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ORIGINAL ARTICLE

Approaches to rhythm control: Impact of electrical cardioversion versus pharmacological management on left atrial size and systolic performance in atrial fibrillation and flutter

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ABSTRACT

Aim To compare the impact of electrical cardioversion (ECV) and pharmacological cardioversion (PCV) on left atrial size (LA) and left ventricular ejection fraction (LVEF), as well as to identify predictors of rhythm disorder recurrence in patients with atrial fibrillation (AF) or atrial flutter (AFL).

Methods A prospective observational cohort study was conducted on 105 patients with persistent AF or AFL at the University Clinical Centre Tuzla. The patients were divided into two groups: 53 underwent ECV and 52 received PCV. Demographic and clinical data, including ECG and transthoracic echocardiography, were collected. Follow-up assessments were conducted at 7 days, 1 month, and subsequently every 3 months for a year.

Results Baseline characteristics were similar between the groups. Recurrence of rhythm disorder within one year was observed in 52.4% of cases, with ECV showing a slightly lower, though not significantly different, primary failure rate at 7 days compared to PCV (13.2% vs. 23.1%). Significant predictors of recurrence included longer duration of disorder ($p<0.001$), hypertension ($p=0.016$), lack of pre-cardioversion amiodarone ($p=0.027$), and larger LA ($p<0.001$). Both ECV and PCV significantly reduced LA over time, with no significant differences in LVEF between groups.

Conclusion Both ECV and PCV are effective in restoring sinus rhythm, with a trend towards lower recurrence in the ECV group. Predictors such as disorder duration, hypertension, lack of pre-cardioversion amiodarone, and LA should be considered when planning cardioversion to optimize patient outcomes.

Keywords: amiodarone, arrhythmia, atrial enlargement, ejection fraction, hypertension, therapy

INTRODUCTION

Atrial fibrillation (AF) is the most common heart arrhythmia, resulting from abnormal electrical activity in the atria, causing them to fibrillate. It is classified as a tachyarrhythmia, indicating a high heart rate (1). This leads to rapid, irregular atrial activity, causing the atria to quiver instead of contracting. AF significantly contributes to morbidity and mortality related to heart disease (2). Atrial flutter (AFL) is a macroreentrant tachyarrhythmia, usually occurring in the right atrium (3). Typical AFL is identified on an electrocardiogram (ECG) by a "sawtooth" pattern of flutter waves with negative polarity in leads II, III, and aVF (4). Unlike AF, which is sustained by multiple re-entrant wavelets defined by anatomical or functional barriers, typical AFL is maintained by a single re-entrant circuit defined by anatomical obstacles. Both conditions can cause symptoms such as palpitations, shortness of breath, fatigue, and dizziness (2,3). AF is a leading cause of ischaemic stroke and results in more hospital admissions than any other arrhythmia (5).

According to recent data, AF and AFL resulted in 4.72 million new cases, 59.70 million existing cases, 320,000 deaths, and 8.39 million disability-adjusted life years (DALYs). Men under 70 years had higher incidence, prevalence, and DALYs than women, but rates were equal between males and females aged 70 to 74 (6). Recurrence of AF after successful cardioversion is influenced by factors such as atrial remodelling, as AF induces structural and electrical changes in the atria (7). Elec-

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trical remodelling in the atria occurs due to rapid, irregular electrical activity, leading to changes in ion channels and electrical pathways, which increase the likelihood of sustaining AF (8). Structural remodelling involves alterations in atrial tissue, including fibrosis and atrial enlargement. Both electrical and structural remodelling heighten the risk of AF recurrence, worsen symptoms, and contribute to conditions like heart failure (7,8). Additionally, abnormal autonomic nervous system modulation may contribute to AF recurrence following cardioversion (9). Abnormal left ventricular diastolic function, impairing ventricular filling, can also increase left atrial pressure and contribute to electrical and structural remodelling, making the atria more susceptible to AF recurrence (10,11).

Cardioversion is a medical procedure to restore sinus rhythm (SR) in patients with arrhythmias. It involves either delivering an electrical shock trans-thoracically (TTE) or administering medications orally or intravenously. Cardioversion is indicated for conditions like AF and AFL when a fast or irregular heartbeat needs correction (12). Electrical cardioversion (ECV) uses a defibrillator and chest electrodes to deliver quick, low-energy shocks to the heart, synchronising with the QRS complex on the ECG to restore a normal rhythm. ECV acts almost instantly, with an immediate heart response to the shock, but it requires general anaesthesia, which poses risks for some patients and increases the risk of blood clots and strokes (13). Pharmacological cardioversion (PCV), in contrast, does not require sedation and has a favourable safety profile. However, PCV takes longer as medications need time to act, and are typically administered intravenously or orally (14). Recurrence rates of AF are similar between electrical and pharmacological cardioversion (15). No studies comparing these two methods have been conducted in Bosnia and Herzegovina. The aim of this study was to compare the effects of ECV and PCV on left atrial size and the left ventricle (LV) systolic performance and to identify predictors of the recurrence of rhythm disorders in these patients.

SUBJECTS AND METHODS

Patients and study design

This prospective observational cohort study, conducted from January to December 2023, included 105 patients with persistent forms of AF or AFL hospitalised at the Intensive Care Unit at the Clinic for Internal Medicine, University Clinical Centre Tuzla. The patients were divided into two groups: ECV and PCV group.

Inclusion criteria were persistent non-valvular AF and AFL lasting over 72 hours, age between 18 and 75, CHA_2DS_2-VASc score <5 (clinical prediction tool in assessing risk of stroke for patients with non-rheumatic atrial fibrillation adding points for Congestive Heart failure, Hypertension, Age, Diabetes Mellitus, Prior Stroke, Vascular disease, Sex) (16), left atrial size (LA) <5.5 centimetres (cm), and symptomatic European Heart Rhythm Association (EHRA) class <4 (17). The exclusion criteria were patients <18 or >75 years, those with LA dilatation >5.5 cm, LVEF <35%, unstable coronary artery disease, severe aortic stenosis, poorly controlled grade III hypertension, significant chronic obstructive pulmonary disease (COPD), active alcoholism, history of stroke, and uncorrected hyperthyroidism. All patients provided an informed consent after clearly explaining the study and signing a consent form.

The Ethical Committee of the University Clinical Centre Tuzla approved the study.

Methods

Demographic and clinical data were gathered by conducting a comprehensive medical history evaluation, physical examination, and laboratory tests for all patients. The duration of AF and AFL was determined from medical history and documentation review. Each patient underwent ECG and TTE evaluations, measuring left ventricular systolic function and left atrial dimensions (Figure 1) in 2D mode in the PLAX (Vivid T8, General Electric Medical Systems, Jiangsu, China). Before the ECV or PCV procedures, patients were treated with an oral vitamin K antagonist to achieve a target INR of 2–3. This approach was chosen due to the wide availability and proven efficacy of vitamin K antagonists, as many patients were unable to afford new oral anticoagulants (NOACs) due to their high cost. Additionally, a uniform therapy across all patients was ensured. Antiarrhythmic medications such as amiodarone or propafenone, alone or combined with beta-blockers or non-dihydropyridine calcium channel blockers, were administered to maintain rhythm control post-procedure.

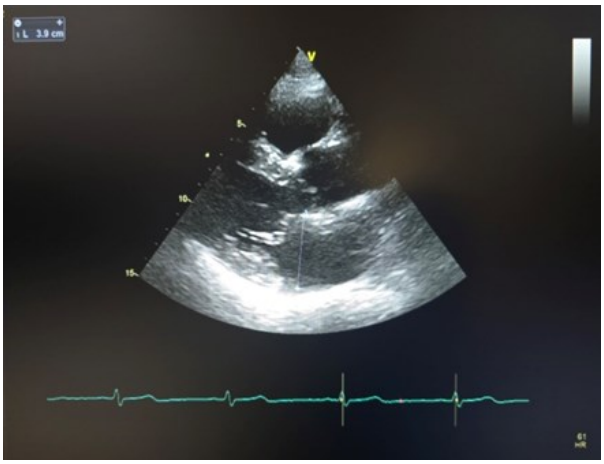

Figure 1. Measurement of left atrium size (LA) anteroposterior diameter in parasternal long-axis view (PLAX) (Clinic for Internal Medicine, University Clinical Centre Tuzla, 2023)

The protocol for the ECV procedure involved instructing patients to refrain from consuming food or beverages for at least six hours prior. Before the treatment, patients received short-term hypnotic sedation with midazolam, typically administered at doses ranging from 5 mg to 7.5 mg. Sequential ECV involved delivering up to three successive shocks. If sinus rhythm was not restored after three consecutive synchronized shocks, the procedure was deemed ineffective. A monophasic General Electric defibrillator was used with anterolateral electrode placement, and patients were continuously monitored for at least 24 hours post-procedure.

For PCV, intravenous amiodarone was administered by diluting a 600 mg dose in 500 ml of 5% dextrose or glucose solution. The infusion commenced at a rate of 1 mg/min over the first 6 hours, followed by 0.5 mg/min for the subsequent 18 hours, totalling a 24-hour infusion period. An intravenous infusion pump ensured precise delivery rates. Oral propafenone was ad-

ministered as a single 600 mg dose in tablet form, with patients instructed to chew the tablets thoroughly for rapid absorption. The patients were monitored for 24 hours post-administration to assess efficacy and potential adverse effects.

After discharge, initial follow-up occurred on day 7, followed by subsequent evaluations at one month and every three months thereafter, which included clinical assessments, ECG, and TTE evaluations. The final assessment took place 12 months following the rhythm conversion.

Statistical analysis

Data were presented as frequencies (N) and percentages (%) for categorical variables, while for continuous variables, deviation from normal distribution was determined using the Kolmogorov-Smirnov test, and results are presented as median and interquartile range (IQR). Pearson's χ^2 test was used for categorical variables, and the Mann-Whitney U test for continuous variables. Variables with statistically significant differences were further analysed using multivariate regression analysis. Accuracy was determined by area under the curve (AUC) analysis and presented with a receiver operating characteristic (ROC) curve. Statistical significance was set at ≤5%.

RESULTS

In a cohort of patients undergoing electrical cardioversion (ECV) (N=53) or pharmacological cardioversion (PCV) (N=52), demographics and baseline rhythm disorder characteristics showed no significant differences between the two groups (Table 1). Most patients were males, 76 (72.4%), with a median age of 58 years. BMI did not show a significant difference among the groups (p=0.584). Atrial fibrillation (AF) was a predominant disorder, 76 (72.4%), while the recurrence within a year was observed in 55 (52.4%) patients. Prior pharmacological therapy differed significantly between the ECV and PCV groups, with amiodarone administered more frequently in the ECV, 58 (55.2%) compared to PCV, 47 (44.8%) (p<0.001).

The follow-up data after cardioversion interventions revealed that while baseline characteristics were similar between ECV and PCV groups, prevalence of primary failure of cardioversion at 7 days post-intervention was slightly lower in ECV, 7 (13.2%) compared to PCV, 12 (23.1%), albeit not significantly different (p=0.096) (Table 2). Subsequent follow-ups at 30 days, 3 months, 6 months, and 1 year showed trends of recurrent rhythm disorders, with sinus rhythm generally more sustained in the ECV group, although statistical significance varied. The LA decreased over time in both groups, while LVEF remained relatively stable.

An analysis of the recurrence of rhythm disorder after cardioversion interventions revealed several significant findings. A longer disorder duration was significantly associated with higher recurrence rates (p<0.001; OR=1.14, 95% CI: 1.00-1.29). Hypertension emerged as a significant risk factor for the recurrence (p=0.016; OR=2.7, 95% CI: 1.18-6.15), while the absence of amiodarone therapy prior to conversion was also significantly associated with higher recurrence rates (p=0.027; OR=2.4, 95% CI: 1.09-5.30) (Table 3).

Additionally, larger left atrial size prior to conversion was significantly associated with higher recurrence rates (p<0.001; OR=3.92, 95% CI: 2.46-8.59). Both left atrial size (AUC=0.800; 95% CI: 0.717-0.889; p<0.001) and duration of the disorder (AUC=0.773; 95% CI: 0.683-0.863; p<0.001) exhibit strong predictive value for recurrence of the rhythm disorder after cardioversion interventions (Figure 2).

Table 1. Characteristics of the electro-cardioversion and pharmacological cardioversion groups

Variable		ECV (N=53)	PCV (N=52)	Total	p
Sociodemographic and anthropometric data					
Gender (No; %)	Male	39 (73.6)	37 (71.2)	76 (72.4)	0.781
	Female	14 (26.4)	15 (28.8)	29 (27.6)	
Age (Median; IQR) (years)		57 (52-61)	59 (54-64)	58 (53-62)	0.240
BMI (Median; IQR) (kg/m^2)		24 (21-25)	24 (20-26)	24 (21-26)	0.584
Data related to rhythm disorder (No; %)					
Type	AF	38 (71.7)	38 (73.1)	76 (72.4)	0.874
	AFL	15 (28.3)	14 (26.9)	29 (27.6)	
Recurrence in one year	YES (or primary fail)	27 (50.9)	28 (53.8)	55 (52.4)	0.089
	NO	26 (49.1)	24 (46.2)	50 (47.6)	
Structural heart disease	YES	18 (34.0)	18 (34.6)	36 (34.3)	0.944
	NO	35 (66.0)	34 (65.4)	69 (65.7)	
Duration of rhythm disorder (Median; IQR)		180 (60-400)	120 (60-175)	130 (60-250)	0.096
Comorbidities (No; %)					
Hypertension	YES	34 (64.2)	33 (63.5)	67 (63.8)	0.941
	NO	19 (35.8)	19 (36.5)	38 (36.2)	
Diabetes Mellitus	YES	16 (30.2)	17 (32.7)	33 (31.4)	0.782
	NO	37 (69.8)	35 (67.3)	72 (68.6)	
Pharmacological therapy before conversion (No; %)					
Amiodaron	YES	40 (75.5)	18 (34.6)	58 (55.2)	<0.001
	NO	13 (24.5)	34 (65.4)	47 (44.8)	
Propafenone	YES	20 (37.7)	14 (26.9)	34 (32.4)	0.236
	NO	33 (62.3)	38 (73.1)	71 (67.6)	
β-blockers	YES	39 (73.6)	36 (69.2)	75 (71.4)	0.621
	NO	14 (26.4)	16 (30.8)	30 (28.6)	
Ca blockers	YES	7 (13.2)	8 (15.4)	15 (14.3)	0.750
	NO	46 (86.8)	44 (84.6)	90 (85.7)	

ECV, electro cardioversion; PCV, pharmacological cardioversion; IQR, interquartile range; BMI, body mass index; AF, atrial fibrillation; AFL, atrial flutter; Ca, calcium;

Table 2. Follow-up data after pharmacological or electric cardioversion intervention

Variable		ECV (N=53)	PCV (N=52)	Total	p
At admission					
LA (Median; IQR) (cm)		4.6 (4.4-4.8)	4.6 (4.4-4.8)	4.6 (4.4-4.8)	0.735
LVEF (Median; IQR) (%)		55.00 (50-60)	55.00 (50-60)	55.00 (50-60)	0.758
1st follow-up (7 days)					
Rhythm (No; %)	Primary fail	7 (13.2)	12 (23.1)	19 (18.1)	0.096
	Recurrence	5 (9.4)	8 (15.4)	13 (12.4)	
	SR	41 (77.4)	32 (61.5)	73 (69.5)	
LA (Median; IQR) (cm)		4.5 (4.2-4.7)	4.4 (4.3-4.5)	4.4 (4.3-4.6)	0.394
LVEF (Median; IQR) (%)		57.50 (50-60)	55.00 (55-60)	55.00 (55-60)	0.382
2nd follow-up (30 days)					
Rhythm (No; %)	Recurrence	18 (34.0)	26 (50.0)	44 (41.9)	0.211
	SR	35 (66.0)	26 (50.0)	61 (58.1)	
LA (Median; IQR) (cm)		4.4 (4.2-4.6)	4.3 (4.2-4.4)	4.3 (4.2-4.5)	0.105
LVEF (Median; IQR) (%)		55.0 (50-60)	55.0 (50-60)	55.0 (50-60)	0.417
3rd follow-up (3 months)					
Rhythm (No; %)	Recurrence	11 (20.8)	17 (32.7)	28 (26.7)	0.230
	SR	42 (79.2)	35 (67.3)	77 (73.3)	
LA (Median; IQR) (cm)		4.3 (4.1-4.5)	4.2 (4.1-4.3)	4.2 (4.1-4.5)	0.056
LVEF (Median; IQR) (%)		60.0 (55-65)	60.0 (55-60)	60.0 (55-60)	0.673
4th follow-up (6 months)					
Rhythm (No; %)	Recurrence	11 (20.8)	15 (28.8)	26 (24.8)	0.167
	SR	42 (79.2)	37 (71.2)	79 (75.2)	
LA (Median; IQR) (cm)		4.2 (4.0-4.4)	4.2 (4.0-4.4)	4.2 (4.0-4.4)	0.386
LVEF (Median; IQR) (%)		60.00 (55-65)	60.00 (60-60)	60.00 (55-65)	0.609
4th follow-up (1 year)					
Rhythm (No; %)	Recurrence	11 (20.8)	15 (28.8)	26 (24.8)	0.337
	SR	42 (79.2)	37 (71.2)	79 (75.2)	
LA (Median; IQR) (cm)		4.0 (4.0-4.3)	4.0 (4.0-4.2)	4.0 (4.0-4.3)	0.521
LVEF (Median; IQR) (%)		60.0 (60-65)	60.0 (60-65)	60.0 (60-65)	0.788

ECV, electro cardioversion; PCV, pharmacological cardioversion; N, frequency; IQR, interquartile range; AF, atrial fibrillation; SR, sinus rhythm; LA, size of left atrium; LVEF, left ventricular ejection fraction

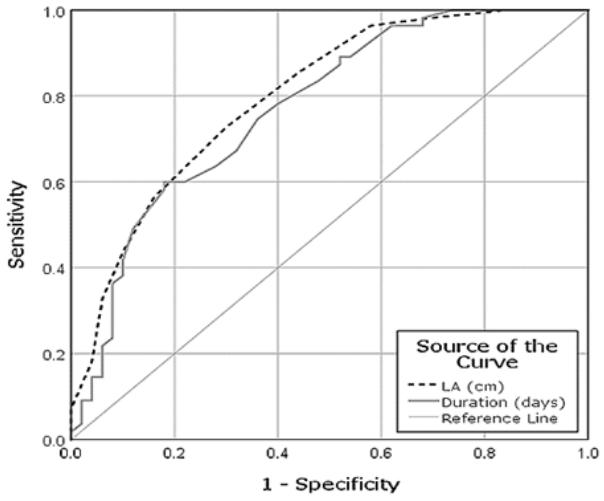

Figure 2. Receiver operator curve (ROC) analysis for prediction of recurrence after cardioversion*

*ROC/AUC_{LA} = 0.800 (95% CI: 0.717-0.889; p<0.001) and $ROC/AUC_{Duration}$ = 0.773 (95% CI: 0.683-0.863; p<0.001).

LA, left atrium size

DISCUSSION

The main findings indicate that both ECV and PCV are comparably effective in restoring sinus rhythm, with a somewhat lower recurrence rate observed in the ECV group during the one-year follow-up. Factors predicting successful cardioversion and maintenance of normal heart rhythm include smaller left atrial size and the administration of amiodarone before cardioversion.

Rhythm control methods, particularly ECV and PCV, significantly affect the size of the LA and enhance cardiac contractility in patients with AF and AFL (18,19). Previous studies suggest ECV may lead to a more rapid improvement in the systolic function of LV compared to medication administration, though both methods effectively reduce LA size in AF patients (20,21). Our study examined the efficacy and outcome of ECV compared to PCV in treating AF and AFL in 105 patients (53 receiving ECV and 52 PCV). No significant differences in demographic and baseline characteristics between the ECV and PCV groups were found.

Preferences for rhythm control management vary across European health institutions, with Eastern Europe favouring pharmacological therapy and Northern and Western Europe preferring ECV (22). Most patients were male (72.4%) with a median age of 58. AF was the most common rhythm abnormality, present in 72.4% of patients. Westerman et al. also reported a higher prevalence of AF in male patients (23). Recent research by Volgman et al. indicates that AF may be more prevalent in females than previously acknowledged, with a significant number of female patients affected. Moreover, females with AF have a higher risk of stroke and mortality compared to men, highlighting the importance of effective rhythm control in this population (24). Within a year, 24.8% of patients in our cohort experienced AF recurrence, regardless of the cardioversion method used. More patients in the ECV group (75.5%) used amiodarone before cardioversion compared to the PCV group (34.6%). Other studies have shown similar results, confirming that amiodarone remains widely used for rhythm control before ECV due to its effectiveness in maintaining sinus rhythm and

Table 3. Data related to the recurrence of rhythm disorder after cardioversion

Variable		Inter-group analysis			Multivariate regression analysis	
		Recurrence (N=55)	Without recurrence (N=50)	p	OR (95% CI)	p
Gender (No; %)	Male	40 (72.7)	36 (72.0)	0.934	0.95 (0.40-2.25)	0.911
	Female	15 (27.3)	14 (28.0)		referent	
Age (Median; IQR) (years)		58 (53-62)	59 (50-63)	0.382	1.09 (0.50-2.36)	0.526
Data related to rhythm disorder (No; %)						
Conversion type	ECV	27 (49.1)	26 (52.0)	0.766	1.09 (0.50-2.36)	0.828
	PCV	28 (50.9)	24 (48.0)		referent	
Type	AF	40 (72.7)	36 (72.0)	0.934	0.96 (0.41-2.27)	0.934
	AFL	15 (27.3)	14 (28.0)		referent	
Structural heart disease	YES	23 (41.8)	13 (26.0)	0.088	0.49 (0.21-1.12)	0.090
	NO	32 (58.2)	37 (74.0)		referent	
Duration of disorder (Median; IQR) (days)		180 (100-380)	80 (30-150)	<0.001	1.14 (1.00-1.29)	0.007
Comorbidities (No; %)						
Hypertension	YES	41 (74.5)	26 (52.0)	0.016	2.7 (1.18-6.15)	0.018
	NO	14 (25.5)	24 (48.0)		referent	
Diabetes mellitus	YES	17 (30.9)	16 (32.0)	0.904	0.95 (0.42-2.16)	0.417
	NO	38 (69.1)	34 (68.0)		referent	
Pharmacological therapy before conversion (No; %)						
Amiodarone	YES	36 (65.5)	22 (44.0)	0.027	referent	0.029
	NO	19 (34.5)	28 (56.0)		2.4 (1.09-5.30)	
Propafenone	YES	16 (29.1)	18 (36.0)	0.450	referent	0.611
	NO	39 (70.9)	32 (64.0)		1.30 (0.47-3.59)	
Beta-blockers	YES	38 (69.1)	37 (74.0)	0.578	referent	0.381
	NO	17 (30.9)	13 (26.0)		1.86 (0.47-7.45)	
Ca blockers	YES	8 (14.5)	7 (14.0)	0.936	referent	0.538
	NO	47 (85.5)	43 (86.0)		1.72 (0.31-9.68)	
Echocardiographic data (prior conversion)						
LA (Median; IQR) (cm)		4.7 (4.5-4.9)	4.4 (4.2-4.6)	<0.001	3.92 (2.46-8.59)	0.010
LVEF (Median; IQR) (%)		55.0 (45-55)	60.0 (55-60)	<0.001	0.96 (0.86-1.07)	0.445

ECV, electro cardioversion; PCV, pharmacological cardioversion; IQR, interquartile range; AF, atrial fibrillation; SR, sinus rhythm; LA, size of left atrium; LVEF, left ventricular ejection fraction

preventing AF recurrence (25). However, there is evidence supporting the emerging use of other antiarrhythmic drugs with similar efficacy and fewer side effects, such as flecainide and propafenone, particularly for patients intolerant to amiodarone or those with contraindications (26–28).

In Bosnia and Herzegovina, intravenous antiarrhythmic drugs are limited to amiodarone. Propafenone is more affordable than flecainide, leading to its widespread use. Other antiarrhythmic medications, like sotalol and dronedarone, recommended by the European Society of Cardiology (ESC) and American Heart Association (AHA) guidelines, are not available, restricting therapeutic options. Medications like dofetilide and ibutilide, used in other regions, are also unavailable in Bosnia and Herzegovina (29,30). This highlights the need for individualised treatment plans and ongoing research to optimise antiarrhythmic therapy in AF management, considering both clinical efficacy and socioeconomic constraints (31).

In our study, initial cardioversion success and subsequent results indicate that the ECV group tends to show faster improvement, likely due to ECV's superior efficacy in quickly restoring sinus rhythm compared to pharmacological treatments. ECV has a success rate of about 90%, while PCV shows lower efficacy and a higher risk of side effects (15). The ESC and AHA guidelines recommend ECV for its rapid action and high success rates, especially for recent-onset AF (29,30).

Our results showed the primary failure of conversion within 7 days was slightly lower in the ECV group (13.2%) compared to the PCV group (23.1%), though this difference was not statistically significant. Ejection fraction (LVEF) remained similar between groups throughout the follow-up. Klocek et al. found electrical cardioversion more effective than drug treatment in achieving and maintaining sinus rhythm at discharge during the cryoablation procedure and for treating AF in general (32). In our investigation, the ECV group-maintained sinus rhythm more commonly during the one-year follow-up, and patients with poorly controlled hypertension and a longer duration of rhythm abnormalities before cardioversion were more likely to experience recurrence. These results align with Wang et al.'s findings that hypertension significantly increases the risk of AF recurrence after cardioversion (33). Our results showed the absence of pre-conversion amiodarone treatment significantly raised recurrence rates. Recent studies indicate that amiodarone reduces recurrence rates more effectively than other antiarrhythmics (25). Despite newer antiarrhythmic agents, amiodarone remains a cornerstone of rhythm control (34). A larger LA before conversion was significantly associated with increased recurrence risk, with patients exhibiting a nearly fourfold higher risk (35). Maintaining a normal heart rhythm over time remains a challenge due to high recurrence rates for both treatments (36).

The outcome of our results has significant implications for managing AF patients. Before choosing between ECV and PCV, it is crucial to consider factors like the duration of rhythm abnormality and comorbid conditions. Given that LA size and rhythm abnormality duration are robust predictors of post-

cardioversion outcomes, these factors should be closely monitored when planning cardioversion and follow-up (37). Further research should focus on understanding how clinical and echocardiographic factors influence recurrence rates. Additionally, investigating the efficacy of new antiarrhythmic drugs and advanced ablation techniques could provide valuable insights for improving long-term outcomes in rhythm disorder patients (38).

The limitations of our study include a small sample size, necessitating further research with larger cohorts to validate these findings. Additionally, being a single-centre study, institutional practices and resources may have influenced results and may not represent the situation in other centres. Randomised, controlled multicentre trials are needed to establish definitive therapy guidelines (39).

In conclusion, our study highlights the crucial relationship between the type of cardioversion, prior medication, and rhythm disorder recurrence, emphasising the need for tailored treatment approaches. Aggressive hypertension management and the use of amiodarone to reduce AF recurrence improve cardioversion effectiveness and overall management of AF and other rhythm disorders.

AUTHOR CONTRIBUTIONS

Conceptualization, E. B. and M. B.; methodology, A. B.; software, E. B.; validation, L. T. R., B. Č. and S. H.; formal analysis, L. F.; investigation, E. B.; resources, A. B.; data curation, M. S..; writing—original draft preparation, E. B.; writing—review and editing, M. B., A. J. E.; visualization, A. R.; supervision, M. E.; project administration, funding acquisition, E. B. All authors have read and agreed to the published version of the manuscript.

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TRANSPARENCY DECLARATION

Conflict of interests: None to declare.

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