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Original Article

Electrical Cardioversion in Atrial Fibrillation: Success Rates

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Abstract

Background: To study the immediate and long term success of Direct Current (DC) Cardioversion for persistent non-valvular atrial fibrillation.

Methods: In this prospective study 200 patients with persistent non-valvular atrial fibrillation presenting to arrhythmia clinics were selected. They were anticoagulated to INR of 2-3, a transesophageal echocardiogram was performed 3 weeks later to rule out left atrial thrombus and then patients were subjected to external electrical cardioversion. Patients were followed up 3 monthly for a total period of 3 years to assess maintenance of sinus rhythm.

Results: The mean age of study population was 69 years and 65.5% were male. Immediate success was achieved in 65.5% patients. At 3 months 54.5% were in sinus rhythm and this percentage dropped to 43.5% at 6 months.185 patients completed 1 year follow up and 28.5% were found to be in sinus rhythm. At 2 years 172 patients reported out of which 19.50% were still in sinus rhythm. In relation to the LA size immediate success was achieved in 58.01% with size less than 4cm, 35.11% with LA size between 4 to 4.5cm and only in 6.8% with LA size greater than 4.5cm. This trend was maintained in long term as well. And in relation to drugs those on amiodarone had best success. Complications were encountered in two patients, one patient had transient ischemic attack and other suffered bradycardia needing temporary pacing.

Conclusion: DC cardioversion for rhythm control in atrial fibrillation is a safe and effective treatment strategy with reasonable short term success and although limited but meaningful long term success.

Key Words: Atrial fibrillation, Rhythm control, Electrical cardioversion, Left atrial size.

Introduction

Rhythm control for atrial fibrillation has theoretical advantages associated and can be a beneficial approach in selected population Atrial fibrillation (AF) is the most common sustained arrhythmia.[1,2] It is associated with high health care costs and a high morbidity and almost doubled mortality.[3,4] Since its prevalence being high in older age it is thought to be an increasing health care problem as people live longer because of better health care.[5]

The two management strategies for atrial fibrillation that is rate and rhythm control have been intensely investigated over the past two decades and not much difference was found in the end points of mortality and morbidity, however there are still some issues to be resolved. [2,6-8] Some controversies are linked to these trials.Study population consisted of older and at high risk for stroke(Atrial Fibrillation Followup Investigation of Rhythm Management;AFFIRM), one prior cardioversion and recurrence of atrial fibrillation(RACE), thus results cannot be generalized to all AF populations.[1,9] Secondly the maximum follow up was up to 3.5 years.[1,3] Mortality rates were actually found to decrease after 5 years in rhythm control strategy.[3] Mortality benefit in rhythm control was also supported by Danish Investigation of Arrhythmia and Mortality on Dofetilide (DIAMOND) and on treatment analysis of AFFIRM.[2] Lastly the beneficial effects of rhythm control might have been offset by the reduced efficacy and toxicity of antiarrhythmic drugs. Even in these trials comparable efficacy of the two strategies had moderate strength of evidence.[3]

Theoretical benefits have been associated with rhythm control like improved cardiac performance, prevention of thromboembolism and tachycardia induced cardiomyopathy.[4,9] Sinus rhythm maintenance may be favoured owing to disruption or reversal of adverse atrial remodeling, improved exercise tolerance and quality of life. [2,6,8,11] It may be the preferred approach in younger patients, extremely symptomatic patients and patients with heart failure.[3,9]

Rhythm control by electrical cardioversion is more effective than pharmacological cardioversion with upto 90-95% success depending upon patient selection.[12,13,14] In external cardioversion biphasic waveform is superior to monophasic.[3,15] Our study aims to find the immediate and long term success rates of direct current cardioversion (DCCV) for persistent non valvular AF in Asian population particularly

subcontinent. Purpose is to encourage the use of rhythm control strategy where appropriate.

Patients and Methods

This study was a prospective study and was performed at the Armed Forces Institute of Cardiology. The study included 200 consecutive patients undergoing cardioversion for persistent atrial fibrillation from May 2012 to May 2016. All patients were seen in arrhythmia clinic in Armed Forces Institute of Cardiology, placed on anticoagulant (Warfarin) and INR was maintained between 2–3 for at least 3 weeks prior to electrical cardioversion. All patients were subjected to transesophageal echocardiogram (TOE) after three weeks to rule out the presence of any thrombus in the left atrium, prior to DCCV. And warfarin was continued for 4 weeks post DCCV. Protocol for DC -Cardio –Version (DCCV): The procedure was carried out in the cardiac emergency or coronary care unit after obtaining a formal written informed consent. The patients were fasting overnight, premedicated with I/V Midazolam and Nalbuphine. Synchronized Cardioversion was carried out with a M-series Zoll biphasic defibrillator. We used non-escalating energy protocol (200J, 200J, 200J). If unsuccessful, then single shock of 200J with paddles in the anteroposterior position on precordium was attempted. Post DCCV, the patients were detained for 04 hours and discharged if stable. Immediate success was defined as successful conversion to sinus rhythm, documented on ECG.The patients were followed up on 03 monthly basis in the arrhythmia clinic. They were subjected to an electrocardiogram, an echocardiogram and Prothrombin time/INR on every visit.All patients were subjected to transthoracic echocardiogram and all the parameters were recorded. Left Atrial (LA) size was calculated (Normal range considered was less than 4.0 cm). Ejection fraction was also calculated and so was any other abnormality.

Results

The mean age was 69 ± 2 years (range: 30-75 years). In the study group, 09 (15.51%) patients had previously undergone coronary artery bypass grafting (CABG), 38 (65.51%) patients were diabetic and 34 (58.62%) patients hypertensive (Table 1).Immediate success was achieved in 65.5%, out of which 68.7% were males and 41 (31.29%) were females. At 3 months follow up, 198 patients reported, 109(54.5%) patients were in sinus rhythm, in which 72 were males and 37 were females. At 6 months follow up, 194 patients (51 Male, 36 Female) reported, out of which 87(43.5%) patients were in sinus rhythm. At 1 year, 185 (33 Male, 24 Females) patients reported, 57(28.50%) patients were in sinus rhythm (SR).One hundred and seventy two patients (21 males and 18 females) completed follow up for 2 years, of which 39 (19.50%) patients were still in sinus rhythm. DCCV was carried out for a second time in 08 patients on recurrence of atrial fibrillation. Out of them, 6 patients were in SR at end of 1 year follow up (Table 1).

Table 1:Summary of sinus rhythm maintenance

Follow up schedule	Immediate success	At 03 months	At 06 months	01 year	02 years	03 years
Maintenance of sinus rhythm	131 (65.5%)	109 (54.5%)	87 (43.5%)	57 (28.50%)	39 (19.50%)	21 (10.50%)
Lost to follow up	0	2	4	9	13	19

Of the 131 patients in whom immediate success was achieved 76 (58.01%) patients had LA size less than 4.0 cm, while DC cardio version was successful in only 09 (6.8%) patients with LA size of more than 4.5 cm. At 06 months follow up, out of 87 patient in SR, 54 (62.06%) patients had left atrial size in normal range. At three years out of 21 patients (10.50%) in sinus rhythm, 18 (85.71%) were those having LA size less than 4.0 cm, while no patient with LA size greater than 4.5 cm was in sinus rhythm (Table 2).

Table 2:Distribution of patients maintaining sinus rhythm according to LA size

Left atrial size	Total No. of patients (200)	Immediate Success (131)	At 03 months (109)	06 months (87)	01 year (57)	02 years (39)	03 years (21)
Less than 4.0cm	110	76 (58.01%)	65 (59.63%)	54 (62.06%)	46 (80.70%)	32 (82.05%)	18 (85.71%)
4.0-4.5cm	60	46 (35.11%)	36 (33.02%)	29 (33.33%)	11 (19.29%)	07 (17.19%)	03 (14.25%)
More than 4.5 cm	30	09 (6.8%)	08 (6.1%)	04(4.5%)	0	0	0

The patients were on various medications before enrollment into study. Most common drug used was Beta Blockers group (39.6%), 31.3% were on Amiodarone in, 15% were on combination of amiodarone and digoxin, and 14.1% of patients no clear idea of the exact drug taken during last 03 months could be obtained.In patients on amiodarone, there was 100% immediate success (62 out of 62). Of those, who continued taking maintenance dose of amiodarone, 52 (83.87 %) remained in SR at the end of

03 months and 33 (53.22%) remained in SR at the end of 06 months. One patient developed severe bradycardia and asystole, which necessitated temporary pacemaker and assisted ventilation. However, sinus rhythm returned after three days. Another patient had transient weakness of left arm for a few hours a day after DCCV.

Discussion

Our success rates in terms of immediate conversion to sinus rhythm are comparable to the previous studies, however we demonstrated better results in maintenance of sinus rhythm in long term, which may be attributed to the fact that we had sizeable amount of serving military personal (all male and relatively young with normal left atrial sizes) in our study population. [15]

Dilated and fibrosed left atrium (LA) provide substrate for reentry necessary for AF generation. [1] AF also causes electrical and structural remodeling of left atrium leading to its sustainability and recurrence.[1] Early cardioversion leads to atrial size reduction and restores atrial contractility.[1] LA volume indexed to body surface area (LAVI) has been shown to be superior in predicting recurrence of nonvalvular AF after successful cardioversion.[21-24] In our setup because of limited experience and more time consuming method for LA volume measurement, one-dimensional/linear LA sizes measured which despite some limitations is reproducible and has been shown to correlate with both CMR and angiographic measurement.[20] In this study, LA size was negatively correlated to the success in sinus rhythm maintenance just like in previous studies.[7,15-19]

Pretreatment with antiarrhythmic drug enhances restoration and maintenance of sinus rhythm after electrical cardioversion and especially amiodarone has been shown to be the most effective.[15] In this study patients who were on amiodarone had best success both in immediate achievement and long term maintenance of sinus rhythm. So we report similar results to previous work on patients undergoing DCCV for persistent AF.[25,26]

AF duration has also been related to the outcomes of cardioversion.[15] In our study we also observed that patients with shorter duration of AF had better results in terms of sinus rhythm maintenance.The trends of sinus rhythm achievement were similar in both preserved and reduced LV ejection fraction (EF) in our study and all patients experience symptomatic improvement as assessed subjectively.

In view of improvement of EF with sinus rhythm achievement and favorable results in NYHA class and QOL in patients with reduced EF and heart failure we support the use of rhythm control in heart failure patients both with reduced and preserved EF.[3, 10, 27]

Non-escalating protocol and use of biphasic waveforms have been shown superior in cardioversion.[3,16,27] We used non escalating energy protocol with impedance compensated biphasic waveform in this study.

Though generally DCCV has been considered a safe procedure, a few complications have been attributed like thromboembolic risk and electrical complications such as asystole or bradycardia. Thromboembolic stroke was linked to rhythm control as to AFFIRM (occurred where anticoagulation was stopped in high risk study population, which now is recommended to continue in this group).[1]

The rates of thromboembolism are equal in both electrical and pharmacological cardioversion.[4] Stroke risk few weeks post cardioversion is 5% which is equivalent to the yearly stroke risk in AF population.[4] In previous studies, thromboembolism has been shown to be reduced markedly by anticoagulation prior to cardioversion and 4 weeks afterwards (to compensate for atrial stunning) and so did the use of TOE to exclude LA thrombus.[4] We also performed TOE in all patients and continued with anticoagulation after successful cardioversion for 4 weeks irrespective of CHADVASC score.

We did not encounter any stroke in our study though one patient had transient ischemic attack on second day which recovered fully. This occurred despite adequate anticoagulation and preprocedure Trans Oesophageal Echocardiograph (TOE) had not revealed any intracardiac thrombus. Another patient developed severe bradycardia and asystole requiring temporary pacing. That patient regained sinus rhythm, however on subsequent workup she was found to have sinus node dysfunction. The overall incidence of complications is low and should not be used to justify withholding rhythm control efforts in patients who might benefit from it.

In present study surface ECG was used ,on follow up visits, to find out AF status and hence might have underestimated the paroxysmal AF occurrence however we would Holter monitor in patients who would complain of palpitations and other symptoms, in between. We could not assess symptomatic improvement objectively in the earlier part of study, however later on we started collecting that data as well. A substantial proportion of study population

were from poorer socioeconomic group, hence follow up was limited by financial difficulties and transportation problem.

Conclusion

1.DC cardioversion is safe and effective way of restoring sinus rhythm in carefully selected patients with non valvular persistent AF.

2.Younger patients with new onset AF should be subjected to DCCV cardioversion as they have the best chance of maintaining sinus rhythm in long term.

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