REVIEW ARTICLE

Cardiac ablation compared to drug therapy in the treatment of atrial fibrillation: a systematic review

Ablação cardíaca comparada à terapia medicamentosa no tratamento da fibrilação atrial: uma revisão sistemática

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Abstract

Objective: to evaluate differences in atrial fibrillation recurrence rates between patients undergoing catheter ablation and those receiving drug therapy. **Methods**: systematic searches were conducted in PubMed and SciELO databases for clinical studies published between 2020-2024 evaluating symptomatic atrial fibrillation outcomes. The PICO strategy was implemented using MeSH descriptors with Boolean operators. Inclusion criteria comprised comparative studies between drug intervention and catheter ablation with recurrence as primary endpoint. **Results**: seven clinical studies were analyzed: three comparing radiofrequency ablation and four comparing cryoablation with class I and III antiarrhythmic agents. All studies demonstrated lower atrial fibrillation recurrence rates with ablation compared to pharmacological treatment. Catheter ablation showed superior efficacy in reducing atrial tachyarrhythmia recurrence, with success rates of 48-75% versus 30-45% for drug therapy. Cryoablation as initial therapy proved superior to antiarrhythmics in preventing paroxysmal atrial fibrillation recurrence. Ablation demonstrated superior efficacy regardless of atrial fibrillation type, showing better symptomatic control and quality of life across paroxysmal, persistent, and long-standing persistent categories. Patients undergoing ablation reported improved functional capacity and reduced symptom burden compared to pharmacological management alone. **Conclusion**: catheter ablation demonstrates superior efficiency in reducing symptoms and atrial fibrillation recurrence compared to pharmacological therapy, establishing it as the preferred therapeutic approach for appropriate candidates.

Keywords: atrial fibrillation; cardiac ablation; catheter ablation; arrhythmia; antiarrhythmic drug.

Resumo

Objetivo: avaliar as diferenças nas taxas de recorrência da fibrilação atrial entre pacientes submetidos à ablação por cateter e aqueles que recebem terapia medicamentosa. **Métodos**: foram realizadas buscas sistemáticas nas bases de dados PubMed e SciELO para estudos clínicos publicados entre 2020-2024 avaliando desfechos da fibrilação atrial sintomática. A estratégia PICO foi implementada utilizando descritores MeSH com operadores booleanos. Os critérios de inclusão compreenderam estudos comparativos entre intervenção medicamentosa e ablação por cateter com recorrência como desfecho primário. **Resultados:** sete estudos clínicos foram analisados: três comparando ablação por radiofrequência e quatro comparando crioablação com agentes antiarrítmicos classe I e III. Todos os estudos demonstraram menores taxas de recorrência da fibrilação atrial com ablação comparada ao tratamento farmacológico. A ablação por cateter mostrou eficácia superior na redução da recorrência de taquiarritmias atriais, com taxas de sucesso de 48-75% versus 30-45% para terapia medicamentosa. A crioablação como terapia inicial provou ser superior aos antiarrítmicos na prevenção da recorrência de fibrilação atrial paroxística. A ablação demonstrou eficácia superior independentemente do tipo de fibrilação atrial, mostrando melhor controle sintomático e qualidade de vida nas categorias paroxística, persistente e persistente de longa duração. Pacientes submetidos à ablação relataram melhora da capacidade funcional e redução da carga sintomática comparado ao manejo farmacológico isolado. **Conclusão**: a ablação por cateter demonstra eficiência superior na redução de sintomas e recorrência da fibrilação atrial comparada à terapia farmacológica, estabelecendo-se como a abordagem terapêutica preferencial para candidatos apropriados.

Palavras chave: fibrilação atrial; ablação cardíaca; ablação por cateter; arritmia; droga antiarrítmica.

INTRODUCTION

Atrial fibrillation (AF) represents the most prevalent cardiac arrhythmia in clinical practice, affecting approximately 2% of the general population and 10-12% of individuals aged 80 years or older[1]. This condition is associated with a significant increase in morbidity and mortality, including an elevated risk of stroke, cardiac failure, and late cognitive impairment[2]. In 2017, AF contributed to more than 280,000 deaths globally, with an estimated prevalence of up to 33.5 million individuals worldwide[3].

The pathogenesis of AF involves spontaneous depolarizations of atrial tissue originating mainly in the pulmonary veins (95% of cases), a phenomenon called ectopic activity[4]. Perpetuation of arrhythmia results from changes in electrical remodeling of cardiac ion channels and fibrotic modifications in the atrial cardiomyocyte. Modifiable risk factors include obesity, diabetes

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mellitus, obstructive sleep apnea, and sedentary lifestyle, while advanced age, male sex, and genetic predisposition are non-modifiable factors[5].

The treatment of AF is based on two main strategies: pharmacological control and catheter ablation. Drug therapy uses class I and III antiarrhythmics to maintain sinus rhythm, but has limited efficacy and potential adverse effects[6]. Catheter ablation, developed in recent decades, aims to eliminate arrhythmogenic foci by isolating the pulmonary veins using radiofrequency or cryoenergy[7].

Recent studies suggest superiority of ablation over pharmacological therapy in reducing AF recurrence, especially in young patients with paroxysmal AF[8]. However, scientific evidence needs consolidation through a broad systematic review. This study aims to analyze, through a systematic review, the main differences in AF recurrence rates between catheter ablation and pharmacological therapy.

METHODS

The systematic review was conducted using a systematic and comprehensive search strategy to identify relevant studies, aiming to evaluate the results of surgeries with cardiac ablation medical devices compared to drug therapy in the treatment of atrial fibrillation. The searches were performed in the PubMed (States National Library of Medicine) and SciELO (Scientific Electronic Library Online) databases, selected for the wide coverage of scientific and medical literature, including dissertations, clinical studies, systematic reviews, and journal articles.

The review included publications from 2020 to 2024, in Portuguese or English, with a comparative approach of the symptomatic effectiveness between catheter ablation intervention and drug intervention for atrial fibrillation, considering the success rate in the recurrence of the pathology. The selection of articles followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology for planning and organizing the search of publications.

Search targeting was based on Medical Subject Heading (MeSH) descriptors combined with Boolean operators: "Atrial Fibrillation", "Pharmacological treatment", "Drug treatment", "Drug therapy", "Pharmacotherapy", "Ablation", "Catheter ablation", "Cardiac ablation", and "Recurrence". The PICO strategy was implemented to construct the research question, representing Population (P), Intervention (I), Comparison (C), and Outcome (O).

The complete screening by titles and abstracts against the eligibility criteria was performed by the main author, based on the exclusion of duplicates and review of the complete content. Inclusion criteria were: publications from 2020-2024; comparative studies between patients with atrial fibrillation undergoing drug intervention versus catheter ablation; studies with recurrence outcome; clinical trials or observational studies. Exclusion criteria included: studies with ventricular fibrillation; publications not available in English or Portuguese; studies without comparison between pharmacological treatment and ablation considering recurrence; animal studies; unpublished or incomplete articles. The last search was conducted on November 3, 2024.

Data extraction included: author, year of publication, number of patients, study characteristics, type of intervention, analysis data, and respective results. The quality of the publications was evaluated considering random sequence generation, blinding of the evaluation, allocation concealment, incomplete data, and selectivity of the reports.

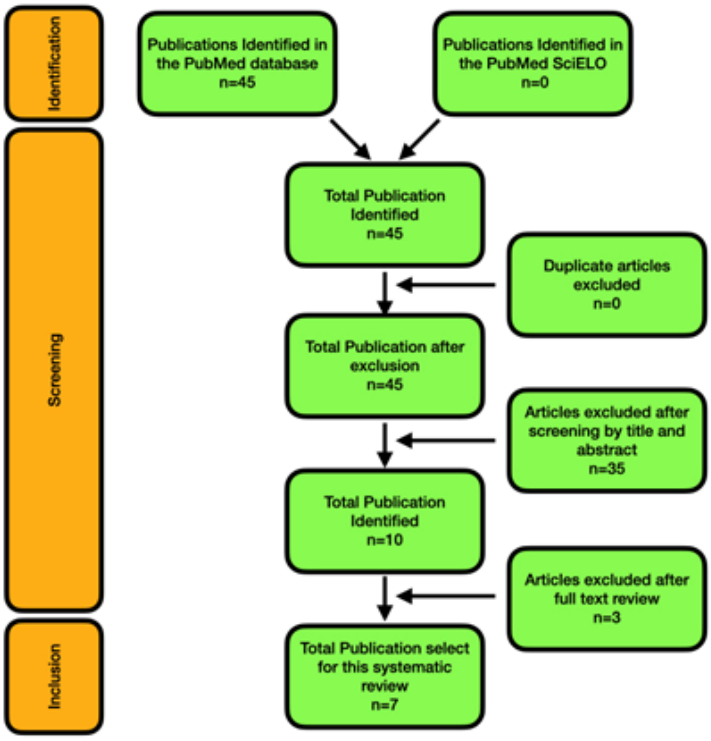
RESULTS

Using the search strategy described, 45 publications were identified in the PubMed database, while none were found in SciELO. Absence of duplicates was observed due to the result coming from a single base. The evaluation by title and abstract, considering inclusion and exclusion criteria, resulted in 10 publications in the second screening. In the final screening, upon complete evaluation of the texts, seven publications were selected for inclusion in this systematic review. The selection, screening, and inclusion steps were illustrated in Figure 1.

Selected clinical trials demonstrated low risk of bias, with patients receiving randomized treatment with written and informed consent. All presented random sequence generation and allocation concealment, exhibiting acceptable methodological quality. The data extracted from each publication were organized in Table 1, including author, year, treatment, comparative method, participant characteristics, results, and conclusions.

Among the seven studies, three compared radiofrequency catheter ablation and pulmonary vein isolation versus drug therapy, while four compared cryoablation with drug therapy. The analysis of the recurrence of atrial fibrillation showed that all studies showed a lower recurrence rate in ablation treatment compared to drug therapies with antiarrhythmics, both for radiofrequency ablation and cryoablation, indicating the therapeutic superiority of invasive procedures over conventional pharmacological management.

Figure 1. Flowchart of the selection and extraction of the articles selected for the construction of this systematic review.



Source: designed by the author

Table 1. Data extracted from PubMed database publications chosen by the author for analysis.

Authors and year of publication	Treatment	Comparison method	Population	Outcomes	Conclusion
Poole JE, et al., 2020	Catheter ablation with pulmonary vein isolation and antiarrhythmic drugs.	Recurrence of any atrial tachyarrhythmias was analyzed in the post-blanking period (after 90 days since randomized treatment) and the burden of atrial fibrillation. Follow-up was performed within 5 years after starting treatments.	1240 patients with atrial fibrillation. 611 underwent catheter ablation, and 629 underwent drug therapy. 43.0% of patients had paroxysmal atrial fibrillation, and 57.0% had longstanding persistent or persistent atrial fibrillation. Median age of the 1240 patients was 68 years.	Over 60 months of follow-up, the first recurrence of either symptomatic or asymptomatic AF (HR 0.52, 95% CI: 0.45, 0.60, P < 0.001) or the first symptomatic-only AF (HR 0.49, 95% CI 0.39, 0.61, P < 0.001) was significantly reduced in the catheter ablation group. The atrial fibrillation burden in both treatment groups was 48%. At 12 months, the AF burden in ablation patients was on average 6.3%, and in drug therapy patients it was 14.4%. AF burden was significantly less in catheter ablation compared to drug therapy patients over the 5-year follow-up (P < 0.001).	Catheter ablation was effective in reducing the recurrence of any type of AF by 48% over the 5 years of follow-up. Whereas drug therapy showed a reduction in recurrence of approximately 30% in any type of AF. In addition, AF burden was also significantly reduced in patients with catheter ablation, regardless of the type of AF.
Wazni OM. et al., 2021	Cryoballoon ablation with pulmonary vein isolation and class I or III antiarrhythmic drugs (flecainide 50 to 375 mg, propafenone 450 and 650 mg, amiodarone 200 and 400 mg, sotalol 80 and 160 mg, and dronedarone 800 mg).	The primary endpoint was treatment success (no initial failure of the procedure or recurrence of atrial arrhythmia after a blanking period of 90 days lasting 30 seconds or longer). For the ablation group, the occurrence of serious procedure-related adverse events and quality of life were also evaluated.	203 patients aged 18 to 80 years with paroxysmal atrial fibrillation without prior rhythm control therapy. 104 underwent ablation and 99 received drug therapy.	In the ablation group, initial success of the procedure was achieved in 97% of patients. The Kaplan-Meier's estimate of the percentage of patients with treatment success at 12 months was 74.6% (95% CI, 65.0 to 82.0) in the ablation group and 45.0% (95% CI, 34.6 to 54.7) in the drug-therapy group (P < 0.001 by log-rank test).	Cryoballoon ablation as initial therapy was superior to drug therapy for the prevention of atrial arrhythmia recurrence in patients with paroxysmal atrial fibrillation.
Andrade JG, et al., 2020	Catheter ablation by cryoablation with pulmonary vein isolation and antiarrhythmic drug therapy for initial rhythm control (flecainide as the most prescribed, sotalol, propafenone and dronedarone).	Primary endpoint: first recurrence of any atrial tachyarrhythmia (atrial fibrillation, atrial flutter, or atrial tachycardia) analyzed in the post-blanking period (after 90 days since randomized treatment) lasting 30 seconds or longer. Secondary endpoints: freedom of symptomatic arrhythmia, atrial fibrillation burden and quality of life, success of multiple ablation procedures, utilization of health care and serious adverse events. The follow-up period was 1 year after the initiation of treatments.	303 adult patients with symptomatic, paroxysmal, and untreated atrial fibrillation, excluding patients who had a history of daily use of a class I or class III antiarrhythmic drug at therapeutic doses. 154 underwent ablation, and 149 underwent antiarrhythmic drug therapy.	At 1 year, a recurrence of atrial tachyarrhythmia occurred in 66 of 154 patients (42.9%) assigned to undergo ablation and in 101 of 149 patients (67.8%) assigned to receive antiarrhythmic medicatios (HR 0.48; 95% CI, 0.35 to 0.66; P < 0.001). Symptomatic atrial tachyarrhythmia had recurred in 11.0% of patients who underwent ablation and in 26.2% of those who received antiarrhythmic drugs (HR 0.39; 95% CI, 0.22 to 0.68). The median percentage of time in atrial fibrillation was 0% (interquartile range, 0 to 0.08) with ablation and 0.13% (interquartile range, 0 to 1.60) with antiarrhythmic drugs. Serious adverse events occurred in 5 patients (3.2%) who underwent ablation and in 6 patients (4.0%) who received antiarrhythmic drugs.	Among patients who received initial treatment for symptomatic paroxysmal atrial fibrillation, there was a significantly lower rate of atrial fibrillation recurrence with cryoballoon catheter ablation than with antiarrhythmic drug therapy, as assessed by continuous cardiac rhythm monitoring.

Authors and year of publication	Treatment	Comparison method	Population	Outcomes	Conclusion
Monahan KH, et al., 2022	Catheter ablation with pulmonary vein isolation and antiarrhythmic drugs.	The primary endpoint was death, disabling stroke, severe bleeding, or cardiac arrest. And secondary endpoints included mortality or cardiovascular hospitalization, AF recurrence (analyzed in the period after 90 days since treatment lasting 30 seconds or longer), and quality of life outcomes. Follow-up was performed within 5 years of starting treatments.	2204 patients older than 65 years or younger than 65 years with at least one risk factor for stroke. Of these, 946 had paroxysmal AF, 1042 had persistent AF, and 215 had long-standing persistent AF. 1108 underwent ablation and 1096 received drug therapy	Compared with drug therapy alone, catheter ablation produced a 19% relative risk reduction in the primary endpoint for paroxysmal AF (HR 0.81; 95% CI: 0.50, 1.30) and a 17% relative reduction for persistent AF (HR 0.83, 95% CI: 0.56, 1.22). For long-standing persistent PAF, the ablation relative effect of was a 7% reduction (HR: 0.93, 95% CI: 0.36, 2.44). Ablation was more effective than drug therapy in reducing first AF recurrence in all AF types: by 51% for paroxysmal (HR: 0.49, 95% CI: 0.39, 0.62), by 47% for persistent (HR: 0.53, 95% CI: 0.43, 0.65), and by 36% for long-standing persistent (HR 0.64, 95% CI 0.41, 1.00). Ablation was associated with a greater improvement in symptoms and a greater improvement in quality of life in all subgroups showing a clinically significant improvement.	Regarding to reductions in AF recurrence and improved quality of life, ablation was more effective than drug therapy in all three AF type subgroups.
Wazni OM, et al., 2022	Cryoballoon catheter ablation with pulmonary vein isolation and antiarrhythmic drug therapy (class I or III).	The primary efficacy endpoint was treatment success at 12 months after the 90-day post-treatment blanking period. The primary safety endpoint was assessed only in the CBA arm, including specified procedure-related serious adverse events. The follow-up period was performed within 1 year after starting treatments.	203 patients aged 18 to 80 years with symptomatic paroxysmal atrial fibrillation who had not previously received rhythm control therapy. 104 underwent cryoballoon ablation, and 99 underwent antiarrhythmic drug therapy.	Improvements in AFEQT summary and subscale scores were significantly larger with CBA than with AAD therapy at 6 and 12 months ($P < 0.02$ for all). Clinically significant improvement (> 5 points) in the AFEQT summary score from baseline to 12 months was observed in 96.0% (100) of patients in the CBA arm vs 72.2% (71) of patients in the AAD arm ($P < 0.001$). No significant between-group differences were observed in the change in the European quality of life index. Overall, 54.4% (57) of the CBA group vs 29.7% (29) of the AAD group reported no recurrence of AF-specific symptoms ($P = 0.0005$).	First-line cryoballoon ablation versus antiarrhythmic drug therapy is associated with larger improvements in AF-specific quality of life and a higher rate of symptom resolution.

Authors and year of publication	Treatment	Comparison method	Population	Outcomes	Conclusion
Bahnson T et al., 2023	Catheter ablation with pulmonary vein isolation and antiarrhythmic drugs.	The primary endpoint was death, disabling stroke, severe bleeding, or cardiac arrest. Secondary endpoints were mortality, cardiovascular hospitalization, and AF recurrence (atrial arrhythmia episode outside the 90-day blanking period lasting 30 seconds or longer) The follow-up period was within 48.5 months after starting treatments.	2204 patients older than 65 years or younger than 65 years with at least one risk factor for stroke. Of the 766 patients aged < 65 years, 375 underwent ablation and 391 drug therapy. Of the 1,130 patients aged 65-74 years, 577 underwent ablation and 553 drug therapy. Of the 308 patients aged ≥ 75 years,156 underwent ablation and 152 drug therapy	Catheter ablation was associated with a 43% reduction in the primary endpoint for patients aged <65 (HR 0.57, 95% CI 0.30-1.09), a 21% reduction for age 65–74 (HR 0.79; 95% CI 0.54-1.16), and an indeterminate effect for age ≥75 (HR 1.39; 95% CI 0.75-2.58). Four-year event rates for ablation versus drug therapy across all age groups, respectively, were 3.2% versus 7.8%, 7.8% versus 9.6%, and 14.8% versus 9.0%. For every 10-year increase in age, the primary outcome aHR increased (i.e., less favorable to ablation) by an average of 27% (interaction p-value = 0.215). A similar pattern was observed with all-cause mortality: for every 10-year increase in age, aHR increased by an average of 46% (interaction p-value = 0.111). AF recurrence rates were lower with ablation compared to drug therapy in all age subgroups (aHR 0.47, 0.58, and 0.49, respectively). Treatment-related complications were infrequent for both arms (<3%), regardless of age. In the ablation, patients aged <65 years had a 4-year AF recurrence rate of 48% versus 57% and 52% for patients aged 65–74 and age ≥75, respectively. In the drug therapy arm, the corresponding 4-year AF recurrence rates were 69%, 72%, and 78%, respectively.	There were age-based variations in clinical outcomes for catheter ablation compared to drug therapy, with the largest relative and absolute benefits of catheter ablation in younger patients. No prognostic benefits for ablation were seen in the oldest patients. No differences were found by age in the treatment-related complications or in the relative effectiveness of catheter ablation in preventing recurrent atrial arrhythmias. The absence of recurrent AF was consistently improved by catheter ablation relative to drug therapy across the age spectrum.
Pavlovic N et al., 2021	Cryoballoon catheter ablation with pulmonary vein isolation and antiarrhythmic drug therapy (flecainide 100 to 200 mg, propafenone 150 to 300 mg or 225 to 425, dronedarone 400 mg and sotolol 80 to 160 mg)	The primary endpoint was atrial arrhythmia recurrence greater than or equal to 30 seconds outside of a 90-day blanking period. Secondary endpoints were the evaluation of quality of life and symptomatic palpitation. The follow-up period was performed within 1 year after starting treatments	218 patients aged 18-75 years with symptomatic paroxysmal AF. 107 underwent ablation and 111 underwent drug therapy	Clinically important improvements in the CBA vs AAD group, larger improvements in the EHRA class were observed at 6, 9 and 12 months ($P < 0.05$). After the blanking period, 30 of 107 subjects in the CBA arm (28.0%) had 307 days with palpitations and 49 of 111 subjects in the AAD arm (44.1%) had 1042 days with palpitations (4.6 vs 15.2 days per year, respectively; incidence rate ratio: 0.30, $P < 0.001$). In addition, the daily duration of palpitations after blanking was shorter in the CBA arm (54.4 ± 131.1 minutes) vs. AAD arm (102.7 ± 162.8 minutes).	In patients with symptomatic AF, first-line cryoballoon ablation was superior to pharmacological treatment to improve quality of life and AF-specific symptoms. Patients treated by ablation had a lower percentage of palpitations and shorter duration compared to those with drug therapy.

Source: designed by the author.

DISCUSSION

Atrial fibrillation (AF) is the most prevalent cardiac arrhythmia, significantly associated with increased rates of cardiovascular morbidity and mortality when not properly treated. Consequently, it is essential to analyze the main therapeutic methods to prevent recurrences, improve quality of life, and minimize the resulting symptomatology.

The present study aimed to compare therapeutic results between standard pharmacological treatment with antiarrhythmics versus catheter ablation in radiofrequency or cryoablation modalities, aiming to determine the most effective approach in reducing AF recurrence. The analyzed studies[9-15] consistently demonstrated that atrial tachyarrhythmia recurrence was assessed after the "blanking period," defined as 90 days post-initiation of ablative treatment. This methodology is based on the evidence that early recurrences are not reliable predictors of long-term therapeutic failure[16].

Catheter ablation involves the destruction of abnormal cardiac tissue by heat (radiofrequency) or cold energy (cryoablation), both incorporating pulmonary vein isolation as a fundamental procedure, considering that ectopic foci triggering AF originate predominantly in these structures[11]. Wazni et al[10]. showed that 75% of patients undergoing ablation achieved therapeutic success after a single procedure without concomitant medication, corroborating recent observations of improvement in ablative efficacy and low rates of post-cryoablation recurrence without prior drug therapy.

Andrade et al[11]. demonstrated that cryoballoon ablation as an initial strategy resulted in lower rates of arrhythmic recurrence compared to class I and III drug therapy in patients with paroxysmal AF. Monahan et al[12]. showed a 50% reduction in ablation recurrence with absolute rates of freedom from recurrence higher in paroxysmal AF (55%) versus long-standing persistent AF (28%).

Bahnson et al[14]. demonstrated lower recurrence rates in patients undergoing ablation across the age spectrum, observing a 43% reduction in the primary outcome (death, disabling stroke, severe bleeding, or cardiac arrest) for patients <65 years, 21% for 65-74 years, with an indeterminate effect for ≥75 years. Mortality after ablation increased with age (2.2% <65 years; 4.7% 65-74 years; 11.7% ≥75 years), contrasting with drug therapy (5.8%, 5.3% and 3.8%, respectively).

Economic considerations reveal different costs: ablation approximately R$24,920.11 (single procedure), while annual drug therapy varies between R$3,471.55 and 3,630.96, depending on the anticoagulant used [17,18].

Although drug therapy does not eliminate AF recurrences, it maintains a relevant role in long-term control in patients not eligible for ablation, requiring careful evaluation of the benefit/risk profile. However, antiarrhythmic drugs fail to prevent recurrences in 43-67% of patients, potentially associated with serious extracardiac and proarrhythmic adverse effects[19].

Catheter ablation has established itself as an effective therapeutic option, preventing recurrences, reducing AF burden, and improving quality of life, with growing evidence favoring its use as the first line of therapy. However, practical limitations include patient inadequacy due to factors that reduce the likelihood of a positive response and the need for emergency surgical support[20].

This study presents limitations including language restriction, search on limited bases, absence of pharmacological standardization, and heterogeneity in population characteristics. The results consistently converge to the superiority of ablation in reducing arrhythmic recurrences, corroborating previous findings. A patient-centered strategy, considering individual characteristics, can significantly optimize quality of life, while continuous developments in arrhythmology promise to improve therapeutic efficacy and accessibility.

CONCLUSION

This systematic review analyzed seven clinical studies that compared the efficacy of antiarrhythmic pharmacological treatment with radiofrequency ablation and cryoablation procedures in the management of atrial fibrillation. The results consistently demonstrated that patients undergoing ablation had significantly lower recurrence rates compared to those treated exclusively with antiarrhythmic drugs. These findings corroborate growing evidence that catheter ablation represents a superior therapeutic strategy for heart rhythm control, offering sustained clinical benefits and improved quality of life to patients. Therefore, the analyzed data support ablation as a first-line therapeutic option in the treatment of atrial fibrillation, particularly in selected patients, and its indication should consider individual factors such as age, comorbidities, type of atrial fibrillation, and previous response to drug treatment.

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