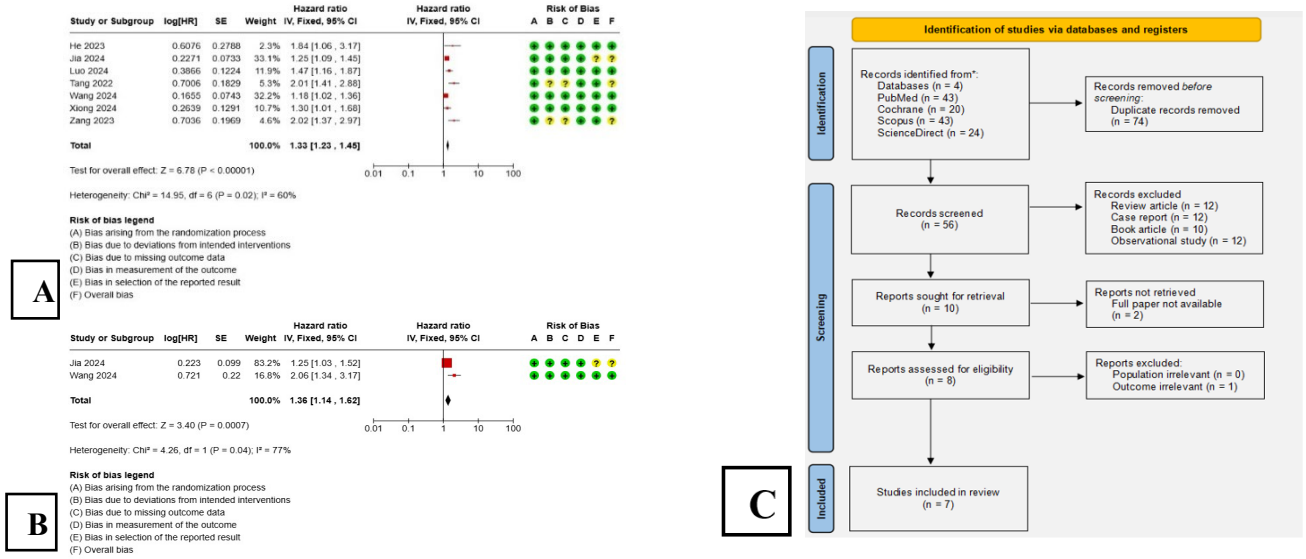

Figure 1. (A) Association between TyG and AF risk (per 1 unit increase). Forest plot and subgroup analysis of the Association between the TyG (analyzed as a continuous variable) and the risk of AF; **(B)** Association between TyG and risk of AF (highest vs. lowest)**.** Forest plot and subgroup analysis of the association between TyG (analyzed as a categorical variable) and the risk of AF; (**C**) PRISMA flowchart.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV55]

Catheter Ablation Compared to Anti-Arrhythmia Drug Therapy in Elderly Atrial Fibrillation Patients: A Systematic Review

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[2]Krakatau Medika Hospital, Cilegon, Indonesia

Background: Various therapeutic options are available for atrial fibrillation, including antiarrhythmic drug (AAD) therapy and catheter ablation. Recent research indicates that catheter ablation is the cornerstone of atrial fibrillation therapy, which has been steadily increasing in prevalence among the aging population worldwide. This study reviewed the evidence comparing catheter ablation with antiarrhythmic drug therapy for AF recurrence.

Methods: A systematic review was conducted using the Cochrane and PubMed databases. Three studies (randomized controlled trials) were analyzed in this review.

Results: Three clinical trials from several countries, involving 622 patients, were included in our analysis. A lower rate of AF recurrence was observed in the catheter ablation group than in the antiarrhythmic group (RR: 0.79, 95% CI [0.66-0.94], p <0.0009).

Conclusion: Catheter ablation appears to minimize recurrence compared to AADs.

Keywords: Atrial Fibrillation, Antiarrhythmic Drug Therapy, Catheter Ablation, Recurrence.

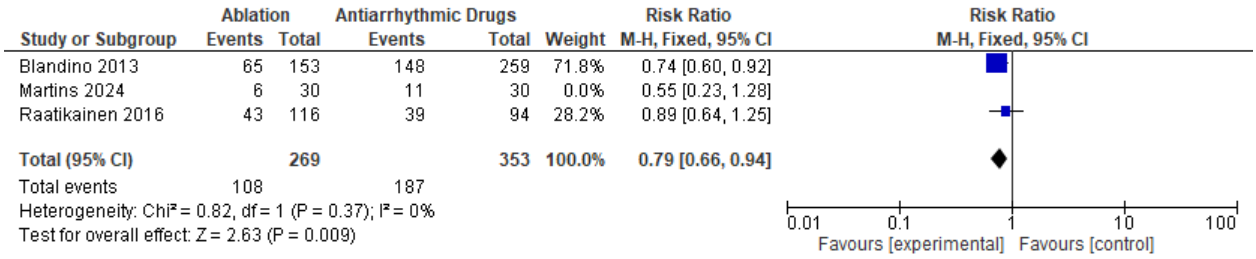

Figure 1. Forest plot of comparison between catheter ablation and antiarrhythmic drugs in elderly atrial fibrillation patients.

The 12th Annual Scientific Meeting InaHRS 2025

Indonesian Journal of Cardiology
Indonesian J Cardiol 2026:47:suppl_A
pISSN: 2830-3105 / eISSN: 2964-7304
doi: 10.30701/ijc.2125

[12INAHRS-RV56]

Physiologic versus Conventional Pacing Strategies for Cardiac Resynchronization Therapy in Patients with Heart Failure and Left Bundle Branch Block: A Network Meta-Analysis

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Background and Aims: Cardiac resynchronization therapy (CRT) via biventricular pacing (BiVP) is the standard treatment for heart failure (HF) with left bundle branch block (LBBB); however, physiological pacing strategies such as His bundle pacing (HBP) and left bundle branch pacing (LBBAP) have emerged as alternatives.

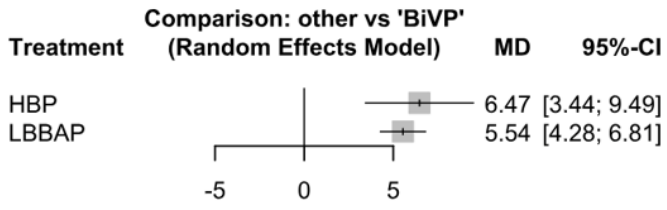
Materials and Methods: A systematic search was conducted in Scopus, PubMed, Cochrane, and EuropePMC to identify studies comparing LBBAP, HBP, and BiVP in patients with HF and LBBB who underwent CRT. The primary outcomes included changes in left ventricular ejection fraction (LVEF), CRT super-response rate (≥15% LVEF increase), heart failure hospitalization (HFH), QRS duration reduction, pacing threshold at 6 months, and lead dislodgement/failure. Pooled mean differences (MD) and risk ratios (RR) with 95% confidence intervals (CI) were estimated using random-effects pairwise and frequentist network meta-analysis.

Results: Twelve studies with 1745 participants were included (LBBAP= 726, HBP=19, BiVP=1000). Pairwise meta-analysis demonstrated that both LBBAP (MD 5.36%, 95% CI 4.52 to 6.21; $p < 0.00001$) and HBP (MD 8.40%, 95% CI 2.18 to 14.61; $p = 0.008$) significantly improved LVEF compared with BiVP. LBBAP was also associated with greater QRS narrowing (MD –25.63 ms, 95% CI –31.89 to –19.37 ; $p < 0.00001$), higher CRT super response rates (RR 1.34, 95% CI 1.12 to 1.61, p=0.003), and reduced the risk of HFH (RR 0.48, 95% CI 0.35 to 0.66, $p < 0.00001$) compared to BiVP. Regarding safety, LBBAP was associated with significantly lower pacing thresholds than BiVP (MD –0.54 V, 95% CI –0.66 to –0.42, $p < 0.00001$), whereas HBP demonstrated significantly higher thresholds than BiVP (MD 0.63 V, 95% CI 0.35 to 0.96, $p < 0.00001$). The network meta-analysis revealed that LBBAP was the most effective in reducing QRS duration, HFH, and pacing thresholds. HBP was optimal for improving LVEF and achieving CRT super-response, although the difference in LVEF compared with LBBAP was not statistically significant (network MD 0.93; 95% CI, –2.21 to 4.06). BiVP was associated with the lowest risk of lead dislodgement.

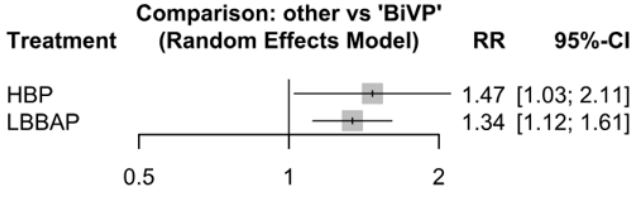
Conclusion: Physiologic pacing strategies (LBBAP and HBP) showed superior clinical and echocardiographic outcomes compared with BiVP, supporting their use as first-line CRT approaches in patients with HF and LBBB.

Keywords: Cardiac Resynchronization Therapy, Left Bundle Branch Area Pacing, His Bundle Pacing, Biventricular Pacing, Heart Failure with reduced Ejection Fraction, Left Bundle Branch Block.

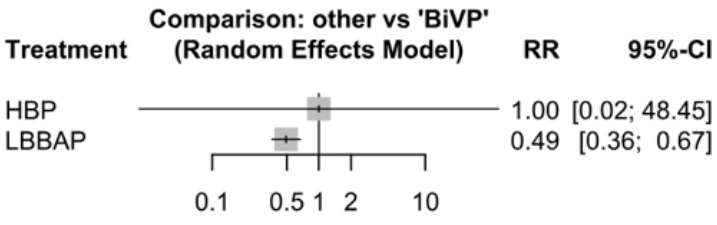
a. LVEF Improvement



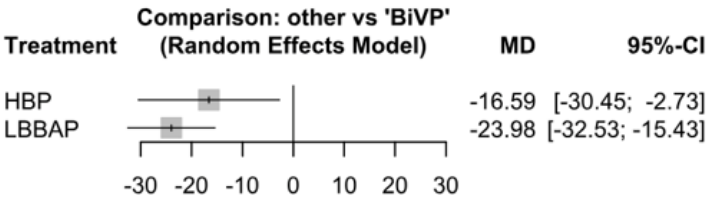
b. CRT Super Response-rate



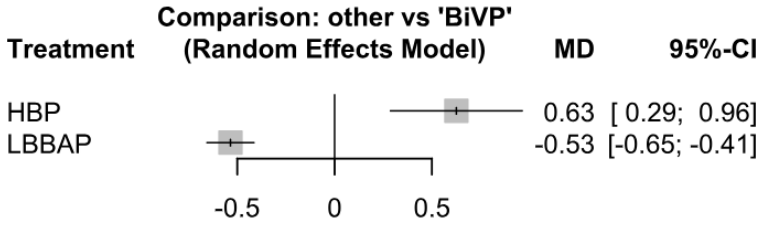
c. Heart Failure Hospitalization



d. QRS duration reduction



e. Pacing threshold at 6 months



f. Lead dislodgement/failure.

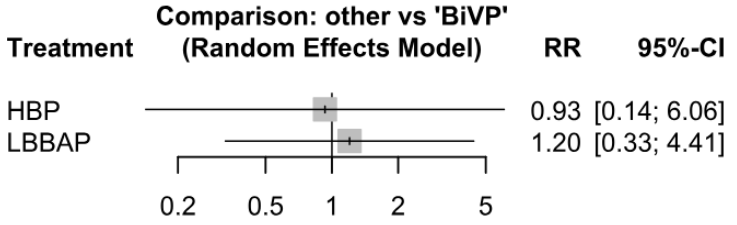


Figure 1. Network meta-analysis forest plots comparing the efficacy of different pacing strategies (LBBAP, HBP, and BiVP) for CRT in HFrEF patients with LBBB.