

Role of antazoline in cardioversion of atrial fibrillation

A PRISMA-compliant systematic review and meta-analysis

Danyal Bakht, MBBS^a, Muhammad Arham, MBBS^b, Faiza Yousaf, MBBS^a, Maaz Amir, MBBS^a, Maha Akbar Baloch, MBBS^a, Tooba Munir, MBBS^a, Farwa Batool, MBBS^a, Esha Gulzar, MBBS^a, Zarwa Rashid, MBBS^a, Syed Faqeer Hussain Bokhari, MBBS^a, Muhammad Numan Awais, MBBS^{c,*} , Kinza Bakht, MBBS^b, Hafiz Muhammad Haris, MBBS^a, Fahad Saleem, MBBS^d, Muhammad Saad, MD^e

Abstract

Background: Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia. Antazoline, a first-generation antihistamine with antiarrhythmic properties, has shown efficacy in the rapid conversion of recent-onset AF to sinus rhythm; however, direct comparative evidence against standard antiarrhythmic agents remains limited. This study aims to systematically evaluate the efficacy and safety of antazoline for pharmacological cardioversion of AF, in comparison with standard antiarrhythmic agents such as amiodarone and propafenone.

Methods: The methodology of this systematic review and meta-analysis adhered to the preferred reporting items for systematic reviews and meta-analyses guidelines. A systematic search was conducted in ScienceDirect, Embase, PubMed, and Cochrane Library from inception to April 2025, including citation and reference screening. Statistical analyses were performed using R version 2025.05.0 + 496.

Results: From 172 records, 5 studies comparing antazoline with propafenone ($n = 5$) or amiodarone ($n = 3$) for AF were included. For antazoline vs propafenone, conversion to sinus rhythm favored antazoline (risk ratio [RR] 1.13 [95% confidence interval (CI): 1.04–1.23], $P = .017$). No significant difference was observed in time to conversion (mean difference -10.98 [95% CI: -124.93 – 102.98], $P = .436$), bradycardia (RR 0.84 [95% CI: 0.35–2.03], $P = .478$), hypotension (RR 0.40 [95% CI: 0.14–1.12], $P = .056$), or other adverse events (RR 1.24 [95% CI: 0.01–247.13], $P = .694$). For antazoline vs amiodarone, conversion to sinus rhythm favored antazoline (RR 1.22 [95% CI: 1.08–1.36], $P = .018$, $I^2 = 0\%$), with no significant differences in bradycardia (RR 1.36 [95% CI: 0–1072357.09], $P = .823$) or hypotension (RR 1.05 [95% CI: 0.04–26.16], $P = .877$).

Conclusion: Antazoline might be more effective than propafenone and amiodarone in achieving sinus rhythm in AF, with no significant differences in safety outcomes.

Abbreviations: AF = atrial fibrillation, AV = atrioventricular, CI = confidence interval, ERP = effective refractory period, RCT = randomized controlled trial, RoB = risk of bias, RR = risk ratio.

Keywords: amiodarone, antazoline, atrial fibrillation, propafenone, sinus rhythm

1. Introduction

Atrial fibrillation (AF) is a supraventricular arrhythmia, identified by an irregularly irregular heartbeat, absence of clearly defined P waves, and erratic atrial activity in electrocardiography.^[1] AF affected an estimated 33.5 million people globally

in 2010, with prevalence rising more sharply among men than women between 1990 and 2010.^[2]

AF significantly increases the risk of ischemic stroke by 5 fold^[3–5] and heart failure by over 3 times.^[4–6] It also contributes to frequent healthcare utilization and diminished quality of

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^a King Edward Medical University, Mayo Hospital, Lahore, Punjab, Pakistan,

^b Sheikh Zayed Medical College, Rahim Yar Khan, Punjab, Pakistan, ^c Shaheed Ziaur Rahman Medical College & Hospital, Bogura, Rajshahi, Bangladesh,

^d Punjab Medical College, Allied Hospital, Faisalabad, Punjab, Pakistan, ^e The Jewish Hospital of Cincinnati, Cincinnati, OH.

* Correspondence: Muhammad Numan Awais, Shaheed Ziaur Rahman Medical College & Hospital, Bogura 5800, Rajshahi, Bangladesh (e-mail: muhammadnumanawais433@gmail.com).

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life.^[5] Managing AF depends upon the hemodynamic stability. Hemodynamically unstable, immediate electrical cardioversion is required. Management of hemodynamically stable patients involves rhythm control, using antiarrhythmic drugs, including class IC and III agents, and rate control with medications such as beta-blockers or calcium channel blockers.^[4] Rhythm control is generally preferred for younger patients with severe symptoms, while rate control is more suitable for older patients with milder symptoms. Preventing stroke is also crucial, as AF greatly increases its risk.^[4,7] According to American Heart Association guidelines 2023, pharmacological cardioversion is a reasonable alternative to electrical cardioversion in stable AF patients in acute settings. Recommended drugs include ibutilide and amiodarone.^[8] DeSouza et al also found that pharmacological cardioversion with several anti-rhythmic agents significantly increases the likelihood of restoring the sinus rhythm in emergency settings.^[9]

Antazoline is a first-generation antihistamine that has been found to play a substantial role in managing AF as a pharmacological cardioverter.^[10] It has been found that IV Antazoline proved to be safe and effective treatment for converting AF in the emergency department, showing better results than amiodarone and similar success to propafenone.^[11] It exhibits antiarrhythmic effects through multichannel blockade, primarily targeting sodium and potassium channels. This mechanism leads to prolongation of the effective refractory period (ERP) in both atria and ventricles.^[12–14] Antazoline has been observed to produce notable changes on the electrocardiography (specifically, prolongation of the P-wave, QRS complex, and corrected QT interval).^[15]

While multiple individual studies have demonstrated favorable results regarding the use of antazoline, the existing literature lacks a comprehensive and systematic evaluation of its overall efficacy and safety. No quantitative study currently synthesizes the available evidence to determine the clinical value of antazoline in the treatment of AF. The objective of this meta-analysis is to systematically assess the efficacy and safety of antazoline when used as a pharmacological agent for the cardioversion of AF in adult patients.

2. Methods

This systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 guidelines.^[16]

3. Search strategy

A comprehensive and systematic literature search was conducted across several electronic databases: PubMed, Embase, the Cochrane Library, and ScienceDirect (from their inception through April 2025). The search strategy incorporated both medical subject headings and relevant free-text terms related to antazoline, alternative antiarrhythmic drugs, and AF. Keywords included: “Atrial Fibrillation” OR “atrial fibrillation,” “Antazoline,” “Antiarrhythmic Agents,” “Antiarrhythmic drugs” OR “Antiarrhythmic therapy,” and “Propafenone.” Boolean operators (AND, OR) were applied to enhance both search sensitivity and specificity. Additional manual screening of references from included articles and previously published reviews was undertaken to identify further eligible studies.^[17] A full account of the search protocol has been provided in the File S1, Supplemental Digital Content 1.

4. Eligibility criteria

Studies qualified for inclusion if they met the following criteria: original studies designed as randomized controlled

trials (RCTs), prospective or retrospective cohort studies, or case-control studies with comparative clinical data; adult patients with a confirmed diagnosis of AF (whether paroxysmal, persistent, or recent-onset) who required pharmacological treatment; administration of intravenous antazoline as part of the therapeutic protocol; use of a comparator group receiving an antiarrhythmic agent, including propafenone and amiodarone; and documentation of at least 1 efficacy outcome, particularly the successful restoration of sinus rhythm. Additionally, no language restrictions were applied, and non-English studies were professionally translated when feasible.

Exclusion criteria applied to studies that: lacked a comparator arm, such as single-arm designs; used placebo as the comparator; focused solely on non-pharmacological interventions, including electrical cardioversion without a drug-based comparison; did not present original data, including reviews, editorials, commentaries, or conference abstracts; involved non-human subjects; or presented duplicate findings from overlapping cohorts, in which case the most comprehensive or recent dataset was selected.

5. Ethical approval and patient consent

This study is a systematic review and meta-analysis of previously published data and therefore did not require institutional review board approval. No new patient consent was necessary, as only aggregated and de-identified data were analyzed.

6. Data extraction and outcomes

Two independent reviewers screened titles and abstracts, followed by full-text assessment based on the eligibility criteria. Data extraction was performed independently using a standardized Google Sheet. Extracted data included author information, study design, dosage regimens, sample size, baseline patient characteristics (e.g., mean age, sex distribution), baseline laboratory characteristics (e.g., heart rate, serum K⁺ levels), and reported clinical outcomes.

The primary efficacy outcome was the conversion of AF to sinus rhythm. All remaining outcomes were termed secondary. Discrepancies in study selection or data extraction were resolved by consensus or, when necessary, by a third reviewer.

7. Risk of bias (RoB) assessment

The RoB for included studies was assessed based on study design. RCTs were evaluated using the Cochrane RoB 2.0 tool, which examines 5 domains: bias arising from the randomization process, bias due to deviations from intended interventions, bias due to missing outcome data, bias in measurement of the outcome, and bias in selection of the reported result.^[18] Non-randomized studies were assessed using the RoB in non-randomized studies of interventions tool, covering 7 domains: bias due to confounding, bias in selection of participants, bias in classification of interventions, bias due to deviations from intended interventions, bias due to missing data, bias in measurement of outcomes, and bias in selection of the reported result.^[19]

8. Statistical analysis

Statistical analyses were performed using R software (version 2025.05.0 + 496; Posit Software, PBC). For dichotomous outcomes, pooled risk ratios (RRs) with 95% confidence intervals (CIs) were calculated. For continuous outcomes, mean differences with 95% CIs were reported. Heterogeneity

across studies was assessed using the I^2 statistic. A random-effects model was employed to calculate pooled estimates in order to account for potential heterogeneity among the included studies. Pre-specified Leave-one-out sensitivity analyses were conducted to identify sources of heterogeneity and evaluate the stability of the findings. Publication bias was assessed using visual inspection of funnel plot asymmetry (for outcomes with ≥ 10 studies) and Egger regression test when appropriate. All statistical tests employed 2-tailed distribution assumptions, with P values $< .05$ considered statistically significant.

9. Results

9.1. Study screening and selection process

A total of 172 records were identified through database searches: ScienceDirect ($n = 69$), Embase ($n = 64$), PubMed ($n = 30$), Cochrane ($n = 9$), and ClinicalTrials.gov ($n = 0$). Citation and reference searching yielded no additional studies. After removing 36 duplicates, 136 records were screened. Of these, 119 were excluded, and 17 full-text articles were assessed for eligibility. Ultimately, 5 studies were included in the final synthesis (Fig. 1).

9.2. Systematic review of included studies

This systematic review included 5 studies comparing antazoline and propafenone for AF management. One study^[20] was a RCT; the others were retrospective observational studies.^[11,21–23] Studies also included amiodarone as a comparator.^[11,22,23] Table 1 provides a comparative summary of study characteristics, baseline patient demographics, and baseline laboratory and echocardiographic parameters across included studies evaluating antazoline, propafenone, and amiodarone.

9.3. Comparison of antazoline and propafenone for AF management

Conversion to sinus rhythm was assessed in 5 studies, with results significantly favoring antazoline over propafenone (RR: 1.13; 95% CI: 1.04–1.23; $P = .017$). However, the time to achieving sinus rhythm showed no significant difference between the 2 groups (mean difference: -10.98 ; 95% CI: -124.93 – 102.98 ; $P = .436$). Incidence of bradycardia, reported in 3 studies, also revealed no significant difference (RR: 0.84; 95% CI: 0.35–2.03; $P = .478$). Hypotension and other adverse events were each reported in 2 studies. No significant differences were observed between antazoline and propafenone for hypotension

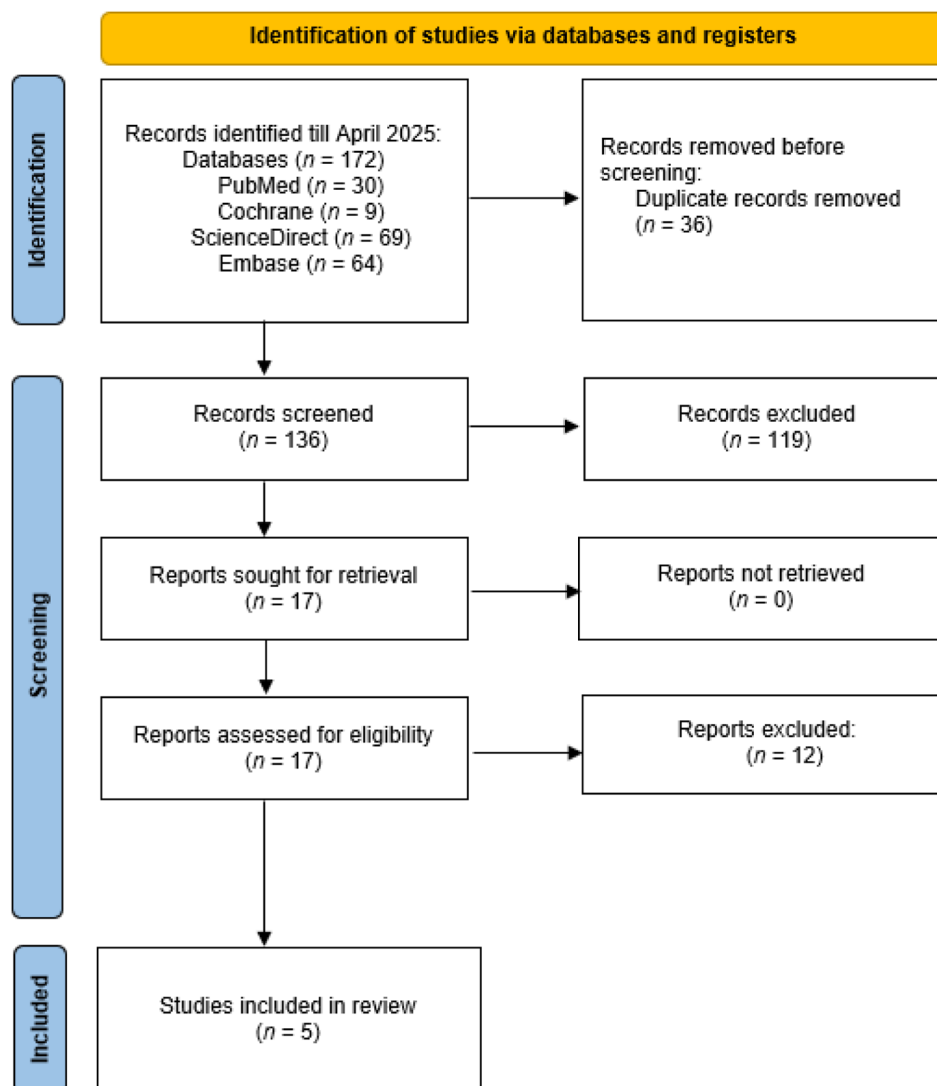


Figure 1. PRISMA flowchart of study screening and selection process. n = number of studies, PRISMA = preferred reporting items for systematic reviews and meta-analyses.

Table 1**Baseline patient and study characteristics.****Baseline patient and study characteristics***

	Farkowski et al, 2016 ^[21]	Karwowski et al, 2024 ^[20]	Springer et al, 2024 ^[22]	Wybraniec et al, 2022 ^[23]	Wybraniec et al, 2018 ^[11]
Study characteristics					
Study design	Retrospective case control	RCT	Retrospective Cohort	Retrospective Cohort	Retrospective Cohort
Dosage (mg/d)	148 + -56/ 70 + -0/-	Upto 300/ Upto 140/-	172.9 + -88.3/ 85.9 + -29.5/ 587.7 + -388.4	166.67 + -74.31/ 196.67 + -224.56/ 450.00 + -223.52	200 + -150.26/ 140 + -107.46/ 550 + -335.91
Sample size (n)	334/98/-	46/ 48/-	1080/ 88/ 129	600/ 150/ 287	109/ 42/ 210
Baseline Patient Characteristics					
Age (yrs)	68.8 + -9.8/ 69.7 + -9.9	66.8 + -15.4/ 68.2 + -12.6	64.5 + -11.3/ 64.0 + -8.9/68.7 + -10.8	68.2 + -2.4/ 69.3 + -3.3/ 68.67+ -11.18	62.8 + -12.0/ 64.2 + -12.4/ 67.7 + -11.2
Male sex (n, %)	223/ 57/-	19/ 21/-	351/ 46/ 78	350/ 68/ 123	60/ 9/ 95
BMI (kg/m ²)	-	-	29.0 + -4.6/ 27.2 + -5.7/ 27.9+ -4.3	28.06 + -4.24/ 26.41 + -3.35/ 28.74+ -4.79	-
History of AF	303/ 86/-	13/ 14/-	877/ 46/ 45	-	-
Arterial hypertension	202/ 55/-	32/ 38/-	-	401/ 80/ 210	77/ 25/ 156
DM	58/ 15/-	8/ 9/-	-	111/ 17/ 50	17/ 4/ 40
Ischemic stroke/ TIA	66/ 14/-	-	-	19/ 3/ 14	5/ 3/ 11
BB use	15/ 2/-	27/ 24/-	658/ 5/ 49	333/ 37/ 77	39/ 23/ 58
CAD/PAD	138/ 28	7/ 5/-	-	231/ 35/ 82	44/ 9/ 65
Baseline laboratory and echocardiographic parameters					
HR (beats per minute)	-	117.8 + -18.4/ 120 + -21.7/-	-	-	122.1 + -23.8/ 122.2 + -19.8/ 119.8 + -25.8
Potassium level (K ⁺) (mEq/L)	-	4.3 + -0.46/ 4.28 + -0.3/-	4.3 + -0.8/ 4.5 + -0.4/ 4.4 + -0.4	4.20 + -0.45/ 4.27 + -0.41/ 4.28 + -0.48	4.2 + -0.4/ 4.2 + -0.3/ 4.3 + -0.5
LAD (mm)	-	-	-	44.34 + -6.27/ 39.57 + -5.93/ 42.62+ -4.95	42.3 + -4.5/ 39.5 + -5.8/ 42.6 + -5.1
LVEF (%)	-	61.6 + -5.5/ 61 + -6.5/-	-	56.00 + -6.69/ 58.33 + -3.74/ 55.00 + -7.45	55.0 + -5.9/ 54.7 + -8.2/ 51.6 + -10.6
WBC count (×10 ³ /μL)	-	-	-	7.39+ -1.98/ 7.6 + -1.82/ 7.91 + -2.13	7.42 + -2.25/ 7.27 + -1.63/ 7.95 + -2.39

AF = atrial fibrillation, BB = beta-blocker, BMI = body mass index, CAD = coronary artery disease, DM = diabetes mellitus, HR = heart rate, HTN = hypertension, K = potassium, LAD = left atrial diameter, LVEF = left ventricular ejection fraction, n = number of patients, PAD = peripheral arterial disease, RCT = randomized controlled trial, TIA = transient ischemic attack, WBC = white blood cell.

*Data are presented as antazoline/ propafenone/ amiodarone.

(RR: 0.40; 95% CI: 0.14–1.12; $P = .056$) or for adverse events (RR: 1.24; 95% CI: 0.01–247.13; $P = .694$). Notably, the wide CIs regarding bradycardia and adverse events provide little interpretative value, which may stem from 0 events. (Fig. 2).

9.4. Comparison of antazoline and amiodarone for AF management

Conversion to sinus rhythm was reported in 3 studies, with results significantly favoring antazoline over amiodarone (RR: 1.22; 95% CI: 1.08–1.36; $P = .018$). Bradycardia and hypotension, each reported in 2 studies, showed no significant difference between the groups. For bradycardia, the RR was 1.36 (95% CI: 0–1072,357.09; $P = .823$), and for hypotension, it was 1.05 (95% CI: 0.04–26.16; $P = .877$). Importantly, the CIs for bradycardia and hypotension are excessively wide and non-informative, likely attributable to the absence of events (Fig. 3). Table 2 presents a detailed summary of all outcomes common to antazoline, propafenone, and amiodarone, along with their corresponding results.

9.5. RoB

The RoB assessment using the Cochrane RoB 2.0 tool for Karwowski et al^[20] indicated some concerns (Fig. 4). According to the Cochrane RoB tool for non-randomized studies of interventions, Farkowski et al^[21] and Wybraniec et al^[11] were judged

to have a serious RoB, primarily due to confounding. In contrast, Wybraniec et al^[23] and Springer et al^[22] were assessed as having moderate overall RoB (Fig. 5).

9.6. Sensitivity analysis

Heterogeneity was 0% across all outcomes, except for time to achieve sinus rhythm and incidence of bradycardia in antazoline versus propafenone comparisons, where moderate heterogeneity was observed ($I^2 = 53.2\%$), each based on 2 studies. Leave-one-out sensitivity analysis was not feasible for outcomes reported by only 2 studies.

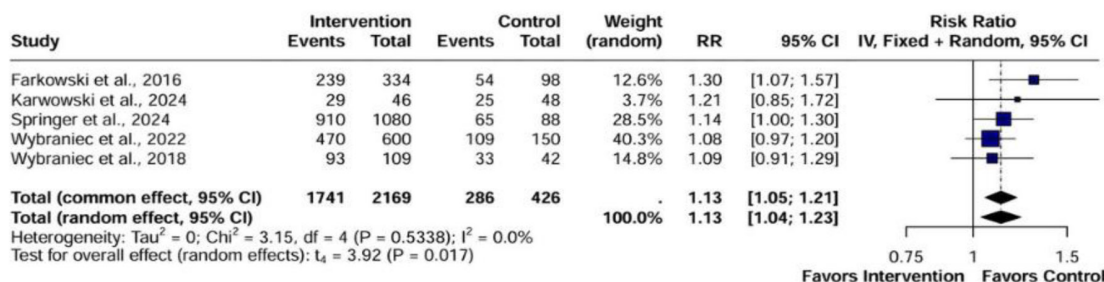
9.7. Publication bias

In line with established methodological guidelines, formal assessment of publication bias using Egger test was not conducted, as such statistical methods are deemed unreliable in meta-analyses comprising fewer than 10 studies.^[24]

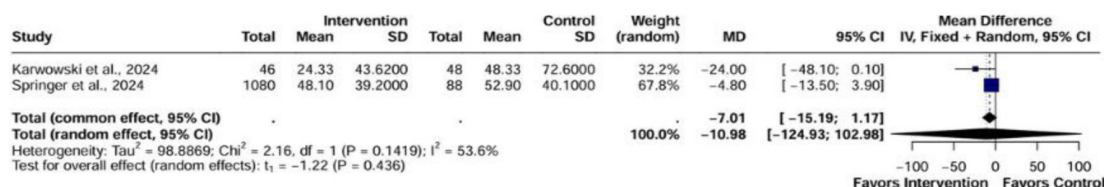
10. Discussion

This systematic review and meta-analysis was conducted to evaluate the efficacy of antazoline in achieving cardioversion in patients with AF. When compared with propafenone, antazoline was associated with a statistically significant increase in successful conversion to sinus rhythm. A similar statistically

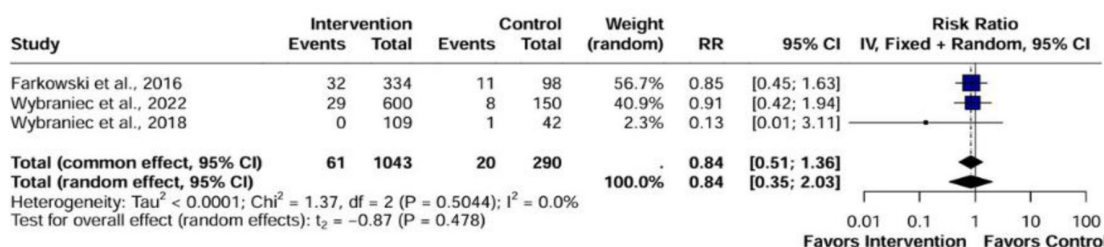
3.1 Forest Plot for Conversion to Sinus Rhythm



3.2 Forest Plot for Time to Reach Sinus Rhythm



3.3 Forest Plot for Bradycardia



3.4 Forest Plot for Adverse Events



3.5 Forest Plot for Hypotension

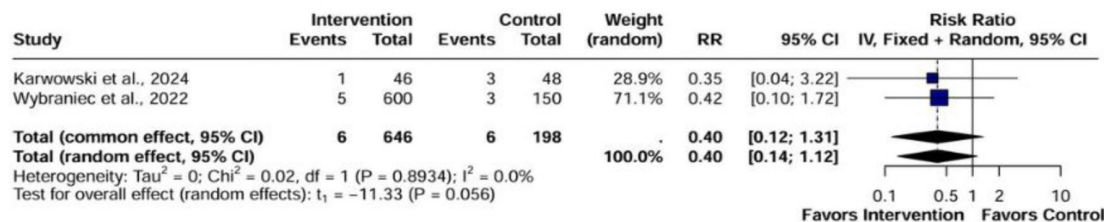
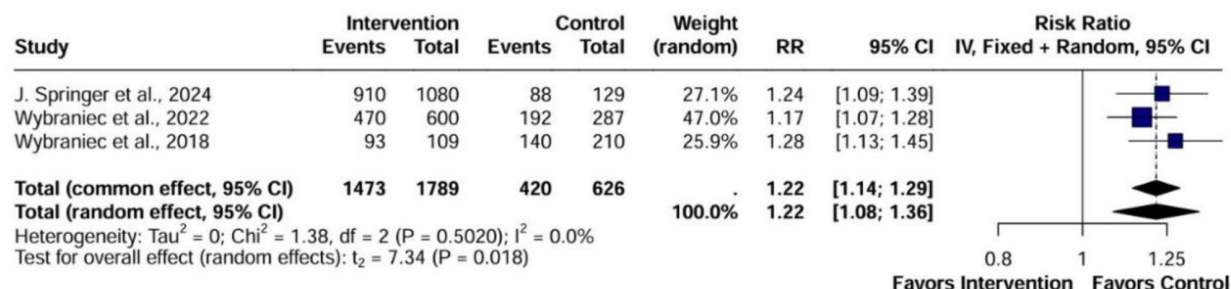


Figure 2. Forest plot for antazoline versus propafenone for AF management. AF = atrial fibrillation, CI = confidence interval, IV = instrumental variable, MD = mean difference, RR = risk ratio, SD = standard deviation.

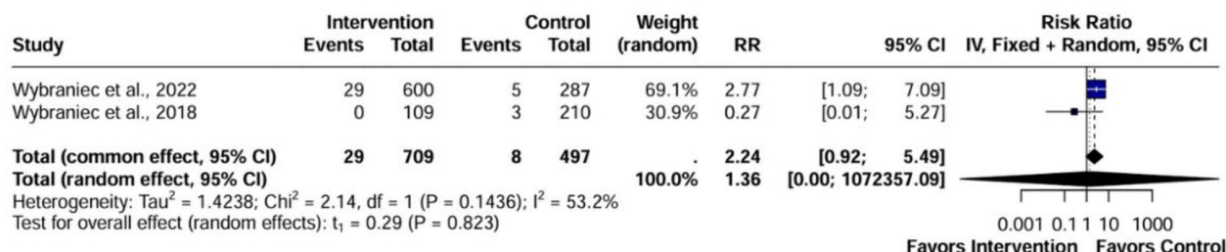
significant advantage was observed when antazoline was compared with amiodarone. In contrast, there were no statistically significant differences between antazoline and either comparator in terms of time to achieving sinus rhythm, incidence of bradycardia, hypotension, or other reported adverse events. These findings suggest that antazoline may be a clinically effective and well-tolerated option for pharmacologic cardioversion of AF, performing comparably to or more favorably in terms of rhythm restoration without added safety concerns.

Although the initial objective was to assess antazoline more broadly, the comparative analyses were limited to propafenone and amiodarone due to the availability of eligible studies. A study comparing antazoline with placebo was identified but was excluded from the meta-analysis due to concerns about introducing substantial heterogeneity, as the other 5 included trials all featured active comparators.^[25] Additionally, we identified multiple individual studies in which antazoline was compared with other active comparators; however, these trials were

4.1 Forest Plot for Conversion to Sinus Rhythm



4.2 Forest Plot for Bradycardia



4.3 Forest Plot for Hypotension

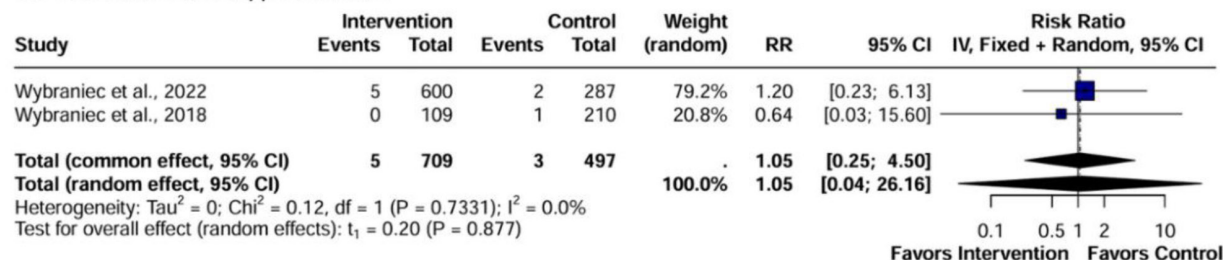


Figure 3. Forest plot for antazoline versus amiodarone for AF management. AF = atrial fibrillation, CI = confidence interval, IV = instrumental variable, RR = risk ratio.

Table 2

Summary of all outcomes.

Table of Outcomes

	Studies (n)	RR/ MD, 95% CI	P value	Tau ²	Chi ²	P	P _h
Outcomes							
Antazoline vs propafenone							
Conversion to sinus rhythm	5	1.13 (1.04–1.23)	.017	0	3.15	0	.5388
Adverse events	2	1.24 (0.01–247.13)	.694	0	0.57	0	.4500
Bradycardia	3	0.84 (0.35–2.03)	.478	0	1.37	0	.5044
Hypotension	2	0.40 (0.14–1.12)	.056	0	0.02	0	.8934
Time to achieve sinus rhythm	2	–10.98 (–124.93–102.98)	.436	98.89	2.16	53.6	.14
Antazoline vs amiodarone							
Conversion to sinus rhythm	3	1.22 (1.08–1.36)	.018	0	1.38	0	.5020
Bradycardia	2	1.36 (0–1072357.09)	.823	1.423	2.14	53.2	.1436
Hypotension	2	1.05 (0.04–26.16)	.877	0	0.12	0	.7331

Chi² means Cochran Q test statistic for heterogeneity, P means percentage of total variation across studies due to heterogeneity, Tau² means between-study variance.

CI = confidence interval, MD = mean difference, n = number of studies, P_h = P value for heterogeneity, P value = probability value, RR = risk ratio.

limited to single-study comparisons. Due to the lack of multiple trials assessing the same comparator, these studies could not be pooled for quantitative synthesis and were therefore excluded from the meta-analysis.

The mechanism of the antiarrhythmic action of antazoline might be mediated through altering membrane permeability

to sodium and potassium currents.^[13] Antazoline was found to prolong the duration of the action potential, prolong phase 0 (mediated by fast inward Na^{2+} channels), and reduce the resting potential of phase 4 (early diastolic depolarization mediated by hyperpolarization-activated cyclic nucleotide-gated channels).^[25] As we discuss the mechanism of antiarrhythmic

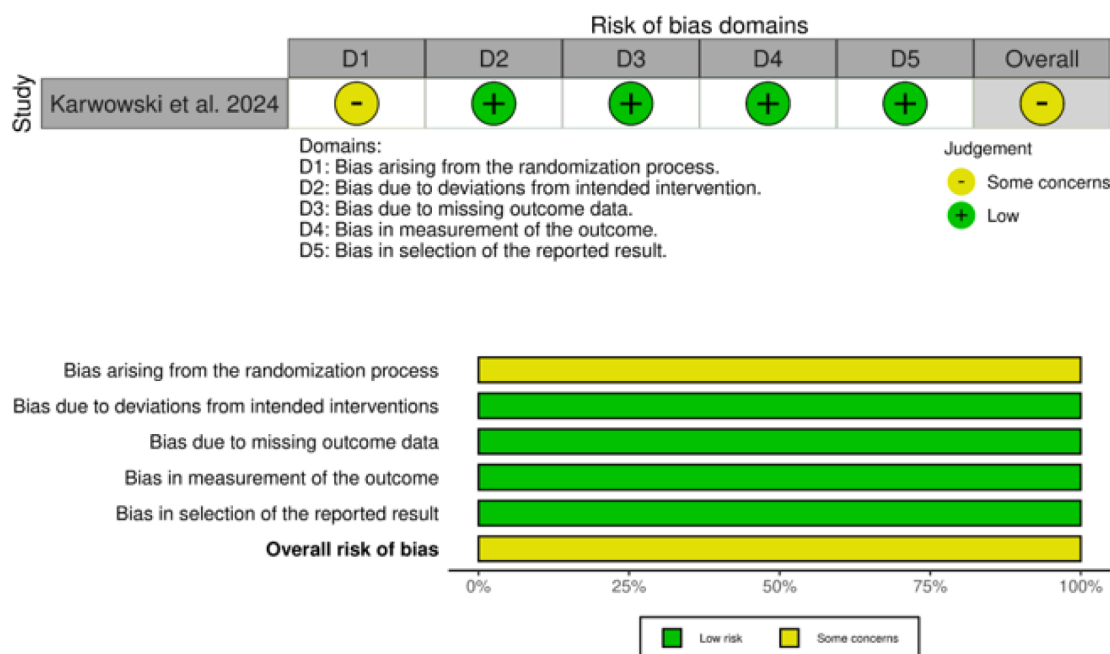


Figure 4. The RoB assessment using the Cochrane RoB tool. The traffic plot and summary plot were drawn using robvis (visualization tool). RoB = risk of bias.

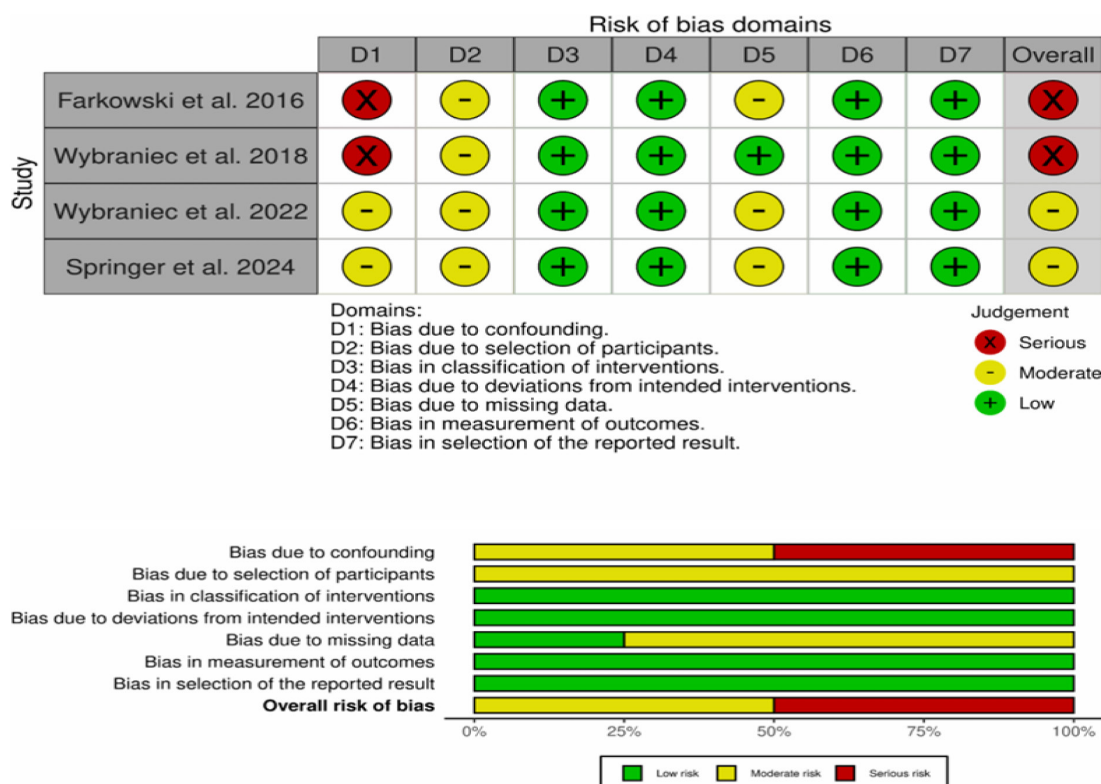


Figure 5. The RoB assessment using the Cochrane RoB tool ROBINS-I. The traffic plot and summary plot were drawn using robvis (visualization tool). RoB = risk of bias, ROBINS = RoB in non-randomized studies of interventions.

action of antazoline, it is important to highlight that antazoline has selective effects on atrial tissue, with minimal influence on nodal conduction. In an electrophysiological study, antazoline prolonged several conduction intervals (His–ventricle, QRS [ventricular depolarization], corrected QT, high right atrium to coronary sinus ostium and high right atrium to distal coronary sinus) as well as right and left atrial refractory

periods. Notably, it had no effect on atrium–His, Wenckebach point, atrioventricular (AV) nodal ERP, or sinus node recovery time. This strongly suggests its atrial-selective action.^[13] In an experimental study on rabbit hearts, antazoline significantly increases the atrial ERP and postrepolarization refractoriness, both of which help suppress reentrant circuits, while only modestly affecting atrial action potential duration. These

changes, along with prolonged interatrial conduction time and reduced AF inducibility, disrupted the electrophysiological substrate necessary for AF maintenance.^[12]

The results of our meta-analysis suggest that antazoline is a clinically effective agent for pharmacological cardioversion of AF, with conversion rates significantly higher than both amiodarone and propafenone. This is in line with findings from several independent studies. Maciag et al^[25] conducted a randomized, double-blind, placebo-controlled trial and found that antazoline successfully restored sinus rhythm in 72.2% of patients compared to only 10.5% in the placebo group, with a median conversion time of just 16 minutes. Similarly, another study reported an 83.6% efficacy with antazoline in achieving sinus rhythm during pulmonary vein isolation procedures for paroxysmal AF, reinforcing its rapid and reliable action.^[26] Piotrowski et al^[27] demonstrated that antazoline effectively terminated AF during ablation in patients with Wolff–Parkinson–White syndrome, with sinus rhythm restored in all patients using a mean dose of 176 mg. A systematic review incorporating observational studies and 1 randomized trial also concluded that antazoline achieved higher cardioversion rates than other commonly used agents like amiodarone and propafenone, suggesting its comparative superiority across multiple settings.^[17] Farkowski et al^[10] further supported the evidence, reporting 100% success in pharmacological cardioversion during electrophysiological studies. Palimonka et al^[28] concluded that antazoline may have the highest success rate of all contemporary cardioversion agents (up to 85.3%) especially in cases of paroxysmal rather than persistent AF.

In terms of safety, antazoline consistently showed a favorable profile across the literature. Our meta-analysis found no significant differences in adverse events (such as bradycardia, hypotension, or time to sinus rhythm) when compared to standard agents. Maciag et al^[25] reported no atrial tachyarrhythmias or major complications in the antazoline group. Another study confirmed that antazoline did not block accessory pathways and allowed ablation procedures to continue safely. A separate study similarly reported no detrimental effects on sinus node function or AV conduction, a finding echoed by Farkowski et al,^[10] who observed stable AV nodal parameters and no serious adverse events. In our meta-analysis, however, it is important to recognize that some of the adverse event analyses, particularly bradycardia, were characterized by wide and non-interpretable CIs. This statistical limitation restricts the strength of conclusions regarding safety, even though the available evidence overall supports a favorable profile for antazoline.

One of the primary limitations of this meta-analysis is that although it aimed to broadly evaluate the efficacy and safety of antazoline for the cardioversion of AF, the analysis was limited by the availability of comparators. Specifically, all included studies compared antazoline only with either propafenone or amiodarone. Another limitation pertains to the inclusion criteria: while the meta-analysis was restricted to studies involving patients with AF, 1 of the 5 included trials enrolled a mixed population, with approximately 10% of patients not having AF.^[21] Furthermore, the strength of the evidence is limited by the predominance of non-randomized designs among the included studies; 4 of the 5 studies were observational in nature, with only one RCT. Also, the imprecision reflected by wide and non-interpretable CIs in certain outcomes, including bradycardia and adverse events, represents a notable limitation of our analysis. Additionally, due to incomplete or inconsistent data reporting across some studies, we employed a statistical conversion tool^[29] to transform median and interquartile range values into means and standard deviations. This necessary conversion may have contributed to estimation imprecision and introduced further statistical heterogeneity.

Beyond these primary limitations, it is worth noting that the included studies varied in their definitions of successful cardioversion and follow-up durations, which may have influenced the reported outcomes. Taken together, these limitations highlight the need for larger, high-quality RCTs comparing antazoline with a broader range of antiarrhythmic agents, employing standardized endpoints, and ensuring comprehensive safety reporting to confirm and extend our findings. Future research should also explore the best dosing strategies, long-term outcomes after cardioversion, and whether certain subgroups of patients benefit more than others.

11. Conclusion

This meta-analysis demonstrates that antazoline might be more effective than both propafenone and amiodarone in achieving sinus rhythm in patients with AF, without increasing the risk of adverse events such as bradycardia or hypotension. Despite its primary role as an antihistamine, antazoline's atrial-selective antiarrhythmic properties support its use in acute cardioversion. While the findings suggest clinical benefit, the evidence is limited by the small number of studies, the predominance of observational designs, and lack of comparator diversity. Larger, high-quality randomized trials are warranted to confirm antazoline's efficacy and safety and define its optimal role in AF management.

Author contributions

Conceptualization: Muhammad Arham, Maaz Amir, Tooba Munir, Muhammad Saad.

Data curation: Muhammad Arham, Zarwa Rashid.

Methodology: Faiza Yousaf, Maaz Amir, Maha Akbar Baloch, Esha Gulzar, Kinza Bakht.

Formal analysis: Farwa Batool, Esha Gulzar, Syed Faqeer Hussain Bokhari, Hafiz Muhammad Haris.

Project administration: Danyal Bakht, Faiza Yousaf, Maaz Amir.

Software: Muhammad Numan Awais.

Supervision: Danyal Bakht, Tooba Munir, Zarwa Rashid, Syed Faqeer Hussain Bokhari, Muhammad Numan Awais, Kinza Bakht, Muhammad Saad.

Writing – original draft: Danyal Bakht, Maha Akbar Baloch, Tooba Munir, Farwa Batool, Esha Gulzar, Zarwa Rashid, Syed Faqeer Hussain Bokhari, Kinza Bakht, Fahad Saleem.

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