

SYNCHRONISED CARDIOVERSION FOR CHRONIC ATRIAL FIBRILLATION

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Conflict of Interest: None

SUMMARY

Objective: To determine whether elective cardioversion was successful in establishing sinus rhythm in patients with chronic atrial fibrillation and the energy used for the cardioversion using a monophasic defibrillator.

Design: This is a retrospective descriptive study.

Setting: Intensive care unit of the National Cardiothoracic Centre, Korle-bu Teaching Hospital.

Subjects: Twelve consecutive patients referred by physicians with chronic atrial fibrillation which had not responded appropriately to pharmacological agents.

Method: Using the intensive care admissions and discharge register and report book, the patients case notes were retrieved. The pre-cardioversion echocardiography diagnosis and drugs were noted. The results of cardioversion, and the current rhythm status were also reviewed.

Results: There were twelve elective cardioversions for chronic atrial fibrillation during the period under investigation. All the patients were on warfarin with INR-2.2-2.8. Eight of the patients had initial echocardiographic evidence of thrombi in the left atrium. Sinus rhythm was established in 9(75%) of the patients. The mean energy used for the cardioversion was 384.4±167.7J. Of the 3 with failed cardioversion, one was later successfully cardioverted to sinus rhythm. On review, 9(75%) of the patients are still in sinus rhythm 6 months to 15 months after cardioversion. Six of these patients continue with oral amiodarone however.

Conclusion: Synchronized cardioversion for chronic atrial fibrillation is safe and may be successful after failure of pharmacologic cardioversion in patients where sinus rhythm is desirable.

Keywords: Atrial fibrillation, synchronized cardioversion, monophasic defibrillator.

INTRODUCTION

Atrial fibrillation (AF) is the commonest arrhythmia in adults accounting for a third of hospitalization for arrhythmias.¹ Atrial fibrillation is less common in women as compared to men.² The commonest cardiac associa-

tions of atrial fibrillation are rheumatic mitral valve disease, coronary artery disease congestive heart failure, and hypertension.² Non-cardiac causes of atrial fibrillation are hyperthyroidism, hypoxic conditions, surgery, especially thoracic surgery, and alcoholic intoxication. Usually a predisposing condition can be found in most patients but rarely, in a minority of patients, no identifiable cause can be found.^{3,4,5}

The problems associated with AF include haemodynamic, heart failure and thromboembolic abnormalities.¹ Compared with matched controls the incidence of thromboembolic strokes in patients with atrial fibrillation is increased up to 7 fold.^{1,6} It is because of these problems that some physicians try to convert their patients to sinus rhythm. Pharmacological agents are the first line of therapy and electrical cardioversion is an option if this fails.^{7,8}

Cardioversion for chronic atrial fibrillation is usually elective and done after a period of anticoagulation to prevent thromboembolic events.^{9,10} There has been a gradual increase in the number of cases referred by the cardiologists for cardioversion. This has prompted this study. The study is to find out how effective synchronised cardioversion is in establishing sinus rhythm in patients with chronic atrial fibrillation.

MATERIALS AND METHODS

Using the ICU admissions book the names of patients who had synchronized cardioversions from 1st January 2005 to 31st June 2006, for chronic atrial fibrillation were selected. Their case notes were then retrieved and their primary diagnosis, duration of atrial fibrillation (AF), drugs and echocardiograph reports were looked at. All the cardioversions took place at the Cardiothoracic Intensive Care unit under cardiovascular monitoring of non-invasive blood pressure, ECG and pulse oximetry. The sedation used for the defibrillation, the energy used for defibrillation (monophasic), results of cardioversion and current cardiovascular status of the patients were also noted. Precondition for defibrillation was anticoagulation with warfarin INR 2.0-3.0.

All the patients had cardioversion using the intensive care units protocol of a progressive increase of the energy. Patients were therefore shocked with 100J, 140J, 240J, and repeat 240J if cardioversion was unsuccessful. All the patients were discharged to the general ward after 3 hours and were subsequently discharged home the next day. The results were analysed using Microsoft Excel 2003 software

RESULTS

There were only two females aged 35 years and 42 years respectively. One was hypertensive and the other had a cardiomyopathy. Fifty-eight percent of the patients were over 40 years old. Hypertension (5) and ischaemic heart disease (4) formed 75% of the diagnoses (Table 1).

Table 1 Age and diagnosis

Age	Hypertension	IHD	Cardiomyopathy	Unknown
20-30	0	0	1	1
31-40	1	1	1	0
41-50	2	1	0	0
51-60	1	1	0	0
61-70	1	1	0	0
Total (%)	5 (42)	4(33)	2(17)	1(8)

Age: mean \pm SD = 44.2 \pm 13.8years, IHD – ischaemic heart disease

Eight (66.7%) initially had evidence of thrombi in the left atrium at the time of diagnosis and 33% had impaired cardiac contractility as their ejection fractions were less than 40%.

Duration of Atrial Fibrillation and Drug Therapy

Six (50.0%), 4(33.3%), 2 (16.7%) had had the atrial fibrillation for 2-4 months, 4-6 months and greater than 6 months respectively. The mean duration was 4.3 \pm 1.56 months. All the patients were on anti-arrhythmics and these included amiodarone (6), atenolol (2), digoxin (3), and carvedilol (4).

Indication for cardioversion

The cardiologists cited cardiovascular instability (5), thrombo-embolic phenomenon (5) and rate control (2) as their indications for the cardioversion.

Four (33.4%) of the patients with reduced cardiac function had etomidate or midazolam alone as sedation for the cardioversion, Midazolam was however used alone or in combination with other drugs in 10 (83.3%) of the patients as shown in Table 2. No patient had any recall of the procedure.

Table 2 Sedation used for cardioversion

Drug	No (%)
Etomidate	2 (16.7)
Midazolam	2 (16.7)
Midazolam +fentanyl	1 (8.3)
Midazolam + propofol	7 (58.3)
Total (%)	12 (100)

Table 3 Cumulative energy used for cardioversion

Energy (J)	NO. (%)
100	1(11.1)
240	2(22.2)
480	5(55.6)
720	1 (11.1)
Total (%)	9(100)

The average cumulative energy used for the cardioversion was 384.4 \pm 167.7 J with a range of 100-720 J. Six (66.7%) needed energy levels of 480-720 J for successful cardioversion as shown in Table 3.

DISCUSSION

Atrial fibrillation is one of the common arrhythmias associated with rheumatic and non rheumatic cardiac conditions. The incidence actually increases from 0.2% around the age of 30 years to 2.3 % around 80 years with a male to female ratio of 2:1^{1,2} The study shows that the mean age was around 44.2 years although 58 percent were above the age of 40 years. This mean is lower than data seen in other studies where most of the cases were above 60 years.^{2,3} The male to female ratio in the study of 5:1 was surprising although this does not indicate the actual incidence of atrial fibrillation in the community as a whole. The lower age group could be due to an aggressive management policy by the cardiologists to prevent complications in younger patients with atrial fibrillation. The two females in the study were also young, aged 35 and 42 years respectively. Like other studies hypertension and ischaemic heart disease were the commonest cause of the atrial fibrillation in the group who had the cardioversion and this formed 75% of the causes in the present study. In the Atrial Fibrillation Follow-up Investigation of Rhythm Management (AFFIRM) trial, 70.2% were hypertensive and 38.2% had ischaemic heart disease.¹¹

All the patients had transthoracic echocardiography and this revealed thrombi in the left atrium of 8 of the patients. Echocardiographic studies have shown that large left atrium, thrombi in the left atrium and reduced peak velocities in the left atrium are high risks for thromboembolism.^{12,13}

Poor left ventricular function in 33% of the patients also increased the risk of thromboembolism. All the patients were fully anticoagulated for a minimum of three weeks, with therapeutic INR before being referred for cardioversion. Studies have shown that transoesophageal echocardiograph may reduce the period of anticoagulation as it is more efficient in diagnosing thrombi and therefore patients with a low risk of thromboemboli.^{12,13,14} These patients are therefore cardioverted earlier without fear of thromboembolism. None of the patients had transoesophageal echocardiography in our study and therefore needed prolonged therapy with anticoagulants before they were deemed safe for cardioversion. The patients in the current study had atrial fibrillation for a mean duration of 4.3 ± 1.56 month before they were referred for electrical cardioversion.

All the patients were on anti-arrhythmics without a proper rhythm control, although ventricular rates had been reduced in the majority. There is a controversy as to whether patients should have ventricular rate control or be converted to sinus rhythm. The rhythm control method is expensive and is more likely to produce side-effects with the drugs that are used.^{11,15,16} These studies have also not found any advantage of rhythm control over rate control in improving cardiovascular function especially in situations where the ventricular rate is well controlled. However thromboembolic phenomenon are reduced with the establishment of sinus rhythm.^{15,16} Conscious sedation is used to provide optimum conditions before electrical cardioversion. This is usually given by anaesthesiologists or cardiologists if they have been trained in this procedure. Midazolam, a benzodiazepine, is relatively safe for conscious sedation and may be combined with propofol if the haemodynamics are normal.^{17,18} The choice of short acting sedative drugs allows patients to wake up early and in certain countries patients are discharged the same day after electrical cardioversion. Etomidate and midazolam have been successfully used by cardiologists alone during cardioversion without the need of the services of an anaesthetist.¹⁸ However combination of sedatives with potent opiates may cause severe respiratory depression and may be dangerous in inexperienced hands.

The average cumulative energy used during electrical cardioversion was 384.4 ± 167.7 J. This is similar to other studies where monophasic defibrillators were used.^{17,18} Joglar *et al* on the other hand used a cumulative energy of 615 ± 385 J when the initial energy was 100J.¹⁹ When the initial energy was 360 J the cumulative energy reduced to 414 ± 176 J. The success rate using an initial energy of 100J of 75% in the current study was similar to Figueiredo's study where the suc-

cess rate was between 70-75%.¹⁷ Joglar was however able to achieve a success rate of 90% in his study and this increased to 100% when he used an initial energy of 360J.¹⁹ There is recommendation that the initial energy should be around 200J to achieve higher success rates with the cardioversion.¹⁷⁻¹⁹ Biphasic defibrillators have been shown to provide a better success of over 90% with much less energy requirements.²⁰ With the monitoring used during the study there were no complications during the electrical cardioversion although bradycardia, ventricular tachycardia, burns, over-sedation and other complications have been described.^{21,22} Evidence shows that post-cardioversion, sinus rhythm is maintained with the use of amiodarone, sotalol, propafenone, and some β -blockers.^{7,8} Six of the patients continue on amiodarone as their main anti-arrhythmic and are still in sinus rhythm. All the patients still continue on their warfarin including those who are in sinus rhythm. The dilemma facing the cardiologists is when or whether to stop the anticoagulants. Studies have shown slightly more thrombotic strokes in patients who are taken off anticoagulants after rhythm control.^{11,15}

CONCLUSION

Hypertension and ischaemic heart disease were the commonest cause of atrial fibrillation in the patients who had electrical cardioversion. Electrical cardioversion was successfully achieved in 75% of patients with chronic atrial fibrillation. The use of cardio-stable sedative agents makes the procedure very safe.

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