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Original Research Article

OUTCOMES OF TEE-GUIDED DIRECT CURRENT CARDIOVERSION IN PERSISTENT ATRIAL FIBRILLATION: A PROSPECTIVE STUDY

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ABSTRACT

Background: Atrial fibrillation (AF) is a prevalent arrhythmia that poses significant risks to cardiovascular health. Direct current cardioversion (DCCV) is a standard method for rhythm control in AF patients. However, complications such as thromboembolic events may arise if atrial thrombus is not ruled out prior to the procedure. Transoesophageal echocardiography (TEE) has emerged as a valuable tool to detect thrombus, ensuring patient safety during DCCV. This study aims to assess the effectiveness and safety of TEE-guided DCCV in patients with AF.

Materials and Methods: This observational study was carried out over a one-year period from January 2024 to December 2024, in the Cardiology Department at Kamineni Academy of Medical Sciences and Research Centre, LB Nagar, Hyderabad. A total of 50 patients with persistent or recurrent AF were included. All participants underwent TEE to rule out thrombus in the left atrium or appendage before undergoing DCCV using biphasic synchronized shocks. Patients were monitored for immediate procedural success, complications, and follow-up for AF recurrence at one week, one month, and three months. Statistical analyses were conducted using chi-square and t-tests.

Result: The cohort had a mean age of 60.4 years, with 64% males. The TEE-guided DCCV demonstrated a high success rate, with sinus rhythm restoration achieved in 88% of patients. However, 12% of patients experienced failed cardioversion, and 18% had AF recurrence within one month. The procedure was associated with minimal adverse events, including minor bleeding (4%) and one case of pulmonary edema (2%). No major complications such as stroke or esophageal perforation were observed.

Conclusion: TEE-guided DCCV is a highly effective and safe approach for rhythm control in AF, with high immediate success rates and minimal procedural complications. Although AF recurrence remains a challenge, TEE-guided cardioversion provides a reliable strategy for managing persistent AF in appropriate patients.

Keywords: Atrial fibrillation, direct current cardioversion, transoesophageal echocardiography, sinus rhythm, thromboembolism, recurrence rate.

INTRODUCTION

Atrial fibrillation is the most common cardiac arrhythmia, affecting millions of individuals worldwide.[1] The management of this condition often involves the restoration of sinus rhythm through direct current cardioversion, a highly effective and widely employed procedure.[2] However, the risk of thromboembolic complications, particularly stroke, remains a significant concern for clinicians when performing this intervention.[3]

Transesophageal echocardiography has a pivotal role in assessment and management of atrial fibrillation by providing crucial information about the presence and size of intracardiac thrombi.[4] This modality has been increasingly utilized to guide the timing and safety of direct current cardioversion, with the aim of minimizing the risk of periprocedural thromboembolism.[5]

Several studies have investigated the efficacy of transesophageal echocardiography-guided direct current cardioversion in patients with atrial fibrillation. A retrospective analysis by Stoddard et al,[6] found that this approach significantly reduced the incidence of stroke or transient ischemic attack compared to cardioversion without transesophageal echocardiographic guidance. Similarly, a meta-analysis by Syed et al,[7] demonstrated that transesophageal echo-guided cardioversion was associated with a lower rate of thromboembolic events and improved long-term maintenance of sinus rhythm.

Furthermore, the use of direct oral anticoagulants has been shown to further reduce the risk of thromboembolism in patients undergoing cardioversion,[8] with several studies reporting a halving of thromboembolic events compared to warfarin.[9]

Current research indicates that utilizing transesophageal echocardiography-guided direct current cardioversion along with direct oral anticoagulants offers a potentially effective and safe approach for managing atrial fibrillation. Continued research in this area is necessary to further elucidate the optimal approach to this common and potentially life-threatening arrhythmia. This study aims to.

MATERIALS AND METHODS

This observational study was carried out prospectively in the Department of Cardiology at Kamineni Academy of Medical Sciences and Research Centre, LB Nagar, Hyderabad, over a one-year period from January 2024 to December 2024. The study aimed to assess the effectiveness of transoesophageal echocardiography (TOE)-guided direct current cardioversion (DCCV) in patients diagnosed with atrial fibrillation (AF). 50 patients who met with the inclusion criteria were included.

Patients aged 18 years and older with persistent or recurrent AF, requiring cardioversion for rhythm control, were included. Exclusion criteria comprised patients with contraindications to TOE, those with left atrial thrombus detected on echocardiography, hemodynamically unstable patients requiring emergency intervention, and individuals with severe valvular disease or significant left ventricular dysfunction.

All enrolled patients underwent a comprehensive clinical evaluation, including a detailed history, physical examination, and baseline investigations such as electrocardiography (ECG), transthoracic echocardiography (TTE), and blood tests, including coagulation parameters. TOE was performed prior to cardioversion to rule out the presence of left atrial or left atrial appendage thrombus. If no thrombus was detected, patients proceeded to DCCV using biphasic synchronized direct current shocks, with initial energy levels set according to standard protocols. Sedation was administered under monitored anesthesia care.

Successful cardioversion was defined as the restoration of sinus rhythm following DCCV, as confirmed by ECG. Patients were monitored for immediate post-procedure complications, including thromboembolic events, arrhythmias, and procedural adverse effects. Additionally, anticoagulation status before and after the procedure was documented.

Follow-up assessments were conducted at one week, one month, and three months post-cardioversion to evaluate rhythm stability and detect any recurrence of AF. Maintenance antiarrhythmic therapy and anticoagulation adherence were recorded. The primary outcome measure was the immediate success rate of DCCV, while secondary outcomes included the rate of AF recurrence and the incidence of complications.

Data were analyzed using appropriate statistical methods, with categorical variables expressed as percentages and continuous variables presented as mean ± standard deviation.

RESULTS

The study involving 50 patients with atrial fibrillation (AF) aimed to assess the effectiveness and safety of transoesophageal echocardiography (TEE)-guided direct current cardioversion (DCCV). The mean age of cohort was 60.4 years, with a higher proportion of males (64%). Notably, 56% of patients had a history of alcohol use, and 62% had a smoking history, suggesting that lifestyle factors may play a role in the development of AF. A significant portion (56%) had comorbid diabetes, with hypertension affecting 40% of participants. The majority had persistent AF (56%), and the average duration of AF was 6.5 years, indicating a chronic condition in most patients.

Table 1: Baseline data

Variables		Total
BMI (Kg/m^2)		31.2 + 7.4
Age (in years)		60.4 + 11.2
Gender	Males	32 (64%)
	Females	18 (36%)
Alcoholic		28 (56%)
Smoking history		31 (62%)

Comorbidities	Hypertension	20 (40%)
	Diabetes mellitus	28 (56%)
Duration of AF	Mean	6.5 ± 3.2 years
Type of AF	Paroxysmal AF	22 (44%)
	Persistent AF	28 (56%)

Echocardiographic findings revealed a normal left atrial diameter (45.2 mm) and a preserved ejection fraction (57.4%). The TEE-guided DCCV procedure showed a high success rate (96%), with a median duration of 28.5 minutes. Immediate restoration of sinus rhythm was achieved in 88% of cases, underscoring the procedure's effectiveness. However, 12% of patients experienced failed cardioversion, and 18% had AF recurrence within one month, highlighting the potential for relapse. Adverse events were minimal, with minor bleeding (4%) and one case of pulmonary edema (2%), but no major complications like esophageal perforation or stroke were observed. Overall, the results indicate that TEE-guided DCCV is a safe and effective option for managing atrial fibrillation, though longer-term outcomes remain a concern for a subset of patients.

Table 2: Echocardiographic and Procedural Findings (n=50)

Finding	Value
Left Atrium Diameter (mean ± SD)	45.2 ± 4.3 mm
Ejection Fraction (mean ± SD)	57.4 ± 7.1%
TEE Success Rate (%)	48 (96%)
Median Procedure Duration	28.5 minutes

Table 3: Outcomes of Direct Current Cardioversion (n=50)

Outcome	Value
Immediate Restoration of Sinus Rhythm (%)	44 (88%)
Failed Cardioversion (%)	6 (12%)
AF Recurrence within 1 Month (%)	9 (18%)

Table 4: Adverse Events and Complications (n=50)

Event	Number (%)
Minor Bleeding	2 (4%)
Esophageal Perforation	0 (0%)
Stroke	0 (0%)
Pulmonary Edema	1 (2%)

DISCUSSIONS

Atrial fibrillation (AF) continues to be a major clinical concern because of its links to cerebrovascular accidents, heart failure, and reduced quality of life. This study was undertaken to evaluate the efficacy and safety of transoesophageal echocardiography (TEE)-guided direct current cardioversion (DCCV) in patients with persistent or recurrent AF.

The present study's findings show a high success rate for DCCV (96%) and a restoration of sinus rhythm in 88% of cases, which is in line with several other studies examining the efficacy of TEE-guided cardioversion. For example, Natale et al,[9] reported a similar immediate success rate of around 85-90%, reinforcing the utility of TEE in detecting thrombi before cardioversion, thus preventing thromboembolic events. Furthermore, the study's observation of a 12% failure rate is consistent with the literature, where success rates for DCCV typically range from 70-90%, with failures often due to procedural challenges or underlying structural heart disease (Calkins et al.[10]).

In terms of safety, the occurrence of adverse events in this study was minimal, with minor bleeding in 4% and a single case of pulmonary edema. This is congruent with other studies such as those by Li et al,[11] who observed a low complication rate in TEE-guided cardioversion. Notably, no cases of stroke or esophageal perforation were reported, which further emphasizes the safety of the procedure when performed with proper precautions. However, the 18% recurrence rate of AF within one month observed in this study underscores the challenge of maintaining sinus rhythm long term, a common issue reported in the literature (Boden et al.[12]). The persistence of AF following cardioversion may be attributed to underlying electrical remodeling or insufficient antiarrhythmic therapy, warranting close follow-up and tailored therapy to prevent recurrence.

CONCLUSION

This study demonstrates that transoesophageal echocardiography (TEE)-guided direct current cardioversion (DCCV) is a highly effective and safe procedure for the management of atrial fibrillation (AF). With a 96% success rate in achieving sinus rhythm, it provides a reliable rhythm control option, especially for patients with persistent AF. While the immediate restoration of sinus rhythm was successful in 88% of cases, the recurrence rate of AF within one month (18%) suggests the need for closer long-term monitoring and additional therapeutic strategies. The

low incidence of adverse events further supports the procedure's safety profile.

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Conflicts of Interest: None declared

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