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Electrical cardioversion for persistent or chronic atrial fibrillation: Outcome and clinical factors predicting short and long term success rate

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Abstract

Aims: To assess the effectiveness and to identify predictors for successful electrical cardioversion (ECV) and maintenance of sinus rhythm, in long term follow up of patients with persistent (PAF) and chronic atrial fibrillation (CAF).
Methods and results: Retrospective analysis of medical records of 68 patients with PAF or CAF, who underwent 91cardioversions. ECV was successful in 86 attempts (94.5%). In obese (body mass index > 30) and hypertensive patients (blood pressure > 140/90 mm Hg), ECV was less successful in restoring sinus rhythm ($p < 0.05$, $p < 0.021$, respectively). Sinus rhythm was maintained more than half a year in 42 cardioversions (61%). Treatment with beta blockers prior to cardioversion and age younger than 75 were independent factors predicting long term success ($p < 0.013$, $p < 0.034$, respectively). Mild or moderate enlargement of left atrium (<6 cm) did not predict relapse of the arrhythmia. Second ECV was as or more effective than the first in 82.3% of patients that underwent more than one cardioversion.
Conclusions: Conversion of atrial fibrillation by DC shock was found to be safe and effective procedure. Patients should be treated with beta blockers prior to cardioversion, if possible. Mild or moderate enlargement of left atrium is not contraindication to cardioversion. Recurrent cardioversions may be recommended.

Keywords: Electrical cardioversion; Atrial fibrillation; Clinical factors

1. Introduction

Atrial fibrillation (AF) is the most common arrhythmia in medical practice [1]. Restoration of sinus rhythm is more favorable due to improvement of cardiac function and decrease of thromboembolic or anticoagulant treatment complications [2–4]. The advantages of direct current electrical cardioversion include higher success rate, immediate restoration of sinus rhythm, as opposed to the unpredictable time to pharmacologic cardioversion, and the avoidance of potential adverse drug reactions [5]. Many investigators have tried to find out the factors determining the recurrence of AF after cardioversion and many potential predictors have been reported, including old age [6–10], underlying heart disease [6,7,10–14], long AF duration [6,8,11–16], enlargement of left atrium [6,16–20] and low left atrial appendage flow [20–23]. Pretreatment with antiarrythmic agents, calcium or beta blockers were found to reduce atrial fibrillation recurrence [16,24,25]. On the other hand, other trials did not find that advanced age [26–28], underlying heart disease [27], long AF duration [27], enlargement of left atrium [8,11,27,29–31], low left atrial appendage flow [29] were factors determining recurrence of AF and pretreatment with calcium blockers were not predicting factor for maintenance of sinus rhythm [32]. Thus the existing literature contains conflicting evidence on which factors are useful predictors of successful maintenance of sinus rhythm. The purposes of the present study were: 1) to determine the short and long term success rate of electrical cardioversion approach. 2) To identify clinical and echocardiographic predictors for successful electrical cardioversion and maintenance of sinus rhythm in patients with persistent and

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chronic AF. 3) To asses the additional effect of recurrent cardioversion after relapse of AF.

2. Methods

2.1. Study patients

Sixty eight patients with, persistent or chronic atrial fibrillation of at least 48 h duration (mean 4.4 months, range 0.07–72 months), with normal thyroid studies, who underwent 91 non-emergency cardioversions at the Internal Medicine C in Rambam medical center, Israel, between January 1995 and February 2002 were included in the analysis. Eleven patients underwent two successful cardioversions and six patients underwent three successful cardioversions. There were 42 (61.8%) women and 26 (38.2%) men. The mean age was 75.4±11.8 years (range 41–96 years). Seven patients (10.4%) were obese with BMI (body mass index) >30. The associated cardiovascular diseases included hypertension in 48 patients (70.5%), ischemic heart disease in 27 patients (39.7%), rheumatic heart disease in 8 patients (11.8%) and nonrheumatic mitral valvular heart disease in 34 patients (55.7%). According to echocardiography, forty six patients (70.7%) had normal left ventricle ejection fraction and the mean left atrium size was 4.5±0.48 cm (range 3.4–5.8 cm). Pretreatment with calcium blockers was recorded in 38 of cardioversions (41.8%), with angiotensin converting enzyme (ACE) inhibitors in 37 of cardioversions (40.7%), with beta blockers in 33 of cardioversions (36.3%), with amiodarone in 18 cardioversions (19.7%) and with digitalis in 13 cardioversions (14.3%).

2.2. Study design

We performed an observational analysis of retrospectively collected data of 68 patients and 91 cardioversions. The data included the following parameters for each patient: age, sex, weight, thyroid stimulating hormone, past history of hypertension, hypercholesterolemia, smoking, diabetes mellitus, ischemic heart disease and medications that were taken before and after each cardioversion. Left atrial diameter, left ventricle ejection fraction, function of the mitral and other valves were estimated by echocardiography, while the patient were on AF. Duration of the arrhythmia before cardioversion, number of shocks and the voltage in joules were recorded. Immediate success of cardioversion was defined as sinus rhythm on the discharge day. Maintenance of sinus rhythm was evaluated by electrocardiogram done on the next admissions to our hospital or by electrocardiogram done by the family doctor in the clinic. The proportion of patients maintaining sinus rhythm month, half a year, year and more than 3 years was recorded. The mean follow up was 3.1 years (range 8 months–6.5 years).

2.3. Statistical analysis

Data was analyzed using the SPSS statistical software. Data are expressed as mean±standard deviation. We used two end points immediate success of cardioversion and maintenance of sinus rhythm after the cardioversion. To evaluate discrete variables such as gender, hypercholesterolemia, hypertension, diabetes mellitus, obesity, smoking in the past, rheumatic heart disease, ischemic heart disease, and treatment before and after cardioversion influencing both endpoints we used Mann Whitney, Kruskel Valis or chi square test if appropriate. Spearman correlation was used to evaluate the influence of age, duration of AF before cardioversion, left atrial size and ejection fraction to both endpoints. Multivariate analysis (logistic regression) was applied for covariates in univariate analysis. We considered the results significant when the p value was <0.05.

3. Results

3.1. Immediate success

Of the 91 cardioversions included in the study, 86 (94.5%) were successfully, immediate cardioverted to sinus rhythm. Sixty eight from them (74.7%) were successfully cardioverted by the first shock, 12 (14.1%) by the second, 5 (3.5%) by the third and in one cardioversion (1.1%) four shocks were employed. Mean voltage was 235±74 J (range 50–360 J). Age, gender, left atrium enlargement, ejection fraction by echocardiography and pretreatment with medications (amiodarone, calcium blockers, beta blockers, ACE inhibitors, digitalis) were not significantly different between those who remained in AF and those who converted to sinus rhythm. When patients were further classified according to duration of AF before cardioversion (<2 weeks, 2 weeks–3 months, 3–12 months and >12 months) no significant difference in initial outcome was noted (95.7%, 92.3%, 90.9% and 100% successful cardioversions, respectively, difference not significant). Eighty eight percent of patients (16 patients) with hypercholesterolemia, 94.7% with diabetes mellitus (18 patients), 100% (13 patients) with rheumatic heart disease, 94.3% with ischemic heart disease (33 patients) and 94.9% (39 patients) with nonrheumatic mitral valve disease were initially converted. In contrast only 82.4% of patients (14 patients) with uncontrolled hypertension and 80% (8 patients) of the obese patients with BMI>30 were converted to sinus rhythm ($p<0.021$ and $p<0.093$, respectively). In logistic regression analysis hypertension and obesity ($p<0.03$ and $p<0.05$, respectively) remained as independent predictors of immediate success.

3.2. Maintenance of sinus rhythm during the follow up

Sinus rhythm was maintained less than a month in 4 cardioversions (5.8%), between 1–6 months in 23 cardio-